Fertility and pension systems

Rizzo, Giuseppe

Università di Catania

20 January 2009

Fertility and Pension Systems*

Giuseppe Rizzo
Dipartimento di Economia e Metodi Quantitativi, Università di Catania,
Corso Italia 55, 95129 Catania, Italy

February 4, 2009

Abstract

A broad political economy literature explained the introduction and expansion of pension systems, but the effects caused by the endogenous reduction of fertility have been largely disregarded, as the fertility choice is usually considered exogenous. This paper suggests a model that takes into account this effects and analyzes the net effect of the breakdown of family ties on the dimension of pension systems. The empirical analysis support an inverted-U development pattern: a continuous and progressive weakening of family ties, after inducing the introduction of pension systems, tends to reduce, *ceteris paribus*, their political support.

JEL classification: H55; D72; O15; J13; J14
Keywords: Family economics; Fertility; Political sustainability; Social security; Voting

1 Introduction

In the last century, in most developed countries, the transition from a state with low economic growth and a primarily rural economy to a state with fast growth and industrial economy had some strong effects on the domestic economy causing, on the one hand, a huge reduction of the fertility rate and, on the other hand, the introduction and subsequent development of pension spending.

Among the factors that led to the decline of the fertility rate are: the increase of the return on human capital, which induces the substitution of quantity with quality of children (see Becker and Lewis, 1973; Becker and Barro, 1988; Barro and Becker, 1989); the agricultural and medical development, which reduced the mortality rate and its volatility, hence reducing the need for a high number of children (see Kalemli-Ozcan, 2002); the change in family relations (weakening of the family ties, reduction of the socioeconomic differences between men and women), which induced a reversal in the direction of the net

*I thank Roberto Cellini and Alice Schoonbroodt for guidance and helpful comments. The responsibility of any errors or shortcomings remains mine.

wealth flows reducing the economic attractiveness of fertility (see Caldwell, 1976, 1978; Boldrin and Jones, 2002); some social policies (pensions, compulsory education, child labour regulation), usually accompanying the economic development, which increased the fertility costs and decreased the fertility benefits (see Leibenstein, 1957; Caldwell, 1976, 1978; Cigno and Rosati, 1992).

As regards the introduction and development of pension systems, a broad literature has studied this phenomenon, developing models that explain why they exist and have been continuously expanding during the 20th century. The question that immediately arises is why these pension systems exist and why their growth is supported by the voters: it needs to be noticed, in fact, that the main purpose of pension systems is to transfer wealth from a majority of worker-voters to a minority of pensioner-voters. Since the Seventies, numerous papers have tried to answer this question, and some interesting reviews of the literature are offered by Breyer (1994), Galasso and Profeta (2002) and de Walque (2005). Focusing the attention only on the voting models, which is the approach used in the present paper, Galasso and Profeta (2002) identify five motives for the introduction of pension system: dynamic inefficiency, limited time horizon, crowding-out of the investment, intragenerational redistribution and optimal social contract.

The first explanation for the political support to pension systems is given by their economic attractiveness in the special case of dynamic inefficiency: if the ratio between interest rate and growth rate, also called Aaron variable, is less than one then the present value of the wealth of future generations does not converge, therefore a pay-as-you-go pension system (and public debt) is Pareto-efficient (see Samuelson, 1958; Diamond, 1965; Aaron, 1966).

Another explanation is given by the fact that the portion of pension contributions already payed are considered a sunk-cost by the voters, hence if for the median voter the present value of the benefits coming from the pension system is higher than the portion of contributions yet to be paid then a majority of voters will support the pension system; moreover the older is the median voter, the higher will be the size of the system (see Browning, 1975).

The third explanation relates to the crowding-out effect of pension systems (and public debt) on investment, which increases the return on capital hence motivating interest-earners to support it (see Cukierman and Meltzer, 1989; Cooley and Soares, 1999; Boldrin and Rustichini, 2000).

A typical characteristic of pension systems is that contributions are proportional to income, whereas benefits are partially independent of it, suggesting us another explanation for the political support for pension system: low-income voters are favorable toward the introduction and development of pension systems (see Tabellini, 1991, 2000; Casamatta et al., 2000).

The last explanation comes from the hypothesis of ascendant altruism: individuals tend to "undersave" during youth in order to obtain a transfer during old age from the young generation, therefore the introduction of social security would be Pareto-efficient and supported even under unanimity rule (see Hansson and Stuart, 1989; Veall, 1986).

These motives, however, do not explain the timing of the introduction of social security. In other words, they do not explain why pension system have been implemented just at the same time as economic development. Several reasons have been proposed as possible answers to this question, summarized by Cutler and Johnson (2004) as follows: insurance against the risks of the capitalist system (e.g., Great Depression and the 1935 U.S. Social Security Act); political legitimacy of non-democratic governments (e.g., the German and Argentinean social security systems introduced by Bismarck and Perón); the Wagner's law, which assumes social insurance as luxury good (e.g., U.K. and Australia implemented social security when they were the richest countries in the world, and it was financed by general revenue); the demographic heterogeneity, which may induce the implementation of income redistribution policies; the Leviathan theory, which claims that the governments tend to expand their range of action; the demonstration effect, which induces countries to copy their neighbours'successful policies.

Caucutt et al. (2007) suggest the transition from a rural economy to an urban one as a possible explanation for the development of pension systems. They conclude that the faster technological progress of the city compared with that of the farm and the increase of the life expectancy led to the urbanization, because of the larger productivity of the urban economy, and the need for a larger amount of savings. This transition caused the passage from a rural median voter, who grounds his old-age economic security on the land rent and is not interested in a pension system (even though it could be more profitable), to an urban median voter, who has a flat (or even hump-shaped) age-earning profile, therefore more favourable to the introduction of the pension system.

This last model draws a parallel with the Caldwell hypothesis about fertility: the economic transition from a rural-Malthusian to a urban-Solowian economic system affects the domestic economy; the individuals cannot ground their old-age economic security on children (Caldwell) and land factor (Caucutt et al.), hence, on the one hand, they choose to reduce their fertility, triggering the demographic transition and, on the other hand, support a system which is able to substitute the old familiar structure. Since the reduction of the overall fertility rate affects the attractiveness of a pay-as-you-go pension system, the economic transition has two opposite effects on it.

The purpose of the present paper is to study these two effects, in order to evaluate their empirical relevance on the development of pension system. It will be suggested a model which tries to evaluate the effects of the family breakdown on the introduction of pension system, taking into account the effect of fertility reduction. The paper is organized as follows: section 2 presents the model, section 3 presents the empirical results of the estimation of the model and section 4 concludes.

2 The basic model

2.1 The environment

In our economy agents live a maximum of two periods: at the end of the first period, which is called middle-age, agents face a probability π of surviving to the second and last period of life. Moreover the economy has two locations, the *farm* and the *city*. In the farm family ties are stronger than in the city, and this is reflected in the amount of transfer that children award to their parents. A proportion γ of the population lives in the farm and the others live in the city. Individuals differ in their income (w^i), which is distributed in the population with mean w and cumulative distribution function $F(\cdot)$, which is positively skewed. The objective function of a middle-aged agent living in the $k \in (C, F)$ location and having an income level w^i is:

$$u(c_1^{ik}, c_2^{ik}) \equiv \ln(c_1^{ik}) + \beta\pi \ln(c_2^{ik}) \tag{1}$$

where $c_t^{ik}, t \in (1, 2)$ is the consumption of the unique good in the t-th period of life and β is the discount factor.

In the first period each agent i receives w^i units of good, upon which she has to pay a contribution τ proportional to her income (if a pension system is established). Moreover, she chooses how many children to have: for each child she bears a cost of θ. The income that is not invested in children should be consumed, otherwise it is wasted. Hence the budget constraint for the first period is:

$$c_1^{ik} + \theta N^{ik} \leq (1 - \tau)w^i \tag{2}$$

In the second period, agents receive a transfer d^k from each child they had in the first period; this transfer depends on the strength of family ties: I assume that in the farm the transfer is higher than in the city ($d^F > d^C$). Moreover agents receive a transfer from the social security system, which is equal to the total amount of contributions collected from workers by the system divided by the number of agents survived. Hence the budget constraint in the second period is:

$$c_1^{ik} \leq d^k N^{ik} + \frac{N\tau w}{\pi} \tag{3}$$

where N is the total (or mean) fertility, hence it is given by:

$$N \equiv \gamma N^F + (1 - \gamma)N^C$$

where with N^k stands for the mean fertility in location k.

It should be noticed that as savings are not allowed, the only way in which agents can voluntary transfer wealth from the first period to the second is by having children. In this economy, children are perceived as investment, and this investment is more profitable for farmers than for urban residents.

The choice of establish a social security system is taken by vote. If the system is established, it cannot be abolished the following period. This assumption is necessary because if agents would expect the abolition of the pension system, they would not vote for it, even if its approval would be optimal.

The social security system allows people to transfer wealth to their old-age, but the amount they can transfer is chosen collectively. Therefore there are agents who would prefer to transfer more than what is established, and they will have children, and other agents who would like to transfer a smaller amount, and they will not have children (actually they would like to have a "negative" amount of children, which is obviously not possible).

2.2 Voters' behaviour

Maximizing (1) subject to (2) and (3), with respect to the choice variables $\{c_t^{ik}, N^{ik}\}_{t=1,2}$, we obtain the following three expressions:

$$c_1^{ik} = \frac{\theta w^i}{d^k(1+\beta\pi)}\left[\frac{d^k}{\theta} + \tau\left(\frac{Nw}{\pi w^i} - \frac{d^k}{\theta}\right)\right] \tag{4}$$

$$c_2^{ik} = \frac{\beta\pi w^i}{(1+\beta\pi)}\left[\frac{d^k}{\theta} + \tau\left(\frac{Nw}{\pi w^i} - \frac{d^k}{\theta}\right)\right] \tag{5}$$

$$N^{ik} = \frac{\beta\pi w^i}{d^k(1+\beta\pi)}\left[\frac{d^k}{\theta} - \tau\left(\frac{Nw}{\beta\pi^2 w^i} + \frac{d^k}{\theta}\right)\right] \tag{6}$$

From equation (6), we can easily see that if the pension system becomes too large (as an extreme $\tau = 1$), we have a corner solution, with $N^{ik} = 0$. Through some straightforward algebra, we easily obtain the threshold for each agent:

$$\hat{\tau}^{ik} = \frac{\beta\pi\frac{d^k}{\theta}}{\beta\pi\frac{d^k}{\theta} + \frac{Nw}{\pi w^i}} \tag{7}$$

If $\tau \geq \hat{\tau}^{ik}$, then the agent will choose not have children and the consumption in the two periods will be:

$$c_1^{ik} = (1-\tau)w^i$$
$$c_2^{ik} = \frac{N\tau w}{\pi}$$

It should be noticed that for every τ°, there exists a threshold endowment $w^{\circ k}$, such that agents living in k with endowment lower than $w^{\circ k}$ will not have children:

$$w^{\circ k} = \frac{N\theta\tau^\circ}{\beta\pi^2 d^k(1-\tau^\circ)}w$$

The effect on individual fertility of an increase in τ is unambiguously non-positive: as τ increase, the agents have a smaller available income to invest on children, and, at the same time, they already have a larger amount of transfer from the pension system in the second period, then they need to shift a smaller amount of income to the old-age through children investment. In general the effect will be negative, because $N(\tau)$ can become flat only if $\tau = 1$, and neither the richest among the farmers wants to have children, but in equilibrium this may happen only if the elderly are the majority in the population.

Moreover a migration from the farm to the city (i.e., an increase in γ) would imply a reduction in the total fertility, hence in the profitability of the pension system, because urban residents have a lower fertility.

2.3 Political equilibrium

In order to obtain the preferred policy by each agent, first we have to look at how a marginal change in the policy affects the voters' welfare:

$$\frac{\partial V^{ik}}{\partial \tau} = \frac{1+\beta\pi}{(1-\tau)\frac{d^k}{\theta} + \tau\frac{wN(\tau)}{w^i\pi}} \left[\frac{w}{w^i\pi}(N(\tau) + \tau N'_\tau(\tau)) - \frac{d^k}{\theta} \right] \tag{8}$$

A marginal increase in the rate of contribution has three effects on the voters' indirect utility. First, an increase in the share of income compulsorily invested in the pension system: this effect depends on the return on pension system, which is higher for poorer voters. Second, a decrease in the return on pension system, keeping fixed the amount of income invested in it. Third, a decrease in the share of income invested in children: this effect depends on the return on children, which is higher in the farm than in the city.

The sign and the size of the overall effect is different between farmers and urban residents and between poor and rich voters: farmers have a larger negative effect, as they have to give up a larger return from children; rich voters have a smaller positive effect, as for them the return on pension is smaller.

We can rewrite equation (8) as follows:

$$\frac{\partial V^{ik}}{\partial \tau} = \frac{1+\beta\pi}{(1-\tau)\frac{w^i d^k}{w\theta} + \tau\frac{N(\tau)}{\pi}} \left[\left(\frac{N(\tau)}{\pi} + \frac{\tau}{\pi}N'_\tau(\tau) \right) - \frac{w^i d^k}{w\theta} \right] \tag{9}$$

From this equation we can easily identify a pair of farmer and urban resident who have similar preference toward the policy rule. In fact we get:

$$w^{iF} = \frac{d^C}{d^F} w^{iC} \tag{10}$$

For any urban resident with income w^{iC}, there is always a farmer, with income w^{iF}, with the same preference toward the policy rule, and the farmer is always poorer than his urban correspondent. Since a farmer has a higher return from children investment, he must have a lower income (then a higher return from pension) in order to prefer the same level of pension of an urban resident.

Since preferences are monotonic in endowment, the single crossing condition is satisfied and a Condorcet winning tax rate does exist. To find the equilibrium policy, we need to know which is the pair of voters (a farmer and an urban resident) who play the median voter role. Let w^{*k} be the endowment of a voter resident in k and with preferred policy τ^*; setting (9) equal to zero and solving for w^{*k}, we find that the relation between favourite policy and endowment is given by:

$$w^{*k} = \frac{w\theta}{\pi d^k} \left[N\left(\tau^*\right) + \tau^* N'_{\tau}\left(\tau^*\right) \right] \tag{11}$$

Let τ^{*m} be the equilibrium policy; in equilibrium, the number of voters who support $\tau > \tau^{*m}$ must be equal to the number of voters who support $\tau < \tau^{*m}$. In the first coalition there will be all the elderly and the poorer among the middle-aged voters (with a larger proportion among the urban residents, as they are more favourable to the pension system). Using equations (10) and (11) the equilibrium is defined by the following equation[1]:

$$\begin{aligned} (1-\gamma)F\left(\frac{w\theta}{\pi d^C}[N(\tau^{*m}) + \tau^{*m}N'_{\tau}(\tau^{*m})]\right) & \\ + \gamma F\left(\frac{w\theta}{\pi d^F}[N(\tau^{*m}) + \tau^{*m}N'_{\tau}(\tau^{*m})]\right) &= \frac{N(0)-\pi}{2N(0)} \end{aligned} \tag{12}$$

A higher level of urbanization has two opposite effects: it increases the weight of urban voters, who are more willing to support the pension system, but it also decrease the fertility, making the pension system less attractive. It is important to notice that this second effect is not captured in a model with exogenous fertility; therefore in this model the positive effect of the urbanization on the probability of introduction of the pension system is dampened, and several relation patterns between pension expenditure and urbanization may occur.

A lower family-based transfer from children in one location makes the voters of that location more willing to substitute children with pension system, but at the same time it reduces the total fertility, hence the number of voters who support pensions in both locations.

A higher survival probability increases the total fertility, because agents are willing to save more, but increases also the number of agents that will survive to the last period. Therefore the effect on the profitability of pension system depends on the level of the parameters. Moreover, a higher survival probability increases the number of current old voters, thus increasing the number of voters who support the pension system. The overall effect on the equilibrium policy is ambiguous, and it will depend on the shape of the income distribution function.

3 Empirical findings

As the relation between strength of the family ties and pension system may assume several patterns, an empirical evaluation of such a relation is needed.

The main conclusion of the model is that the weakening of family ties at first promotes the introduction of pension systems, due to the reduction of the economic support from the descendants and the need for substitution between a familiar system and a centralized one, and then causes a reduction of the

[1]The number of elderly is $\frac{\pi}{N(0)}$, as in the previous period the pension system had not yet been introduced.

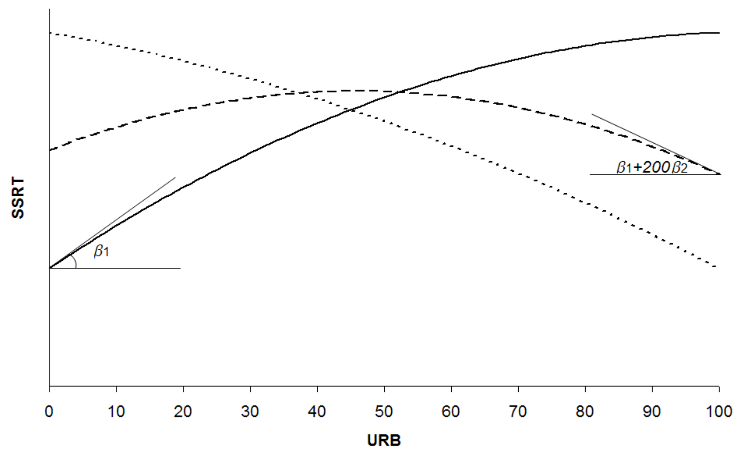

Figure 1: Possible development patterns of pension systems

political support, due to the reduction of total fertility and resulting reduction of the profitability of the centralized system[2].

3.1 Methodology

The basic specification that will be used for the regression is the linear model:

$$\tau_i = \beta_0 + \beta_1(1-\gamma)_i + \beta_2(1-\gamma)_i^2 + \beta_3 w_i + \beta_4 N_i + \beta_5 \pi_i + u_i \qquad (13)$$

The idea, to sum up, is to test the coefficients β_1 and β_2, in order to pick up the prevalent development pattern. On the strength of what has been said above, we expect β_2 to be negative, whereas the relation between β_1 and β_2 will allow us to pick up the pattern (since $(1-\gamma)$ is measured in percentage, if $\beta_1 > -200\beta_2$ the relation is monotonically increasing, if $0 < \beta_1 < -200\beta_2$ the relation is an inverted-U, whereas if $\beta_1 < 0$ the relation is monotonically decreasing; see figure 1).

Initially, I will use the OLS method and, after an endogeneity test, I will eventually use the IV estimator. Moreover, at first it will be shown the results obtained using cross-sectional data, and then those obtained with panel-data.

3.2 The data set

Given the specification (13), the data set needs to include:

SSRT the dimension of pension system, measured by the ratio between contributions and GDP;

[2]Numerical simulations, available upon request, showed three possible development patterns (monotonically increasing, monotonically decreasing and inverted-U), all of them concave.

Variable	Description	Mean	St. Dev.	N	Min	Max
SSRT	Social contributions (% of GDP)	5.49	5.31	90	0	17.94
URB	Urban population (% of the total)	62.51	21.66	90	9.16	100
OPOP	Over-65 population (% of the total)	9.34	5.19	90	1.08	18.88
GDPPC	Per-capita GDP, PPP (thousands of 2005 international dollars)	14.03	13.02	90	0.34	65.81
TFR	Total fertility rate	2.37	1.3	90	0.84	6.8
CMR	Child mortality rate (under 5 per 1000 births)	37.14	46.38	89	3.22	186.1
SCFMRT	Ratio of female to male in the secondary school enrollment	99.58	12.68	87	42.6	121.3
GINI	Gini index	39.08	9.43	66	25	60.05
TAXAT	Tax revenue (% of GDP)	16.28	6.3	90	0.96	29.53

Table 1: Descriptive statistics (2002 cross-section)

URB the urban rate, that is the ratio of urban to total population;

GDPPC the per-capita GDP based on PPP;

TFR the total fertility rate, that is the average number of children per woman;

OPOP the size of old-age population, measured by the ratio of over-65 to total population.

Moreover I will use some control variables, the Gini index (GINI), as a measure of income heterogeneity, and the fiscal incidence (TAXAT), measured by the ratio of fiscal contributions to GDP.

For the endogeneity test and the IV regressions other two variables will be used: the child (under the age of five) mortality rate (CMR) and the female education level, measured by the ratio of female to male secondary enrollment (SCFMRT). Thus, I consider such variables relevant in explaining the fertility rate (because of the "hoarding" effect and the Caldwell hypothesis about social policy and fertility cost), but exogenous with respect to the estimated model.

The data used are those provided by the World Bank[3]. Since we need a data set which include the largest possible number of countries, we can perform two type of analysis: either a cross-sectional one on 2002 data (the year with the highest number of observations) and, if not available, on the closest ones, or a panel one on five-year average data between 1990 and 2005, which will have

[3]World Bank, World Development Indicators April 2008, ESDS International, University of Manchester

Variable	A	B	C	D	B2	B2-IV
URB	0.1053**	0.1753***	0.0948**	0.1733***	0.1778***	0.1514**
	(2.385)	(2.867)	(2.103)	(2.881)	(2.935)	(2.499)
URBSQ	-0.0011**	-0.0014**	-0.0011**	-0.0014**	-0.0013**	-0.0011*
	(-2.583)	(-2.504)	(-2.444)	(-2.569)	(-2.49)	(-1.969)
OPOP	0.8485***	0.7632***	0.8837***	0.748***	0.7946***	0.6926***
	(9.577)	(6.685)	(9.725)	(6.658)	(7.592)	(6.144)
GDPPC	0.055*	0.0242	0.0598**	0.0126		
	(1.981)	(0.833)	(2.134)	(0.422)		
TFR	0.2674	0.5195*	0.2918	0.4834*	0.5807**	0.1054
	(0.97)	(1.966)	(1.068)	(1.85)	(2.149)	(0.331)
GINI		-0.1222***		-0.1181***	-0.13***	-0.1331***
		(-3.017)		(-2.909)	(-3.101)	(-3.192)
TAXAT			-0.0593	0.081		
			(-0.894)	(1.121)		
Constant	-5.4967***	-3.3746	-4.6515**	-4.3179*	-3.5276	-0.8212
	(-3.231)	(-1.475)	(-2.244)	(-1.941)	(-1.556)	(-0.322)
URB^{MAX}	46.707	63.902	45.004	63.200	66.749	70.513
	(5.455)	(7.914)	(6.853)	(7.601)	(8.817)	(12.065)
N	90	66	90	66	66	65
AIC	448.694	309.96	449.427	310.121	308.593	
BIC	463.693	325.288	466.925	327.639	321.731	
R^2	0.732	0.804	0.735	0.809	0.802	0.806

* 10% significant; ** 5% significant; *** 1% significant
Standard errors are Huber-White corrected
T-statistics in parentheses for the estimated coefficients
Standard errors in parentheses for the estimated URB^{MAX}

Table 2: Cross-section estimates

a limited validity because of the smaller number of observations per country. Using the cross-sectional data we can analyze up to 90 countries (except when we will include the Gini index in the regression, reducing the number of observations to 66).

3.3 Estimates

Table 2 shows the results of the regression analysis. The model A is the basis one, represented by equation (13), whereas the others add more control variables. It is important to notice that the B and D estimations include a smaller number of countries, because of the fewer observations of the Gini index, therefore the results are not perfectly comparable.

The first important result is the important role played by the share of elderly:

this result is quite predictable, both from a political viewpoint (elderly get a stronger political power) and from an economic one (a higher number of elderly requires a bigger pension system). The estimated coefficients imply that a 1% increase in the old-age share of the population induces a 0.8% increase in the ratio between social contributions and GDP.

The URB and URBSQ estimated coefficients support the concavity of the relation, and in particular the inverted-U pattern: for low levels of the urbanization rate, as it increases the pension system expands, but for higher levels of urbanization the relation is inverted. URB^{MAX} is the estimated maximum of the relation. The considerable difference between the models including the Gini index or not may be ascribed to the reduction of the observed countries, hence to a different distribution of the URB variable.

The per-capita income level seems to have a small positive effect on the dimension of pension system, as claimed by the Wagner law. However, such effect is rather limited, and it is not significant when the Gini index is taken into account.

The Gini index is significant, but the sign of the estimated coefficient is negative, which seems to contradict the hypothesis that a higher income heterogeneity leads to bigger pension system, due to the demand of income redistribution policies. The negative relation, instead, seems to catch the effect of the welfare state level of development: in countries where higher is the development of welfare state, the Gini index is lower as outcome of the income redistribution policies. Moreover, when the Gini index enter the equation, it makes the per-capita income not significant, absorbing its role of measure of the socioeconomic development. The B2 model does not take into account the per-capita income variable, and the results are not significantly different from the B model.

The fiscal incidence is never significant in explaining the size of pension systems: this in part contradicts the Leviathan theory about the tendency of governments to expand as much as possible the scope of their authority.

For the B2 model, I performed an endogeneity Hausman test on fertility, using the child mortality rate and the ratio of female to male in the secondary school enrollment, and the null hypothesis of exogeneity was rejected. Then I estimated the B2 model, using the IV estimator, and the results are shown in the last column of table 2. In the first stage, the two instruments resulted highly significant and the F-statistic was equal to 64.82. The null hypotheses of the J-test and the Sargan test about the exogeneity of the instruments were not rejected (respectively with 0.513 and 0.582 p-value). The estimated coefficients results quite similar to those obtained with the OLS estimator, and URB^{MAX} becomes higher, but not significantly.

In conclusion, all the estimates support the inverted-U pattern of development. However the models provide noticeably different estimates of the maximum of such curve, in particular when the Gini index is taken into account (probably because of the smaller number of observations and the consequent different distribution of URB). The best estimates seem to be the A, because of the higher number of observations, and the B2-IV, because it takes into account also the Gini index and seems to be more precise. Both models suggest that

Variable	A	B	C	B2	A-IV	A2-IV
URB	0.1623***	0.1428***	0.1585***	0.1407***	0.1494**	0.1434**
	(3.423)	(3.036)	(3.397)	(2.933)	(2.316)	(2.247)
URBSQ	-0.0015***	-0.0011**	-0.0014***	-0.001**	-0.0013**	-0.0012**
	(-3.227)	(-2.396)	(-3.189)	(-2.139)	(-2.351)	(-2.316)
OPOP	0.4864***	0.431***	0.4796***	0.4995***	0.5768***	0.6046***
	(5.214)	(3.298)	(4.962)	(4.512)	(6.258)	(7.474)
GDPPC	0.0263	0.0566	0.0236		0.0244	
	(0.905)	(1.107)	(0.881)		(0.773)	
TFR	-0.2317*	-0.1158	-0.2435*	-0.0598	-0.0772	-0.1208
	(-1.797)	(-0.758)	(-1.89)	(-0.363)	(-0.205)	(-0.32)
GINI		-0.111***		-0.1184***		
		(-3.439)		(-3.292)		
TAXAT			0.038			
			(1.051)			
Constant	-2.4842**	1.8052	-2.9188**	1.7376	-3.6474	-3.4024
	(-2.124)	(0.936)	(-2.449)	(0.875)	(-1.299)	(-1.208)
URB^{MAX}	55.275	64.220	55.411	69.261	57.830	58.741
	(4.714)	(9.358)	(4.847)	(12.731)	(7.827)	(7.391)
N	226	130	226	131	182	186
N_g	99	75	99	76	95	98
g	2.283	1.733	2.283	1.724	1.916	1.898
R^2	0.706	0.707	0.7	0.701	0.723	0.72

* 10% significant; ** 5% significant; *** 1% significant
Standard errors are cluster corrected
T-statistics in parentheses for the estimated coefficients
Standard errors in parentheses for the estimated URB^{MAX}

Table 3: Panel estimates

over a certain level of urbanization, between 50 and 70%, the pension systems tend to become smaller.

Table 3 shows the results of the panel analysis: the specification are analogous to those of table 2, and are estimated with random effects.

The pattern supported by all the estimates is still the inverted-U one. The maximum of the relation, again, depends on whether the Gini index is included in the regression or not.

Both the per-capita income and the fiscal incidence are not significant, whereas the Gini index is highly significant and, again, seems to have a negative influence on the dimension of pension systems.

The fertility rate results significant only for the specifications which do not include the Gini index. In this case the Hausman test rejects the null hypothesis of exogeneity, hence I used IV, and the results are shown in last two columns. The main difference concerns the coefficient on old-age population, whereas the maximum of the relation between pension system and urban population holds essentially steady at 58%.

4 Conclusions

Part of the economic literature, and particularly the Caldwell hypothesis, explain the reduction of fertility with the evolution of the social structures and the transition from a rural economy, in which the children were a source of wealth, to a urban and westernized economy, in which children subtract resources from the domestic economy.

The smaller ascendant intergenerational transfer causes the need for a social policy able to maintain old-age consumption, stimulating the introduction of pension systems and their expansion.

The theoretical model presented in section 2 analyzes the net effect of the weakening of family ties on the dimension of pension system, taking into account the reduction of fertility and, therefore, the reduction of the rate of return of pay-as-you-go pension systems. The relation between the strength of family ties and the dimension of pension system may assume several shapes, either monotonic or not, but presumably concave.

The empirical analysis, shown in section 3, support an inverted-U development pattern: a continuous and progressive weakening of family ties, after inducing the introduction of pension systems, tends to reduce, *ceteris paribus*, their political support.

The reduction of political support toward social security systems, caused by the reduction of the fertility rate, is partially offset by the progressive ageing of the population which, on the one hand, reduces as well the profitability of pension system, but on the other hand increases the political weight of old-age voters: the overall effect of the ageing of the population is positive, as acknowledged by the previous literature in the field.

However, if fertility rates continue their rapid decline, as in the past years, pay-as-you-go pension systems may not be sufficiently profitable for them to be supported by the majority of the voters, hence being destined to disappear or replaced by the funded ones.

References

Aaron, H., 1966. The social insurance paradox. Canadian Journal of Economics and Political Science 32, 371–374.

Barro, R. J., Becker, G. S., 1989. Fertility choice in a model of economic-growth. Econometrica 57, 481–501.

Becker, G. S., Barro, R. J., 1988. A reformulation of the economic-theory of fertility. Quarterly Journal Of Economics 103, 1–25.

Becker, G. S., Lewis, H. G., 1973. On the interaction between the quantity and quality of children. Journal of Political Economy 81, S279–88.

Boldrin, M., Jones, L. E., 2002. Mortality, fertility, and saving in a Malthusian economy. Review of Economic Dynamics 5, 775–814.

Boldrin, M., Rustichini, A., 2000. Political equilibria with social security. Review of Economic Dynamics 3, 41–78.

Breyer, F., 1994. The political economy of intergenerational redistribution. European Journal of Political Economy 10, 61–84.

Browning, E. K., 1975. Why social insurance budget is too large in a democracy. Economic Inquiry 13, 373–388.

Caldwell, J. C., 1976. Toward a restatement of demographic transition theory. Population and Development Review 2, 321–366.

Caldwell, J. C., 1978. A theory of fertility: From high plateau to destabilization. Population and Development Review 4, 553–577.

Casamatta, G., Cremer, H., Pestieau, P., 2000. The political economy of social security. Scandinavian Journal Of Economics 102, 503–522.

Caucutt, E. M., Cooley, T. F., Guner, N., 2007. The farm, the city, and the emergence of social security. Working Paper 12854, National Bureau of Economic Research.

Cigno, A., Rosati, F. C., 1992. The effects of financial markets and social security on saving and fertility behaviour in Italy. Journal of Population Economics 5, 319–41.

Cooley, T. F., Soares, J., 1999. A positive theory of social security based on reputation. Journal Of Political Economy 107, 135–160.

Cukierman, A., Meltzer, A. H., 1989. A political theory of government debt and deficits in a Neo-Ricardian framework. American Economic Review 79, 713–732.

Cutler, D. M., Johnson, R., 2004. The birth and growth of the social insurance state: Explaining old age and medical insurance across countries. Public Choice 120, 87–121.

de Walque, G., 2005. Voting on pensions: A survey. Journal Of Economic Surveys 19, 181–209.

Diamond, P. A., 1965. National debt in a neoclassical growth model. American Economic Review 55, 1126–1150.

Galasso, V., Profeta, P., 2002. The political economy of social security: a survey. European Journal of Political Economy 18, 1–29.

Hansson, I., Stuart, C., 1989. Social security as trade among living generations. American Economic Review 79, 1182–95.

Kalemli-Ozcan, S., 2002. Does the mortality decline promote economic growth? Journal of Economic Growth 7, 411–439.

Leibenstein, H., 1957. Economic backwardness and economic growth. Wiley, New York (NY).

Samuelson, P. A., 1958. An exact consumption-loan model of interest with or without the social contrivance of money. Journal of Political Economy 66, 467–482.

Tabellini, G., 1991. The politics of intergenerational redistribution. Journal of Political Economy 99, 335–57.

Tabellini, G., 2000. A positive theory of social security. Scandinavian Journal Of Economics 102, 523–545.

Veall, M. R., 1986. Public pensions as optimal social contracts. Journal Of Public Economics 31, 237–251.