

Aging Populations and Social Challenges

Paper Presented on IIASA's 20th Anniversary

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Foreword

IIASA celebrated its twentieth anniversary on May 12–13 with its fourth general conference, *IIASA '92: An International Conference on the Challenges to Systems Analysis in the Nineties and Beyond*. The conference focused on the relations between environment and development and on studies that integrate the methods and findings of several disciplines. The role of systems analysis, a method especially suited to taking account of the linkages between phenomena and of the hierarchical organization of the natural and social world, was also assessed, taking account of the implications this has for IIASA's research approach and activities.

This paper is one of six IIASA Collaborative Papers published as part of the report on the conference, an earlier instalment of which was *Science and Sustainability*, published in 1992.

If there is anyone who writes with authority on pensions and the problems that all industrial countries will confront in at most the next 20 years it is Professor van Praag. He has been far ahead of his time in pointing out the fatal defect hidden in the present arrangement of social security. It was introduced and is now maintained and defended less from the viewpoint of long-term workability than for its short term convenience.

The system I refer to is called Pay As You Go (PAYG), wherein no reserve is maintained; each year's tax collections (necessarily from those working) are paid out that same year to those retired. The convenience of PAYG was that as soon as announced it could start to pay retirees almost irrespective of the amounts they had contributed. It necessarily reduces saving in the economy, turns one generation against the preceding generation, and has other incidental ill-effects, but these are not what concern van Praag and Dalen most.

What they fear is its instability in the face of demographic fluctuations, specifically the day when the postwar baby boom starts to

retire. Subsequent to the baby boom of the 1950s birth rates went down and stayed down, so that the cohorts to pay the pensions will be relatively small, just as the cohorts coming to collect them will attain record size. Beyond that fact, caused by the changing birth rate, is the decline in mortality, the increased fraction of each cohort living to extreme old age. What happens when these facts require that payroll taxes go up to the 25 percent of all wages that will ultimately be necessary if the retired are to have social security incomes equal to 80 percent of the average wage?

PAYG depends on each generation as it makes its payments trusting that the next generation will continue do the same; once doubt starts to spread the fragility of the whole system is revealed. We are told that the system is supported by a “contract between the generations” but the “contract” is metaphorical, as will be revealed in a few years when the crunch comes.

Effects go beyond the social security system; they create a wholly artificial and unnecessary conflict between the generations. With PAYG a shortsighted younger generation can become alarmed at what is ultimately good news for all – the rapidly growing number of octogenarians and people even older – and be tempted to vote against further use of their taxes for research into and therapy of the chronic diseases of old age.

But you do not require my explanation of the problem of PAYG. You not only have it better expressed by van Praag and Dalen, but they provide a remedy, one that will be the more painless the sooner it is initiated.

Committee for IIASA '92

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Aging Populations and Social Challenges

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Abstract

The aging of populations can have some severe implications for the present social security systems. In this paper we discuss the challenges aging poses to social security design. The pro and contra arguments for social security are examined, followed by the challenges social security has to face in decades to come, viz. combining equity with efficiency, and the international integration of economies and regions. Immigration as a policy instrument to counter aging is rejected as a viable option. The implied increase in savings, brought about by a shift toward capital-reserve systems, and investing those resources in the capital-scarce regions could be the most important challenge for the world economy.

1 Introduction

At every moment in time some people will try to bring the message across that we are living at a remarkable juncture in time. So if we say at this moment that we are living at such a juncture, this

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Table 1. Some demographic figures.

	CBR* (births per 1000)	CDR* (deaths per 1000)	TFR*	Dependency rate	Life expectancy at birth
<i>USA</i>					
1965-70	18.0	10	2.6	15.1 ^a	70.4
1985-90	15.1	9	1.8	19.1 ^b	75.0
<i>Japan</i>					
1965-70	17.8	7	2.0	9.7 ^a	71.1
1985-90	11.4	7	1.7	16.8 ^b	77.2
<i>Germany (BRD)</i>					
1965-70	16.7	12	2.3	20.7 ^a	70.3
1985-90	10.4	12	1.4	22.1 ^b	74.5
<i>Netherlands</i>					
1965-70	19.2	8	2.7	16.0 ^a	73.6
1985-90	11.8	9	1.5	18.6 ^b	76.5

*CBR = crude birth rate, CDR = crude death rate, TFR = total fertility rate.

^a1970.

^b1990.

is in fact a traditional message. This message is not inspired by the abrupt transition of Eastern Europe from a centrally planned economy to a market-oriented economy, but by a much less conspicuous phenomenon. In nearly all Western welfare states we are confronted with a rather unique development: the fall of the birth rate below replacement rate and consequently a future fall in the total population and an increase in life expectancy leading to an aging of populations; an aging which has already begun making its imprint in industrialized countries. In earlier times we witnessed similar trends, but this was due to famines, wars, mass migration and the like; in our time it is a trend not triggered from such outside forces. Additionally, in contrast to earlier situations the trend seems to be rather permanent. *Table 1* presents some demographic trends.

Standard economic theory has always taken a positive and constant population growth rate for granted. We do not dare to say that if we had a theory covering negative growth rates, it would have been of much use to counter the very real problems caused by the present development of population in the first world. However, it shows how unexpectedly this downturn has come.

Why is it that aging populations present such a problem for modern economies? There are two main reasons. First, there is the productivity problem. [See for a discussion and analysis of this problem, Murphy and Welch (1990) and Theeuwes *et al.* (1985).] Productivity seems to be more age-related than in earlier periods when early education and skills required during apprenticeship were sufficient for a lifetime. Due to swift technical progress, intensive monitoring of individual productivity, together with the socially excluded possibility of lowering wages in accordance with falling productivity, nowadays in many sectors of industry there is only one way out for the older worker: early retirement or dismissal, as downwards and internal mobility within the firm is mainly excluded.

The second reason why aging is such a problem nowadays, is that there is such an extensive social security system which prescribes that the *workers* in society have to take care of the *aged*. Due to a decline in population growth the potential work force will decrease, whereas the number of old-aged will increase due to an increase in life expectancy. In short, the *dependency ratio* rises. *Table 2* shows how dependency ratios in the next 60 years will develop if the aging process remains unaltered. Under such conditions the welfare state may come into jeopardy.

In this paper we shall at first consider the specific relations between the welfare state and demography. It will be argued that social security is very sensitive to changing demographic structures. In Section 3 we explain that social security itself is not the main villain, but that most of the risks result from the specific way of financing social security, viz. by a pay-as-you-go (PAYG) system. It is argued that most parts of the system could just as well be run on the basis of a compulsory capital reserve (CR) system and that a thoughtful and flexible mix of a PAYG and a CR system

Table 2. Old age dependency ratios in a selected number of OECD countries (population 65 and over / population 15–64), in percent.

	1980	1990	2000	2010	2030	2050
USA	17.1	18.7	18.3	18.5	31.7	31.8
Japan	13.4	16.6	22.4	27.5	31.8	37.6
Germany	23.4	22.5	25.1	30.3	43.4	42.3
France	21.9	21.0	23.1	24.0	35.9	37.8
United Kingdom	23.3	23.1	22.3	22.1	31.3	30.4
Italy	20.8	20.3	22.9	25.6	35.3	37.8
Canada	14.1	16.8	19.0	21.3	37.2	36.4
Major 7	19.1	19.9	21.9	24.2	35.2	36.3
Small countries	18.9	19.7	20.9	23.2	34.0	35.1
Total OECD ^a	19.0	19.8	21.2	23.5	34.4	35.4

^aUnweighted average.

Source: OECD (1988).

would make society less prone to both demographic and other risks; risks that cannot be insured by market systems. In Section 4 we consider the transition problem, that is, how can we shift from a PAYG to a CR system with minimum waste of society's resources? Our conclusion will be that such a shift, contrary to folklore, is not very painful and in fact perfectly feasible within a limited number of years. Actually, we do not advocate a 100% shift and this makes things even more feasible. In Section 5 we consider the widely cited suggestion of promoting more immigration to the aging countries as a substitute for the lacking indigenous population growth. In our view this is a non-solution. Finally we give a thought to the idea of investing capital, generated by new CR funding, in LDCs where there is shortage. We then summarize our standpoint.

2 Demography and the Welfare State

In this section we shall try to analyze the notion of the modern welfare state and the way in which it is related to demographics. After the Second World War the welfare state expanded rapidly. The Beveridge report (1942) propounded the state's responsibility

for individual welfare “from the cradle to the grave” and from that moment on the term *welfare state* is linked to the idea of such a mixed economy. Although the welfare state is a phenomenon we all know, there is a great variety of forms. The USA, Japan, Germany, the Netherlands or Sweden all have their own types of welfare states. That makes it rather hard to define one national characterization of *the* welfare state. A second point which has to be kept in mind is that all Western welfare states have not been constructed after a carefully planned “grand design”, but that they have been developed piecemeal during a long period of legislation stretching over at least 50 years. So in most countries the structure of the welfare state may be seen as a building which has been extended and renovated over various periods; most parts, added during various periods, are still distinguishable and the link between the parts is frequently less than perfect.

Against this background let us look for some common basic features of Western welfare states. The core point seems to be the existence in society of a *social security system* which may be described by the following characteristics:

- (a) A collective compulsory insurance for specific groups of the population against “risks” such as health costs, sickness, labor disability, uncertain lifetime, unemployment and retirement.
- (b) At an individual level insurance premiums are not automatically equivalent to the insured risk.
- (c) The insurance schemes are determined by legislation by some governing body (state, municipal, provincial, Federal legislation), that is to say, they are influenced by the prevailing political pressure groups.
- (d) Enrollment in such a scheme is *compulsory* for (by law) well-defined groups and at the same time impossible for other groups who do not qualify for the enrollment criteria.

It is evident that most, but not all of these “risks” can be insured in the free market by commercial insurance companies. However, it is likely that under these circumstances premiums will be risk-differentiated according to market criteria and it follows that premiums will differ between persons or groups of persons. If this were not so, insured persons with a low risk who were asked by

company A to pay a higher than market premium would leave the insurance scheme and go to another company B, which offers insurance for less. In such a way company A would be forced to ask a higher premium for the remaining high risks and again some crowding out to company B would take place. It follows that in a free market *without* a compulsory schedule it will be impossible to insure risks at other premiums (prices) than market-equilibrium prices.

It is only due to the *compulsory* character that social security schedules for market-insurable risks are possible. In fact, as most people do not insure themselves twice, this will eliminate the viability of private insurance against such risks. However, a notable exception is found in the British health insurance system where a substantial part of the population has itself privately insured in addition to the mandatory national health service.

In the case of a market-insurable risk it may be safely said that the situation generated by social security schedules is not Pareto-optimal or Pareto-efficient. Let the present allocation be denoted by *C*, then there is a situation *B* which is Pareto-efficient compared to *C*. (A market-allocation *C* is called *Pareto-inefficient* if another allocation *B* were possible, which makes some people better off and no one worse off.) That it is not Pareto-optimal is easily seen since the allocation cannot be generated in a free market economy; it is not sustainable by the market.

In the theory of welfare economics much weight is given to the criterion of Pareto-optimality. It is a well understood criterion. The primary reaction to Pareto-inefficiency is to improve upon that situation (by moving toward the contract curve in the Edgeworth box). However, that is too easily argued. In fact, it is possible to eliminate the social security schedule and to give the market its way. In this case the Pareto-optimal outcome *A* of the allocation process will depend on the initial allocation of physical wealth, human wealth and power over individuals. It may and probably will be the case that the resulting Pareto-optimal situation *A* does not equal the desirable situation *B*. It is even likely that *A* is considered by society to be worse than *B*. This brings to light that there are *two* optimality concepts by which to judge a social allocation, viz.

- (a) Pareto-optimality (“optimality in the small”).
- (b) Social optimality (“optimality in the large”).

The second concept is based on the notion that a social allocation may be judged by means of a *social welfare function* (SWF). One social allocation is better than another if it entails higher social welfare, i.e., if it scores higher in terms of our social welfare function. If we allow the social welfare evaluation of an allocation A be $SWF(A)$, then we may have $SWF(A) < SWF(C) < SWF(B)$. As B is not reachable via the market given our initial allocation of wealth and A is estimated worse than C , it can be completely rational to accept the Pareto-non-efficient social allocation C . Actually, Pareto-optimality (denoted by $\overset{P}{\succ}$) is a partial ordering of allocations only. Clearly, if $C \overset{P}{\succ} B$ then, too, $SWF(C) < SWF(B)$ for any reasonable notion of social welfare. However, situations A and C cannot be ordered according to the Pareto criterion as in the case of switching from C to A , some people will improve themselves, while others will be worse off. Hence we do not know whether $C \overset{P}{\succ} A$ or $A \overset{P}{\succ} C$. The Pareto-criterion can lead a person to tolerate states in which wide-spread poverty exists amidst small-scale plenty and this same person may still be tempted to call this state “optimal”. Therefore, if we have the idea that C is better than A , this judgment is based on a social welfare ordering, by means of which *all* allocations may be compared with each other. We assume that it may be described by a social welfare function. Now, the acceptance of such a social welfare function implies an interpersonal comparison of individual welfare. Mainstream economics (since Robbins, 1935, and Samuelson, 1947) rejects the possibility of interpersonal utility comparison and hence the notion of an SWF. Nevertheless, in some branches of economic theory other than welfare economics (e.g., optimal growth theory) the idea of an SWF is accepted as a viable instrument. It may be said that economists are rather schizophrenic about the issue. Only recently [see van Praag (1991) and other contributions in a special issue of the *Journal of Econometrics* (edited by Maasoumi, 1991) about the possibility of welfare measurement], has it been reluctantly recognized by some economists that welfare economics without the use of the wider Bergsonian social welfare ordering concept (Bergson, 1938) will not bring us very far.

The upshot of this discussion is that, given that one accepts an SWF-ordering, a non-Pareto-optimal allocation with social security may be preferred to a Pareto optimum *without*. In addition to this ethical argument, one can empirically support the view that public choices in heterogeneous societies are inspired by income-distributional concerns. Tabellini (1990) found that the cross-country differences in social security outlays are well explained by the inequality of the *pre-tax* income and by the age-composition of the population. The theory behind this finding is that in equilibrium, the size of social security is larger the greater the pre-tax income inequality and the larger the fraction of old aged persons in the population. In a similar cross-country study Persson and Tabellini (1992) found that there exists a positive relationship between the pre-tax income distribution and the rate of economic growth. In short, the more equal the pre-tax income distribution the higher the rate of economic growth.

So far, we have been discussing *market-insurable* risks. There are, however, risks which are *not market-insurable*. The first example is the risk of unemployment. A commercial unemployment insurance is impossible since people can choose to become unemployed. Besides this argument one should take account of the fact that unemployment risks of many insured are strongly positively correlated, due to the business cycle and the fact that many workers are employed in the same firm or industry. For non-market insurable risks there are only two options, viz., to abstain from any insurance or to create a social security scheme on a compulsory basis. In this situation, too, the SWF-ordering may point to setting up a social security scheme. This analysis does not imply that presently established social security systems are always defensible from a social welfare point of view. In this respect there are three points which are a matter of concern.

2.1 Changing social preferences

In the first place citizens do not have the same SWF. As governments and parliaments in particular express and reflect the preferences of citizens they are intended to represent, the SWF, which the

legislating body utilizes, may differ over time according to the political composition. Clearly the ideas about and realizations of social security advocated by political parties co-determine the number of votes they will be given, and hence a socio-political equilibrium with a rather stable social security scheme coupled with a stable political composition of government is probable. However, it is certainly not always true. Hence, the answer to the question of which social security system is considered optimal may change with shifting political preferences or a changing rate of time preference (van Dalen, 1991).

2.2 Changing demographics

Most of the risks insured by social security systems depend on the *demographics* of a country. First, what do we mean by demographics? Actually, this is a somewhat complex notion, but we think primarily of the age-distribution, the frequency of divorce and widowhood, the birthrate and the mortality rate. Purely demographic risks are child allowances and retirement pensions. Apart from those factors, there are many risks which are partly determined by demographics. These risks are age-related. We think of:

- labor disability;
- illness;
- health costs;
- unemployment;
- early retirement;
- social assistance for families and persons in need;
- widow(er) pensions.

In all of those risks it is clear that higher age brackets run a higher risk than younger age brackets. For an example of how health care claims and age-related disability incidence in the Netherlands really are, see *Tables 3* and *4*. From *Table 3* one can deduce that the distribution of health cost claims is strongly age-related. The frequency of claims in individuals older than 65 years is approximately 4 times as high as the frequency of individuals younger than 25. If one realizes that the value of the claims also increases steeply with age, then it must be clear that health cost

Table 3. Relative number of claimants claiming health care according to age, based on a sample of 35,246 persons, The Netherlands, 1976.

Age in years	Hospital care	From specialists		Physiotherapy & mobility aids	Transportation services	Total
		In-patient care	Out-patient care			
16-19	0.0362	0.0369	0.2889	0.0246	0.0134	0.3026
20-24	0.0425	0.0432	0.2570	0.0153	0.0111	0.2827
25-29	0.0638	0.0567	0.2975	0.0268	0.0193	0.3546
30-34	0.0781	0.0776	0.3521	0.0353	0.0149	0.3879
35-39	0.0703	0.0697	0.3817	0.0501	0.0124	0.4092
40-44	0.0766	0.0766	0.3953	0.0578	0.0170	0.4191
45-49	0.0796	0.0768	0.4334	0.0664	0.0202	0.4610
50-54	0.0915	0.0905	0.4484	0.0709	0.0270	0.4770
55-59	0.0868	0.0861	0.4486	0.0792	0.0301	0.4711
60-64	0.1048	0.0996	0.4578	0.0809	0.0343	0.4928
65-69	0.1250	0.1190	0.4769	0.0723	0.0527	0.5045
70-74	0.1356	0.1310	0.5033	0.0818	0.0725	0.5273
75-79	0.1553	0.1513	0.5133	0.0712	0.0890	0.5480
≥ 80	0.1412	0.1274	0.4691	0.0832	0.1135	0.5296
Total	0.0836	0.0814	0.3986	0.0558	0.0280	0.4284

Source: van der Laan (1988, pp. 65-67).

Table 4. Disability incidence rates by age and sex in the Netherlands, 1989, in percent.

Age bracket	Males	Females
15-24	0.5	0.6
25-34	1.0	1.5
35-44	1.7	1.9
45-54	3.1	3.8
55-64	4.6	5.7
Total	1.6	1.7

Source: Aarts and De Jong (1992).

insurance is closely related to the demographic state of a country. As one can see from *Table 4* the same type of reasoning applies to the Dutch disability insurance scheme.

It follows that if demographics change, a social security scheme which was preferred until now, gradually may become undesirable. It is not only the risks that are demographically determined. If a risk increase implies a shift in secondary income from some groups to others in the form of public pension benefits, it implies as well that the source groups have to pay more. For instance, to take a simple example, if people under 65 pay social contributions, from which the over-65 get their old age benefits under a pay-as-you-go system, an increase in the elderly population implies a larger burden in the aggregate. If the young population increases proportionally, the contribution per capita does not change. However, as is frequently the case, the young population does not grow proportionally with the old to be supported, and the young have to pay a growing contribution per capita.

From this example it is clear that a specific social security scheme may yield widely varying social allocations depending on the demographic situation. Should the SWF of government remain the same, this would already pose a problem. However, it may be conjectured that an older population will have another preference with regard to social allocations than a younger one. It follows that not only social security schemes yield different allocations under different demographics, as argued before, but that they are also judged by different social welfare functions, e.g., a “young” and an “old” SWF, respectively.

As time goes by and demographic parameters such as the mortality rate and birth rate change, the age distribution changes as well. Until recently, neither politicians nor citizens have been aware of this phenomenon, except at a very abstract level. Social security schemes have been legislated during the last century nearly invariably under the tacit assumption that the age distribution would stay nearly the same in the decades to come. But this assumption has not come true. Roughly speaking, populations have become older, and this implies that as the chance of eligibility rises with age, the benefit burden for existing schedules and given benefit rates is increasing and the young population of contribution payers is shrinking. The dependency ratio is rising for nearly all programs.

2.3 Social tensions and Ponzi-games

It will be obvious to most of us that the sketched situation prevails in many Western welfare states and that it leads to growing social tensions. It is true that nearly all social security schemes are fixed by law. This is not only done because such schemes are infeasible if not based on a compulsory basis. It is also fixed for a long term, usually indefinitely, in order that people can plan their lives around it.

For instance, a state pension or a state health insurance would not inspire any confidence in people, if one would not be reasonably sure that approximately the same system will be there throughout one's remaining lifetime. Hence, such systems are based on an enormous amount of confidence, guaranteed by law. However, it is not the normal confidence between contract partners where both partners are giving and taking on a *quid pro quo* basis; it is also not the situation of mutual support where parties give and take alternately. In social security we have a separation in time, where the *young give* and the *old take*. There is a one-way dependency. Let us now assume that at a specific point in time the dependency rate is rising so high that the young generation refuses to pay altogether or at least wants to reduce the benefits. What can the beneficiaries do? They may cite the law, but if the young have the political majority they can change the law. If the beneficiaries do not have the political majority, the threat of a turnover of the existing political system is real. It is this predicament which might soon become a real problem in some countries and even more so as the social security contract in the form of a pay-as-you-go system is basically a Ponzi-game based on the assumption that the succeeding generation will not step out of the schedule. [For the conditions of a rational Ponzi-game, see O'Connell and Zeldes (1988).] If a young generation knew, or at least presumed, that when they are old they will not be supported by their offspring as they themselves are supposed to support their parents, the current young generation would have to pay twice, first for the benefits of their parents, the now old generation, and secondly they would have to save out of their present income for their own old age. This is not easily done. Most

likely, support for the old would be reduced severely to make room for the necessary savings.

The upshot of this section may be summarized as follows:

- (a) All social security systems have the same traits. They are insurance systems where the younger/stronger part of the population promises to pay the risks for the older/weaker part of the population.
- (b) The social security premium is not a market price.
- (c) The system is compulsory and established by law. As the system is compulsory there is virtually no room left for individual insurance against those risks.

Although the social security system cannot be sustained by the market and hence is not Pareto-optimal, we do not see this as a major flaw, since the system may be socially better than other systems, which are Pareto-optimal. Problems arise because most of the arrangements considered are, to a large extent, dependent on the demographic structure. First, social preferences concerning issues of equity and efficiency are determined by the dependency ratio; second, the whole volume of social insurance depends on the dependency ratio. This implies that changes in demographic structures will change what is considered to be the optimal system. This may lead to social tensions and a breakdown of the actual social security system. In the next section we will look at solutions.

3 The Confidence Problem in Social Security

Social security is a very old phenomenon. In Biblical times social security was ordained by the Lord. First, we have the Ten Commandments which prescribe: "Honour your father and your mother..." There is also the famous law that one-tenth of personal income should be given to the poor, that the cornfield should not be cut twice, etc., etc. In fact, these laws describe social contracts. It was not set up by democratic negotiations, but by the priests, maybe through divine inspiration. Its purpose, its outcome, and its workability were to a certain extent the same as what the present social security system is aiming at. These systems, at least

in spirit, have been taken over by Christianity and Islam. In non-Western religions we find similar elements. The *raison d'être* for such social security systems is that otherwise a society with all of its enormous economies (generated by cooperation and a division of labor) is not viable.

Did these old systems suffer from the same problems we sketched for modern systems? There is no doubt that they did. However, the demographic risk was countered by giving high value to married life and high fertility. In this way, as well as a lack of reliable contraception techniques, a low dependency ratio was realized. Population growth was held in check by wars, famines and other disasters. Moreover, there was the wrath of God toward those who sinned too heavily against the solidarity rules.

After the Industrial Revolution this system did not seem to work any more. First, in the urban societies with their large proletariat, the generalized dependency ratio of weak versus strong was just too large to be insured. Although even in the beginning of the 19th century there was some social support system in England, it was completely insufficient. Second, the religious discipline and the sanction of God was no longer credible for most (well-to-do) people. The collapse of the old social security system, guaranteed by God, was gradually replaced by a worldly inspired system. Under the pressure of early socialist movements through Marx' preachings, the German Chancellor Otto von Bismarck initiated, in 1871, the prototype of the modern social security system on the basis of a pay-as-you-go system. It was followed by programs in other countries. There is no doubt that the existence of a social security system enhanced the quality of life, reduced social tensions, furthered the social fabric and was a major precondition for Western economic growth.

The system really is based on confidence and ethical/legal prescriptions; the working and evaluation of the system depends on the (generalized) dependency ratio. As demographic conditions in most countries are on the move toward historically high dependency ratios, it follows that we have to expect a breakdown or at least a substantial trimming of the present system. This holds for both varieties of public finance, i.e., for the pay-as-you-go system

with a nominally separate financial flow and for the payroll-tax system where contributions and benefits are channelled via general tax revenues. In this paper we do not differentiate between either variation.

If others cannot care for you when you are in need, you should look for ways in which you can do it yourself. The other way is the *capital reserve system* (CR). Individuals save during their working lives, or rather when they are young, and they cash in their savings when they are old. It is this system which is of course used to a large extent in private pension insurance. However, in the pure market solution there is no room for complete equalization and leveling between heterogeneous risk groups. In order to get some decent income redistribution between bad and good risks we may think of a *compulsory* capital-formation system. The practice of the Dutch civil service, which is running the second-biggest pension fund in the world (ABP) for all Dutch civil servants on the basis of a (compulsory) capital reserve system is an example.

Indeed, the idea that people are eating up their own savings is a not completely valid metaphor. The capital, which has been saved via collective insurance, is invested in physical capital goods, firms and human capital. The capital itself cannot so easily be drawn back. The money which has been invested has to be paid back by the young generation, which works with this capital. Hence, there is some similarity with the social security system described before. If the young generation refuses to pay back the value of the capital invested, actually a case of *expropriation* of the old, the old generation does not get its support either. However, we estimate this risk as a far lower one than without the collateral of capital investment. In a modern open economy like the Netherlands the fund, governed by young and old, may and should diversify its investments according to risks. In this respect the risk of refusal should be minimized by investing on the international capital market, so that the risk of refusal to pay back becomes negligible, or at least smaller.

Let us now look at the comparative advantages and disadvantages of the CR and the PAYG system respectively.

3.1 The demographic risk

The first risk we run is the demographic risk, nowadays made visible by the phenomenon of aging populations. It is obviously a big threat to the sustainability of the PAYG system. For the CR system, the basic risk of a demographic shift is absent, for each cohort pays for itself. Demographic shifts are not completely without consequences for the capital-formation system either, as the young may fail to pay their interest dues to the old. It is also conceivable that in an aging population capital productivity may fall and hence the interest rate, out of which the repayments have to be made, may fall as well. However, if investments are internationally distributed the demographic risks may be spread over a large number of countries, and that risk will be minimal for the CR system.

3.2 The inflation risk

One of the points in favor of the PAYG system is undoubtedly that it is inflation-proof. Current dollars are cashed in and cashed out immediately. Only in a time of hyper-inflation might the PAYG system yield strongly devalued benefits. The capital reserve system is not inflation-proof, at least when investment is placed in one or a few currency areas. Inflation reduces the value of the defined benefit entitlements because pension benefits are fixed in nominal terms. Most pension insurance arrangements do not provide anti-inflation provisions. A number of reasons are put forward by Bodie (1990) for this arrangement:

- (a) These funds can in no way be used to avoid the inflation risk by an appropriate investment strategy.
- (b) People already have enough inflation insurance, viz., through the indexed social security benefits and investments in residential real estate.
- (c) People suffer from “money-illusion”, they mistakenly treat nominal values as if they were real. The lack of inflation hedge is a rather weak argument for the absence of inflation insurance. If investments are widely spread over a variety of currency areas, preferably in shares, indexed bonds and real investments, the long-term inflation-risk can be minimized.

3.3 The interest rate risk

The capital reserve system depends heavily on the interest rate. The interest rate fluctuates and, given the open capital markets, it is virtually impossible to escape the risk of interest fluctuations. The real value of the principal, in general, will fluctuate with the interest rate; there is not much consolation to be had. The PAYG system is immune to interest rate fluctuations, although this immunity is not entirely watertight, since wage-income developments are tied to capital-market developments. If capital is invested in various countries, as it should be, we cannot ignore the exchange rate fluctuations. With a wisely distributed spread of investments the risk may be minimal.

3.4 Savings potential

A point in favor of the CR system is that it generates savings. Given the growing scarcity of capital in the world these savings are badly needed. They increase labor productivity, too, and hence the wages of the workers. This is doubly advantageous. During the working period workers get better wages, and when they are pensioned their successors have higher productivity and better pay, and hence it is easier for the second generation to pay off the debts to their parents.

Savings actually stem from two sources: entrepreneurial savings and private savings. The latter is tantamount to postponed consumption. It stands to reason that the more assured people are that consumption in old age will be provided by others, the less they will be motivated to save for themselves, and this lack of demotivation will be strengthened when the same workers simultaneously have to pay their contribution rates to the PAYG system. So for two reasons PAYG does not motivate private saving, while the CR system on a compulsory basis generates a fair amount of investments. Estimates of the negative influence of social security on private savings are ambiguous, however. Feldstein (1974) argued that the US social security system crowded out 40% of private savings in the period 1929–1971. The picture becomes blurred, however, if we restrict our attention to the period 1947–1971. Feldstein (1977) found some

confirmation of the negative influence by a cross-section study of a number of industrialized countries. Other studies show that the effect of social security is not as clear as Feldstein's estimates imply. Barro and MacDonald (1977) show that for a cross-section of 16 countries the Feldstein (1977) results cannot be confirmed. There is no negative influence but also no positive influence. [Bernheim and Levin (1989) show in a recent panel study the importance of expectations. For a panel of US pre-retirement workers (58–63 years of age in 1969), followed for a period of ten years, social security had a significant negative effect on the private asset accumulation of single households, whereas the effect on the asset accumulation of couples was somewhat positive, but insignificant.]

3.5 Starting-up problems

The CR system needs a maturation period. At first the insured have to pay, but the benefits start to flow only after a maturation period. The PAYG system works immediately; this was one of the reasons why it was such a popular method for financing social security. This makes it difficult to replace a PAYG system by a CR system. In the time of maturation the enrolled would have to pay twice, once for the current benefit entitlements of the old and simultaneously for building up their own future entitlements. It follows that the substitution of CR by PAYG can only be done very *gradually*.

3.6 The social security trap and moral hazard problem

A well-recognized problem in social security, especially unemployment insurance, is the so-called *social security trap*. [See van Praag and Emanuel (1983), van Praag and Konijn (1983) and van Praag and van Beek (1991).] If people become unemployed, the benefit burden increases *and* the number of contributors falls. It follows that social premiums have to be *increased* on a *per capita* basis and this will increase wage-costs for the employer, either directly or with some delay. However, since hiring and firing is done by employers for economic reasons and labor becomes more expensive, it will be

necessary to fire some additional workers, causing again higher social premiums. The process is still more complex and amplified by the fact that many insurances cover incidents like sickness, disability (see Aarts and De Jong, 1992), and early retirement, which are not purely stochastic. In those cases, by means of collusion between employer and worker, people may declare themselves sick, disabled, etc. This problem is a moral hazard and its backfiring through the PAYG system may either trigger an explosive process or converge to reach a new equilibrium with higher unemployment. It is clear that under ideally strict circumstances this will not occur; moral hazard is also an issue under CR. However, under PAYG it is easy to adapt premiums year by year, i.e., to loosen financial discipline. Under CR, financial discipline will make it virtually impossible to admit moral hazard while the social security trap itself is absent.

3.7 The risk of expropriation or default

In a CR system there is one big “if”. When you want to eat up your savings, are they then available to you? There is a slight chance of expropriation, but clearly this is negligible in most societies except in pre-revolutionary societies like Germany in 1919 and Russia in 1917. However, the Maxwell scandal (1991) points to the fact that even nowadays a CR system runs the risk of non-performance. Even the Dutch government tries to extract wealth from the civil service pension fund, which may be seen as a partial expropriation of the policyholders by the state. Obviously, this expropriation risk is comparable in some sense with the demographic risk under PAYG where the young generation refuses to fulfill its obligations. In a good, stable legal structure where investments have been well spread the expropriation risk is remote or at least much less than the demographic risk under PAYG, which is completely based on “good faith” between generations.

The pros and cons are summarized in *Table 5* where “+” stands for good, “-” for bad and “0” for so-so.

Given this table we see that both insurance systems are somewhat complementary in their pros and cons. It follows that we should look, ideally, for a mixture of both systems. Given the big demographic risks, the capital shortage reflected by the historically

Table 5. Qualitative comparison of CR and PAYG system.

	Capital reserve	PAYG
Demographic risk	+	-
Inflationary risk	0	+
Interest rate risk	-	+
Savings potential	+	-
Starting-up	-	+
Social security trap	+	-
Moral hazard	0	-
Expropriation risk	0	+

high level of world interest rates (see, e.g., Homer and Sylla, 1991), the existence of well-established property rights for investments and the prominent phenomena of the social security trap and moral hazard, we feel that, at the moment, *it would be wise to strive for a mixture which contains more CR elements than it does today*. The solution of more funding in the face of fluctuations in public spending is in line with the optimal fiscal policy rule of *tax rate smoothing*. Various authors have emphasized the need for such an optimal tax policy since it minimizes the distortionary effect of taxation. [See, e.g., Barro (1979), Keyfitz (1988), Hagemann and Nicoletti (1989) and Marchand and Pestieau (1990). Van Praag and Poeth (1975) reach the same conclusion on the basis of a stylized model.]

4 The Shift From PAYG Toward CR

Lionel Robbins once stated that “...for good or for bad, on the whole economic history is a history of mixed systems – the practical question concerns always the degree of the mixture” (Robbins, 1971). The mixture of finance methods of PAYG and FF is a case in point. The central problem of steering toward CR is the *additional premium* to be paid. As we believe that hard times are ahead when we do not shift, we would prefer the softer medicine of gradual replacement of PAYG by CR above the hard solution where the PAYG system has to be trimmed considerably overnight before it can be replaced by the CR system. As will be clear from

the previous section we do not advocate a 100% shift from the PAYG system to the CR system. However, let us for the sake of argument consider such an experiment for pension insurance. Let us assume that population growth, technological progress, the inflation rate and the real interest rate are zero. All these factors should be brought into play when the experiment has to be realized, but these factors complicate the reasoning and do not change the essence of the argument.

In its essence, when risks are pooled, a pension insurance reserve may be compared to an empty bottle which is filled during the working period and emptied during retirement. Looking at the level of that bottle we see the reserve profile over life, as sketched in *Figure 1*, where the assumption was made for the sake of convenience that all mortality is concentrated at the age of 75. Consequently, this age distribution is rectangular. Work starts at the age of 20. The wage rate equals one and the benefit level is denoted by $b\%$ of the wage rate.

It is obvious that for the situation of a non-zero interest rate the reserve profile becomes non-linear, but it remains essentially (topologically) the same. In the case of a constant consumption level over a lifetime, the premium at an annual rate of $(1 - b)$ is paid throughout the working life of 45 years length and the reserve is depleted over 10 years of retirement with an annual benefit of b . In the practice of running a company's pension fund, contributions and benefits will be frequently wage- or price-indexed which implies annual corrections for the contribution rate. In the present context we abstain from such complexities. It is obvious that on an aggregate basis, a lowering of the retirement age is just a shift of the top of the triangle to the left.

In discussing the transition from a PAYG to an FF social security system, there are two points which have to be questioned. First, is this transition only applicable for the case of public pensions or can we apply the shift from PAYG to FF also to insurances like health, disability and unemployment? The reason for saying "yes" is that there is a *specific pattern of risks* over time, where the risk is at first minimal and grows over a lifetime. A similar picture to that in *Figure 1* may therefore be sketched for labor disability

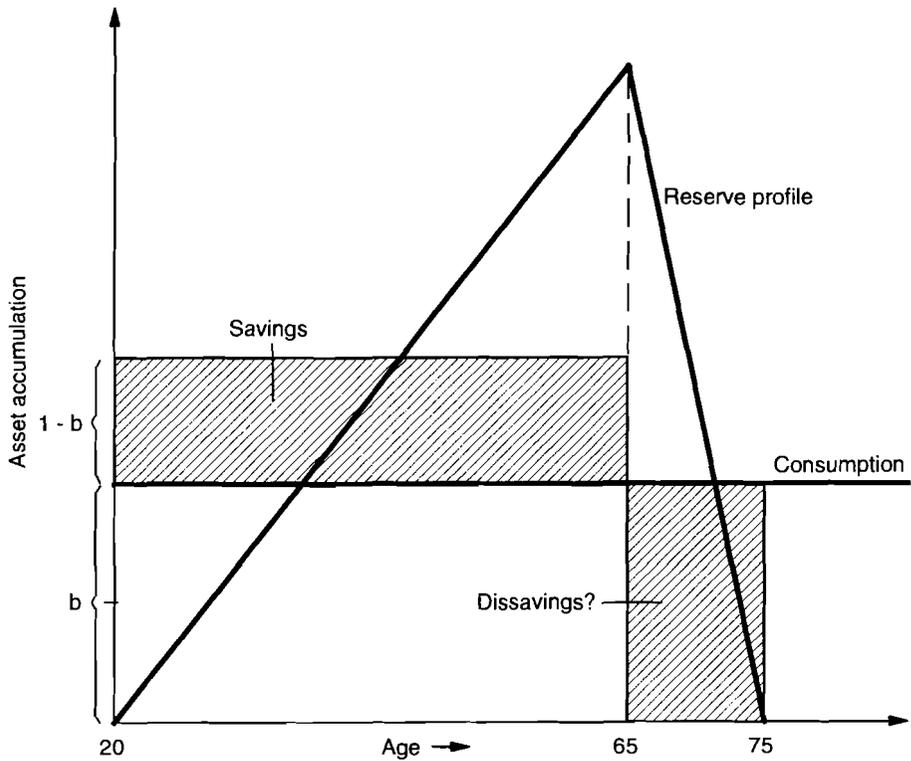


Figure 1. Individual life-time asset accumulation.

insurance since this risk is heavily age-related. The main difference in the retirement case of *Figure 1* is that one has to save for aggregate risks over the working lifetime instead of the entire lifetime. For instance, for labor disability one would find the profile as drawn in *Figure 2*.

In this case we assume that labor disability incidence starts to appear at about 40 and that the number of newly disabled increases with age. At first, the premiums exceed the benefits and we see the accumulated reserve grow. Therefore, the reserve profile does not go under the horizontal axis. This implies, in plain words, that the insurer does not have to honor obligations before the premium is earned. However, it is obvious that this holds only if the insurance is compulsory over an entire lifetime. In practice, compulsion is

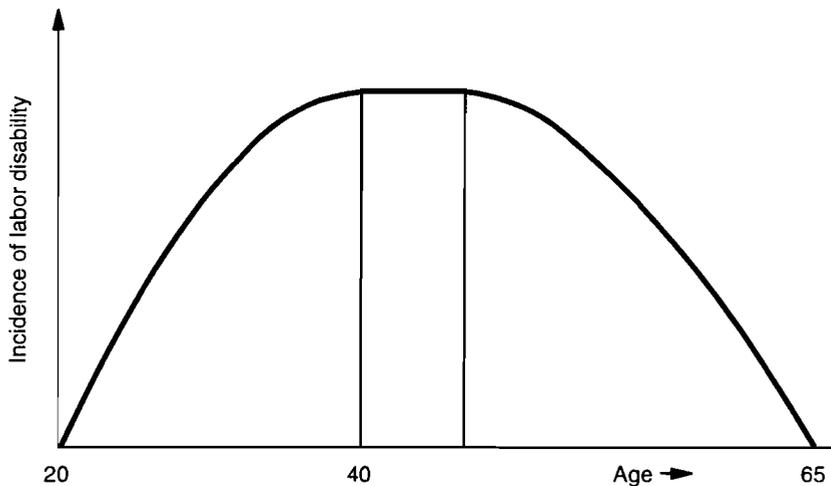


Figure 2. Labor disability reserve profile per cohort.

only a point at the beginning, for later on the insured will have saved capital which makes it rather disadvantageous to leave the insurance program just when it starts to pay out. The reserve curve becomes flatter at age 40 and the actual depletion of the fund at an accelerating rate starts at 50. *Table 6* gives some support to this disability profile. Similar reasoning describes the reserve patterns for sickness and health care insurance. (The majority of health cost insurance schemes are based on the method of PAYG, but there are examples, as in Germany, where health insurance is partly financed on a CR basis.)

A second point is again that of *moral hazard*. As we pointed out before, the risk of unemployment or labor disability is not purely random, so it may (and as Dutch experience has shown) be rather advantageous both to the employer and the older employee to be declared disabled, etc., when times are hard on the firm. The risk incidence is endogenous, even if we introduce severe monitoring and control. The only way in which this self-selection can be countered is by setting up (dis)incentives both for workers and employees. For employees, early retirement has to be accompanied by a reduction in the benefits. Firm-specific premiums have to be *experience-rated* (see Burdett and Wright, 1989). However, we should keep in mind

Table 6. Age distribution of the disability beneficiaries and the insured population, and age-specific DI-dependency rates for the Netherlands, 1986.

Age brackets	Disability beneficiaries	Insured population (percentages)	Disability insured dependency rate ^a
15-24	1.5	24.2	0.1
25-34	9.0	31.9	3.9
35-44	18.5	24.0	9.9
45-54	28.7	14.3	22.2
55-64	42.3	5.6	52.0
Total	100.0	100.0	12.5

^aNumber of DI-beneficiaries as a percentage of the population at risk, including DI-beneficiaries.

Source: Aarts and De Jong (1992, p. 38).

that the moral hazard problem is just as harsh for PAYG insurance as under CR, while PAYG undoubtedly gives more possibilities for “budgetary flexibility” than the CR system.

The basic difference between CR and PAYG is the insured population. In PAYG the whole population is insured under the same terms, and the terms are fixed each year anew, mostly on the basis of demographic changes. Under CR each age cohort is insured separately for essentially fixed terms, over a lifetime. This is evidently only possible if a cohort is big enough to get a good risk-pooling and if insurance per cohort is compulsory to avoid a self-selection phenomenon. Looking at *Figure 1* and assuming our stylized condition of no population growth, no wage growth and a zero interest rate it is obvious that both PAYG and CR will lead to the same contribution rate for a given benefit rate. If capital is assumed to grow at an interest rate $r > 0$, it is obvious that the contribution per year may be less than in the case of a zero interest rate, since the accumulated capital increases. If capital becomes more productive due to a technological progress rate g , this is another advantage. In a similar way, if there is positive constant population growth n , the ratio of old to young, i.e., the *dependency rate*, will be lower than under zero growth; consequently, contribution rates may be

Table 7a. Interest rates and growth rates for selected OECD countries, 1970–1979.

	USA	Japan	Germany	France	UK	Italy	Canada
1. Capital market interest rate	7.5	7.7	6.5	9.8	11.4	10.3	8.0
2. Growth rate wages, private sector	8.2	14.3	9.8	13.5	16.4	18.9	9.1
3. Inflation ^a	7.1	9.1	4.9	8.9	12.6	12.3	7.4
4. Real interest rate (1–3)	0.4	-1.4	1.6	0.9	-1.2	-2.0	0.6
5. Growth of real wage rate, private sector (2–3)	1.1	5.2	4.9	4.6	3.8	6.6	1.7
6. Labor force growth	2.5	0.9	0.2	1.0	0.5	0.7	3.2
7. Aaron-condition (4–5–6)	-3.2	-7.5	-3.5	-4.7	-5.5	-9.3	-4.3

^aPrice level household consumption.

Sources: OECD, Labour Force Statistics, Economic Outlook.

lower for a given benefit rate than for a stagnant population. For stylized models the Aaron-condition (1966) tells us that if $r > n + g$ it is more advantageous to use the CR system than a PAYG system, while for $r < n + g$ the PAYG system would be advantageous. Evaluated according to that condition and assuming that the rate of technical progress is reflected in the real wage growth rate, *Tables 7a* and *7b* show the trend of this inequality over the last two decades in selected OECD economies.

We see that in the 1970s there was (*ex post*) some reason according to the Aaron-condition to utilize the PAYG system. In the 1980s the inequality was inverted and a CR system should have been preferred. However, apart from obviously needed model complications the practical value of this Aaron-condition is rather limited,

Table 7b. Interest rates and growth rates for selected OECD countries, 1980–1989.

	USA	Japan	Germany	France	UK	Italy	Canada
1. Capital market interest rate	10.6	6.5	7.7	12.4	11.5	14.7	11.5
2. Growth rate wages, private sector	5.8	4.6	4.5	8.5	9.7	13.2	7.3
3. Inflation ^a	5.5	2.5	2.9	7.4	7.5	11.2	6.5
4. Real interest rate (1-3)	5.1	4.0	4.8	5.0	4.0	3.5	5.0
5. Growth of real wage rate private sector (2-3)	0.3	2.1	1.6	1.1	2.2	2.0	0.8
6. Labor force growth	1.7	1.2	0.8	0.4	0.7	0.9	1.9
7. Aaron-condition (4-5-6)	3.1	0.7	2.4	3.5	1.1	0.6	2.3

^aPrice level household consumption.

Sources: OECD, Labour Force Statistics, Economic Outlook.

against the background of all relevant aspects given in *Table 5*. [An obvious candidate for extending the model is the age-related income profile instead of the constant wage-rate growth. Empirically one can find enough evidence that the age-income profile has an inverted U-shape (see Theeuwes *et al.*, 1985, and Murphy and Welch, 1990).]

Finally, we have to look at the question of how a transition has to take place. We assume a stylized demography where people work from age 20 to 65 and live for 10 years after retirement. Moreover, we assume a zero interest rate and population growth rate.

It is true that the transition will cost additional money temporarily. For instance, let us assume, referring to the case of *Figure 1*, that the pension benefit/wage ratio or replacement rate is $b = 0.6$. The social security contribution ratio α is found from the

balanced budget equation $\alpha \times (65 - 20) = 0.6 \times (75 - 65)$. The RHS of this equation represents the expenditure side and the LHS the income of the social security system. It follows that $\alpha_0 = 0.6 \times \frac{10}{45} = 13.3\%$ is the initial PAYG premium. We set $\alpha_1 = \alpha_0$.

Consider now a temporary surcharge (β_1) of 4%: that is, workers pay 17.3% of their wage income, viz., 13.3% to pay the elderly and 4% to build up a capital reserve. Furthermore, assume that the sum of the premiums of this mixture of PAYG and CR systems will be held constant at 17.3%. It follows that the total premium is $\alpha_1 + \beta_1 = 17.3\%$. In year 2 we have a yield of 45 ($\alpha_1 + \beta_1$) and we have to pay $45 \cdot \alpha_1$. In year 3 the retiring cohort has a capital of β_1 and hence part of the retirement benefit, viz. $\beta_1/10$, and can be paid out of forced savings. From this it is clear that the PAYG benefit of being covered is only $10 \cdot b - \beta_1/10$. Consequently, the implicit PAYG premium α_2 is found from the equation $45 \cdot \alpha_2 = 10 \cdot b - \beta_1/10$, and consequently $\beta_2 = 17.3\% - \alpha_2$. In year 4 there are two retired cohorts to be supported. The first has saved $\beta_1/10$ the second $(\beta_1 + \beta_2)/10$. We can see that PAYG premium α_3 is given by $45 \cdot \alpha_3 = 10 \cdot b - \beta_1/10 - (\beta_1 + \beta_2)/10$. Again it is clear that $\beta_3 = 17.3\% - \alpha_3$. In short, the system is built up according to the following equations:

$$45 \cdot \alpha_2 = 10 \cdot b - \beta_1/10 \quad (1)$$

$$45 \cdot \alpha_3 = 10 \cdot b - (2\beta_1 + \beta_2)/10 \quad (2)$$

...

$$45 \cdot \alpha_{11} = 10 \cdot b - (10\beta_1 + \dots + \beta_{10})/10 \quad (3)$$

where $\alpha_t + \beta_t = 17.3\%$. Notice however that in this (simplified) system with zero interest and population growth, the stationary CR premium is again given by the equation:

$$45 \cdot \beta = 10 \cdot b \quad (4)$$

We notice that in the transition period α_t is steadily declining at an ever quickening rate and β is growing, their sum being constant. When α_t falls to the surcharge level of 4%, the PAYG system has vanished, the CR has taken over and we stop the surcharge of 4%.

Table 8. Number of years to complete transition to fully funded social security.

	Benefit-wage ratio, b :			
	0.70	0.65	0.60	0.55
Initial surcharge β_0 (%)				
4	44	42	41	39
5	39	37	36	34
6	35	33	31	29
7	31	30	28	26

After some calculations it can be seen that in 3 to 4 decades during which the premium is held at 17.3%, the original service may be totally financed from the capital reserve system, while the overall premium may be reduced to 13.3% if one wants to stay at the original benefit level. Of course, if we start with a smaller surcharge the shift will take longer. If we do not plan a complete but rather a partial transition from PAYG to CR, the shift takes, obviously, a shorter time period. *Table 8* gives us an impression of the number of years to complete the transition from 100% PAYG to the fully funded situation of 100% CR.

Obviously this is a simplified calculation, but it catches the essentials. It is easy to complicate it with details, but the result is not very different under a wide range of parameter values. The general conclusion is that *a transition is a painful but not impossible process*. In this example we considered the retirement insurance. A (gradual) shift from PAYG to CR for the other demographic insurances is feasible as well. Evidently, this analysis is only intended to show that a shift is not that formidable, lengthy and painful as is often thought and feared. For practical policy it is obvious that a detailed descriptive model is necessary, including a positive interest rate, non-stationary population growth, productivity growth, etc.

5 International Migration as a Solution

It is frequently suggested that if a population is too old, one can fall back on a ready solution, viz., immigration of young people from the less developed countries. The reasoning behind this suggestion is that the North has the capital and the South has the people or labor. What could be more obvious than promoting immigration from the poor countries (notably countries in Africa) to the rich countries? We view this as an extremely naive and simplistic solution, which is actually dangerous for the North and not helping the South at all. It cannot be denied that the influx into a population of many young persons and families makes the host population younger. However, taking the Dutch population of 15 million as an example, we see that this solution would give rise to ridiculous results. The age bracket [14, 64] consists of 10.3 million people and the people of 65 years and older number 1.9 million individuals. The resulting ratio of retired persons to workers is 18.5%. Assuming an influx of only people of working age we see that it would require about 400,000 immigrants to change the dependency ratio one unit point. It is obvious that immigration into our already crowded country is not a viable way to change its demography significantly. In this example we assumed a short giant influx, which would clearly unbalance the age distribution over many years.

Another possibility is a gradual inflow of about 50,000 persons per year. In this case the dependency ratio will not proportionately change in the short run. The main structural parameters behind the demographic situation are birth and mortality rates. So the question is really, what will be the impact of a gradual inflow on long-term birth and mortality rates? Again, we see that this impact will be small. Let the fraction of the old and new population be p and $(1 - p)$ and let their birth rates equal β_o and β_n respectively, then the overall birth ratio will be just the weighted average $p\beta_o + (1 - p)\beta_n$. It follows that if p is relatively small, say below 10%, the birth ratio will not increase very much. In addition, the whole phenomenon is rather short-lived because the new immigrants will adapt themselves to the indigenous population and their fertility behavior will tend to the (lower) indigenous birth rate. The same reasoning holds for the mortality rate. In accordance with the views

of various authors like van Dalen (1992, ch. 5), Felderer (1992), Ritzen and van Imhoff (1992), we conclude that immigration of a realistic size can never solve the demographic aging problem of the Western welfare state.

However, there is more to say about immigration. It is frequently thought that natives and immigrants are alike in terms of productive capacity and their contributions to national welfare. This is a popular and sympathetic misunderstanding, based on the critical presumption that everyone is alike. In the present context we cannot deny that there are differences. We have to look at the relative differentials between the indigenous population and the immigrants on various points:

- (a) Social and cultural differences like race, religion, language and social norms.
- (b) Human capital in terms of health.
- (c) Education and experience with modern production organizations.
- (d) Experience with market economies.

It is obvious that socio-cultural absorption by the host country becomes more difficult when there are more socio-cultural differences. In this respect we do not necessarily refer to real differences, but differences as they are perceived, sometimes based on mere prejudice. If absorption is difficult, the immigrants will form their subsocieties, as the Chinese, Italians, and Jews did in the first decade of this century when they immigrated into the USA and Canada. However, such subsocieties have to maintain themselves more or less, which requires a critical mass in numbers, physical concentration and social education. It is in these terms that the immigration waves from Europe during the period 1850–1950 into the New World have to be understood.

Measuring the new potential immigration flows to the Western welfare states we see that there are great differences between the waves into North America during the period 1850–1950 and the new waves into North America from Latin America and into Western Europe from the Far East and Africa. Firstly, the socio-cultural differences between host and immigrants are on average larger. Secondly, the modern welfare states have grown enormously in richness,

wealth and complexity of technology and socio-economic fabric during the last 50 years, while Eastern Europe and most African countries have stagnated. In short, the *gap* between, e.g., the USA and Russia 70 years ago was much less pronounced than nowadays and this holds *a fortiori* for present-day Europe compared with countries like Turkey, North Africa or Eastern Europe. It follows that the absorption of immigration nowadays is really more difficult than 50 years ago.

The points (a) to (d) listed above are, of course, related to the first point on socio-economic differences. However, they relate more directly to the burden which immigrants may lay on the social security system of the host country. First, we have to recognize that the health capital of the individual is created during childhood. Therefore, immigrants are almost always at a disadvantage compared with the children in the host country. The risk of falling ill is greater and life expectancy is shorter than in the host country. Therefore it is not strange, for instance, that about half of the beneficiaries of Dutch disability benefits have been born elsewhere. The same holds true for education, technical skills and market orientation. Therefore, the admission of large-scale unscreened immigration will almost certainly create a *socio-economic underclass* in the host countries. Given the solidarity in the modern welfare state, the rights to family reunification, and the equality of rights granted on ethical grounds to immigrants (even before naturalization, as in the Netherlands) immigration will almost certainly generate a heavy strain on the social security system. *Instead of alleviating the pressure on the social security system the most likely outcome of mass immigration will be an aggravation of the problems of the modern welfare state*, as Dutch society tragically demonstrates at the moment.

A final point which should be kept in mind is that of the *optimal population size*. There are countries which are underpopulated and countries which are overpopulated. Immigration into overpopulated countries like Japan or the Netherlands should be discouraged. However, the abstract optimal population concept is rather difficult to substantiate. It varies according to time, technology and with the prevailing age distribution. Apart from that, we have to

ask where immigrants go to *within* the countries of their choice. For instance, France as a whole is probably underpopulated. However, most immigrants tend to go to the big urban regions like Paris, Lyon and Marseille. In those places there is overpopulation.

At the level of economic analysis the capital-labor ratio in the developed countries is much larger than in the LDCs. One way to get equalization is to bring people to capital. As argued before, this is not advisable in practice. Another option is to bring capital to people; in other words, export capital generated by the developed countries to the LDCs. This looks more hopeful for both partners. First, there is an enormous scarcity of capital in LDCs. Second, as argued before, it is very desirable for our aging societies to base our social security to a greater extent on a capital reserve system. This will generate additional savings which can be used for investment possibilities. On condition that the LDCs offer a good investment climate with well-defined property rights, the possibility of appointing foreign staff in high positions for a temporary period and the possibility of transferring at least part of the profits to the country that invests, this type of investment may simultaneously aid the LDCs and support the ailing social security systems of the developed countries.

Is this arrangement tantamount to *neo-colonialism*? It cannot be denied that there is some similarity. However, in this case the relation may be based on a more even-handed relationship as the interests of both partners are evidently at stake and both partners are also able, by a vote, to end the relationship and to inflict severe damage on the other party. This solution, which has among others been suggested by van Dalen (1992), seems to be the only viable solution to the aging problem *and* the development problem.

6 Conclusions

In this paper we have attempted to develop some theses about the problems connected to the changing population structure in Western societies. Obviously, we aimed at a non-technical exposition. This is not really weakening our standpoint very much, since the real model is not exactly known. It might be, although it is not very

probable, that birthrates will rise again in the coming decade. A model is always an imperfect description of reality and in this context the exactitude of any model is only apparent, since there are so many differences between countries. However, we assume that we have made it sufficiently clear to the readers that the phenomenon of the aging society is a situation which poses a serious threat to modern welfare states as they developed after the Second World War. The Achilles heel results from the pay-as-you-go method of finance, by means of which the great majority of social security systems are financed nowadays. In this respect, it does not make a major difference whether the system is financed by a separate pay-as-you-go fund or that the contributions are made as part of regular taxes and the benefits distributed from the general tax revenue of the state. In both cases the dependency ratio, which may increase to dangerous levels, is the factor which will certainly cause a lot of social tension. We have noticed, in this respect, that the whole social security structure suffers from the same problem. It is not only a problem of old age retirement benefits, but it is also pertinent to the benefits for labor disability, sickness and unemployment.

Given this point, it is absolutely necessary to look in time for a solution which can at least alleviate the problem. We plead for a reconsideration of the capital reserve system as a partial substitute for the present system of finance. We outlined the various advantages and disadvantages of the two main financing structures and made it clear that a transition toward the CR system from the PAYG system is painful, but certainly feasible in a limited number of years. Given a global capital shortage for the decades to come and the fact that the worst time is still to come, since the dependency ratio will really reach dramatic levels in the '20s and the '30s of the next century, there is still the possibility of increasing the capital reserve part of the social security system. The shift will be more painful in the next century and the resulting investments are, at the moment and for the decades to come, badly needed. We hope very much that this position paper will lead to discussions in the circles around IIASA. IIASA has built up in the last 20 years an impressive structure for scientific research. It is also one of the few places from which a really international network of scientists

and policy-makers emanates. The problem we dealt with today is a problem with interesting scientific aspects. However, it is, foremost, a political problem which should be solved by policy-makers in the various countries.

The second point which we have tried to make is that the demographic imbalances in the Western world, although superficially just the opposite of the current imbalances in the less developed world, cannot and should not be solved by mass *immigration* from the LDCs to the developed countries. This will make no sense and, in reality, will make the problems worse for developed countries. However, for the LDCs also, a mass *emigration* is not advisable. It is obvious that the people who will emigrate from the LDCs will be mostly the young and highly-skilled persons. Their emigration would constitute a loss for their own countries. On the other hand, the controlled export of capital and investment of Western capital in less developed countries and Eastern Europe would have a favorable effect both on the exporting and the importing countries. In this respect the World Bank can play a still greater role.

Let us finish now by wishing IIASA all the best in its mission for our global society and with the hope that in the future much more attention will be given to the problems we have tried to expose today.

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Rapporteur's Report

Wolfgang Lutz

Population aging – to be distinguished from individual aging – is the demographic process in which the age distribution of the population moves toward the older age groups. This can be measured either through the increase in the mean age of the population or through the increasing proportions of the population above a certain high age, e.g., age 60, 65, 70, etc. Because of irregularities in the age distributions these different indicators of aging need not necessarily result in identical pictures of the aging process. The immediate demographic causes of population aging are usually combinations of declining fertility and increasing life expectancy. However, either one of these trends would be sufficient to result in some, although slower, aging. The migration component of population change may also result in the aging of regional populations if there is a high proportion of young people emigrating from a certain area, as is seen in many rural areas, or if an unproportionally high group of elderly immigrate into a specific region, as is the case in parts of Florida.

1 Aging in Industrialized and Developing Countries

At present, human populations are aging in all parts of the world, and it is very likely that they will be aging even more rapidly in the future. According to the medium variant of the UN population projections, the mean age of the population is likely to increase by 1.5

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Table 1. Mean ages of the population in 6 world regions by the year 2100 according to an extension of the UN medium variant, in years.

1990	22.2	25.8	29.8	24.8	24.8	35.8	28.0
2000	22.7	27.4	31.8	26.0	26.1	37.3	29.1
2010	23.8	29.4	34.9	27.8	28.2	39.0	30.8
2020	25.6	31.5	37.5	30.0	30.4	40.5	32.5
2030	28.1	33.5	39.9	32.9	32.9	41.8	34.6
2040	30.1	35.2	41.9	35.4	35.0	42.6	36.3
2050	31.6	36.3	43.1	37.4	36.4	42.8	37.5
2060	33.0	37.1	43.7	39.0	37.5	42.9	38.3
2070	33.8	37.5	44.1	40.2	38.1	43.0	38.9
2080	34.2	37.7	44.2	40.8	38.4	43.0	39.0
2090	34.3	37.8	44.3	41.1	38.5	43.0	39.0
2100	34.4	37.8	44.3	41.1	38.5	43.1	38.9

Source: Lutz and Prinz (1991).

years between 1990 and 2000 in the industrialized countries taken together (from 35.8 years to 37.3 years). However, the populations of Eastern Asia and Latin America are on track for even more rapid aging, a fact that is often disregarded. As the UN medium variant given in *Table 1* suggests, the mean age of the population is likely to increase by 2.0 years in Eastern Asia (which is essentially China) and by 1.6 years in Latin America. Even in Africa, which has still very high fertility rates, the UN medium variant suggests an increase in the mean age by 0.5 years by the year 2000.

Alternative scenarios calculated by Lutz and Prinz (1991) show that even in the case of a much slower future fertility decline than assumed by the UN medium variant (if the medium variant level is reached only within 60 years instead of 35), moderate population aging will take place in all regions of the world. This scenario, however, would result in a total world population size of more than 14 billion. A rapid fertility decline scenario, on the other hand (that would bring Western European fertility levels to all regions of the world by 2025), would effectively curb world population growth to peak at around only eight billion by the middle of the next century and decline somewhat thereafter. In this case, however, population

aging would be immense. The mean age of the world population would increase from around 28 years at present, to 34 years by 2020, 43 years by 2050 and even close to 50 years by the end of the next century. In certain regions, such as Africa, today's very young age structure would experience an even more extreme aging process resulting in a doubling of the mean age between 1990 and 2060. By 2020 Eastern Asia would approach present mean ages in the industrialized countries, followed by the rest of the world, except for Africa, by 2030. [A detailed account of alternative assumptions and projections for 12 world regions is given in Lutz (1994).]

In short, these calculations can be summarized by the statement that mankind has a choice between excessive further population growth or extreme aging. A compromise between these extremes, as described, e.g., by the UN medium variant, will result in both significant further population growth and significant aging. Even in this intermediate case, aging in most developing countries will be more rapid than in Europe and North America. However, there is a big difference between the two hemispheres in their experience and ability to cope with the social and economic problems of population aging. The industrialized countries and especially Europe have three decades of experience in population aging and have an even longer tradition of very elaborate social security systems to support the increasing proportion of elderly. Of course, as the population continues to age these systems will come under great pressure and, as will be discussed below, some modifications are inevitable. On the other hand, it should be pointed out here that these problems in the industrialized countries seem to be of a different order of magnitude compared with the developing countries, which generally do not have any old age security systems, neither private nor public, no social infrastructure of support for the elderly aside from the family, and no savings or reserves that could be in any way compared with that of the industrialized countries. If family size declines rapidly and some persons have no children at all – which is highly desirable from a population growth point of view – then the rapidly increasing number of elderly people in those countries will have little if nothing to rely on in the future.

Despite these gloomy prospects in the developing countries, the discussion in the conference session on population-aging focused largely on industrialized countries and their problems in restructuring old age social security systems. Nevertheless, such a discussion is justified and will be reported here for two reasons: first, it is a real question that is heavily discussed in political and scientific circles in most industrialized countries and, second, it is hoped that the solutions found in the North will also prove useful for the developing countries in designing and building up their old age security systems in the future.

2 Specific Aspects of Aging in Industrialized Countries

The following comments refer to relevant points made during the discussion and hence do not always logically follow each other.

When talking about the changing shape of the age pyramid in the process of aging it is useful to distinguish between aging at the top of the pyramid (i.e., a relative expansion at the older ages) which is induced by declining mortality, and aging at the bottom (i.e., a relative shrinking at the young ages) which results from declining fertility. Although the origin and determinants for these two processes are very different they have similar effects on the mean age of the population or on the proportions of the population beyond certain ages. For a more detailed analysis of aging by specific age groups such as the very old or school-age population, the distinction between mortality induced and fertility induced aging is very relevant.

A frequently used demographic indicator of the economic and social security burden, which the active population has to carry for the economically not active population, is the dependency ratio. The old age dependency ratio is defined as the population above a certain critical age (mostly 65) divided by the population in active age (mostly defined as 15–64). This ratio is based only on the sizes of age groups and does not reflect actual economic activity and unemployment, actual ages of beginning work and of retirement,

nor actual productivity of certain age groups. Hence, it is only a very rough indicator of the actual economic burden of aging.

The young age dependency ratio is defined similarly as the number of persons aged 0–14 divided by the population aged 15–64. The total dependency ratio, therefore, is the sum of the young age and old age dependency ratios. Empirically, most industrialized countries have seen over the past years an increase in old age dependency and a decrease in young age dependency (because of declining fertility). Total dependency ratios generally did not change much. Now, depending on what ratio is chosen, researchers tend to give very different messages. The ones focusing on old age dependency only point to rapidly increasing stress on the whole system and the likelihood of considerable decreases in welfare. The ones looking at total dependency point at relatively stable conditions with the burden only moving from caring for children to caring for the aged. One comment from the audience: “Looking after children is fun, caring for the aged less so”. One further difference is that caring for children is largely considered to be the individual responsibility of the parents, while caring for the elderly in modern societies is mostly a public responsibility.

Is aging in the history of populations only a transitory process, one specific aspect of the demographic transition? If this is the case then the present concerns might be only of limited relevance. A look at the laws of population dynamics shows that if at some point life expectancy no longer increases and fertility remains constant then, indeed, population aging is only an episode in population history, and ultimately there will be a stable population age structure. If, however, fertility remains constant below replacement level and there are no significant migration gains, then the stable population pyramid will be broader at the top than at the bottom. At some point the mean age of the population would not increase any more and, technically, there would be no more aging, but the population would shrink at a constant rate. If only fertility remained constant and life expectancy continued to increase, then aging would continue. The same is true if fertility declined further.

Do the consequences of aging affect different cohorts in different ways? It has been often stressed that the members of the baby

boom (i.e., the large birth cohorts of the 1960s) are in the worst position throughout their lives. They not only have higher competition from kindergarten to the job market and places in old age nursing homes, but also they will not have an equal number of people in subsequent generations to pay for their retirement benefits once the baby boomer generation reaches pension age. However, actually those smaller cohorts who come after the baby boom seem to be even worse off in many aspects. Admittedly, in kindergarten and school there is less competition because this is strictly age-dependent, but in the job market the baby boomers will have occupied all the good jobs and will keep them for quite a while. Later on, the old age dependency burden will be much greater on the post-baby boomers than on the baby boomers.

One important aspect of population aging concerns the increased health care requirements for the elderly. There is little doubt that there will be a significantly greater demand for health care of the elderly in the future. The extent to which this demand will increase, however, largely depends on future trends in disability-free life expectancy in relationship to total life expectancy. While in the past many studies pointed to a trend of increasing periods in the individual life span that require intensive health care, there are some indications of a reversal of this trend. If disability-free life expectancy actually increased as fast as total life expectancy or even faster, this would significantly help to ease the stress on health care facilities in the future.

3 Population Aging and Changes in Productivity

There seems to be no systematic scientific review of the effects of population aging on economic productivity. There is very little empirical proof for the often stressed statement that an older society is less productive. The argument behind this statement usually refers to individual productivity curves and often takes income as a proxy for productivity. However, even the relationship between age and income varies among industrialized countries. While in North America there seems to be some decline in income even before

retirement, this is not observable in many European countries where automatic age-based salary increases are built into the systems. The other argument, that young people are generally more dynamic and more easily adapt to new technologies may well be true, but it has not yet been shown how this affects overall productivity and how it ranks relative to the experience and wisdom of the elderly. It is clear that more research is needed in this field before conclusive statements can be made.

Another ironic point is that, while many people complain about the negative effects of aging on productivity, they also point to the low productivity of developing countries as being caused by rapid population growth, i.e., too young an age structure. Clearly the age distribution of the population is not one of the most significant factors affecting productivity. Even on the human capital side (leaving out technology) it seems to be more the education and skills of people that matter than simply their age.

4 Can Immigration Compensate for the Negative Effects of Aging?

In the present debate on the desirable levels of immigration into Europe, one can often hear the demographic argument that immigration is absolutely necessary to compensate for the birth gap in most countries. Here again, purely demographic arguments that do not consider skills, the participation of females in the labor force and productivity may be misleading. However, even the demographic effects of immigration on population-aging are not that simple and clear.

If immigrants arrive at young ages, as they usually do, then in the short run it is clear that immigration will counteract aging, especially if the immigrants also have children. Hence, in the short run, they will improve the old age dependency ratio and decrease the mean age of the population. In the long run, however, if immigrants do not return to their home countries they will also age and contribute to an increase in the old age dependency burden. Hence, new immigrants or descendants of the former immigrants will have to enter the labor force in order to neutralize the effects

of retirement of the former immigrants. Since in Western Europe there are presently about 5 men aged 15-64 to 1 man above age 65, 1 immigrant retiring should be replaced by 5 other people in the labor force in order not to negatively influence the old age dependency ratio in that year. Hence, a gain in the near future has to be discounted by a burden in the more distant future. A positive balance is only assured if net migration gains are constant over time, if not increasing. Since European age structures tend to be very irregular, an interesting demographically oriented immigration policy could also be to have immigrants fill in the gaps in the age structure but not add to already exceptionally large cohorts. This may have a generally stabilizing effect.

From the social security perspective it seems to be clear that presently immigrants tend to contribute more to the system than they consume. This will also be true in the near future when very few immigrants will be entitled to draw pensions. As compared with the native population, immigrants who enter the country in their 20s will not be in the position to consume young age benefits such as education and some health expenditures. In the case of unemployment, immigrants who still have foreign citizenship tend to have less social benefits than natives. Also, finally, a certain proportion of immigrants return to their home countries before they are entitled to any pension benefits, although they contributed to the systems.

However, all over Europe one can find strong non-material arguments to oppose immigration. In a positive way these arguments may be summarized as an attempt to preserve specific heritage. Weighing these arguments against the benefits of migrants goes beyond scientific analysis and will be subject to a broad political process of societal consensus-finding. In any case, it is clear that the alternatives cannot be entirely open or completely closed borders but an increase or decrease in immigration and efforts to integrate the newcomers.

On a more global perspective it is clear that immigration into industrialized countries can in no way be a solution to the rapid population growth in developing countries (a figure mentioned in the discussion). At present, only up to two million migrants a

year could realistically be absorbed by the industrialized countries. This is only a minimal fraction of the vast potential of people in less developed countries who might desire to move to the more developed countries.

Although the real number of emigrants from many developing countries tends to be insignificant for these quickly growing populations, the kinds of people leaving may cause serious concerns in those countries. Generally only the more educated, more well-to-do and more dynamic people can find their way to Europe or North America and get a job there. This may result in a painful brain drain in the country of origin.

In conclusion, it can be said that large-scale migration flows bear many risks of instability and are certainly not a perfect and easy remedy against aging in industrialized countries. Limited migration on a manageable scale, however, is likely to add to the flexibility of labor markets and be beneficial for the North and in some cases also for the South if there is a back flow of trained people or resources.

In general, the degree to which population-aging will present a major problem in the industrialized as well as in the developing countries will depend on the future course of development and future increases in productivity. Accounting for population-aging, which is an unavoidable consequence of declining fertility, should, however, become an integral part of the planning for sustainable development.

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