The Geneva Papers on Risk and Insurance, 18 (January 1981) 3-50

Social Security and Saving : A Tentative Survey

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1. Introduction

1. Of the many motives for personal saving, one is of special importance : the accumulation of sufficient assets to enable the saver to stop working at a particular age.

2. For much of history only a small few could make that dream come true, and the prospect of a great number of elderly people without adequate means of support, together with the desire to share the fruits of growth with the older generations has led most governments to establish compulsory schemes for guaranteeing a minimum income to retired persons.

3. Two " pure " systems may be envisaged : the first based on the pay-as-you-go principle and the second on the principle of full funding. In the former, contributions paid each year by active participants are immediately used to finance benefits, while in the latter case the fund manages individuals' contributions on their behalf and they recover their capital and accrued earnings when they retire.

4. For a long time researchers were interested only in problems associated with the financial equilibrium of such schemes. However, following the publication of a recent article by Martin Feldstein showing that social security depressed savings substantially, there has been a revival of interest in the subject and numerous studies aimed at testing the existence of such an inhibiting effect and measuring its magnitude. These studies attempt to ascertain what influence the establishment of social security may have on personal choices between saving and consumption, on participation in the labour force and on bequeathing practices. This paper will be devoted to a description and critical analysis of these studies.

5. The debate on whether social security depresses personal saving embraces both a theoretical dispute and empirical testing. Empirical arguments have assumed increasing importance owing to the inconclusiveness of the theoretical approach, which is based primarily on the life cycle theory and its possible generalizations.

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* The authors belong to the University of Paris-X and E.R.A. No. 86 of the C.N.R.S. They wish to thank W. H. Somermeyer for helpful and valuable comments on an earlier draft. This research was supported by a grant from the UNO.

6. A brief analysis of the theoretical debate is presented in section 2 and is followed by a summary of the many empirical tests which have been carried out in the United States and other countries in order to ascertain the impact of social security on personal saving habits. Lastly, an effort will be made to identify factors which may explain the theoretical and empirical results obtained.

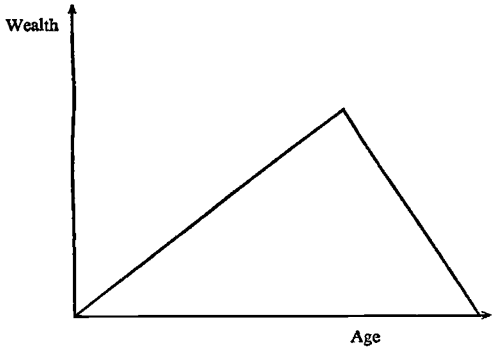
2. Some aspects of the theoretical debate

7. The life-cycle theory assigns to each individual a time-horizon representing his/her life-span. The objective is to choose a consumption profile for the entire life-span. The choice is governed by the total amount of resources available.

8. If a random life-span is used, certain difficulties arise, which can be avoided by assuming that the individual escapes the risk by taking out insurance. Accordingly, for a given length of the working day and a given hourly wage, the volume of total resources will depend only on the age of retirement.

9. Maximum resources and, hence, the highest level of consumption will reflect the situation of the individual who never retires ; his working life is equal to his life-span. However, other factors may come into play in the utility function (in particular, leisure time or the relative arduousness of the work), with the result that a trade-off must be made between the larger assets resulting from a larger volume of work and the converse. In specific circumstances (where the interest rate equals the rate of time preference), the optimum profile will be a constant level of consumption, expressed as a fraction of total resources [1]. In such cases, present value of expected future income is referred to.

10. During a working life-span chosen by him, the individual will save and accumulate wealth, which will be at its maximum level when he/she retires. During the period of retirement, dissaving occurs, since the wealth previously accumulated will be consumed. In the simplest case, in which the interest rate is zero and income constant, the wealth-age profile can be represented as shown below :



[1] Another prerequisite for the optimum profile to be a constant level of consumption is invariance of needs over time in the utility function.

11. The profile may be modified by a number of factors, the two most important being an interest rate higher than zero and an income which varies markedly with age. If income increases as the individual ages, he/she will be tempted to borrow at the beginning of his/her career and pay back at a later time, and his/her wealth will initially be negative.

12. The impact of the emergence and expansion of social security on personal savings has been analysed against this general theoretical background. The fundamental assumptions stems directly from the role envisaged for the accumulated wealth — namely, to guarantee the financing of consumption during retirement. When a social security scheme is set up, at least part of consumption during retirement is covered, and there is less need to accumulate wealth (asset substitution effect, Feldstein [1974]). Social security would therefore be expected to depress savings. Another way of stating this assumption is to consider that the existence of social security provides each individual with a wealth equivalent which increases as the participant's pension rights grow. If individuals consider that social security wealth (*SSW*) is a satisfactory substitute for traditional wealth (*W*), the latter becomes superfluous, at least in part, and the accumulation of such wealth slows down or stops. The expansion of social security is thus responsible for a reduction in the available stock of capital. As far as pay-as-you-go schemes are concerned, the social security wealth which individuals anticipate and which influences the rate of accumulation of traditional wealth has no existence at the macro-economic level. Thus, assuming perfect substituability, the following result is obtained : in the absence of any pay-as-you-go social security system households would accumulate $W' = W + SSW$, but since pay-as-you-go schemes give them the impression that they have *SSW*, these schemes induce them to accumulate only *W*, and bring about a situation in which national wealth (*W*) is substantially less than it should be (*W'*).

13. This outcome can, however, be modified by the influence of social security on the age of retirement (induced retirement effect, Feldstein [1974]). The establishment of social security modifies the parameters for optimization referred to above, which individuals take into account in determining the age at which they will retire. Before the advent of social security some individuals never retired ; they worked throughout their entire life-span. Others expected to stop working, but at a relatively advanced age because it was inconceivable that the wealth accumulated during working life would be sufficient to finance a long period of retirement. The establishment of social security can lead such individuals, who envisaged only a short retirement or none at all, to reconsider their plans and to contemplate that the retirement benefits paid by institutional schemes will really be adequate. Accordingly individuals who did not save because retirement was completely out of the question owing to their modest means will begin to save because the establishment of social security will demand only a little extra effort. At a more general level one possible assumption is that social security leads to a lower age of retirement (which has, in fact, been observed empirically) and that this change in the life cycle leads to greater saving over a shorter working life for the sake of improving the level of consumption during an extended retirement. Accordingly, one cause for increased savings emerges which can moderate the depressing effect discussed in the preceding paragraph.

14. The issue of the substituability of social security wealth and traditional wealth raises the question whether a claim on a future generation can really be considered as net wealth initiated by Ricardo. This debate has been settled in new terms by the works on rational expectations. Either the government bonds which finance this debt are perceived by society as an additional wealth (Modigliani [1961], Blinder and Solow [1973]), or individuals consider that a future tax will be induced by these bonds (Bailey [1962], Barro [1974]). This is an instance of the " principle of equivalence " which states that future taxes will rise in order to offset the benefits. The problem remains of the use of these funds ; investment or consumption. As far as the benefits are concerned, one can presumably guess that they will be largely consumed. If individuals feel that they are in possession of new net wealth, consumption will increase and savings will decline. The same will be true if individuals think of social security wealth as being the same as traditional wealth. Conversely, if the reality of social security wealth is disputed on the theoretical ground of the principle of equivalence, social security schemes should have no impact on the behaviour of households.

15. Even if we accept that social security may influence savings, this may not in fact be a novel phenomenon. Before such systems were introduced, periods of economic inactivity were not wholly financed by previously accumulated personal savings. Part of the resources available to the inactive came from their own families especially their children. This solidarity between the generations took either the direct form of the shelter and care of aged parents or the indirect form of financial support. Thus, the introduction of social security schemes does not radically alter solidarity between the generations but would simply institutionalize it (Barro [1974] [1978]). What used to be transferred directly from children to their parents would now pass through social security. As long as the inflow and the outflow of funds were equal, nothing would have changed and there would be no reason to expect a negative impact on savings.

16. It is conceivable, however, that social security may have increased solidarity between the generations by making it more widespread, to the point that current money flows from young people to old people are greater than before. If this new situation reflects individual preference, increased transfers may lead to a reduction in savings if recipients save less than contributors. In these circumstances, we must recognize that preferences have changed, with the community seeking to transfer to the elderly greater purchasing power than it did in the past (in other words, before the introduction of social security). If we reject the hypothesis that preferences have changed, we must be prepared for an inverse transfer : parents' bequests to children must increase to offset the unsought growth in the transfer in the other direction [2]. When this is so, the original situation is restored and aggregate savings will remain unchanged (Barro [1978]).

17. The foregoing description is longitudinal and organized in terms of capital stock. In it the pattern of personal life-cycle accumulation has been analysed from the

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[2] Empirical evidences of an increase in parents' bequests to children in France can be found in Strauss-Kahn [1977], Kessler [1979] and Kessler and Masson [1979].

point of view of the substituability of social security wealth for traditional wealth. The problem can also be presented, however, transversally and in terms of flows. The question would then be whether or not, at a given time, individuals equate their contributions with savings. If they do, it is reasonable to suppose that their " voluntary " savings will diminish. But if these contributions are overlooked (miscalculation of gross income) or equated with taxes, there is no reason why the rate of savings from disposable income should be affected.

18. Thus, the problem can be formulated in two different ways :

— Do individuals consider social security wealth to be the same as traditional wealth ? If so, has the development of social security caused a decline in the accumulation of traditional wealth ? Or has this social security wealth merely replaced a " family solidarity asset ", in which case the accumulation of traditional wealth would not be affected ?

— Do individuals regard their contributions to social security as compulsory or contractual saving (even when they operate on a pay-as-you-go basis) ? If so, are their savings affected ? Or are these contributions perceived as taxes, in which case savings would be only marginally affected.

19. For each of the two groups of questions we can advance arguments for and against each of the hypotheses presented, so that it would be extremely risky to draw conclusions solely on the basis of theoretical considerations. Most writers agree that the issue is now being discussed primarily at the empirical level, which no doubt explains the proliferation of econometric studies. Most of these studies have approached the problem from the standpoint of the life cycle theory and this theory calls for an empirical analysis based on the stock of social security wealth. Some studies, however, have approached the issue in terms of a contribution flow, which is treated as savings or taxation. These two aspects will be dealt with in the following section.

3. Empirical testing

20. Since 1974 numerous studies have been made in an attempt to determine the effect of social security systems on household saving. Four main groups of studies can be identified : macro-economic and micro-economic studies, on the one hand, and longitudinal and transversal studies, on the other (see table A). It is easily seen that micro-longitudinal data are difficult to obtain.

21. The studies can, however, also be divided into studies of private pension schemes and these analyzing government schemes. This distinction is important, since it overlaps significantly with another dividing line, that between funded systems and pay-as-you-go systems.

22. We shall first consider studies dealing with private pension schemes (3.1.) and then studies dealing with government schemes (3.2.).

3.1. The effect of private pensions on the savings behaviour of households

23. There has been strong growth in pension schemes, particularly since the Second World War. As they are a form of contractual saving, the question of a possible

depressive effect on household personal savings has also arisen. The case of private pensions is very different from that of government schemes, however. Private pension schemes are often, but not always, funded. Accordingly, the question of a possible depression of personal savings is less relevant than in the case of pay-as-you-go systems. If we assume that personal savings decline as a result of the growth of pension systems, the impact on over-all household savings is uncertain. If such decline is only partial, in other words if a 100 dollars increase in contractual saving causes a 50 dollars reduction in personal savings, total savings will increase by 50 dollars and, even if the two offset one another, total savings will not vary.

Table A

Papers dealing with public schemes (PU) and private pension schemes (PR)

	Macro-economic		Micro-economic	
Longitudinal	Feldstein [1974]	(PU)		
	Munnell [1974]	(PU)		
	Barro [1978]	(PU)		
	Darby [1979]	(PU)		
	Hemming [1978]	(PU)	Kotlikoff [1979]	(PU)
	Boyle & Murray [1979]	(PU)		
	Kessler, Masson & Strauss-Kahn [1980]	(PU)		
	Saito & Shome [1977]	(PU)		
	Feldstein [1976]	(PR)		
	Denny & Rea [1979]	(PU)		
	Markowski & Palmer [1979]	(PU)		
	Pfaff, Hurler & Dennerlein [1979]	(PU)		
	Berg & Bentzel [1980]	(PU)		
Transversal	Aaron [1967]	(PU)	Cagan [1965]	(PR)
	Feldstein [1977]	(PU)	Katona [1965]	(PR)
	Feldstein [1979]	(PU)	Munnell [1976]	(PR)
	Barro & McDonald [1977]	(PU)	Schoeplein [1970]	(PR)
			Feldstein & Pellechio [1978]	(PU)

24. It must be pointed out, however, that pension schemes may operate on a pay-as-you-go basis (as in the case of supplementary pensions in France) or with a blend of funded and pay-as-you-go arrangements. In such cases, the impact on total savings is more difficult to determine.

25. Several writers have tried to test the impact of pension schemes on the personal saving of households. Cagan [1965] and Katona [1965] used household surveys to determine the impact of pensions on savings and reached the rather surprising conclusion that households which belonged to a private pension scheme saved more than other households. This phenomenon was explained by a " recognition effect " (Cagan [1965]). As a result of belonging to a pension scheme, households come to realize that financing the retirement period is a problem and that the desired income level for that period can be achieved by an extra savings effort. Another explanation offered is that households increase their savings effort as they approach the desired retirement income level (goal feasibility effect) (Katona [1965]).

But these results may also be explained in another way : people exceptionally " savings inclined " may tend to be more fond of joining private pension schemes than others. For similar results for the Netherlands, see Somermeyer and Banninck [1973].

26. Munnell [1976] has used data from a series of surveys held from 1966 to 1971 to study the effect of belonging to a pension scheme on the savings behaviour of 2600 households aged from 45 to 69 years old.

27. The results of these surveys show that the households not covered by a pension scheme appear to have less wealth than the households belonging to a pension scheme. Munnell tests afterwards three different forms of the life cycle model where two dummy variables representing the belonging to social security or to a private pension scheme are introduced among other explanatory variables (Table C). These two variables are negatively correlated with the saving rate, and they can be considered as significant (at least as far as the results on the 1969-71 sample are concerned). It is the sole study that concludes to a negative effect of pension scheme on personal savings, contrarily to the results obtained by Cagan, Katona, Feldstein and Schoeplein.

28. In a study aimed at demonstrating the impact of private pensions on household saving and describing their pattern of accumulation, Feldstein [1977] advances five explanatory factors.

29. The first factor is the relative rate of return on different forms of saving. As a result of favourable tax laws and more efficient management, the rate of return on contractual saving is generally higher than that on other forms of saving. This may be reflected in more sustained accumulation of wealth by households. The second factor is the ongoing nature of benefits from pension schemes : they are provided until death and reduce the need for saving to finance the retirement period. In addition, benefits are not transferable (except to spouses), and individuals may therefore be inclined to make different choices than they would have made if the assets accumulated in pension schemes were paid out in the form of stock. The third factor is induced early retirement, an effect identical to that occurring in government pension schemes, which would give rise to additional saving. The fourth factor is that individuals may be com-

pelled to accumulate because they have to belong to a pension scheme. This is particularly true of low-income contributors. In such cases the spread of pension schemes increases total savings.

30. Finally, individuals may not know precisely to what pensions they are entitled or they may miscalculate their amount. If, for instance, they underestimate the amount of their pension, they may increase their savings unnecessarily, thereby resorting to totally unjustified saving or dissaving behaviour for which there is no real reason.

31. Since no conclusion can be drawn from theoretical analysis, Feldstein uses aggregate time series to test a function modelled on the life cycle, in which the dependent variable is total private savings (i.e. personal savings plus retained earnings ($ST = S + RE$) and the explanatory variables include social security wealth and net savings for private pensions (SP).

32. The coefficient for the variable SP is positive but cannot be regarded as significant (on the contrary, the SSW variable has a negative sign as could be expected from Feldstein earlier results). Thus pension growth over the past 40 years does not seem to have had a negative impact on household saving but rather to have slightly increased it (Table D).

33. In this line of research, we might also mention the study by Schoeplein [1970] which seeks to demonstrate possible substitution between contractual saving with private pension systems and other forms of retirement saving (life insurance) but not all personal savings. Schoeplein uses Canadian tax data on 2,173 people and divides his sample into 16 income classes. He carries out a regression analysis for each class in order to explain the ratio of other retirement saving to income in the light of relative pension contributions and the age of the head of household (Table E).

34. He finds that the coefficient for relative pension contributions is negative in 12 of the 16 income classes but that this variable is positive and significant for the aggregated households. Thus, there is complementarity, and not substitution, between saving with pensions schemes and other forms of retirement saving. This leads the author to conclude that " lower and middle income classes do substitute pension contributions for alternative forms of retirement saving, though the substitution is far from perfect ", and that " pension saving may be complemented by other retirement saving only in the highest income classes, ... which have high propensities to save..."

35. Finally, it appears that private pension systems tend generally to have the effect of increasing household personal savings, because of the inducements associated with them and, in all cases, to increase total household savings (personal savings, plus contractual savings with a pension system).

3.2. Pay-as-you-go social security systems

36. The first section is devoted to a detailed account of earlier time-series analyses which utilize a variable representing social security wealth or refer directly to the flow of contributions. The second section describes some results derived from cross-section data.

3.2.1. Time-series analyses

37. Two types of analysis can be conducted. The estimate of the influence of social security on savings can be worked out by using either a stock variable or a flow variable. The first variable will represent social security wealth and the second the annual flow of contributions. Inasmuch as it is difficult in many countries to identify what proportions of the contributions are to be assigned to individual risks (sickness, disability, old age), the use of a contributions variable produces results which may be tricky to interpret. Accordingly, this section will be devoted primarily to analysing studies based on social security wealth. However, a brief summary will be given of some results based on the flow of contributions.

38. A number of writers have attempted to estimate the effect of social security on savings on the basis of United States aggregate data (Feldstein [1974], Munnell [1974], Barro [1978] and Darby [1979]). Feldstein uses a consumption function of the Ando-Modigliani type by adding to the traditional explanatory variables a social security wealth series. The function that he uses for estimating uses aggregate data, in real values, includes variables such as income, lagged income, retained earnings of lagged wealth, the unemployment rate and social security wealth.

39. Feldstein presents ten regressions (Table F) seven of them estimated on the period 1929-71 and the other three on the period 1947-71. These equations are estimated either with a series of gross social security wealth or with a series of net social security wealth. The unemployment rate appears as an explanatory variable only in some regressions. The *SSW* variable is supposed to stand for *the total effect* of the social security system on the level of consumption resulting from a negative effect due to the substitution between fungible wealth and social security wealth and the positive effect due to induced retirement.

40. The conclusions drawn by Feldstein from his estimates are well known. They started a debate which seems likely to go on for some time. Feldstein maintains that the expansion of United States social security has substantially depressed household savings — by an estimated 30 - 50 per cent. This fall in savings means lower growth in global capital and accordingly in future income.

41. Doubts arise, however, when the results obtained by Feldstein are carefully scrutinized, because the conclusions he draws from his regressions are based on a handful of equations which not only embody estimates for the period 1929-1971 but also exclude the unemployment rate from the explanatory variables.

42. We must initially note that results are not sensitive to a modification of the definition of the social security wealth variable, as the comparison of equations 1 and 3 (Table F) shows, where two different estimates of *SSW* are introduced. In addition, the results are not different whether one retains the gross or net definition.

43. But it must be noted that in none of the three regressions carried out for the period 1947-1971, the *SSW* variable is significant, whether or not the unemployment rate appears in the equations. It would therefore seem that the social security system does not depress saving since the war. This result will be confirmed by the later work of Barro and Darby.

44. On the long term, the results differ according to whether or not the variable U figures in the equation thus in equation 6 the t of Student of *SSWB* is only .9 and one can therefore consider the coefficient of this variable as not being significantly different from zero at the 20 % level [3].

45. There is no theoretical reason for excluding the unemployment rate from the extended life-cycle equation ; as the author himself says, " the rate of unemployment has often been included in the consumption function to adjust for the cyclical variations of consumption and income " [4]. And neither is there any empirical reason. There is, of course, a problem of collinearity between these two variables, but in any event using the rate of unemployment does not affect the coefficients of the other explanatory variables. Why then keep the *SSW* variable and not the unemployment variable ?

46. Feldstein does not present any regression where the *SSW* variable would not be introduced but where the unemployment rate would figure. According to Esposito [1978], Lesnoy has reestimated the same function as Feldstein's using the same data without the *SSW* variable but with the unemployment rate. He found that the unemployment rate in this case appears to be as significant as the *SSW* variable when the unemployment rate is not introduced.*

47. The conclusions drawn by Feldstein from his own estimates, therefore, need a great deal of qualification. The hypothesis that social security depresses savings is not true for the period 1947-1974. It is true for the period 1929-1971 only if the rate of unemployment is excluded from the estimated equation. Since there is no empirical or theoretical reason for excluding that variable from the consumption function used, it is unlikely that Feldstein's estimates are conclusive. This will be confirmed by the later work of Barro and Darby.

48. Munnell [1974] undertook a very similar study to Feldstein's [1974]. She also uses a function inspired from the life cycle model. Two variables are supposed to stand for the effect of the growth of the social security system on saving ; on the one hand *SSW* and on the other hand a composite variable, the activity rate among the aged multiplied by income (αY) representing the induced retirement effect. Two dependent variables are estimated : the households' saving and retirement saving.

49. The results that she obtains are relatively contradictory with those of Feldstein. When the dependent variable is household saving, *SSWB* does not appear to be significant for the 1949-1969 period. In addition the variable αY is never significant. In the case of retirement saving, *SSW* (gross or net) appears with a negative sign and is hardly significant for the 1929-69 period : it is no longer significant for the post war period.

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[3] Equation 7 of the table F is special : the author has bounded to equality the coefficients of the two variables W_{t-1} and *SSWB* to test the statistical significance of the variable U.

[4] See also Modigliani [1975] : " There were, in fact, many reasons for supposing that the saving ratio should fluctuate pro-cyclically. In particular, cyclical fluctuations of income would be accompanied by inverse fluctuations in the rate of unemployment, which in turn should be correlated with the ratio C/Y since the unemployed could be expected to consume on a scale commensurate with that of the employed though not contributing to income ".

* A recent investigation by Lesnoy & Hambor [1980] has shown that the series used by Feldstein [1974] were miscalculated. The revised series lead to results opposite to Feldstein's.

50. According to the empirical results of Munnell, social security systems seem to have an effect on the structure of saving rather than on its level.

51. In addition to theoretical arguments against the Feldstein's thesis, Barro [1978] has also provided a series of estimates of a consumption function where social security wealth figures. His results are somehow different from those obtained by Feldstein and Munnell.

52. Barro used the same data as Feldstein [1974] but his approach is different. Barro's observation period is a little bit longer (1929-1974 instead of 1929-1969). There are additional explanatory variables in the function estimated by Barro (government surplus, fixed capital, stock of durables and real per capita income times unemployment rate). The variables are not exactly defined as in Feldstein [1974] especially as far as unemployment rate is concerned. Barro presents two sets of estimates. The first series of equations are estimated without constant and the second with a constant. According to Barro the constrained estimates — without constant — are more appropriate because the households' utility functions are rather homothetic.

53. Barro seems to consider *SSW* rather as a wealth indicator and not like Feldstein as a true wealth. In fact he uses another variable to represent the growth of transfers through social security system. This variable is equal to the coverage of the social security system times the mean benefit (*SS* variable). This variable appears as not significant. Table H presents only some of the results obtained by Barro. The variable standing for the growth of the social security system is the gross social security wealth corresponding to Feldstein's estimates.

54. Equation 6, Table H, is the nearest from equation 1, Table F, the one from which Feldstein draws his main conclusion. It does not include the rate of unemployment ; the equation is not constrained and estimated over the longest timespan. It can be seen that, like in Feldstein, the gross social security wealth has a positive sign. But in all other cases — constrained equation, presence of the rate of unemployment — this variable *SSWB* is not significant. In the constrained equation estimated on the post war period, this variable appears even with a negative sign.

55. Feldstein simply uses the unemployment rate as found in the National Accounts while Barro uses the time series established by Darby corrected to take into account the variation of employment during the 1930's due to the New Deal. Barro in fact does not directly introduce this corrected unemployment rate but a composite variable $U \cdot Y$. Barro having said that since the unemployment rate (in relationship with the natural or average rate) seems to be a proportionate measure of the income gap relative to its " normal " position, the $Y \cdot U$ specification seems preferable to the linear U form. Barro thus sees no reason for eliminating the unemployment rate from the equation, as does Feldstein.

56. Furthermore Barro's results confirm those of Feldstein on one point : the post-war period does not present the same characteristics as the pre-war period. Over the period 1947-1974 the *SSW* variable is significant in none of the equations.

Barro concludes his study by stating that no statistical proof can be inferred from the time series data of a positive or negative effect of the social security system

on household's consumption. As noted by Esposito [1978] this confirms the close observation of the results obtained by Feldstein in 1974.

57. The most recent study on Feldstein's hypothesis in the case of the U.S. has been undertaken by Darby [1979]. Contrary to Feldstein [1974] and Barro [1978] who use a consumption function inspired by the life cycle model, Darby uses a consumption function related to the permanent income hypothesis. Darby has already estimated such a function in earlier works (Darby [1974], [1975] and [1977]). He uses in addition to *SSWG* and *SSWN,* two other variables e.g. Barro's " coverage times benefits " variable and the net total contributions.

58. Explanatory variables of Darby's equation include the permanent income and the transitory income, the money supply, the stock of durables, the relative price of durables to nondurables, the interest rate and of course different variables reflecting the influence of the social security system.

59. It must be noted that unlike Feldstein and Barro, Darby uses total and not per capita variables.

60. This function is estimated over 2 sub-periods, identical to those of Barro (1929-74 and 1947-74) and with two definitions of the money supply (M_1 and M_2). According to Darby the M_2 definition is the most relevant one notably due to the legal changes coming in 1933 and 1935. M_1 is rather vaguely defined during the pre-war period.

61. The results appearing in Table I only include the estimates with *SSWG* and *SSWN*, because the results of the regressions with the " coverage times benefits " variable are not significant at all as in Barro's work. The same holds as far as the regressions with the contributions are concerned.

62. Darby's results reveal an important difference between pre-war and post-war periods as in Feldstein's and Barro's work. In none of the regressions estimated for the post-war period the *SSW* variable is significant.

63. Furthermore the sign of the *SSWN* and *SSWG* variables is negative when the M_1 definition of money supply is used.

64. Over the period 1929-1974, the *SSWN* and *SSWG* variables can only be considered significant when the M_1 definition of the money supply found by Darby to be vague is used. It is for this reason that the author's comment apply especially to the regression results where M_2 is present. But in this case *SSWN* and *SSWG* are not significant even so their sign is identical to that obtained by Feldstein.

65. Darby's estimates confirm those of Barro : the growth of the social security system seems to have generated no effect on households' saving in the U.S. In any case one must distinguish between the pre-war and post-war periods. A possible depressive effect on saving has only been verified in the pre-war period. This period was however very chaotic, and the *SSW* variable may represent, at least in part, the economic fluctuations of that time. But no effect has been discovered for the post-war period.

66. Boyle and Murray [1979] have tried to test the assumption of Feldstein and Munnell on Canadian data. They used a consumption function inspired by the life

cycle model and they add two variables representing the development of the social security system : the gross *SSW* variable and the activity rate for persons aged 65 and over.

67. The *SSW* variable doesn't seem to be significant in any of Table J's nine regressions. Moreover its sign changes according to the additional variables introduced in the basic equation whose dependent variable is saving. These regressions give a surprising result : the α variable which represents the rate of activity of persons over 65 has a positive sign, contrary to the sign to which the theoretical analysis leads.

68. Boyle and Murray have also estimated equations strictly in line with those of Feldstein and Munnell. The results appear more significant here than in the previous table's equations. In the Canadian case a problem of collinearity between *SSWB* and the unemployment rate also seems to exist. In the saving equations identical to those of Munnell [1974], the $Y \cdot \alpha$ variable is not significant and has a negative sign, contrary to the American case.

69. Thus in Canada, the wealth built up through the social security systems does not seem to be substitute for other forms of household saving. Boyle and Murray present several arguments to explain this absence of effect. In addition to that of Barro [1978] concerning transfers between different generations, they maintain that the Canadian social security system is too recent for the households to have already adjusted their behaviour. However the conclusions to be drawn from the American example urge us to think that if social security systems have any effects, it is above all during their initial period of application and not at a later time when they have reached maturity. Denny and Rea [1979] who find results similar to those by Boyle and Murray give another interpretation for the lack of depressing effect of social security on saving or even for the evidence of a weak upward trend. They underlined a strong influence of earlier retirement on the saving rate.

70. Using a consumption function inspired by the function of Ando-Modigliani, Hemming [1978] has tried to test the effect of the public pension scheme on the behavior of British households. The function he estimates is the following :

$$C'_t = \beta'_0 + \beta'_1 Y_t + \beta_2 W'_{t-1} + \beta_3 SSW'_t + \varepsilon_t$$

with

$$C'_t = C_t - \lambda C_{t-1}$$
$$W'_t = W_t - \lambda W_{t-1}$$
$$SSW'_t = SSW_t - \lambda SSW_{t-1}$$
$$\beta'_0 = (1-\lambda)\beta_0$$
$$\beta'_1 = (1-\lambda)\beta_1$$

71. Hemming estimates this equation by assigning different values to the parameter λ. The two equations presented in the Table L correspond to values of λ respectively equal to 0.2 and 0.14. According to Hemming they give the best fit. One realizes that the variable representing gross *SSW* appears with a negative sign (unlike Feldstein's results). Furthermore this variable does not appear statistically significant. On the contrary net *SSW* is significant with a negative sign.

To interpret these results Hemming uses a simple model that shows the effect on saving of a modification of the level of benefits or contributions.

If c is the marginal propensity to consume and μ the tax rate, the simplest saving function will be :

$$S = - b_0 + (1-c)(1-\mu) Y$$

If one makes the hypothesis that the individual reacts to a modification of his social security wealth, the equation becomes :

$$S' = - b_0 + (1-c)[(1-\mu) Y - \Theta Y] - b_1 SSWB$$

with ΘY = contribution for the period t.

The effect on saving of the introduction of the social security system is :

$$\Delta S = - (1-c) \Theta Y - b_1 SSWB$$

The derivation of ΔS shows the effects of the variables Θ_t and SSW_t :

$$\mathrm{d}\Delta S = - (1-c)\,\mathrm{d}\,\Theta Y - b_1\,\mathrm{d}\,SSWB$$

If we use net SSW, we obtain :

$$\Delta S = - \mathrm{b}_1 SSWN$$

and

$$\mathrm{d}\Delta S = - b_1\,\mathrm{d}\,SSWN$$

72. The gross SSW variable being unsignificant, one can have a variation in saving only if the level of the contributions increases. If we use net SSW, Table L, equation 2 shows that saving is about 30 % higher than what would have occurred without a social security system. Thus, for the U.K. these two forms of saving seem more complementary than substitutable.

73. Markowski and Palmer [1979] use in the case of Sweden a model based on the permanent income hypothesis unlike most studies based on the life cycle hypothesis. They argue that the induced retirement effect is weaker in Sweden than elsewhere due to different institutional features. In fact the introduction of a social insurance pension program will affect permanent income in two ways. A positive effect on permanent income will result from the rise in future expected income streams on one hand, but on the other hand a depressing effect can be derived from the fact that contributions are actually taken from personal income. The results indicate " that an average decrease in the personal saving ratio of over 2 percentage point occurred as a result of the introduction of the social security scheme (ATP) ".

74. Bentzel and Berg [1980] using a Houthakker and Taylor savings function with a social security wealth variable, find results contradicting Markowski and Palmer's conclusions. The social security variable appears with an unexpected positive sign but the coefficient cannot be considered as significant. The case for Sweden is still unconclusive.

75. The estimates from Tables M and N concern France (Kessler, Masson and Strauss-Kahn [1980]). In the first table the dependent variable is saving, in the second the saving rate.

76. In equations 1 and 2, the α variable stands for the activity rate of persons over 65. It is well known that this rate tends to decrease. The coefficient of this variable is negative but of little significance. Thus when activity after age 65 decreases

(i.e. when social security develops) saving increases, which is in line with the theoretical analysis.

77. Equations 3 and 4 use a variable which tries to represent the coverage of the pension scheme. Thus,

$COUV$ = Average benefit per retiree × Percentage of retirees in the population

The coefficient of this variable is significant and negative. But the values of the Durbin-Watson statistics are abnormally high (the same remark can be done for the other equations of Table M). The unemployment rate (U) introduced in the fourth equation has an unsignificant coefficient and it should be noted that the use of this variable does not modify the significance of the $COUV$ variable. In Table N, all monetary variables have been divided by current income. Equations 12, 13 and 14 would mean that not only saving but also the saving rate is affected by the development of social security. But this time, the introduction of the unemployment rate has an effect on the t-value associated to variable $COUV$.

78. In equations 5 and 7, an estimate of gross SSW is used. Its coefficient is not significant and the same is true of the coefficient of $SSWB / Y$ in equation 15. Surprisingly enough, when this variable has a one-period lag (equations 6 and 9), a negative effect appears. One should note that the D.W. statistic is very high. As far as equations 16 and 18 are concerned the significance of $SSWB_{-1} / Y$ remains questionable, but as before this significance is notably better than in equation 15.

79. The introduction of the unemployment rate leads to variable results. In equation 10, the effect is nil and the $SSWB_{-1}$ variable keeps its negative influence. But in equation 17 which concerns the savings rate the $SSWB_{-1} / Y$ coefficient is notably modified by the use of a lagged unemployment variable. Lastly, in equation 11, with the lagged unemployment rate the influence of $SSWB_{-1}$ comes to naught.

80. Finally, with French data social security seems to have no significant effect on saving.

81. The elasticity of saving with respect to SSW is about -0.15 and the elasticity comes to -0.67 for the saving rate. Thus when the $SSWB / Y$ ratio increases by 1 % the saving rate decreases by 0.67 % i.e. 0.1 point.

82. The general conclusion from these aggregate time series studies is not so clear. In Table O the summary of the results shows that the more often the effect of social security on saving is unconclusive. Nevertheless when the effect is significant it is always negative as expected by the theoretical analysis.

83. Several studies have tried to estimate the influence of the contributions made by households into social security systems on the level of their saving. The main assumption rests upon the idea that households compare at least a part of the contributions with saving. By noting SD the desired saving, S the amount voluntarily saved by households beyond the compulsory social security systems, and COT the payments to these systems, we have :

$$SD = S + \beta\, COT$$

where β is constrained between 0 and 1. When $\beta=0$ it is assumed that households

do not consider at all their contributions to be saving, and when $\beta=1$ all the contributions are considered as saving. At the same time, the disposable income of households is written :

$$YD = Y - T - (1-\beta)\, COT$$

where T represents taxes and $(1-\beta)\, COT$ the portion of the contributions perceived as a tax. It is assumed that a relationship exists between desired saving and disposable income that could possibly include other explicative variables. Restricting ourselves to the simplest function, we have :

$$SD = a_0 + a_1\, YD$$

or replacing SD and YD by using the previous equations :

$$S = a_0 + a_1\, Y - a_1\, T - (a_1(1-\beta)+\beta)\, COT$$

84. Saito and Shome [1977] have estimated an equation with this form for Malaysia. Their estimate for the COT coefficient is not significantly different from zero and one must agree with the authors in concluding that these payments do not seem to have any influence on private saving [5].

85. Darby [1978] estimates an equation similar to the previous one over the period 1929-74 and 1947-74 for the U.S. The dependent variable is consumption and the sign of the variable representing contributions is always positive but significant in only one case out of four.

86. For Munnell [1974] contributions have an effect upon retirement saving but not upon aggregate saving whatever the period of estimation.

87. To avoid at least part of the problems connected with the collinearity of the variables we have estimated an equation in which all the variables are divided by income :

$$S / Y = a_0 + b_1 / Y + b_2\, T / Y + b_3\, COT / Y$$

This relation has been estimated for nine developed and developing countries. The results found are summarized in Table P. One remarks that practically all the situations exist : the coefficient b_3 is sometimes significant and sometimes not ; sometimes positive and sometimes negative. The sign of b_3 estimate found for the U.S. is coherent with Darby's. Nevertheless the evidence is fragile. Hence it seems difficult to reach a definite conclusion on the influence of contributions on saving.

3.2.2. Cross-section analysis

88. At the micro-economic level empirical evidence of the depression of savings by social security has been sought by means of econometric cross-section analysis at the individual level (Feldstein and Pellechio [1979]). By using survey data dating

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[5] An analogous approach has been attempted by Reviglio [1967] who estimated for 58 countries the influence of contributions upon the total taxes. He concluded that his results do not contradict the assumption according to which contributions are also close substitutes for direct taxes.

from 1963, the authors estimated a function in which the dependent variable is the physical and financial wealth of households and the explanatory variables include *SSW* and disposable income. The households studied numbering 138, were in the 55-64 age group, were contributors to the social security system and had made no large bequests.

89. The results obtained showed (Table Q) that there is a negative correlation between social security wealth and net household wealth. It must be noted, however, that the data used are relatively old, and that the outcome merely provides additional confirmation of the results of other tests, including tests on time-series and cannot in itself be decisive.

90. Three macro-economic cross-section studies have been carried out by Feldstein [1977] and [1979], and Barro and McDonald [1978] [6].

91. Feldstein has carried out two cross-section studies to test the hypothesis he advanced in 1974 of a possible depression of savings by social security. But in that instance he did not utilize social security wealth to measure the impact of the system, but used instead a series of variables. Among those used in the 1977 study were the rate of economic activity of persons over the age of 65, the average retirement benefit as a proportion of disposable income and the proportion of recipients in the old-age population. In the 1979 study another variable is introduced : the ratio of the retirement benefits of a couple to the average income of a wage-earner in industry (Table R). It should also be noted that the samples of countries are different [7]. But the most important difference between the two studies involves the period of observation : the values of the individual variables are averages for the period 1954-1960 in the first study and averages for the 1969-1975 in the second.

92. The author draws identical conclusions from the two studies : " a high level of contributions reduces savings ". It would be better to say that a high level of contributions is associated, all things being equal, with a lower rate of savings in as much as the direction of causality in a macro-economic cross-section is difficult, if not impossible, to determine. The other variables show the expected positive or negative sign. A high level of income and a high life expectancy at age 65 are associated with higher savings rates, whereas a high proportion of people older or younger than the adult population is associated with a lower rate of savings. The negative sign of α is also expected from the theoretical analysis.

93. It must be pointed out, however, that in the 1979 study the variable Y is not significant in all equations, particularly those embodying life expectancy at age 65. Similarly, the ratio of social security contributions to disposable income is not always

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[6] Aaron's work [1967] must also be mentioned. He finds a strong relationship between the saving rate and the social security expenditures in a cross-section analysis on industrialized countries. According to the author the sense of causality remains difficult to determine.

[7] The 1977 study includes 15 countries : Australia, Austria, Belgium, Canada, Costa-Rica, France, Italy, Japan, the Netherlands, Norway, Spain, Trinidad, U.K., U.S.A. and Germany. While the 1979 study has only 12 : Austria, Canada, Denmark, France, Germany, Italy, the Netherlands, Norway, Sweden, Switzerland, U.K. and U.S.A.

significant in the 1977 study. Since the sample is very small in both studies, the conclusion that social security undeniably affect savings is open to question.

94. Barro and McDonald [1977] have also tried to test the hypothesis of a negative effect of *SSW* on saving. Data concerning 16 industrialized countries [8] are used and the consumption function including a social security benefits variable is tested cross-sectionally. They used mean values of the variables for the period 1951-1960. The consumption function estimated is analogous to the equation of Modigliani [1970] and Feldstein [1974], [1977].

95. It is quite difficult to interpret their results (Table T). When the equation is estimated with a constant, the coefficient of the *SS / GDP* variable (real *SS* benefits divided by the real *GDP*) is negative, which means that higher benefits would correspond to a lower consumption rate. This is contrary to the hypothesis and results of Feldstein [1977]. But if the equation is not constrained, the coefficient of this variable is positive. Barro's conclusion is as he says " an uninspiring negative one — that the cross-country evidence neither provides empirical support for the hypothesis that social security depresses private saving nor provides convincing contrary evidence ". His conclusion is also ours.

96. This brief survey of empirical studies would be incomplete without a reference to the recent study by Kotlikoff [1979] which is unusual in being micro-economic and longitudinal. The author states that his aim is directly to test the effects of social security on life-cycle accumulation. Unlike other studies made on the subject, he uses micro-economic longitudinal data from the National Longitudinal Survey. The basic equation he uses explains the volume of the individual's wealth as the amount accumulated in the social security system (discounted value of benefits less discounted value of contributions already paid and to be paid) at the age at which the person expects to retire and total life-cycle earnings, plus a number of additional dummy variables.

97. The variable " cumulative amount of social security contributions " emerges as negative in sign and significant, a result consistent with life-cycle theory. But the absolute yield of the social security system is also positive in sign, which Kotlikoff interprets as households' unawareness of the benefits they are going to receive. This is contrary to one of the central hypotheses of the life cycle, which assumes very extensive information throughout the life cycle. Moreover, Kotlikoff thinks that the depression of young persons' savings by social security is offset by the increased savings of older people, which therefore has no effect on global savings. He, too, therefore, concludes that the effect of social security on savings is uncertain.

4. Conclusions

98. The impact of social security on the level of savings has, as we have seen, given rise to a wealth of litterature on both the theoretical analysis of the problem and

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[8] The sample includes Australia, Austria, Belgium, Canada, Denmark, Finland, France, Italy, Luxembourg, the Netherlands, New Zealand, Norway, Sweden, Switzerland, United States and West Germany.

empirical measurement of its effects. The resulting controversy has caused some disquiet, which needs to be discussed.

99. The apparent absence of links between the theoretical argumentation and empirical tests derived from it is striking. The controversy has given rise to two virtually self-contained debates.

100. The first is primarily theoretical. It investigates the possible impact of the introduction of a social security scheme in a life-cycle model. Several questions have to be answered. Does the existence of social security adversely affect wealth accumulated as financial provision for retirement ? Does retirement occur earlier once a social security scheme is in being ? How is permanent income affected by such schemes ? Is there any change in intergenerational transfers ? Generally speaking, work is confined to the study of the global impact and no attempt is made to quantify these effects separately, the reason most frequently advanced being the lack of data or doubts about their reliability [9].

101. The second debate is essentially econometric. Its sole concern is the global impact on savings of the establishment and apread of social security. In most cases, the approach taken is to estimate a consumption function embodying a variable reflecting the influence of social security. It has to be said (see White [1978]) that such an equation, in which aggregate consumption depends on both income and wealth is not truly representative of the life cycle theory but is as much derived from other consumption theories, notably the keynesian formulation, with particular attention devoted to capital gains.

102. Most of the studies therefore demonstrate the dichotomy between theoretical considerations and attempts to measure the real effects on saving. The fact that the latter seems to be " strictly empirical " adds to the dismay caused by the approach of most of the writers, who try to fit their interpretation of the signs and values of coefficients into the theoretical framework which they cite as a starting point, whereas other interpretations are often possible.

103. Another equally surprising feature of the debate adds to the general confusion. In their empirical tests, almost all these writers use the same set of data : those for the United States from 1920 to the present or for a group of other countries over the same period. Yet by a judicious choice of variables and sub-periods it would enable any of them to obtain results which are both desired and consistent with his preliminary theoretical analysis. This possibility of producing alternatively either a positive or a negative effect of pensions on savings is equally valid for the time series analysis and for the cross-section country studies. The only consensus visible between 1974 and 1979 is a movement towards increasingly empirical argumentation accompanied by the replacement of the cut-and-dried statement which were a feature of earlier discussions by more qualified and cautious conclusions.

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[9] A notable exception can be found in Somermeyer and Bannink [1973] where government employees have been compared individually with other employees.

104. This explains why we start by a critical analysis of the empirical approaches. This critique is not directly linked with the theoretical analysis and concerns only the relevance of the econometric results presented. We would like to underline a few important points in order to clarify the debate and soften a little bit the pessimistic conclusion of Darby ([1979], p. 54) stating that " There is no obvious way to resolve this impasse... The effect of social security on saving is still an open issue ".

4.1. Critique of empirical results

105. Here again we face the well-known problems of econometric analysis, which seeks to isolate the impact of one variable on another. The difficulties derive from both the form of the analysis and the data collected. The main difficulties are : apart from the fact that the " other things being equal " prerequisite is frequently artificial, the problem arises of determining whether the variables selected really provide a picture of the phenomenon studied ; in other words, whether institutional and historical differences are not sufficient in themselves to invalidate any analysis which links the level attained by one variable to the level of another variable, as if the whole of past practice and social behaviour could be expressed in a simple variable (see Strumpel [1975] and for an attempt in this direction, see Modigliani [1970]).

106. Moreover, it is a commonplace that econometric analysis on a single equation provides no information on the direction of causality [10]. That is particularly important in this case because there is just as much reason to investigate the influence of savings on social security as the influence of social security on savings.

107. Finally, what sort of effect is to be isolated ? The studies described in section 2 make it clear that the effect in question is micro-economic and dynamic. Nevertheless, a number of ambiguities remain. Is it the transitory effect of the establishment of a new pay-as-you-go social security scheme (the period during which generations receive benefits without ever having contributed), or the effect of a given level of pension on a permanent basis under an existing system ? Is the choice of the variable intended to indicate the level of social security immaterial ? Must it be taken into account in interpreting the results obtained ?

108. The empirical measurement of the impact of social security on savings by the econometric techniques employed involves other difficulties. Two points must be made clear :

Any formulation of a consumption function uses only a specified number of variables (supposedly independent) and thereby excludes all other explanatory variables. Such a procedure is inevitable, but does call for caution.

The kinds of data which are suitable can be subdivided into four groups as a result of the inter connexion of the macro/micro criterion and the time-series / cross-section criterion. Individual data (micro economic) and longitudinal

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[10] This problem can — at least in principle — be taken into account by a system of simultaneous equations. But, even this method is questionable and other technics have been proposed (Hall [1978]).

(time-series) data are rare and have been used only once by Kotlikoff. The estimated equations for the other three types of data are not always equally relevant, particularly when the direction of causality is to be determined.

109. We shall start by demonstrating that cross-section (especially individual) data do not satisfactorily identify the effect being studied. We shall then proceed to study the formulations used in the works which deal with time series notably in the U.S.

110. It is well known that it is difficult to transpose the result of sample family budgets to longitudinal analyses. At least one needs a completely specified model. However, while not really providing any new theoretical arguments, some studies (Munnell [1976], Feldstein and Pellechio [1978]) resort to the same questionable reasoning and try to draw dynamic conclusions on the basis of cross-section data obtained by means of sample surveys of households for the purpose of deducing a depressive effect of social security on agregate saving. Barro [1978] does not refer to the Duesenberry's relative income hypothesis when he stresses a very similar effect of social security wealth on personal saving : because of the existence of intergenerational transfers the level of consumption of households would depend of the gap between their social security wealth and the mean value of *SSW* for the all population. This may explain the results obtained in several studies, *inter alia*, those by Feldstein and Pellechio, although no inference can be made from them about the effect of social security on the aggregate rate of savings.

111. While the use of intercountry comparisons is less disputable than the analysis described earlier, it nevertheless has serious shortcomings. First, the hypothesis of an inverse causality — social security affecting savings — cannot be excluded. One might, for example, advance the hypothesis that countries with a low rate of savings would show greater expenditure on social security than others, precisely because need would be felt more sharply owing to the low level of personal savings. Conversely, it can be argued that the forces which induce a high savings rate are also conducive, through the political process, to generous national saving programmes. In more general terms, it may be accepted that the decision to establish or expand a social security depends on numerous socio-economic and historical factors, which vary greatly from one country to another and are also operative in determining the rate of savings. Accordingly, intercountry comparisons of savings rates reflect fundamental differences in institutions and social structures a great deal more than they reflect the varying significance of social security. The results of Barro and McDonald [1977] seem to authorize such an interpretation : the variations through time for a given country are not comparable with the cross-sectional variations appearing between countries. Owing to the fact that until now in most countries the social security system have experienced an important development it seems necessary to take into account the year of the introduction of the system among other explanatory variables since we may presume that the effects of social security on saving depend directly of the coverage and importance of the program (Feldstein [1979]).

112. Results deduced from intercountry comparisons must therefore be interpreted with caution and do not lend themselves to estimating an effect as precise as that of social security on savings, especially when account is taken of the reliability of data and

of the weakness of the explanatory variables. The use of intercountry data can be no more than a supplement to time-series analysis, especially in attempting to determine the proportions of the effect to be attributed respectively to social security and to other variables whose development has been parallel.

113. The impact of social security on aggregate savings can therefore be assessed only on the basis of time-series data similar to the United States series on which the debate has largely focused. This means that the principal bone of contention is the specification of the consumption function used.

114. One disputed point is the introduction of an unemployment indicator in the regression equation. When this is taken into account, it cancels out the depressive effect of social security on savings. The reasons advanced by Feldstein for excluding this unemployment indicator are less than convincing [11], and it is also unfortunate that the debate has remained confined to this or other equally situational variables, while the variables representing structural changes, which are very often linked to the emergence of social security, have largely been overlooked.

115. Here we may refer to Friedman's analysis of the consistency of the theory of permanent income with time-series consumption and income data. He identifies three historical factors which may explain the long-term trend of the ratio of aggregate consumption to aggregate permanent income : the substantial decline in the agricultural segment of the population, changes in household structure or family size, and the emergence of social security schemes. These variables are obviously correlated, if only because they interact without necessarily indicating either the direction of causality or the existence of reciprocal causalities, which seems more likely.

116. The effects on consumption of variables representing the respective weight of wage earners and self-employed or the size of the family should have been estimated. They may be as significant as a social security wealth variable. It would be possible anyway by doing so to disentangle the role of social security from the effects of other phenomena like urbanization, the development of the structure of the labour force and the reduction of family size.

117. Finally, the evidence that social security depresses savings depends crucially on two factors :

— the neglecting of an unemployment variable ;

— the period of estimation ; in the U.S. for instance, there is no effect on the period 1947-71 (or 1974).

118. The second factor seems especially important : on the sole period 1947-1974, Darby [1979], using different variables as indicators of the expansion of social security, concludes that the effect of social security on saving is " essentially nil or even an

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11 Darby ([1979], p. 46) : " ... the unemployment rate is insignificant just at the 0.10 level on the appropriate one — tailed t — test while the *SSW* coefficient fails the appropriate two-tailed test at the 0.10 level ". And also, inclusion of *SSW* and exclusion of unemployment : " ... is precisely the reverse of standard statistical practice and scientific method ".

increase" (p. 54). In the period 1929-1974, the effect is significant but moderate. Several authors (Barro [1976], Darby [1979], Feldstein [1974]) have cast some doubts on the relevance of the social security variable when the observation period is 1929-1974. This variable is null before 1937, and can be considered as a dummy variable representing the heterogeneity of the period of estimation. This variable divides the period in a pre-war period, marked by a recession and a post-war period characterized by a growth of the real consumption level. There is indeed some evidence that the effect of social security on saving depends of the period considered in the macro-economic cycle. One of the reasons may lie in the fact that the bequest behaviour depends probably on the economic growth.

119. But if it is so, one is led to conclude that the effect of social security depends largely on the social and economic environment and the informations from the recent past period cannot be easily extrapolated. This empirical indeterminacy, the numerous analytical difficulties encountered in testing the models and the contradictory arguments stress the need for further theoretical research before any new empirical testing.

120. What can we learn from this analysis of the empirical debate on the effects of social security savings ? Despite the fragility of the estimates, one clear result seems to emerge for developed countries experiencing economic expansion : namely that there is no effect at all or only a very modest effect the direction of which is, moreover, uncertain. It is perhaps the anticipation of this that for almost 20 years has deterred proponents of the life cycle and permanent income theories from analysing the effects of social security on accumulation. Part of the reason for the recent debate on social security may have been the realization that the period of economic expansion has come to an end and some apprehension as to the disruptive effect of pension schemes on savings in a phase of economic recession or stagnation. Hence the concern to include an unemployment variable in the consumption equation.

4.2. Critique of the theoretical argumentation

121. Broadly speaking, there are two kinds of approaches : one, the longitudinal, studies the consequence of the existence of social security on the wealth accumulation profile of the individual during his life cycle. The main justification for accumulation is the need to guarantee his consumption in old age : the theoretical framework is therefore the basic form of life cycle, without bequest. The individual behaves in roughly the same manner in the case of a funded pension except that the assets accumulated in the form of contributions — net social security wealth — is fictitious : hence the depression of national accumulation by pay-as-you-go systems, inasmuch as the micro-economic savings represented by social security contributions have no counterpart at the macro-economic level.

122. The second, transversal approach, treats the operations performed by social security funds as being primarily intergenerational transfers between contemporary generations and between present and future generations : children are repaid the contributions disbursed to their parents a generation later by means of levies on the grandchildren. The system is based on gambling on solidarity among three generations, the children providing for their parents' old age in the hope that the grandchildren will

do the same for them. Moreover, because they foresee the possibility of the grandchildren contributing nothing (bankruptcy of the social security system), parents are inclined to make transfers in the other direction — to their children.

123. The aim of the following paragraphs is to show that the longitudinal approach (consumption deferred over the life cycle) does not satisfactorily account for the effects of social security and that an analysis of intergenerational transfers occasioned by the social security scheme is probably preferable. In short, the social security scheme would affect accumulation chiefly through its redistributive effects, both between and within generations.

124. The effects of deferred consumption and of early retirement depend very much on information about the life-span. In the elementary form of the life cycle adopted by Feldstein, life-span is treated as given and the same for all, but the early retirement does not necessarily lead to increased saving when no life-span is specified.

125. An other important fact is that the probability of survival to a given age increases with age. This point is often overlooked but by Somermeyer and Bannink [1973] who use it to show that individuals rather than households may be the appropriate saving decision units. Life-cycle profiles projected from age 25 and age 65 are therefore not the same : in particular, the expected length of retirement more than doubles between those two ages. There is therefore no obvious reason to hold that the behaviour of an individual at age 25 is strongly influenced by his retirement prospects. In addition to the remoteness of retirement and uncertainty whether it will occur, its relative weight is small.

126. Either the individual's horizon is treated as virtually infinite because plans to accumulate wealth go beyond the time frame of his own life, in which case transfers to heirs play an important, and sometimes even dominant role, or, the household takes a very short-term view (either by " inclination " or because of the impossibility of saving large sums), in which case projects, if any, likewise do not depend on life-span.

127. Let us take the case of wealthy households which make sizeable bequests or gifts. Although they are few in number, their role in the national capital accumulation is considerable, as is shown in a number of studies which attempt to compute household savings by an analysis based on the life-cycle theory. Accordingly, life-cycle models embodying intergenerational transfers (Blinder [1975], [1976]) seem to yield a better picture of the trend in wealth accumulation, although they work poorly in reflecting " intergenerational immobility of wealth ", that is to say, the correlation between the wealth of a father and that of his son (Kessler and Masson [1979]).

128. The importance attached in these studies to transfers to heirs is not surprising. In most Western countries, the share of all wealth held by the top decile exceeds 50 per cent (Sweden 52 per cent, France and Belgium 57 per cent ; Denmark 60 per cent, United Kingdom 72 per cent, etc.) (Strauss-Kahn [1979]). Therefore, even though this applies to only the upper decile, the effect of such transfers on social security extends to a high proportion of all capital accumulation, whereas the analysis of the impact of deferred consumption, while certainly applying to the majority of the population, covers only a modest proportion of the savings rate.

129. Let us now look at households for which a long-term savings plan is impossible. Admittedly the reduction of disposable income resulting from the deduction of social security contributions will bring about a slight fall in consumption. Conversely, benefits will permit a level of consumption during retirement which would not otherwise have been possible. The social security scheme has therefore forced the household (or individual) to make an effort to " save " which he would not otherwise have done. However, there will have been little variation in total consumption. Overall savings therefore seem to be influenced more by the annual transfers of purchasing power from the young to the old through the social scheme than by the longitudinal effects of such schemes on individual accumulation profiles. Such transfers previously took place within families, but the establishment of social security has probably caused them to expand substantially and perhaps to change direction.

130. The impact of deferred consumption analyzed by Feldstein is therefore probably not as large as he believes it to be ; in fact, although it covers a very large number of households, it involves only a small portion of accumulated wealth.

131. In any event, there is reason to think that the establishment of social security has more complex effects than those on which Feldstein's analysis is based. Instead of slowing down accumulation and thereby leading to a " flatter " wealth profile, the social security could radically change the individual life cycle to such an extent that accumulation follows a completely different course. This is the case for individuals with relatively high incomes — professional staff, for example — whose incomes grow steadily as their career progresses.

132. In the absence of social security these households will accumulate wealth which will enable them to continue to consume when they are no longer working. But, because of the anticipated growth in their income, such households will borrow at the beginning of their working life and pay later when their resources are greater. So, for quite a long period their wealth will be negative. But with a social security system heavy accumulation, and therefore borrowing, is less necessary, so that net wealth may well always remain positive. In order to test this hypothesis and quantify its consequences, data from longitudinal studies on individuals would have to be available for an analysis of the accumulation profiles of two persons who were identical in every respect except participation in a social security. Such data are hard to find, and the execution of such a study is therefore a difficult undertaking.

133. However, another approach can be imagined, one not based on changes in the behaviour of households following the introduction of a social security but on studying the redistributive effects of such social security (see Aaron [1967], Reviglio [1967]). Chief among these effects would be a transfer of purchasing power from young people to the elderly. Because the latter generally have a smaller marginal propensity to save than younger people, this transfer may have a great effect on economic activity. The consequences of the transfer depend mainly on the structure of the population and the prevailing economic situation, i.e., the phase of the cycle being experienced by the economy. This requires an analysis of the role of social security institutions and the characteristics of the social security schemes concerned. In the United States, working beyond the legal retirement age reduces the benefits paid out, whereas this is

not so in Canada, the United Kingdom or Sweden (see Von Furstenberg [1978]). Finally, these transfers occur not only between young and old, but also between social categories, if only because of different life expectancies and the rather regressive nature of payroll social security contributions.

Table B : List of symbols

C	:	Consumption
S	:	Saving, SR saving for retirement
Y	:	Income, $\tilde{Y}$ permanent income, $\bar{Y}$ transitory income
YD	:	Disposable income
$SSWB(N)$	:	Gross (net) social security wealth
SPW	:	Private pension wealth
SS	:	Social security benefits
COT	:	Social security taxes
Θ	:	Social security tax rate
P	:	Consumer price index, $CP = (P - P_{-1}) / P_{-1}$
U	:	Unemployment rate
K	:	Capital
DUR	:	Durables
M	:	Money
RE	:	Retained earnings
G	:	Government expenditures
EXG	:	Government surplus
D	:	Demographic variable $\quad D_1 = \%$ of population over 65
		$D_2 = \dfrac{\text{Retired population over 65}}{\text{Population between 20 and 65}}$
		$D_3 = \dfrac{\text{Population below 20}}{\text{Population between 20 and 65}}$
W	:	Wealth
ESP	:	Life expectancy at 65.
σ	:	Saving rate
γ	:	Social security benefits for a couple / mean income of a wage earner
α	:	Activity rate of the population over 65
i	:	Interest rate
k	:	Rate of increase of real income

In the following tables, figures in brackets are t-values.

Table C : Munnell [1976] (U.S.A.)

(endogeneous variable : saving rate σ)

	Y^1	$COVPP$	$COVSS$	W^1_{-1}	R^2
1966-69 Sample	1.08 (8.6)	−2.392 (1.8)	−1.950 (1.9)	−0.83 (6.2)	0.29
1969-71 Sample	1.06 (10.2)	−5.119 (3.3)	−3.124 (2.6)	−0.87 (7.5)	0.37

$$Y^1 = \frac{(T - N - 1)\, Y}{ESP}$$

$$COVPP = \frac{(T-N)}{ESP} \cdot \overline{\overline{PP}}$$

$$COVSS = \frac{(T-N)}{ESP} \cdot \overline{\overline{SS}}$$

$$W^1 = \frac{W}{ESP}$$

with $\overline{\overline{PP}}$: participation to a private pension scheme

$\overline{\overline{SS}}$: participation to a public pension scheme

$T-N$: retirement duration

Table D : Feldstein [1977] (U.S.A.)

(endogeneous variable : $S + RE$)

	$\frac{Y}{P}$	$\frac{Y_{-1}}{P}$	U	$\frac{W_{-1}}{P}$	SSW	RE	SP	C^{st}	$\bar{R}^2$
1930-74	0.37	−0.14	−0.13	−0.004	−0.024	0.72	0.10	−0.25	0.985
	(5.3)	(−2.8)	(−0.5)	(−0.6)	(−1.1)	(4.8)	(0.3)	(−1.8)	
1930-74	0.38	−0.12	—	0.005	−0.033	0.78	0.04	−0.32	0.985
	(6.3)	(−3.0)		(0.8)	(−2.4)	(7.8)	(0.1)	(−4.0)	
1947-74	0.41	−0.09	−0.32	−0.014	−0.035	0.78	0.40	−0.34	0.944
	(3.4)	(−0.9)	(−0.7)	(−1.4)	(−0.8)	(3.9)	(0.9)	(−1.2)	
1947-74	0.43	−0.09	—	−0.016	−0.039	0.84	0.32	−0.38	0.946
	(3.9)	(−0.9)		(−1.6)	(−0.9)	(4.7)	(0.7)	(−1.3)	

(all quantities are per capita)

Table E : Schoeplein [1970] (Canada)

(endogeneous variable : *OFS / Y*)

	Income Group (in $)	*OFS/Y*	*COT/Y*	Age	R^2
1	1 000 - 1 999 (N = 774)	0.0236	0.38 (19.0)	−0.78 (−1.4)	0.67
2	2 000 - 2 999 (N = 763)	0.0246	−0.22 (−11.0)	0.48 (1.33)	0.34
3	3 000 - 3 999 (N = 189)	0.0188	−0.12 (−0.3)	1.58 (2.6)	0.27
4	4 000 - 4 999 (N = 64)	0.0174	0.06 (0.7)	2.62 (1.8)	0.23
5	5 000 - 5 999 (N = 32)	0.0273	−0.39 (−1.1)	−5.16 (−2.4)	0.45
6	6 000 - 6 999 (N = 20)	0.0346	−0.56 (−2.5)	−7.59 (−2.9)	0.65
7	7 000 - 7 999 (N = 22)	0.0200	−0.02 (−0.07)	−4.34 (−1.2)	0.33
8	8 000 - 9 999 (N = 52)	0.0306	−0.29 (−2.6)	1.84 (1.3)	0.37
9	10 000 - 11 999 (N = 52)	0.0267	−0.43 (−4.3)	−0.21 (−0.1)	0.52
10	12 000 - 13 999 (N = 64)	0.230	−0.06 (−0.7)	0.90 (0.6)	0.12
11	14 000 - 15 999 (N = 41)	0.212	−0.43 (−3.1)	3.28 (1.5)	0.56
12	16 000 - 17 999 (N = 30)	0.216	−0.47 (−3.9)	4.27 (1.3)	0.62
13	18 000 - 19 999 (N = 9)	0.209	−0.27 (−0.9)	4.10 (0.6)	0.32
14	20 000 - 24 999 (N = 22)	0.182	−0.25 (−2.8)	−2.50	0.32
15	25 000 - 39 999 (N = 10)	0.0136	0.02 (0.06)	−8.90 (−2.4)	0.66
16	40 000 and over (N = 29)	0.0369	0.39 (13.0)	−1.35 (−1.0)	0.45
	All (N = 2 173)	0.0283	0.33 (16.5)	0.68 (1.2)	0.39

(1) N = Number of observation — *OFS* = Other forms of savings

Table F : Feldstein [1974] (U.S.A.)

(endogeneous variable : *C*)

	(1)	C^{st}	Y	Y_{-1}	RE	W_{-1}	$SSWB$	$SSWN$	U	$D.W.$
1	1929-71	228	0.530	0.120	0.356	0.014	0.021	—	—	1.82
		(7.3)	(11.3)	(3.4)	(4.8)	(3.5)	(3.5)			
2	1929-71	218	0.528	0.137	0.376	0.013	—	0.032	—	1.85
		(8.1)	(11.2)	(4.0)	(5.2)	(3.2)		(3.5)		
3	1929-71	244	0.530	0.136	0.400	0.008	0.051	—	—	1.82
		(6.6)	(11.0)	(3.9)	(5.3)	(1.6)	(3.2)			
4	1929-71	204	0.538	0.163	0.432	0.009	—	0.075	—	1.71
		(7.0)	(11.0)	(4.4)	(5.5)	(1.5)		(2.8)		
5	1929-71	204	0.675	0.046	—	0.009	0.024	—	—	1.43
		(5.1)	(14.4)	(1.1)		(1.8)	(3.0)			
6	1929-71	155	0.553	0.154	0.436	0.013	0.010	—	1.170	1.80
		(2.4)	(11.1)	(3.6)	(4.5)	(3.2)	(0.9)		(1.3)	
7	1929-71	169	0.549	0.149	0.423	0.012	0.012	—	1.020	1.82
		(5.6)	(11.7)	(4.0)	(5.3)	(3.0)	(3.0)		(1.5)	
8	1947-71	193	0.535	0.139	0.414	0.015	0.014	—	—	1.63
		(1.2)	(5.5)	(1.4)	(2.5)	(1.7)	(0.5)			
9	1947-71	232	0.535	0.119	0.349	0.014	—	0.035	—	1.78
		(2.2)	(6.4)	(1.4)	(2.1)	(2.0)		(1.2)		
10	1947-71	252	0.531	0.106	0.423	0.008	0.029	—	0.786	1.80
		(1.4)	(5.4)	(1.0)	(2.6)	(0.7)	(0.8)		(0.9)	

(1) 1941-1946 always excluded

NOTE : Equations 3 and 4 use a different definition of *SSW*.

Table G : Munnell [1974] (U.S.A.)

(endogeneous variable : Saving S)

	Cst	*Y*	W_{-1}	*SSWB*	*SSWN*	*Y.a*	*U*	R^2
1929-60	28.73 (0.2)	0.272 (2.2)	−0.016 (−1.2)	−0.030 (−1.6)		−0.150 (−1.2)	−4.794 (−2.4)	0.91
1929-60	84.63 (0.6)	0.199 (1.8)	−0.012 (−0.9)		−0.033 (−1.1)	−0.144 (−1.1)	−5.350 (−2.7)	0.91
1946-69	−158.6 (−0.7)	0.382 (1.8)	−0.007 (−0.3)	−0.058 (−1.4)		−0.129 (−0.8)	−7.276 (−1.2)	0.64
1946-69	−197.2 (−1.2)	0.487 (2.7)	−0.017 (−0.8)		−0.117 (−2.3)	−0.198 (−1.4)	−8.428 (−1.6)	0.70

Table H : Barro [1978] (U.S.A.)

(endogeneous variable : *C*)

		Cst	*Y*	Y_{-1}	*RE*	*EXG*	*U.Y*	*K*	*W*	*DUR*	*SSWB*	R^2	*D.W.*
1	1929-40	—	0.79	0.10	0.17	0.21	0.38	0.35	—	−0.153	0.005	0.999	2.11
	1947-74		(19.8)	(2.5)	(1.5)	(3.0)	(4.2)	(1.6)		(−2.2)	(0.6)		
2	1929-40	—	0.78	0.12	0.16	0.17	0.39	—	0.010	−0.098	0.000	0.999	2.03
	1947-74		(15.6)	(3.0)	(1.8)	(2.8)	(4.9)		(1.6)	(−2.0)	(0)		
3	1929-40	—	0.77	0.12	−0.19	0.05	—	—	0.023	−0.148	0.005	0.999	1.70
	1947-74		(12.8)	(2.4)	(−1.7)	(0.6)			(3.3)	(−2.5)	(0.6)		
4	1929-40	146	0.71	0.08	0.27	0.22	0.27	0.005	—	−0.016	0.015	0.999	2.15
	1947-74	(1.8)	(10.1)	(2.0)	(2.2)	(3.7)	(2.4)	(0.18)		(−0.15)	(1.5)		
5	1929-40	138	0.70	0.09	0.25	0.20	0.27	—	0.004	−0.019	0.014	0.999	2.13
	1947-74	(1.9)	(11.7)	(2.2)	(2.1)	(2.9)	(2.4)		(0.6)	(−0.3)	(1.4)		
6	1929-40	254	0.63	0.06	0.18	0.18	—	—	0.004	0.026	0.028	0.999	1.97
	1947-74	(4.0)	(10.5)	(1.5)	(1.4)	(2.6)			(0.6)	(0.4)	(3.1)		
7	1947-74	—	0.69	0.19	0.26	0.21	0.32	0.047	—	−0.206	0.015	0.999	1.84
			(8.6)	(3.2)	(1.7)	(2.6)	(2.1)	(1.3)		(−1.4)	(0.7)		
8	1947-74	—	0.75	0.16	0.21	0.20	0.37	—	0.008	−0.062	−0.005	0.999	1.98
			(10.7)	(2.3)	(1.2)	(2.5)	(2.5)		(1.0)	(−0.8)	(−0.5)		
9	1947-74	—	0.75	0.15	0.20	0.19	—	—	0.009	−0.005	−0.012	0.999	1.64
			(9.3)	(1.9)	(1.0)	(2.1)			(1.0)	(−0.05)	(−1.1)		
10	1947-74	−24	0.70	0.19	0.26	0.21	0.32	0.051	—	−0.220	0.013	0.999	1.94
		(−0.1)	(5.4)	(1.7)	(1.6)	(2.6)	(2.1)	(0.9)		(−1.0)	(0.4)		
11	1947-74	113	0.69	0.13	0.24	0.20	0.36	—	0.005	−0.050	0.014	0.999	1.98
		(0.50)	(4.9)	(1.4)	(1.3)	(2.5)	(2.4)		(0.5)	(−0.6)	(0.4)		
12	1947-74	176	0.65	0.11	0.23	0.19	—	—	0.003	0.011	0.017	0.999	1.72
		(0.7)	(4.3)	(1.1)	(1.1)	(2.1)			(0.3)	(0.1)	(0.4)		

(All quantities are in real terms per capita)

Table I : Darby [1979] (U.S.A.)

(endogeneous variable : C)

		Cst	$\tilde{Y}$	$\bar{Y}$	M_1	M_2	DUR_{-1}	$\frac{PDUR}{PNDUR}$	i	$SSWB$	$SSWN$	R^2	$D.W.$
1	1929-74	21.65	0.835	0.546	—	0.039	−0.148	−22.01	3.54	—	0.025	0.999	2.27
		(1.2)	(23.3)	(13.8)		(0.8)	(−2.6)	(−2.1)	(2.9)		(1.3)		
2	1947-74	−5.36	0.905	0.539	—	0.010	−0.178	−14.56	1.83	—	0.003	0.999	2.33
		(−0.1)	(13.4)	(6.9)		(1.1)	(−2.2)	(−0.3)	(0.9)		(0.09)		
3	1929-74	26.34	0.821	0.541	—	0.042	−0.149	−24.97	3.60	0.017	—	0.999	2.58
		(1.6)	(22.6)	(13.4)		(0.9)	(−2.6)	(−1.5)	(2.9)	(1.3)			
4	1947-74	−0.19	0.893	0.513	—	0.074	−0.203	−13.13	1.42	0.015	—	0.999	2.29
		(−0.00)	(12.7)	(5.6)		(0.9)	(−2.3)	(−0.3)	(0.6)	(0.5)			
5	1929-74	21.54	0.841	0.553	0.164	—	−0.155	−19.79	3.48	—	0.033	0.999	2.27
		(1.0)	(18.2)	(14.1)	(0.3)		(−2.6)	(−0.9)	(2.4)		(2.2)		
6	1947-74	−139.11	1.002	0.455	0.726	—	−0.229	17.26	1.78	—	−0.017	0.999	2.40
		(−2.5)	(17.9)	(7.4)	(4.3)		(−4.0)	(0.5)	(1.2)		(−0.8)		
7	1929-74	25.44	0.830	0.549	0.005	—	−0.159	−20.93	3.38	0.024	—	0.999	2.28
		(1.2)	(17.7)	(13.7)	(0.1)		(−2.6)	(−1.0)	(2.3)	(2.1)			
8	1947-74	−137.64	1.002	0.460	0.711	—	−0.226	17.99	1.90	−0.011	—	0.999	2.42
		(−2.4)	(16.8)	(6.8)	(4.1)		(−3.58)	(0.5)	(1.2)	(−0.6)			

(1941-1946 always excluded)

Table J : Boyle & Murray [1978] (Canada, 1954-1975)

(endogeneous variable : *S*)

C^{st}	Y	W_{-1}	*SSWB*	U	*RE*	$\overline{CP}$	i	Y_{-1}	a	*D.W.*
−0.002	0.297	−0.045	−0.001							1.16
(−2.2)	(5.3)	(−2.1)	(−0.1)							
−0.001	0.361	−0.064	0.02	−0.09						1.64
(−1.5)	(5.9)	(−3.0)	(0.2)	(−2.0)						
−0.001	0.257	−0.055	0.005		0.507					1.99
(−1.3)	(5.2)	(−3.1)	(0.5)		(2.8)					
−0.001	0.271	−0.046	0.001			0.012				2.39
(−2.6)	(8.0)	(−3.7)	(0.1)			(5.5)				
−0.001	0.216	−0.036	−0.001				0.000009			1.20
(−0.9)	(1.9)	(−1.5)	(−0.0)				(0.8)			
−0.001	0.408	−0.048	0.005					−0.137		1.12
(−1.3)	(3.7)	(−2.3)	(0.4)					(−1.2)		
−0.006	0.348	−0.030	−0.005						0.0001	1.31
(−3.7)	(6.9)	(−4.7)	(−0.6)						(2.8)	
−0.001	0.281	−0.049	0.0005	−0.0001		0.011				2.42
(−2.3)	(6.4)	(−3.3)	(0.1)	(−0.4)		(4.5)				
−0.001	0.280	−0.042	0.001		−0.199	0.014				2.42
(−2.8)	(7.9)	(−3.2)	(0.1)		(−0.9)	(3.9)				

$\overline{CP}$: unanticipated inflation.

SSWB : gross social security wealth per head, in 1971 $.

Table K : Boyle & Murray [1979] (Canada, 1954-1975)

(endogeneous variable : *C*)

Cst	*Y*	Y_{-1}	W_{-1}	*SSWB*	*RE*	*U*	*D.W.*
0.001	0.667	0.054	0.057	−0.007	−0.509		1.93
(1.4)	(7.0)	(0.5)	(3.2)	(−0.7)	(−2.8)		
0.001	0.666	0.048	0.058	−0.006	−0.493	0.008	1.93
(1.3)	(6.7)	(0.4)	(2.8)	(−0.5)	(−2.2)	(0.1)	

(endogeneous variable : *S*)

Cst	*Y*	W_{-1}	*SSWB*	*U*	*Y.α*	*SSWB.α*	R^2
0.005	0.361	−0.054	−0.009	−0.005	0.004		0.97
(2.5)	(6.5)	(−2.6)	(−0.9)	(−1.0)	(1.9)		
−0.003	0.284	−0.048	0.022	−0.001	0.004	−0.001	0.97
(−1.1)	(2.4)	(−2.1)	(0.5)	(−1.2)	(1.7)	(−0.7)	
−0.002	0.297	−0.045	−0.001				0.95
(−2.2)	(5.2)	(−2.1)	(−0.1)				

Table L : Hemming [1978] (U.K.)

(endogeneous variable : *C'*)

	Cst	*Y*	W'_{t-1}	*SSWB'*	*SSWN'*	$\bar{R}^2$	*D.W.*
1949-73	3511	0.655	−0.002	−0.004	—	0.996	1.68
	(11.4)	(22.6)	(−0.5)	(−0.6)			
1949-73	3680	0.708	−0.001	—	−0.015	0.997	1.78
	(13.1)	(39.3)	(−0.3)		(−2.1)		

$$W'_{t-1} = W_{t-1} - \lambda W_{t-2}$$
$$SSW' = SSW_t - \lambda SSW_{t-1}$$

with $\lambda = 0{,}2$ for equation 1
$\lambda = 0.14$ for equation 2

Table M : Kessler, Masson and Strauss-Kahn [1980] (France, 1959-1977)

(endogeneous variable : *S*)

	Cst	*Y*	*W*	W_{-1}	*a*	*COUV*	*U*	*SSWB*	$SSWB_{-1}$	R^2	*D.W.*
1	21.2	0.472	−0.0716		−1.72					0.99	2.34
	(1.1)	(3.3)	(−2.1)		(−1.8)						
2	30.8	0.409		−0.0667	−2.08					0.99	2.52
	(1.5)	(4.1)		(−2.3)	(−1.9)						
3	−8.02	0.474	−0.0445			−25.7				0.99	2.91
	(−3.3)	(4.0)	(−2.0)			(−2.5)					
4	−8.87	0.462	−0.0408			−30.5	4.60			0.99	2.64
	(−3.3)	(3.9)	(−1.8)			(−2.6)	(0.9)				
5	−12.0	0.261						−0.0285		0.99	2.34
	(−2.2)	(1.7)						(−0.5)			
6	−13.8	0.410							−0.0929	0.99	3.02
	(−5.3)	(6.0)							(−3.4)		
7	−15.0	0.475	−0.0328					−0.0533		0.99	2.34
	(−2.6)	(2.2)	(−1.3)					(−1.0)			
8*	−13.3	0.425	−0.0340					−0.0340		0.99	2.26
	(−3.5)	(2.4)	(−1.4)					(−1.4)			
9	−13.2	0.446		−0.0128					−0.0880	0.99	3.06
	(−4.7)	(5.4)		(−0.8)					(−3.1)		
10	−14.1	0.440		−0.0109			2.62		−0.0918	0.99	2.89
	(−4.3)	(5.2)		(−0.6)			(0.6)		(−3.1)		
11	−3.49	0.235					−15.6 **		−0.0106	0.99	2.66
	(−1.2)	(4.0)					(−4.2)		(−0.3)		

* The coefficients of *W* and *SSW* are constrained to equality.

** U_{-1}.

Table N : Kessler, Masson and Strauss-Kahn [1980] (France, 1959-1977)

(endogeneous variable : σ)

	Cst	$1/Y$	W/Y	W_{-1}/Y	$COUV/Y$	U	$SSWB/Y$	$SSWB_{-1}/Y$	U_{-1}	$\bar{R}^2$	*D.W.*
12	0.240	−7.17			−15.7					0.82	2.34
	(7.4)	(−4.0)			(−1.8)						
13	0.343	−9.73	−0.0230		−15.4					0.85	2.52
	(5.5)	(−4.5)	(−1.9)		(−2.0)						
14	0.399	−13.7	−0.0357		−12.1	−0.0307				0.86	2.84
	(4.6)	(−2.9)	(−2.0)		(−1.4)	(−0.9)					
15	0.333	−13.3	−0.0261				−0.0123			0.82	2.23
	(2.8)	(−4.4)	(−1.8)				(−0.4)				
16	0.285	−10.7						−0.0433		0.75	2.17
	(4.1)	(−6.4)						(−1.5)			
17	0.269	−11.9						−0.0333	−0.233	0.76	1.94
	(3.6)	(−5.0)						(−1.0)	(−0.7)		
18	0.331	−11.9		−0.0098				−0.0437		0.76	2.30
	(3.4)	(−4.8)		(−1.7)				(−1.5)			

Table O : Summary of results

Endogeneous variable	Country		Author	Exogeneous variable	Sign of the coefficient
C	U.S.A.	1949-1971	Feldstein	*SSWB*	+
				SSWN	+
				SSWB	0
		1929-1974	Barro	*SSWB*	0
				SSWB	0
				SSWB	0
				SSWB	0+
				SSWB	0+
				SSWB	+
			Darby	*SSWB*	0
				SSWB	+
				SSWN	0
				SSWN	+
		1947-1974	Feldstein	*SSWB*	0
				SSWB	0
				SSWN	0
			Barro	*SSWB*	0
				SSWB	0
				SSWB	0
				SSWB	0
				SSWB	0
			Darby	*SSWB*	0
				SSWB	0
				SSWN	0
				SSWN	0
	Canada	1954-1975	Boyle-Murray	*SSWB*	0
				SSWB	0
	U.K.	1949-1973	Hemming	*SSWB*	0
				SSWN	−

\+ positive and significant

− negative and significant

0+ positive slightly significant ($1.4 < t < 2$)

0− negative slightly significant

0 non significant

Table O (continued) : Summary of results

Endogeneous variable	Country		Author	Exogeneous variable	Sign of the coefficient
S	U.S.A.	1929-1969	Munnell	*SSWB*	0−
				SSWN	0
		1946-1969	Munnell	*SSWB*	0−
				SSWN	−
	Canada	1954-1975	Boyle-Murray	*SSWB*	0
				SSWB	0
	France	1959-1977	Kessler, Masson	*SSWB*	0
			Strauss-Kahn	*SSWB*	−
				SSWB	0
				SSWB	0−
				SSWB	−
				SSWB	−
				SSWB	0
S/Y	France	1959-1977	Kessler, Masson	*SSWB*	0
			Strauss-Kahn	*SSWB*	0−
				SSWB	0
				SSWB	0−
SR	U.S.A.	1929-1969	Munnell	*SSWB*	−
				SSWN	−
		1947-1969	Munnell	*SSWB*	0−
				SSWN	0

\+ positive and significant

− negative and significant

0+ positive slightly significant ($1.4 < t < 2$)

0− negative slightly significant

0 non significant

Table P : Influence of social security taxes on the saving rate in some developed and developing countries (1960-1975) (Kessler, Masson, Strauss-Kahn [1980])

(Endogeneous variable : σ)

	Cst	$1/Y$	T/Y	COT/Y	R^2
France	0.092	−5405	−1.395	0.569	0.83
	(0.7)	(−0.6)	(−2.7)	(0.7)	
U.K.	0.095	448.4	−0.608	3.570	0.77
	(0.8)	(0.4)	(−1.9)	(2.3)	
U.S.A.	0.178	−23000	−0.483	−0.446	0.79
	(3.7)	(−2.4)	(−2.4)	(−0.9)	
Germany	0.298	−10588	−0.957	0.556	0.86
	(6.2)	(−2.0)	(−2.4)	(−1.2)	
Sweden	0.492	−14353	−0.673	−2.370	0.69
	(3.2)	(−3.2)	(−1.3)	(−3.5)	
Japan	−0.172	1260.8	2.891	3.259	0.79
	(−1.3)	(1.8)	(2.8)	(2.0)	
Spain	0.178	−54.03	−3.971	−1.407	0.59
	(6.2)	(−3.2)	(−2.1)	(−2.9)	
Colombia	0.089	702.6	−6.431	5.231	0.75
	(2.6)	(1.2)	(−4.5)	(2.9)	
Panama	0.392	−135.4	−5.785	−1.511	0.56
	(1.6)	(−2.3)	(−0.8)	(−0.4)	

Table Q : Feldstein and Pellechio [1979] (U.S.A.)
Micro data — cross section

(endogeneous variable : W)

	Cst	*SSWN*	Y_{65}	$(Y_{65})^2$	$\bar{R}^2$
1	25.1	−0.93	3.49	—	0.16
	(2.4)	(−2.2)	(5.0)		
2	35.3	−1.26	2.93	—	0.13
	(4.0)	(−3.7)	(3.7)		
3	34.9	−0.72	−1.16	0.29	0.17
	(2.9)	(−1.6)	(−0.4)	(1.6)	
4	57.1	−0.69	−9.56	0.86	0.26
		(−2.0)	(−3.5)	(4.8)	

Y_{65} : Income before retirement
Equation 1 and 3 : sample not corrected for married households
Equation 2 and 4 : sample corrected for married households

Table R : Feldstein [1977] (U.S.A.)
Macro data, cross-section

(endogeneous variable : σ)

	k	D_2	D_3		$(SS/Y)^1$	$(SS/Y)^2$	BEN	$100/Y$	ESP_{65}	$INIT$
1	1.34	−1.09	−0.22	−0.25	−0.104				1.81	
	(7.9)	(−4.0)	(−3.1)	(−3.6)	(−4.7)				(2.3)	
2	1.63	−0.98	−0.24	−0.24		−0.108	−0.083		2.03	
	(4.0)	(−2.2)	(−2.4)	(−2.7)		(−2.3)	(−3.8)		(2.0)	
3	1.02	−1.01	−0.16	−0.31	−0.090			8.31	1.60	
	(4.1)	(−3.6)	(−1.8)	(−3.9)	(−3.6)			(1.1)	(2.0)	
4	0.84	−1.06	−0.16	−0.37		−0.067	−0.071	14.06	1.86	
	(1.4)	(−2.7)	(−1.6)	(−3.4)		(−1.4)	(−3.6)	(1.7)	(2.1)	
5	1.17	−1.11	−0.17	−0.26	−0.077					
	(6.2)	(−3.5)	(−2.1)	(−3.3)	(−3.5)					
6	1.50	−0.86	−0.14	−0.23		−0.092	−0.056			
	(3.2)	(−1.7)	(−1.6)	(−2.1)		(−1.7)	(−2.8)			
7	1.42	−1.04	−0.24	−0.25	−0.093				1.67	0.035
	(7.1)	(−3.6)	(−0.9)	(−3.6)	(−3.4)				(2.0)	(0.7)
8	1.69	−0.91	−0.24	−0.24		−0.101	−0.074		1.84	0.029
	(3.7)	(−1.8)	(−2.4)	(−2.4)		(−1.9)	(−2.5)		(1.6)	(0.5)

(The variables are weighted by the population)
$(SS/Y)^1 = SS/Y$ for the whole aged population
$(SS/Y)^2 = SS/Y$ for the retired only
$\overline{R}^2 > 0.90$ for all regressions

Table S : Feldstein [1979] (U.S.A.)
Macro data, cross-section

(endogeneous variable : σ)

	Cst	*k*	D_2	D_3	γ	*a*	*RET*	100/*Y**	*ESP* 65	*INIT*
1	0.92	5.24 (3.9)	−1.21 (−2.7)	−0.77 (−3.8)	−0.37 (−2.8)	−0.54 (−2.0)				
2	1.02	6.07 (5.7)	−1.35 (−4.1)	−0.92 (−5.7)	−0.45 (−3.7)	−0.42 (−2.5)				
3	1.02	6.37 (4.2)	−1.44 (−3.1)	−1.01 (−3.1)	−0.53 (−1.8)	−0.49 (−1.7)			0.85 (0.30)	
4	1.21	6.97 (11.4)	−1.75 (−4.3)	−1.21 (−2.9)	−0.66 (−1.9)	−0.62 (−1.9)		−0.41 (−0.8)	1.43 (5.1)	
5	1.05	4.84 (1.7)	−1.44 (−2.8)	−0.85 (−2.0)	−0.30 (−0.7)	−0.37 (1.0)	−1.64 (−0.7)		−0.62 (−0.2)	
6	2.21	5.64 (2.4)	−1.41 (−2.5)	−0.89 (−1.9)	−0.37 (−0.8)	−0.31 (−0.6)			0.51 (1.5)	−0.07 (−0.5)

Note : The variables are weighted by the population
*Y** : Real income per capita
INIT : Introduction of the *SS* program
RET = 1 if the system has an earning test, 0 if not.

Table T : Barro and McDonald [1977] (U.S.A.)

Macro data, cross-section

(endogeneous variable : *C/GNP*)

	Cst	*G/GNP*	*D*	$\tilde{U}$	GNP/GNP_{-1}	*k*	*SS/GNP*	*1/GNP*	R^2	*D.W.*
1. Variables weighted by population	0.76	−0.62	0.90	0.10	−0.06	−0.71	−0.12	—	0.50	0.4
	(12.67)	(−7.62)	(5.62)	(5.00)	(−1.20)		(−6.00)			
	0.62	−0.29	1.09	0.067	−0.01	−1.19	−0.09	0.044	0.61	0.3
	(12.40)	(−3.22)	(7.27)	(3.50)	(−0.25)		(−4.50)	(6.29)		
	—	−0.04	−2.68	0.007	−0.04	—	0.05	—	0.91	1.4
		(−0.44)	(−5.15)	(7.00)	(−2.00)		(2.50)			
	—	−0.09	−0.20	0.003	0.01	—	0.07	0.095	0.91	1.3
		(−1.12)	(−0.37)	(3.00)	(0.50)		(3.50)	(7.31)		
Unweighted variables	0.58	−0.43	0.67	0.008	0.09	0.30	−0.08		0.20	0.2
	(8.28	(−3.07)	(3.19)	(2.67)	(1.29)	(1.00)	(−2.67)			
	0.54	−0.29	0.65	0.006	0.10	−0.70	−0.08	0.036	0.24	0.2
	(7.71)	(−2.07)	(3.09)	(2.00)	(1.66)	(−2.18)	(−2.67)	(3.00)		
	—	−0.14	−2.54	0.006	0.04	—	0.01		0.91	1.5
		(−0.87)	(−5.29)	(6.00)	(1.33)		(0.33)			
		−0.15	−1.41	0.005	0.03	—	0.05	0.064	0.92	1.4
		(−1.00)	(−2.56)	(5.00)	(1.50)		(1.66)	(3.76)		

• Average data on 1951 - 1960 ; 16 countries

• $\tilde{U}$ is a normalized unemployment rate $\tilde{U} = (U - \bar{U}) / SU$

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