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THE ROLE OF SOCIAL SECURITY IN HOUSEHOLD DECISIONS: VAR ESTIMATES OF SAVING AND FERTILITY BEHAVIOUR IN GERMANY

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Abstract

Estimating saving and fertility simultaneously by the VAR method, we find that social security cover has a positive effect on household saving, and a negative effect on fertility. In Germany, as in other countries where the hypothesis was tested, social security is thus good for growth. A possible explanation for this unconventional finding is that compulsory saving in the form of pension contributions tends to displace intra-family transfers, rather than asset formation. However, the negative effect of social security on fertility tends to erode the system's own contributory base, because it reduces the number of future contributors. That is one of the reasons why, in Germany as elsewhere, pay-as-you-go pension systems tend to be financially unstable. To some extent, this is counteracted by child-related benefits, which tend to encourage fertility, but the effect appears to be weak.

JEL Classification: E21, H31, H55, J13, J14, C32

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1. Introduction

In a series of papers, Cigno and Rosati (1992, 1996, 1997) report that, contrary to conventional wisdom, social security coverage tends to stimulate aggregate household saving, and to depress fertility. This appears to dispell the widely held view that compulsory saving through a public pension system is bad for growth. On the other hand, since the fertility rate is an inverse predictor (for any given trend in life expectancy) of the age-dependency ratio thirty years hence, the finding of a negative effect of social security on fertility provides an explanation for the periodical financial crises, associated in large measure with an ever rising number of beneficiaries for each contributor, undergone by pay-as-you-go pension systems throughout the world. However, the only estimates available for Germany, presented in the 1996 article, show an insignificant effect of social security coverage on household saving. As pointed out to us by Martin Werding, this could reflect the fact that, in the case of Germany, C-R used too broad a definition of social security expenditure, including more than just old-age pensions. The present paper improves on C-R in a number of ways. It uses the correct social security data, introduces various kinds of child-related benefits as additional variables, and extends the sample period. It also uses a more sophisticated econometric methodology, that allows one to recover a number of interrelations lost in the single-equation estimatios carried out by C-R. We shall see that these innovations produce important changes in the results. Social security coverage turns out to have a positive effect on household saving in Germany, as it does in Italy, Japan, UK and USA. In Germany as elsewhere, child benefits stimulate fertility, but their effect is relatively weak. Possible ways of using this information for social security reform are discussed in the last two sections.

2. Theoretical background

Life-cycle theory predicts that compulsory participation in a pension system reduces voluntary household saving. If the system is actuarially fair (in the sense that the expected value of the benefits is equal to the expected value of the contributions), and abstracting from distortions to marginal incentives, forced saving in the form of pension contributions substitutes for voluntary saving one-for-one. If the system is more than actuarially fair, there is a further effect. For a person of working age, the promise of a pension rise, without a corresponding increase in working-life contributions, constitutes an increase in wealth, that (assuming normality) will induce him or her to consume more throughout the life cycle. Voluntary saving will thus fall more, than if the pension rise were matched by a rise in contributions. In other words, there will be a fall in voluntary saving attributable to the pension rise *per se*, and a further drop attributable to the fact that the rise is a gift.

Re-descovering Ricardian equivalence, Barro (1974) maintains that, since the "gift" to the currently active generation will have to be paid for by subsequent ones, parental love will move the beneficiaries to hand the money back to their children. Assuming that they do so in the form of bequests,[3] this will have a positive effect on saving, as current workers accumulate assets to bequeath. While an increase in social security benefits matched by a corresponding increase in contributions affects saving negatively as in life-cycle theory, an intergenerational transfer (such as the one implied by a pension rise unaccompanied by a rise in contributions) will then affect saving positively. Incorporating Becker's ideas on endogenous fertility, Becker and Barro (1988) adjust the aim of Barro (1974) to account for the fact that the increase in bequests induced by an intergenerational transfer would raise the marginal cost of a child, thereby triggering a substitution away from number of children. While an increase in social security cover *per se* (*i.e.,*paid for by the beneficiaries) reduces saving, and has no effect on fertility, as in life-cycle theory and in Barro (1974), an intergenerational transfer will then induce a reduction in fertility, and a rise in the amount saved for each child. Depending on the relative elasticities of per-child saving and number of children to the transfer, this could then have either a positive or a negative effect on per-adult saving (and thus on the saving rate).

Whichever assumption is made about the way a person would respond to a forced transfer from the next generation, the central idea underlying all these theories is that individuals make provision for old age exclusively through the capital market. Cigno (1993) proposes an alternative framework, where working-age individuals can either accumulate assets by saving, or accumulate credits towards their own children by giving them material and personal support in the early stages of life.[4] In developed economies, the return to the latter will be predominantly in terms in personal attention (rather than material support) when the children have reached working age, and the parents are old. As fertility is then seen as a vehicle for life-cycle re-allocations, compulsory saving in the form of pension contributions reduces the incentive to have children. It also reduces voluntary saving for those who would have used the capital market anyway, but increases it for

[3] Or, at any rate, "late" in life.
[4] Rosati (1996) eliminates the dicothomy between saving and fertility by introducing uncertainty. The comparative-statics properties of the model remain substantially unchanged, but the agent will not necessarily jump from one corner solution to the other.

those who would have otherwise invested in children only.[5] Thus, social security *per se* displaces asset accumulation for some, fertility and voluntary transfers for others. While the effect on aggregate fertility is clearly negative, the effect on aggregate household saving may thus be positive or negative (rather than necessarily zero as in Becker-Barro). A forced intergenerational transfer in favour of current workers reduces current saving by those who save (as in life-cycle theory), but it raises the number of those who invest in children instead of saving.[6] The effect on aggregate fertility is thus positive, but the effect on aggregate household saving is ambiguous.

The different household decision models have different implications also with regard to the effects of child-related benefits.[7] An increase in the child benefit rate financed by taxes on current workers re-distributes from individuals in the middle to individuals at the earlier stages of the life cycle. If fertility is exogenous, as in life-cycle theory or Barro (1974), the effect on aggregate household saving is obviously negative, because the young save proportionately less than the middle-aged. If fertility is endogenous, however, child benefits reduce the marginal cost of children. In a model *à la* Becker and Barro (1988), there would then be a positive effect on fertility, an ambiguous one on saving. The same is true of Cigno (1993), but for different reasons. On the one hand, the number of those who invest exclusively in the capital market falls relative to those investing in children. On the other, risk-spreading considerations (Rosati, 1996) will induce the latter to accumulate more assets, as well as to have more children.

Wage rates raise full income, which has a positive effect on saving and, if fertility is endogenous, on the number of children. However, wage rates (particularly the mother's) raise also the opportunity-cost of having a child. In endogenous-fertility models, there is thus a substitution-effect away from number of children, which is empirically found to dominate the positive income-effect in the case of female wage rates, to be dominated by it in the case of male wage rates. In a model *à la* Barro-Becker, where the number of children is a substitute for the lifetime utility ("quality") of each child, the effect of male wage rates is then positive for both saving and fertility, while that of female wage rates is ambiguous for saving, negative for fertility. In Cigno (1993), where children are an alternative to conventional assets, the effect of male wage rates is again positive for both saving and fertility, but the effect of female wage rates is negative for both.

The effect of the interest rate on saving is notoriously ambiguous in life-cycle theory, and so it remains in more complicated models. The same is true of its effects on fertility, in models where the latter is endogenous.

3. The evidence so far

Taking fertility as exogenous, and overlooking the possible effects of intergenerational re-distributions caused by deficit-financing, Feldstein (1974, 1980) and many others after him (*e.g.*, for Germany, Kim, 1992) have found a negative effect of social security on household saving.[8] Taking fertility and household saving as simultaneously determined, and controlling for the social security deficit, however, Cigno and Rosati (1996) find that, in Italy, UK, USA and West Germany, social security coverage has a negative effect on fertility,[9] rather than on saving. Aggregate household saving is found to be positively affected by social security cover everywhere[10] except in West Germany, where the effect is not significant. The social security deficit has no significant effect on fertility, but it has a significantly negative effect on saving in all the countries considered, including West Germany. In the UK, the only country for which such data were available, C-R find that child benefits have a positive effect on fertility, but no significant effect on saving. Fertility is also found to be affected positively by male wage rates, negatively by female ones.[11] Interest rate effects turn out to be either small or insignificant. All in all, these findings appear to reject not only the exogenous-fertility hypothesis underlying both life-cycle theory and Barro (1974), but also the Becker-Barro approach to the simultaneous determination of saving and fertility, in favour of the line of explanation provided by Cigno (1993) and Rosati (1996). They also point to a possible "anomaly": in West Germany, aggregate household saving does not appear to be affected by social security cover like everywhere else. While consistent with the same theoretical model, this suggests that something in that country may be different.

C-R's are single-equation estimates, based on aggregate time series. Using co-integration methods, C-R estimated a saving and a fertility equation separately for each country, using social security coverage, the social security deficit, the child benefit rate (not in the case of Germany), the rate of interest, income, and the average male and female wage rates, as

[5] In the model, making transfers to parents is a condition for receiving transfers from children, but the size of the former (an implicit loan re-payment) is unrelated to the size of the transfers made to children (an implicit loan). Suppose that a person, who would have otherwise relied on this system of intra-family transfers, is obliged to contribute to a public pension scheme. This will make her want to have fewer children, and to lend them less. But, if she lends them anything at all, she must also honour her fixed debt to her own parents, or her children will not honour theirs. If that is not be worth her while, she will drop out of the intra-family transfer system altogether, and top up her expected pension by saving through the capital market.

[6] The reason is that the marginal utility of current income increases with the number of childrren (Cigno, 1993). By introducing uncertainty, Rosati (1996) eliminates the dicothomy between saving and having children.

[7] Although neither Becker nor Barro, even less Modigliani and the other life-cycle theorists, have ever concerned themselves with the issue.

[8] But see the contrary findings of Graham (1987).

[9] Similar results apply to developing countries. For a survey, see Cigno (1992).

[10] Cigno and Rosati (1997) report a positive effect of pension coverage, and a negative effect of the deficit, also for Japan.

[11] Saving is positively affected by income, rather than by the wage rates.

regressors. This estimated equations are interpreted as a reduced form of the aggregate[12] household model that generated the data. Since the theoretical prediction of Cigno (1993) regarding the effect of social security on aggregate household saving is ambiguous, the finding of an insignificant effect could simply mean that, in Germany unlike elsewhere, the positive effect on the amount saved by some of the households (those who invest in children), and the negative effect on the amount saved by others (those who invest exclusively in conventional assets), cancel out. But it could also mean that the C-R estimates are inaccurate. Given the importance of saving and fertility for economic growth, and for the financial balance of pay-as-you-go social security systems, we re-estimated the two equations simultaneously, using longer time-series and a more sophisticated method of estimation, that does not assume, beforehand, which are the independent and which the dependent variables. The latter is relevant, because saving and fertility affect growth, and growth in turn affects not only wage and interest rates, but also social expenditures such as old-age pensions and child benefits. There could thus be reverse causation from saving and fertility to the variables that C-R assume to be exogenous, as well as cross-links, missed out by single-equation estimation. We also used more accurate pension data, and included various measures of child-related benefits (omitted in the C-R estimates for Germany).

4. Variables and data

As in Cigno and Rosati (1996), household saving is defined as the difference between household disposable income and expenditure. Fertility is the total number of births over a woman's lifetime. Social security coverage is alternatively defined as the ratio of total pension benefits to number of persons aged 65 or over (the "intensive" measure), or as the ratio of number of old-age pensions to number of persons aged 65 or over (the "extensive" measure). The social security deficit is the difference between social security benefits and contributions. In their 1996 paper, C-R used, for Germany, a definition of benefits that includes not only pensions, but also other forms of public transfer. In the present paper, by contrast, we only include pensions. We also introduce a new variable, not used for Germany in the C-R study, that provides a measure of child-related benefits. This is defined as the sum, per child, of an actual cash transfer (*Kindergeld*), an additional cash payment reserved for parents of very young children (*Erziehungsgeld*) and a tax allowance (*Kinderfreibetrag*). Another child-related variable is represent by the notional pension contribution credited to parents who withdraw from the labour market in order to look after a new-born child.[13] The other variables are, as in C-R, household disposable income, the average male and the average female wage rate, and the long-term rate of interest. All monetary variables are at 1990 prices. All variables, except the interest rate, are in logs. The sample period is 1960–95, as against 1965-90 in C-R.

FIGURES 1 AND 2 ABOUT HERE

The fertility rate measures completed fertility per woman (the total number of children born, on average, to a woman between the ages of 15 and 49). As shown in Fig. 1, West German fertility rises slowly from 1960 to 1966. After that date, it falls rapidly, from a peak of just over two and a half children per woman, to just under one and a half towards the end of the 70s. From then onwards, the decline tends to slow down, eventually turning into a slight recovery from the second half of the 80s. The same figure shows also the child benefit rate, calculated, as already explained, as the sum of the tranfers and tax allowances to which the average household is entitled for each child. This rate rises fast from 1982 onwards. In particular, there is a big jump in 1986.[14] That is also the year in which a parent withdrawing from the market to look after a child starts to be credited with the notional pension contribution mentioned earlier. However, since the per-child value of these credits, not shown, is collinear with the child benefit rate, the two variables cannot be used at the same time (we choose the child benefit rate, that covers the whole sample period). To test for the possibility of a structural break in the series, we tried a dummy for that year, which turned out to be significant (more about this later).

The saving rate is defined as the ratio of household saving to household disposable income. Fig. 2 shows this rate growing rapidly from the beginning of the 60s to the mid-70s, when it passes the 15 % mark. After the oil shocks of that period, we observe fluctuations around a downward trend, finally bringing household saving below 12 % of household disposable income.

FIGURES 3 AND 4 ABOUT HERE

[12] In Cigno (1993), the theory endogenously determines the proportion of households relying exclusively on the capital market, and that of of households investing also in children.

[13] The credit is equal to a fraction (originally less than one, subsequently raised to 100%) of average earnings. This arragement, first introduced in 1986, was eventually made unconditional on the parent actually giving up work.

[14] That is the year in which the tax allowance (*Kinderfreibetrag*), withdrawn by the social-democrats in 1975, and re-introduced by the christian-democrats in 1982, shows a major increase.

Fig. 3 shows household income, and the ratio of female to male wage rates, fluctuating around rising trends. In relative terms, the average female wage rate goes up from less than 60% of the male average, at the start of the sample period, to about 71% at the end of it (but notice the dip at the end of the 60s). Fig. 4 shows the real interest rate fluctuating (with the nominal rate apparently lagging behind inflation) without any discernible trend.

FIGURE 5 ABOUT HERE

Fig. 5 shows the extensive measure of social security coverage growing throughout the sample period, and getting above 100% by the end of it. Since this index represents the number of old-age pensions per person of pensionable age, a more than full coverage implies early retirement. The intensive measure (old-age benefits per person of pensionable age) grows faster than the extensive measure, indicating a deepening of social security coverage. Although the signs of the various effects are the same whether we use the extensive or the intensive measure of coverage, the latter performs invariably better. The estimates discussed below are based on the intensive measure. The same diagram shows also the behaviour of the intensive measure of social security coverage under the broader definition (social security benefits per person of pensionable age) used by C-R. The latter grows faster than the one used in our analysis. In particular, it continues to grow in the 1975-81 period, when the correct measure is fairly flat.

FIGURE 6 ABOUT HERE

Finally, Fig. 6 shows the behaviour of the social security deficit, expressed as a percentage of household disposable income. Using the narrower definition of pension benefits, this deficit fluctuates around the 1% mark, becoming temporarily negative (*i.e.*, turning into a surplus) only between 1970 and 1975. This contrasts with the broader definition, used by C-R, which is always negative, and shows a strong negative trend (increasing surplus).

4. Econometric methodology

As already pointed out, general equilibrium considerations make it inadvisable to assume that all variables other than fertility and saving are exogenous. Although there are strong theoretical reasons for believing that fertility and saving are affected by the economic variables included in the analysis, the existence of some reverse causation cannot be excluded *a priori*. For example, the policy maker could have responded to the sustained decline in fertility by raising the child-benefit rate. Similarly, it could have responded to the sustained fall in voluntary saving by jacking up compulsory saving (social security contributions). Moreover, there could be important cross-effects between fertility and saving, that would escape single-equation estimation. Put another way, estimating single equations for saving and fertility gets rid of the endogenous correlation between these two variables, and wastes other valuable information on the behaviour of the model. This problems can be overcome by estimating the system as a VAR model. That way, all the variables are considered as potentially endogenous, and it is possible to extract all the information present in the data, without restricting oneself in advance to a particular set of causal relations.

To estimate a VAR model in levels, all the regressors must be stationary. A look at the data tells us that this not the case. To check for the presence of unit roots, we use the D-F and A-D-F tests (Dickey and Fuller, 1979). The results, reported in Table A1 of the Appendix, indicate that it is not possible to reject the null hypothesis of integration of order one, at a high level of significance, in any of the time series. However, the presence of unit roots does not rule out the possibility that we are dealing with I(2) variables. The issue has received considerable attention in the recent econometric literature, because it can lead to several problems in the specification and estimation of a model.[15] To check for the possible presence of I(2) processes it is necessary to perform unit root tests also on the first differences of the variables included in the model. The results of these tests, also shown in Table 1 of the Appendix, indicate stationarity in first differences. In the light of this, it is possible to conclude that all the variables in the model are I(1).

To avoid the problem of spurious regression induced by the presence of non-stationary variables (Granger and Newbold, 1974), it is standard practice to express the model in difference terms only. The drawback of this practice is that it wastes information about long-term relationship (important to economic analysis, crucial for its policy implications). On the other hand, if the variables are co-integrated, the problem of estimation is reduced to the I(0) space, and it is then possible, in a large sample, to use standard estimation techniques, in particular the OLS estimator, that has been proven to be superconsistent (Stock, 1987).

[15] In particular, price and wage levels have been identified as possible I(2) variables. For a comprehensive survey of the I(2) issue, see Haldrup (1998).

Under the assumption of co-integration, it is always possible to apply the Granger representation theorem (Granger, 1987) to the autoregressive representation, and to express a VAR model as an Error Correction Model (ECM). This is an alternative parameterization, that allows the short-term dynamics of the variables in the system to be influenced by deviations fron elong-term quilibrium. By this route, it is possible to estimate the elasticities that pertain to the long-term equilibrium of the model, together with the coefficients that describe the adjustment to displacements from the equilibrium path. The general form of the Error Correction Model is

$$\Delta X_t = \Pi X_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-1} + \boldsymbol{e}_t \ , \ \boldsymbol{e}_t \sim IN_n[0, \Omega] \ , \qquad (1)$$

where X_t is the (n x 1) vector of variables of interest to us, Γ an (n x n) matrix of short-run elasticities, and $\mathbf{P}$ an (n x n) matrix of long-run elasticities. If the number of unit roots in the system is lower than the number of co-integrating vectors, which we call r, the matrix $\mathbf{P}$ has not full rank, and can be written as **ab'.** The (n x r) matrix **b** characterizes the stationary long-run equilibrium.[16] The (n x r) matrix **a** characterizes the adjustment process. After having imposing a number of restrictions in order to identify the co-integrating vectors, these two matrices can be separately estimated by maximum likelihood tecniques,.

5. Estimates

As a first step, we estimate an unrestricted error-correction model with a constant term and eight variables: the fertility rate (Fert), the saving rate (Sav), social security coverage (SSC), the child benefit rate (CB), the social security deficit (SSD), male and female wage rates (Wm and Wf), and the interest rate (Int). Plotting the residuals, and examining the results of the recursive estimations of the model, makes it clear that there is a structural break in the child benefit series in 1986. As already mentioned, we include a dummy to account for this break. Confirming the presence of a break, the dummy turns out to be significant in the fertility equation, and highly significant in the saving equation.

Given the structure of the data, it is necessary to include two lags in order to get rid of autocorrelation problems in the residuals. In Table A2 of the Appendix, we report on the mis-specification tests performed for each equation. These include a version of the Portemanteau test for first-order autocorrelation (sometimes called Ljung-Box statistic), the LM test for autocorrelation of order higher than one, and the Engle test to detect the existence of an ARCH structure of the residuals, (Engle, 1982). We include also the χ^2 test for normality of the residuals.[17] To detect possible mis-specifications in the system as a whole, we also carried out multivariate versions of the Portmanteau and χ^2 normality tests. As Table A2 shows, except for a slight problem of normality in the real interest rate, the model is correctly specified, and there are no problems with the distribution of the residuals for the model as a whole.

In order to determine the rank of the cointegrating matrix $\mathbf{P}$, we perform the likelihood ratio tests proposed by Johansen (1988). The results are shown in Table A3 of the Appendix. The first of these tests refers to the maximum eigenvalue, the second is the trace test, both with small-sample correction. Unfortunately, however, these tests are not very powerful, especially in a small sample, and the results do not provide a definite specification of the cointegrating space. In particular, on the basis of the standard tests, it is not possible to reject the null hypothesis of a number of cointegrating relations that, depending on significance level, goes from 3 to 4 according to the maximum-eigenvalue test, and from 5 to 6 according to the trace test. On the other hand, after the small-sample correction, the results say that there are no co-integrating vectors in the model. Given that the sample is not very large, it is thus clear that both kinds of test can lead to a wrong specification of the co-integrating space. Further investigation is thus required.

To determine the exact cointegrating rank, we go deeper into the analysis of the $\mathbf{P}$ matrix by examining the eigenvalues of the companion matrix. These are reported in Table 1. In the unrestricted matrix, there are five roots very close to one, that can be taken to be unity, and two complex roots with a modulus close to .88. This tells us that the dimension of the cointegrating space is between 2 and 3. If we consider the hypothesis that r =3 (*i.e.*, we restrict only five of the roots, the non-complex ones, to be equal to unity), one of the two complex roots is pushed up to .93, while the other becomes .83. If we consider the hypothesis that r =2 (*i.e.*, we set six of the roots equal to unity), the last root is only equal to .81. This indicates the presence of six unit roots, and two co-integrating vectors, in the eight-variable model.

It is now possible to specify the model as a vector ECM, with a constant term, two lags for each variable, and a dummy to account for the 1986 break in the child benefits series. Given that the dummy is not restricted in the cointegrating space, and that the model is in first differences, the former becomes a step-dummy after cumulation: exactly what we need to control for a break in the child benefits series.

[16] Its columns form the basis of the row space of $\mathbf{P}$.
[17] See Doornik and Hansen, 1994 for a description.

Tab 1: Eigenvalues of the companion matrix

Eigenvalue	unrestricted	restricted r=3	restricted r=2
λ_1	.924	1	1
λ_2	.924	1	1
λ_3	.946	1	1
λ_4	.952	1	1
λ_5	.952	1	1
λ_6	.878	.92	1
λ_7	.878	.83	.81

Our second step is to estimate the eight-variables ECM with two cointegrating relations, using the FIML technique proposed by Johansen. The system of equations (1) to be estimated then becomes

$$\Delta X_t = \boldsymbol{ab}' X_{t-1} + \Gamma_1 \Delta X_{t-1} + \Gamma_2 \Delta X_{t-2} + \boldsymbol{e}_t, \ \boldsymbol{e}_t \sim IN_n[0, \Omega], \qquad (2)$$

where X_t is an eight-variable vector, and the **a** and **b'** matrices have both rank two.

Given that the theory can only make predictions about long-term relationships, we focus on the estimation of the co-integrating vectors that represent these long-term equilibrium. We identify the two vectors by setting the long-term effects of fertility on saving, and of saving on fertility, equal to zero. We thus estimate an over-identified model. The restrictions we are imposing can be tested. The test is distributed as a χ^2, with the number of degrees of freedom equal to the number of over-identifying restrictions. The null hypothesis of a wrong over-identifying restriction is rejected at a high significance level. Our estimates of the two co-integrating relations are shown in Table 2.

Table 2: Long-term relations *(standard errors in brackets)*

$$\underset{}{Fert} = \underset{(.008)}{.19\,CB} \ \underset{(.09)}{-.25\,SSC} + \underset{(.006)}{.07\,SSD} + \underset{(.005)}{.04\,Int} \ \underset{(.38)}{-4.93\,Wf} + \underset{(.38)}{5{,}13\,Wm}$$

$$\underset{}{Sav} = \underset{(.13)}{.25\,SSC} + \underset{(.006)}{.06\,Int} \ \underset{(.55)}{-7.42\,Wf} + \underset{(.56)}{9.03\,Wm}$$

The elements of the first co-integrating vector can be interpreted as long-term fertility elasticities. Fertility is found to be affected negatively by social security coverage, and positively by the social security deficit (the elasticity is small, but significantly different from zero). Child benefits and the interest rate also have a positive effect. The effects of female and male wage rates are, respectively, negative and positive. These findings differ from those of Cigno and Rosati (1996) only in that the latter do not not find a significant effect of the social security deficit on fertility. C-R do not include child benefits in their estimates for Germany, but the effect of this variable is found to be positive in the only country, the UK, for which it is considered. There could thus be two reasons why the social security deficit is insignificant in C-R's estimates for Germany. One, already mentioned, is that the measure of social security deficit used by C-R is incorrect. The other is that C-R do not control for the child benefit rate. Since child benefits are a form of intergenerational tranfer (like the social security deficit, but in the opposite direction), ignoring the former could have biased downwards C-R's estimate of the effect of the latter.

The elements of the second co-integrating vector can be interpreted as long-term saving elasticities. Table 6 tells us that saving is affected positively by social security coverage, and by the rate of interest. The effects of male and female wage rates are, respectively, positive and negative. Those of the social security deficit, and of the child benefit rate are insignificant, and set equal to zero. These estimates differ from those of Cigno and Rosati (1996), who find the effect of social security coverage to be insignificant in the case of Germany (although significantly positive in every other country considered), and the effect of the social security deficit to be significantly negative. Taken together, these findings reject the hypothesis, underlying life-cycle theory and Barro (1974), that fertility is exogenous, and the hypothesis, underlying Barro (1974) and Barro-Becker (1988), that parents regard their children as a form of consumption. They are consistent, however, with Cigno (1993), where children are treated as a form of investment. Our findings show also that, in Germany as

elsewhere, social security coverage has a significantly positive effect on household saving. It would thus seem that, when pension benefits are correctly measured, and all relevant variables (including the child benefit rate) are considered, German saving and fertility behaviour is no different, qualitatively, from that of other industrialized countries. Finding that the social security deficit has an insignificant effect on saving does not substitute one anomaly for another, because the German deficit is very small and practically constant in relative terms (Fig. 6).[18]

Notice that the long-term elasticity of fertility to the child benefit rate is very small, less than .2 per cent (this can be seen by just looking at Fig. 1). That is a very weak effect, especially if we think that it is likely to pick up not only the effect of child benefits as generally understood (*Kindergeld*, *Erziehungsgeld*, and *Kinderfreibetrag*), but also the effect of the notional pension contributions credited to parents of young children (this variable, it will be recalled, was excluded from the estimates beacuse of collinearity with child benefits). In view of very high estimates of the cost of raising a child, particularly of the opportunity-cost of the mother's time (Joshi, 1998), this is not a very surprising result. Child benefits would have to be very large indeed to cover a significant fraction of the cost of parenthood.

Comparing the size of male and female wage effects, we can see that the former is slightly larger than the latter in both equations. An equiproportional wage rise would thus raise both saving and fertility. This is confirmed by the fact that, if we replace the wage rates with household income, the latter has a positive effect on both saving and fertility. Using income instead of wages, however, makes the estimates considerably worse, and using income and wages at the same time makes them lose significance (as one would expect, since household income is determined by the wage rates). Using household income, and the ratio between female and male rates gives us a positive long-run effect of the former, and a negative one of the latter, on both fertility and saving. The results, not shown, are consistent with those obtained using the two wage rates separately, and omitting household income, but not as good econometrically.

Tab. 3: Short-term adjustment coefficients

(standard errors in brackets)

Variable	α_1	α_2
Fert	-1.15 (.09)	.47 (.09)
Sav	.00	-.4 (.2)
SSC	.00	.00
CB	.00	.00
SSD	.00	4.00 (.9)
Int	.00	.00
Wf	.00	.10 (.06)
Wm	.00	.12 (.07)

The elements of the $\boldsymbol{\alpha}$ matrix can be interpreted as the short-run responses of the model to a deviation from the equilibrium path. Our estimates, reported in Table 3, show that none of the variables in the model, apart from fertility itself, reacts to a short-run divergence of the fertility rate from its long-run path. By contrast, not only saving itself, but also fertility, the social security deficit, and the wage rates, respond to short-run deviations of the household saving rate from its long-run path. It is interesting that a temporay slackening of household saving elicits an increase in the social security deficit, rather than a reduction in coverage.[19] This does not necessarily mean, however, that the policy maker responds by reducing contribution rates. It could simply mean that, as income growth slows down as a consequence of the lower propensity to save, contributions (rather than the contribution rate) decline. The finding that the real interest rate does not respond to short-run variations in the saving behaviour of domestic households is, of course, hardly surprising. The responsiveness of fertility, and of the wage rates (but these have low significance), to short-run deviations from equilibrium

[18] The effect of the social security deficit on fertility is statistically significant, but very small.

[19] Although the elasticity is large, absolute changes are small, because small is the deficit itself.

saving confirms the view that asset accumulation, fertility, and labour force participation by marriage partners are part and parcel of the same decision process.

6. Simulations

To highlight the policy implications of our findings, we used our estimated lon-run relationships to project saving and fertility behaviour beyond the sample period, under alternative scenarios. In each scenario, we have left the wage rates to grow at the average growth rate of the sample period, the interest rate constant at tits 1995 level, and the social security deficit constant at the sample mean. All that changes from one scenario to another is social security coverage and child benefits. We consider the following scenarios:

S1 SSC grows at the average rate of the sample period, CB constant at the 1995 level
S2 SSC and CB grow at the avarage rate of the sample period (2 % a year the former, 1,2 % the latter)
S3 SSC constant at the 1995 level, CB grows at the average rate of the sample period
S4 SSC and CB constant at the 1995 level
S5 SSC decreases by 2,7 % a year, CB constant at the 1995 level

FIGURES 7 AND 8 ABOUT HERE

Figures 7 and 8 show the actual fertility and saving rates for the 1980-95 period, and their simulated values (under alternative scenarios) for the subsequent fifteen years to 2010. Being based on long-term relationships, these simulations must not be interpreted as predictions. All they show is possible trends, conditional on alternative combinations of assumptions. Their only purpose is to draw attention to the cumulative long-term effects of alternative policies.

We can see, from Figure 7, that a moderate contraction in social security payments (scenario **S5**) would raise completed fertility by about one child per woman in fifteen years. That is roughly what was lost between 1960 and 1995, causing the crisis in German social security. Notice that what we are hypothesizing is an annual 2.7% reduction in pension payments per person aged 65 or over (our measure of social security coverage), not in the average pension. Therefore, part of the reduction could be achieved by curbing early retirement. It should also be kept in mind, however, that we are holding relative wage rates constant. Further catching-up of female on male wage rates would partially offset the effects of social security retrenchment. Just raising child benefits (**S3**) would not be sufficient to prevent further fertility decline. Holding everything constant (**S4**), or continuing with past policies (**S1**, **S2**) would accelerate fertility decline.

Figure 8 tells us that a modest reduction in social security coverage (scenario **S5**) would stabilize the household saving rate at between 11 and 12 percent of household disposable income. Holding coverage constant (**S3**, **S4**), or allowing it to grow at its average gowth rate in the sample period (**S1**, **S2**), would induce a recovery of the saving rate towards the hights of the early ‘80s and ‘90s. Since child benefits have been found to have no significant effect on saving, it does not seem to matter what happens to them. But this may not be true if we go outside the sample range. Here too, it should be kept in mind that further catching-up of female on male wage rates would have a negative effect on saving.

7. Conclusion

We have found that, in Germany as in every other country where the hypothesis was tested, old-age security *per se* (*i.e.,* apart from any intergenerational transfer caused by deficit-financing) has a positive effect on aggregate household saving, and a negative effect on fertility. There is thus no German anomaly. The reason why Cigno and Rosati (1996) found the effect to be statistically insignificant for Germany is essentially that their definition of pensions was too broad, and that not all the relevant effects were considered. Using the correct definition of pension benefits, introducing child benefits as an additional variable in the model, and estimating the saving and fertility equations simultaneously by the VAR method, which captures possible cross-effects and reverse causations, we find that social security cover has a positive effect on household saving. We also find that child benefits encourage fertility, but that their effect is weak.

In Germany too, social security is thus good for growth. A possible explanation for this unconventional finding is that given in Cigno (1993), Cigno and Rosati (1993, 1996, 1997) and Rosati (1996), namely that compulsory saving in the form of pension contributions tends to displace childbearing and intra-family transfers, rather than asset formation. However, the negative effect of social security on fertility tends to erode the system’s own contributory base. That is one of the reasons why pay-as-you-go pension systems tend to be financially unstable.

A significant recovery of the fertility rate could *not* be achieved, according to our estimates, by moderate increases in child benefits, because their effects do not appear to be sufficienly strong. The reason, as already pointed out, is that the

cost of a child, consisting in large measure of the opportunity-cost of the mother's time, is extremely high. Indeed, in Germany as everywhere else, fertility responds negatively to female wage rates.

Simulation results indicate that a substantial recovery of German fertility, strong enough to eliminate much of the solvency problem faced by the German social security system, could be engineered, without too negative consequences for household saving, by a modest reduction in social security coverage. Some of this reduction could be achieved, without the need to reduce pension levels, by restraining early retirement. In view of evidence that, in Germany, the very old have difficulty in spending their pensions (Boersch-Supan and Stahl, 1991; Boersch-Supan, 1994), some trimming should not be too painful.

Sinn (1998) argues that pay-as-you-go pension systems can be welfare improving only so long as pension benefits are not so high, that pensioners return part of them to their children in the form of bequests. The just mentioned evidence of involuntary saving by the very old suggests that pension benefits in Germany may indeed be too high.

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APPENDIX

Tab. A1: Unit-root ADF tests[1]

Equation	I(1)	I(2)
Fert	2.3	3.6**
Sav	2.8	3.5*
SSC	2.7	3.8**
CB	.2	5.7**
SD	2.4	3.4*
Int	2.0	3.8**
Wf	2.7	3.4*
Wm	2.7	3.9**

[1] Including two lags and a constant term.
Critical values: 5% = 2,9; 1% = 3,6.

Tab. A2: Mis-specification tests

Equation	Portmanteau	LM	Norm	ARCH
Fert	4.2	.2	1.2	.4
Sav	1.6	.1	1.6	.1
SSC	3.9	.3	.07	.0005
CB	7.0	.02	3	.02
SD	3.4	2.7	4.9	.0007
Int	5.9	2.2	11*	.006
Wf	12.7	.0006	2.6	.4
Wm	4.6	.02	1.3	.04
Whole model	*273.3*		*19.9*	

Tab. A3: Cointegration tests

H_0: rank=p	λ max	corrected	95%	trace	corrected	95%
p == 0	95.9**	49.5	51.4	300.2**	154.6	156.0
p <= 1	58.0**	29.9	45.3	204.2**	105.2	124.2
p <= 2	50.2**	25.9	39.4	146.2**	75.3	94.2
p <= 3	37.3*	19.2	33.5	95.9**	49.4	68.5
p <= 4	25.9	13.4	27.1	58.6**	30.2	47.2
p <= 5	17.7	9.1	21.0	32.7*	16.8	29.7
p <= 6	13.7	7.0	14.1	15.0	7.7	15.4
p <= 7	1.3	0.7	3.8	1.3	0.7	3.8

Figure 1

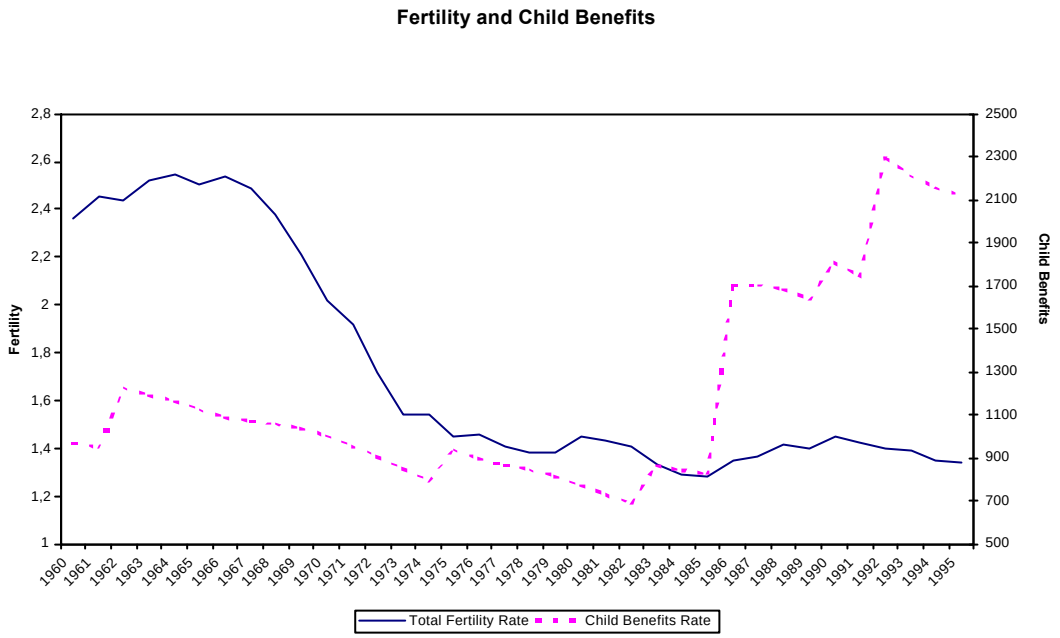

Figure 2

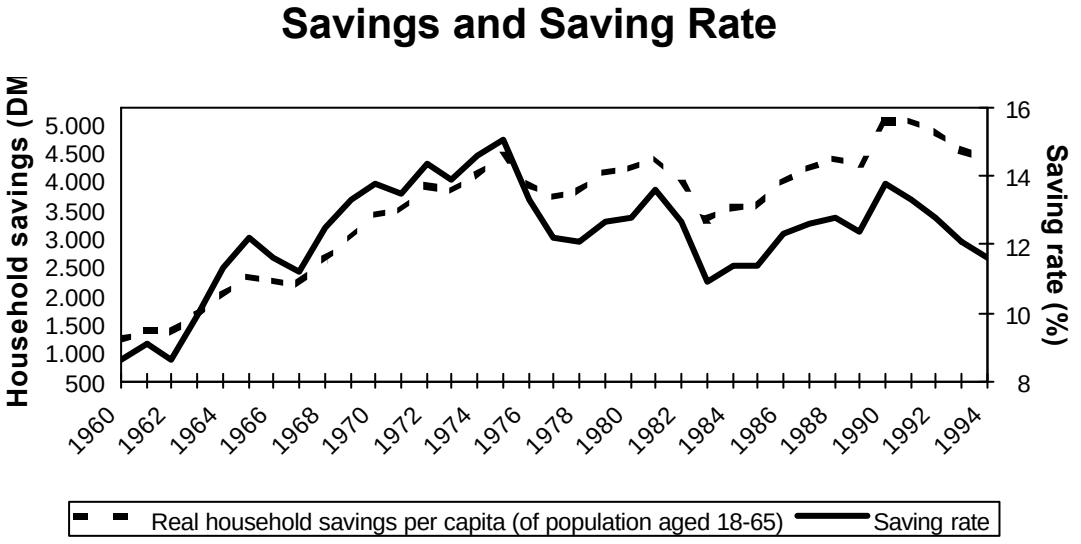

Figure 3

Disposable Income and the Gender Gap

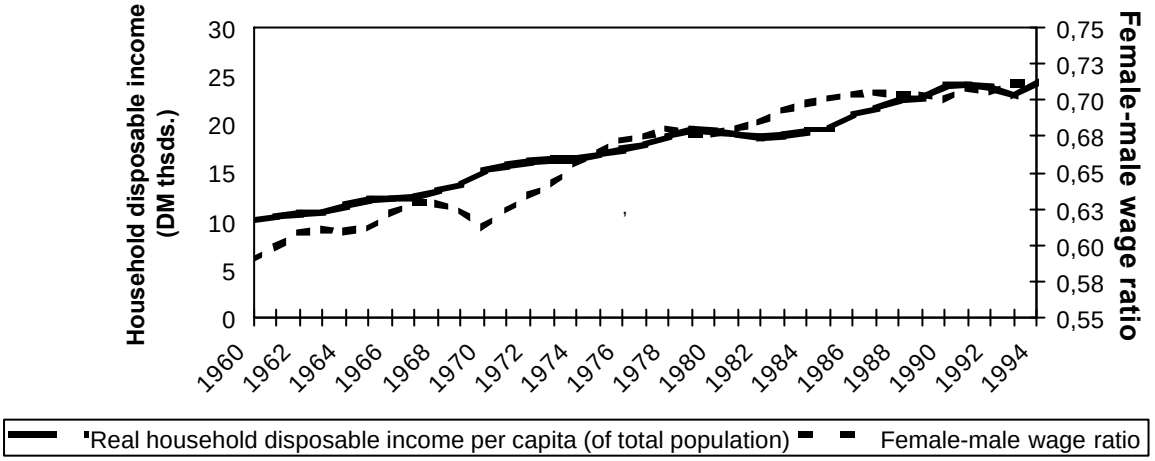

Figure 4

Real Interest and Inflation

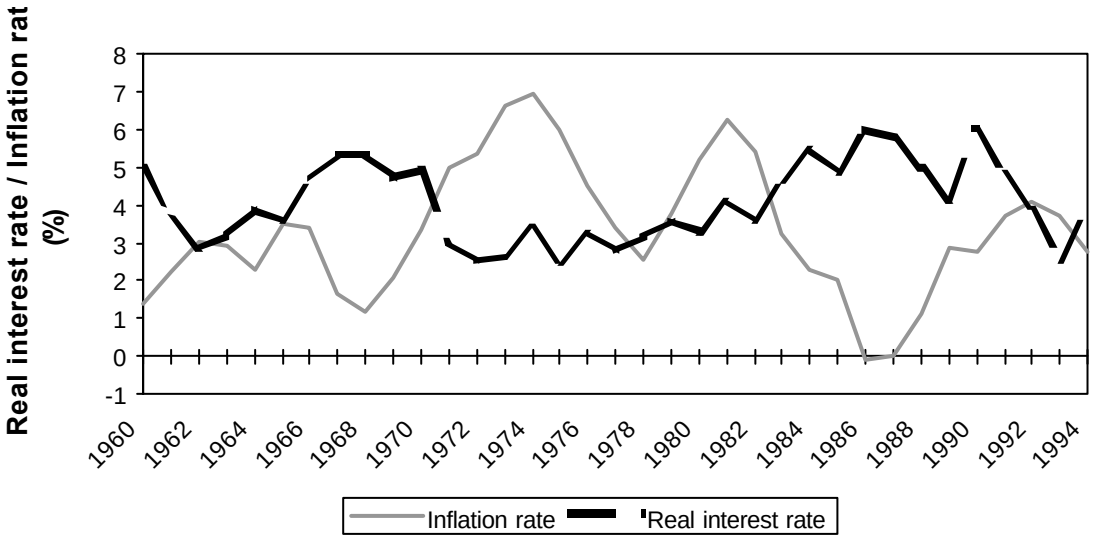

Figure 5

Social Security Coverage

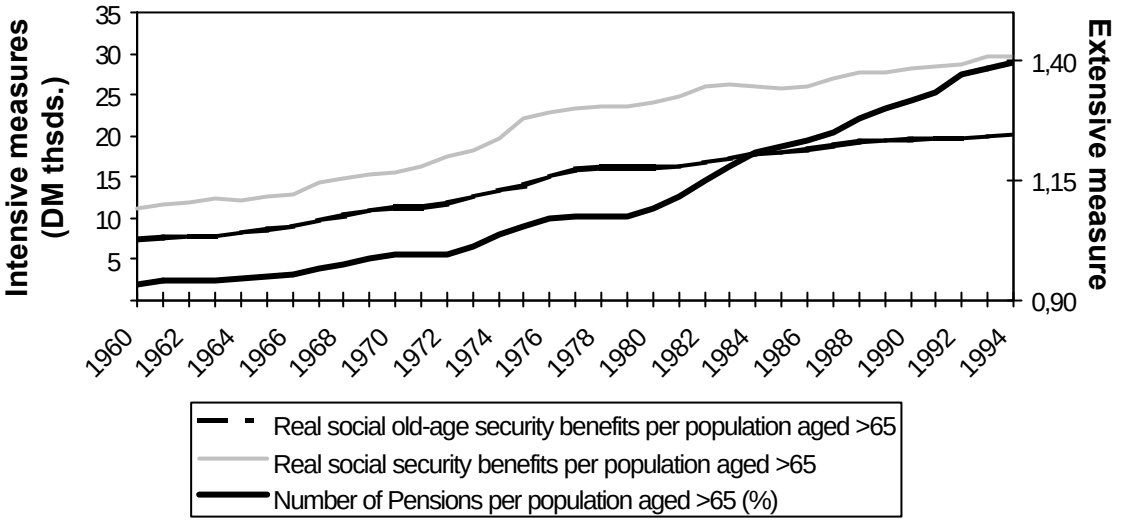

Figure 6

Social Security Deficit

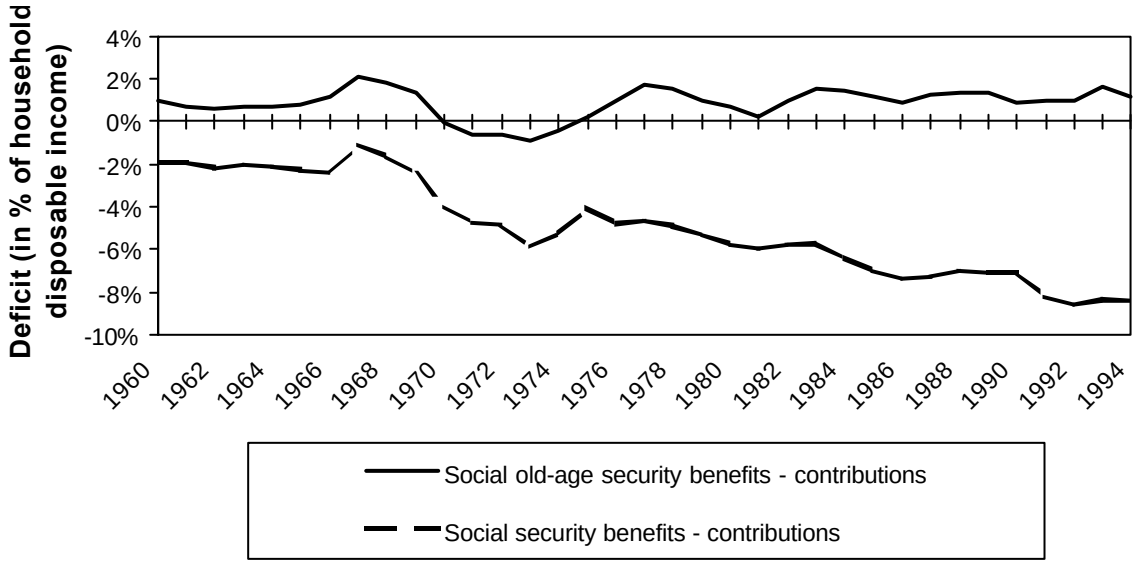

Figure 7
Actual and Projected Fertility Rates

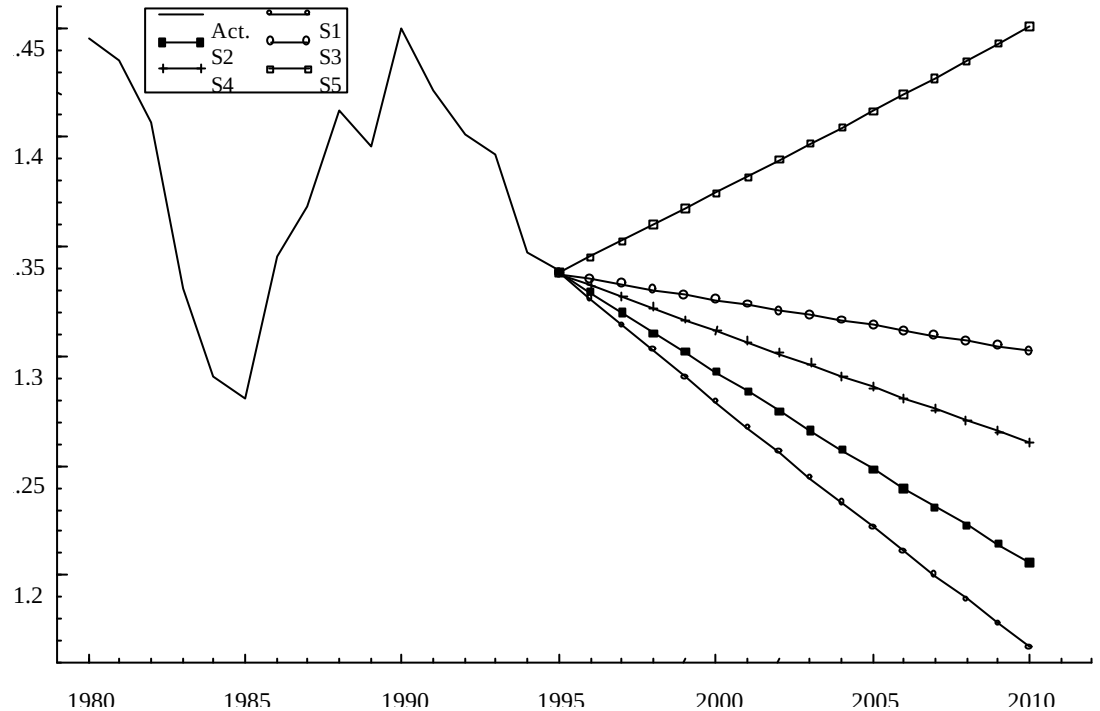

Figure 8
Actual and Projected Saving Rates