

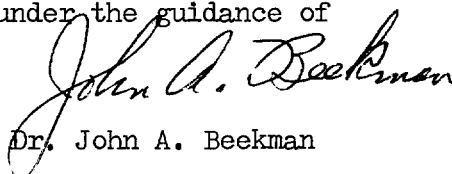
Social Security, Demographic Change,
and Intergenerational Transfers:
The French Example

An Honors Thesis (ID 499)

by

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under the guidance of

A handwritten signature in cursive script that reads "John A. Beekman". The signature is written in black ink and is positioned above the printed name.

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While I was in Paris in June of 1983, I had the pleasure of meeting Jean-François Chadelat of the French social security administration and discussing with him social security cost forecasting. Thanks to this discussion, I realized quickly that demography was but one of many factors influencing social security's financial evolution, and this added much perspective to my work. It was also through Mr. Chadelat that I had access to some recent government documents on French social security.

I have had contact by mail with Francis Netter, formerly of the French Ministry of Labor and Social Security. He provided guidance on the nature of the project as well as additional sources of research material.

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Finally, I must thank my younger sister, Mary, without whose Smith Corona typewriter none of this would have been possible.

ABSTRACT

Social security is a complex instrument of transfer payments in France, consisting of numerous regimes covering different groups of the population. Benefits are extensive and may be classified into three categories: medical, old-age, and family. The system represents a large and increasing part of the national economy and is financed largely through employer and employee contributions.

French demography is characterized by slow decreases in mortality at most ages and by a decreasing fertility. Fecundity rates have fallen below the 2.1 level necessary for the replacement of generations. Population projections through 2075 are presented, given various fecundity hypotheses, both constant and fluctuating.

Financially, French social security since 1968 has been marked by instability. During the 1970's, certain funds (family benefits, for example) were often in a surplus state, while others (medical benefits) often ran a deficit. This instability was due to numerous factors: demography, political changes in benefits and contributions, and economic recession. The demographic factor in the future will favor continued deficits in the medical and old-age branches which will be only partially offset by surpluses in the family branch.

Social security, as a kind of collective intergenerational transfer, is concerned with the ratio of inactives to actives in the population. While actives as a percent of the total population are fairly constant even with a changing fecundity, movements between the groups of young and aged persons can be significant. The cost to the nation of a retiree is only slightly more than that of a young person, so from this perspective, fertility change is not so important. From the perspective of

government though, the change is more important, as government spends 2.50 times as much on individual retirees as on children. In any case the effects of fertility change are seen to be less than the potential effects of a change in the retirement age or an increase in feminine activity in the workforce.

The life of a pay-as-you-go pension scheme involves three groups: the initial generations, the intervening generations, and the terminal generations. These first receive benefits without having contributed to the system; the second receive benefits which reflect, ideally, contributions made plus increases for demographic and economic growth; and the third contribute without receiving any benefits.

A capitalized pension system would establish a fund where contributions would collect interest. Under stable conditions, the individual contributions in a funded system or a pay-as-you-go system would be equal whenever the natural growth rate of the population equaled the interest rate adjusted for inflation. A fully-capitalized system on a national level, however, would probably be impossible due to the capital demands of the fund. A partially-funded scheme, such as exists in Sweden, might be possible, however.

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Introduction

The material survival of any society depends on the work of its active population. These are the people engaged in the production of the goods and services which maintain the standard of living for the entire society. These goods and services will be consumed not only by the active group which produces them, but also by the inactive, dependent sector which is, for one reason or another, not engaged in productive work.

This dependent sector is composed of four groups according to the nature of their inactivity: the "idle by choice," the temporarily or permanently handicapped, the aged, and the young. Our interest in this paper will be the last two of these groups. It will be necessary to note that often there is a certain debatable overlap between the old or the young with the "idle by choice"--for example, the retiree who would be perfectly capable of further work, or the adolescent who could very well leave school and begin contributing to society in a more direct way--and we will make little attempt to answer where the line ought to be drawn. Rather, society's general definition of what constitutes a young person or a retiree will be accepted, and an attempt will be made to examine in an objective manner the intergenerational transfer of resources made from the active population to these two dependent groups.

The examination will concentrate on the public institutions, especially social security, which in our day effect this transfer, the financial pressures undergone by these systems as a result of demographic shifts between the active and inactive groups, and finally, the feasibility of adjustments or alterations in the mechanism of the financial transfer. The majority of the examples and illustrations will

be drawn from France, whose social security system is noted for the strength of its benefits for both groups of the inactive population under consideration (that is, for both the young and the old).

As mentioned earlier, there is some question as to the point at which children cease to qualify as inactive by the fact that they are young and must rather be classified as "idle by choice." If there is, however, no dispute concerning the fact that in today's society there are some who extend their education to a non-productive level, there is also little disagreement over the need of children, at some very young age, for the care and support of the older generation. For our purposes, then, the choice of at what age a child ought to start fending for himself is irrelevant. What is important is that all children are dependent for a certain period of time and that this care must come in one way or another from the active population.

In an earlier day, this care would have come almost exclusively from the immediate family. The child was almost inevitably clothed, fed, and educated in the home up until the time he could establish complete independence. The movement through recent centuries, though, has been away from familial responsibility in the rearing of children and toward an ever-increasing societal role. The lessening family role did not begin, however, with television, microwave ovens, and working mothers in the 1970's; it is rather largely the result of community education, a trend which began centuries ago in the form of parochial schools and which manifests itself in the public schools so common in the industrialized countries of today, including France. In the measure that these schools represent a major expenditure for the rearing of the nation's youth, a significant part of the intergenerational transfer from the active population to the young has passed from the home and the church

into the hands of the government.

In this sense the transfer is more and more one of a block transfer from one group to another whereby the individual relationship within a family is losing out in favor of a collective relationship between the active population and various dependent groups. Without assessing the effects that this shift has undoubtedly had on interpersonal relationships in our society or on any resulting economic and cultural growth, we shall note nonetheless that this transfer is one which is accepted almost without question in our day. Community education (usually public, but also parochial) has taken its place as a seemingly permanent means of publicly administered intergenerational transfer.

Other means of transfer, at least from an American point of view, may not seem so permanent; and even if social security is more of an untouchable in France than in the U.S., it is certainly still more touchable in principle than publicly funded education. Intergenerational transfers to the young through social security are among the highest in the world in France and will be detailed at a later point in this paper. These "family benefits" reflect not only a governmental attempt to influence the birthrate, but also a genuine desire to help families with the financial burdens of raising children. To this extent, they represent a transfer effected between two sectors of the active population --from those without children to those with--as well as an intergenerational transfer from the active group to the young. In the sense, however, that they have altered the nature of the dependency relationship through which parents support their children, we shall consider them as intergenerational transfers.

Like the question of when a child should start work, there exists a question as to when an aged person should stop. As in the case of a

very young child, however, for all those who avoid a sudden death there is a period of inactivity at the end of life which must, of necessity, be supported by the active population. In addition, there is no doubt that there are, in the industrial societies of today such as France, a large number of retirees who depend at least partially on the support of the active population even though they could in theory continue productive work. We shall make no attempt to distinguish between these two groups, accepting instead society's standard of fairness in allowing all those above a certain age (even if this age is poorly defined) a period of inactivity before death.

For those within this group who are truly inactive (in an economic sense) survival is dependent on personal savings, private contributions, or public assistance and social security. Obviously, that part of their survival which is based on personal savings from the active period of life is by no means an intergenerational transfer. Also, to the extent that social security might be based on capitalized reserve funds, the retirement benefits received through this system would not represent such a transfer; but as the old-age social security systems of most countries, including France, are financed almost entirely by a redistribution of wealth from the active to the retired populations (the pay-as-you-go system of financing), public pensions, like public assistance and private contributions, represent a significant intergenerational transfer. Furthermore, the growth of social insurance for the aged in this century marks a change in the nature of this transfer. In days gone by, the only means of support for an invalid retiree was private charity (usually religiously affiliated) or family and friends. Today, as the support becomes more and more public, it becomes a question of block transfers of funds from the active population to the old.

In all cases, then, we must concern ourselves with the dependency relationship between whole groups of the population. If this dependency relied, as it used to, on the relationships within individual families or small groups between the economically productive and the young or aged, our study would be on the changes within that relationship as the proportions of young, old, and actives changed. Our point of view, though, is the demographic movement between these large groups and the effect that this movement will have on social systems established to regulate the transfer of funds. If in any way the prognosis is pessimistic, that will not mean that the newer system is to blame, for surely individual families would have undergone similar strains in dealing on an individual basis with the same problems. Indeed, it is for this reason that public institutions have been established.

To the extent that the public solution may aggravate the problem of dependence, though--through unnecessarily prolonged education or through premature retirement--an alternative solution may be in order. For this reason, we shall consider the funding mechanism of old-age pensions under social security in detail, examining the theoretical possibility of a funded or capitalized system. In this way an entire generation would be forced to save for its retirement and would thus be less dependent in old age. Also to be explored are the effects of changing the retirement age under social security. Although the movement has been toward raising this age in the U.S., France has moved in the opposite direction.

It will first be necessary, then, to consider the social security system as it exists in France today, along with a brief look at its history which should help to explain the present nature of the benefits offered and the contributions required. A certain background on the French demographic situation will be needed also before embarking upon

the financial pressures undergone by the social security system, especially since 1968. Finally, we shall arrive upon a consideration of the theoretical possibilities for social security financing with a comparison of the capitalized (or funded) and pay-as-you-go (or redistribution) systems.

The French Social Security System

The idea of social security as a social institution was born in Bismarck's Germany in the late nineteenth century. The goal was to provide a certain level of protection against various social risks-- illness, old-age, family, unemployment, etc. Benefit formulas were established in the 1880's but were limited to salaried workers. It was not until the Second World War in Great Britain, however, that social security came to be considered a vehicle for the redistribution of income among social classes and was applied to all workers, salaried or not.¹

The present social security system in France dates from after World War II. Various programs covering certain groups within the population had been in effect since the 1930's, but it was after the war that a comprehensive program was established to provide income security for the entire working population and its dependents. If security from life's unforeseeable events was the general goal of the program, there existed also several secondary objectives for which the system would be responsible. For our purposes, these other factors are important for their influence on the benefits offered today. As we shall see, certain areas were heavily emphasized at the birth of this system, and certain irregularities established, which affect to this day the slant of the benefits and make the French system unique.

The characteristics of the system result from three factors which were peculiar to France after the war:

- (1) Decline in the birthrate. This was a trend established at the beginning of the century. It was particularly marked during the period from 1919 to 1939. In 1938 and 1939, the birth rate was about 14 per 1000, lower even than the death

rate. Thus, the post-war social security program reflected a general concern for this fertility crisis in the emphasis it gave to the child bearing and family aspects of the program. The strongest family benefits package in the world was the result.

(2) Existence of numerous older laws. It would not, of course, have been possible to build a social security system from scratch in a country which already had a history of social legislation in this area. It was thus necessary to incorporate into the system such diverse elements as:

--a social insurance law from 1930 to cover low income workers against sickness, maternity, disability, old age, and death;

--a law on family allowances;

--a complete insurance plan for workers in certain categories, including, for example, merchant seamen, miners, railway personnel, and civil servants.

The importance of these influences is that they created certain irregularities in a system established with a stated goal of equality and regularity among all groups concerned.

(3) Influence of democratic traditions. This concerns chiefly the administration of the system and the French tradition of an individual's control in the institutions established for his benefit.²

For our purposes, these first two factors are of great importance: the first, because family benefits represent a significant portion even today of social security outlays and must hence be weighed in any long-term financial analysis against the costs of, for example, old-age pensions; the second, because the administrative irregularities

(for example, the large array of special regimes) require individual analyses as concerns the financial health and stability of the system. Integration of individual programs into a unified whole, although it becomes more and more necessary, appears no more probable today than ever. As Laroque points out, "the rugged individualism of social and economic groups is very powerful in France, and here it won out over the principle of national solidarity that was one of the fundamental bases of the plan of 1945."³

The original stated goals of the French social security system to which Laroque refers were those of (1) the generalization of the system to cover the entire population, (2) the overall unity of the system as concerns contributions and benefits, and (3) the social solidarity to be achieved through the existence of the system. It can be said that the first of these goals, that of generalization, has been largely achieved. In 1945, only 53% of the entire population was covered by health insurance, for example, compared to 98% since 1968.⁴

It is chiefly in terms of the unity of the system that the original goals have not been realized. To the contrary, a look at the complexity of the various regimes shows that the system is far from having a unified character. In addition to the "régime général" which covers more than 65% of all workers, there are numerous special regimes for both salaried and non-salaried workers. These "régimes spéciaux" cover such salaried groups as miners, railway workers, public transport workers, utility employees, civil bureaucrats, merchant marines, notary clerks, and salaried agricultural workers; and such non-salaried groups as artisans and small businessmen, various professional groups, farmers, and voluntary insureds.

This complexity of organization would have fewer consequences, were

it not accompanied by inequalities of coverage which seem scarcely justified. Traditionally, the special regimes have provided their members with benefits which were both more generous and more extensive. These continued inequities are heavily criticized by Laroque⁵:

If these inequalities were the consequence of the varying amount of effort on the part of one group or another to build up reserves, and if the pensions were a reward for accumulated savings, they might have some foundation. But all systems, legal or contractual, generally exclude any capitalization. Their function is purely that of distribution. That is to say, it is actually the economy of the country, the consumers, who support en bloc the burden of all pensions, and the inequality thereby seems all the more shocking. Here again the evolution of the system has run counter to a healthy conception of national solidarity.

Three solutions for rectifying this lack of unity have been suggested:

- (1) the regrouping of all regimes into one for the entire population;
- (2) the unification of all regimes of salaried workers;
- or (3) the unification of contributions and benefits in all regimes through progressive increases, with deteriorating regimes supported by direct state aid or transfers from other regimes.⁶

The national solidarity sought through the establishment of a large-scale social security system has been hampered by persistent irregularities among the various regimes. For instance, according to a Paris Chamber of Commerce study, the return on contributions received by various groups suffers from astonishing inequalities: 1.57% for state personnel, 2.05% for those in liberal professions, 2.09% for miners, and 16.75% for farmers.⁷

The social security system has nevertheless promoted a certain level of solidarity within the country, both within and among the various social groups. The special regimes have encouraged a professional solidarity; the general regime has shown, in supporting financially

weak regimes, an interprofessional solidarity; and the national solidarity has been established through the use of taxes for the support of non-contributory benefits. In short, social security in France has become a very significant economic factor, both on the individual as well as national levels, and has thus, in spite of its irregularities, provided a strong unifying force within the country.

The growth of social security outlays in France, expressed as a percent of the national income, has been continual. The total benefits provided by the early social security systems in 1938 represented only 5% of the total national income. For 1983, total expenses were expected to represent 26.4% of the Gross Domestic Product (GDP).⁸ These expenses also account for 80% of the total "social effort" of the nation and are of a magnitude approximately equal to that of the national budget (which is separate from social security). In Table I we can see the continued growth of social security expenses which outpace from year to year the growth in the GDP. In this way social security in France continues to assume an ever-greater importance in the economy. Also to be noted at this point for future reference is the relative importance of employer contributions beside those provided by the employees.

These vast sums fall under the jurisdiction of various branches of the total scheme. By far the largest of these is the "régime général," which accounts for 65% of all contributing workers. This general regime covers all salaried workers who are not covered by one of the many special regimes. These "régimes spéciaux" regroup some 15% of the French population, but because of the superior benefits offered, they account for 25% of all benefits.⁹ Some of these are remnants of systems in existence long before World War II (those for

TABLE I: Principal Macroeconomic Data Concerning French Social Security
(all totals are in billions of francs, proportions and increases
are in %, data estimated for 1982 and 1983)

	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>
Total S.S. Outlays	508	584	684	801	897
(% increase)		15.0	17.1	17.1	12.0
GDP	2135	2407	2688	3064	3404
S.S./GDP (%)	23.8	24.25	25.45	26.15	26.4
Total Social Effort	634	748	896		
S.S./T.S.E. (%)	80.1	78.1	76.3		
Total Benefits	468	540	635		
Benefits/S.S. (%)	92.1	92.5	92.8		
Total Contributions	456	535	602	704	776
of which:					
Employer (%)	73.5	71.4	72.3	71.4	71.3
Employee (%)	27.2	28.8	27.7	28.6	28.7

Source: Ministère des Affaires Sociales et de la Solidarité Nationale.
Commission des Comptes de la Sécurité Sociale. Rapport présenté à la
session du 20 décembre 1982.

miners, sailors, railroad workers, etc.), while others are more recent
creations (those for utility and public transport workers, for instance).

The "regimes complémentaires" were created to complement the
pensions offered by the other systems. All salaried workers are
covered under one of two programs, one for managerial and the other
for non-managerial employees. Because certain independent workers
desired to maintain their autonomy as concerns social security, the
"regimes autonomes" were established for such groups as artisans and
members of the liberal professions.

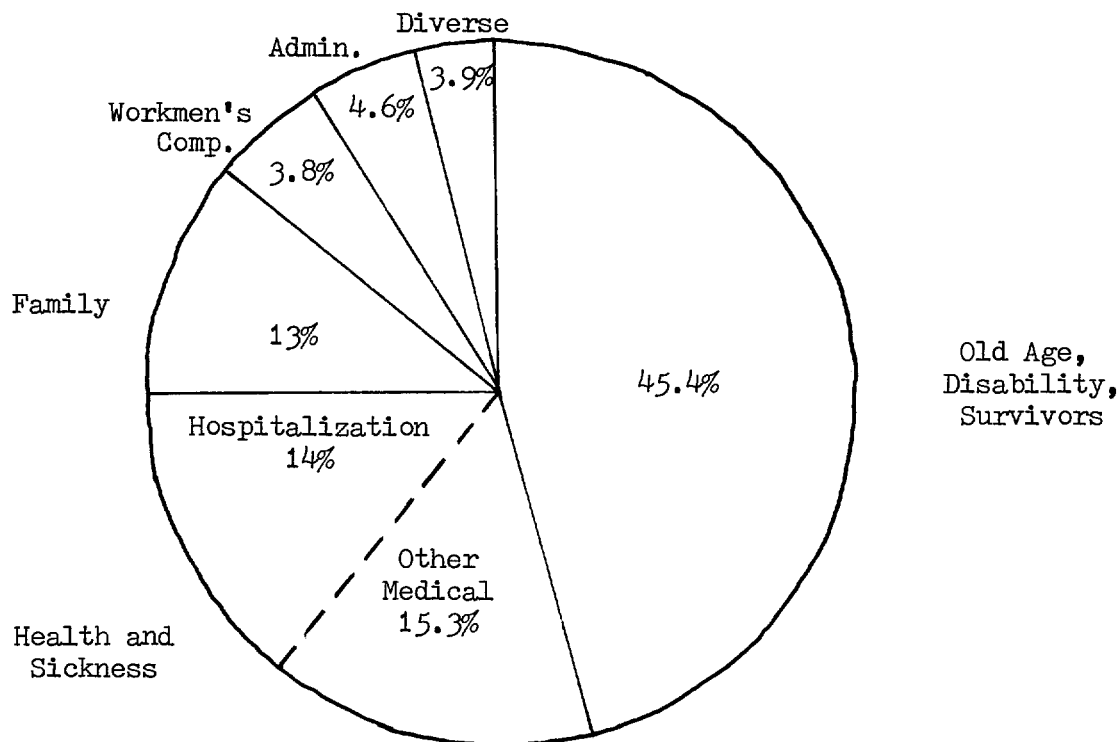
The 684 billion francs spent by these various regimes in 1981
represent expenditures in five categories, as illustrated in Graph I:

- (1) 45.4% of all expenditures went for coverage of the risks of "disability, old age, and survivorship." The largest participants in these pensions were, respectively, the general regime, the special regime covering government employees, the complementary regime covering non-managerial workers, and the system covering agricultural workers. These four groups represented two-thirds of pension expenses.
- (2) 29.3% covered the medical risks, of which the general regime accounted for three-fourths.
- (3) 13% consisted of the family benefits. Three-fourths of these were covered by the general regime.
- (4) 3.8% went for workmen's compensation. Again the general regime assumed three-fourths of all expenditures.
- (5) 6.4% represented the administrative costs involved with the system (4.6%), social and sanitary activities, etc.¹⁰

Within the general regime these expenditures are administered by three large branches controlling benefits and contributions for old-age, medical, and family risks. This organization dates from the reforms of 1967. At the top of each branch is a national fund which receives all contributions and from which are paid all benefits. Transfers between the funds have become common in times of need (as have transfers from one regime to another). We shall discuss the nature of these transfers at length later on, but for now we turn to the financing mechanism which these funds represent, examining first the means of collecting contributions and second the benefits provided.

The largest part of the funding for these three branches comes from employer and employee contributions. In all cases the required contribution is some percent of salary, usually limited by a salary

GRAPH I: Breakdown of Total French Social Security Expenditures--1981



Source: Ministere des Affaires Sociales. Rapport, 1982.

cap. In 1980 this cap was fixed at 60,120 francs per year. The contributions by fund are as follows:

(1) Medical Fund

-for employers: 8.95% within the limit of the salary cap, plus 4.5% of the total salary, plus the workmen's compensation contribution which ranges from 0.5-25% (the average is around 4%) within the salary cap limit;

-for employees: 5.5% of the total salary;

(2) Old-age Fund

-for employers: 8.20% within the limit of the salary cap;

-for employees: 4.70% within the limit of the salary cap;

(3) Family Fund

-for employers: 9.1% within the limit of the salary cap.
If we then retain the 4.0% average for the workmen's compensation contribution, we may summarize total contributions as follows:

- for employers: 30.25% within the limit of the salary cap,
plus 4.5% of the total salary;
- for employees: 4.70% within the salary cap limit, plus 5.5%
of the total salary.¹¹

These employer-employee contributions account for a relatively large part of social security expenditures in France. As we can easily calculate from the data in Table I, total contributions in 1981 represented 88% of all social security outlays. This fact places France in a unique position among the countries of Western Europe, for it is in France that one finds the lowest degree of direct governmental financing of social security and the highest degree of employer participation. For instance, in contrast to the 11-12% financial participation of the French government, governments subsidize around 85% in Denmark, 38% in the United Kingdom, 20.7% in the German Federal Republic, and 23.4% in Italy, of the total social security cost. Inversely, employer contributions in these countries are significantly weaker.¹²

The benefits offered under the system are generous by American standards. The Medical Fund (with which we are the least concerned) assumes almost all costs incurred through hospitalization, medical visits, and pharmaceutical services. Family benefits consist of various "allocations" depending on particular family circumstances. In 1974, 61% of all outlays within this branch were for the general "family allocations" which provide an allowance to all families with

two or more children. Also significant are the single-breadwinner allocation and the housing allocation which accounted for 18% and 14.3%, respectively. Other benefits include the pre-natal allocation, the maternity allocation, and other various benefits.¹³

Far more complicated are the benefits paid by the Old-age Fund, especially if a comparison is made between the general regime and the plethora of other regimes providing old-age pensions. (As we saw earlier, the general regime assumes a more complete role in terms of total family and medical benefits paid out than in the area of old-age pensions.) Before the reforms of 1982, pensions were payable by the general regime beginning at age 60, with 37.5 years of covered earnings needed for a "full" pension. These 37.5 years were divided into 150 quarterly periods, so that each missing period resulted in a reduction of 1/150 of the possible pension. Working women who had also raised children could count an extra two years of covered earnings for each child.

At the time retirement was taken, the pension was calculated based on an individual's 10 highest years of income, which were revalued to reflect current wage levels. At age 60 a "full" pension was 25% of the average 10-year earnings, and this percentage increased 5% for each year of deferred retirement. Therefore, at age 65 the benefit amounted to 50% of the average covered earnings; and at age 70, 75%. Since the average pension at age 60 was thus so low compared to the one received upon waiting five additional years, age 65 remained the "normal" retirement age.¹⁴

Dissatisfaction with a normal retirement age of 60 fostered some preliminary reforms during the 1970's. Much attention had been drawn to the subject, in part because various favored groups already benefited from retirement plans under social security as early as age

55. These groups were generally those covered by one of the special regimes, including agricultural workers, seamen, miners, primary school teachers, government employees, and the self-employed.

In 1975, benefit levels at age 60 were raised modestly, but the increases were inadequate to make early retirement a much more common choice. In response to high unemployment, the government made moves in 1976 to encourage early retirement within certain "underprivileged" groups, such as manual workers with 42 years of contributions and women who had raised children and engaged in blue-collar work. These groups were offered full pensions at age 60. Early retirement provisions also existed for the unemployed.¹⁵

Extension of these early benefits to the entire population came with the reforms of 1982. Those with $37\frac{1}{2}$ years of contributions can now retire at age 60 with a pension equal to 50% of the best ten years' earnings. For retirement between ages 60 and 65, if the retiree lacks a full $37\frac{1}{2}$ years of contributions, the 50% rate is reduced by whichever of the following is more favorable for the employee:

-1.25% per quarter less than 150 quarters;

or -1.25% per quarter less than age 65.

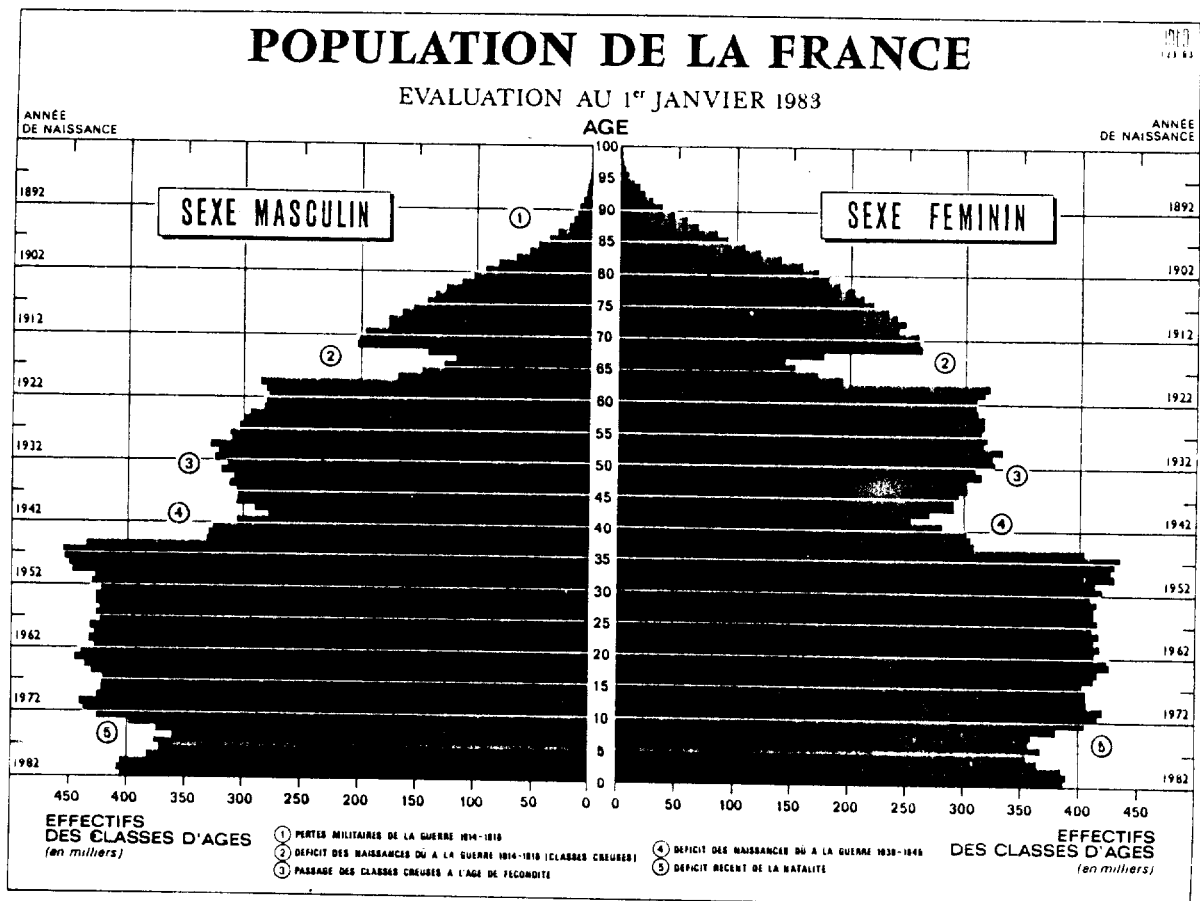
If a worker at age 65 still has not completed 150 quarters of contributions, calculation is based on the actual quarters credited, and the result is then increased by 2.5% per quarter of deferral of retirement after age 65. However, the increase cannot result in the pension being more than 50% of the base pay.¹⁶

This, then, provides a brief description of how the social security system functions in France. Next, we shall consider the French demographic situation before examining the interactions between demography, social security, and intergenerational transfers.

The French Demographic Situation with Projections for the Future

The present demographic situation in France is the result of several interrelated factors. In addition to a generally improving mortality rate and a fluctuating birth rate, there are historical influences such as the two world wars which make their presence felt in the age pyramid as shown below. The circled numbers mark numerically depressed cohorts, with the explanations for these phenomena as follows:

- (1) lives lost in World War I, 1914-1918;
- (2) reduced births during World War I;
- (3) World War I babies at child-bearing age;
- (4) reduced births during World War II, 1939-1945;
- and (5) low birth rate of recent years.



Of course, events such as wars are not foreseeable within demographic predictions. Aside from these factors, though, there are the influences of mortality, fertility, and migration which have a significant influence on the demographic evolution of a country. We shall examine the historic evolution of these factors (especially mortality and fertility) and shall then consider the forecasts which have been made for the French population over the next century.

Mortality in France has in general shown steady improvement over the past century. In Table II we can see these advances at various ages in terms of the life expectancy. It should be noted that it is for the lower ages that the greatest improvements have been made. Also the superior improvements in female mortality become especially apparent at the higher ages.

There are four important factors in the evolution of the French mortality by age group:

- (1) infant mortality has diminished in a continual manner which has affected equally both sexes;
- (2) at all other ages, female mortality has pulled back significantly more than the male mortality, and this is particularly true for young adults (ages 20-40) and the aged (over 60);
- (3) the slowdown in mortality improvements was experienced by both sexes but was accompanied, for males, by a recrudescence of mortality at age 20 as well as at ages 40-50;
- (4) during the 1970's the growth in teenage mortality was amplified and affected females for the first time, whereas at almost all other ages, important advances were again recorded.¹⁷

Disturbing from a social point of view are the increases in mortality among teenagers and middle-aged men, for these reflect a

TABLE II: Evolution of French Life Expectancy at Various Ages

	Ages:	0	1	5	20	60	65	80
<u>Male</u>								
1898-1903		45.31	53.10	53.08	37.52	13.31	10.46	4.37
1928-1933		54.30	58.63	56.47	39.40	13.76	10.86	4.44
1950-1951		63.6	66.1	62.7	43.8	15.1	11.9	4.8
1973-1977		69.10	69.17	65.38	50.98	16.61	13.32	5.90
<u>Female</u>								
1898-1903		48.69	55.34	55.26	40.01	14.58	11.47	4.89
1928-1933		59.02	62.53	60.32	43.52	15.94	12.57	5.09
1950-1951		69.3	71.2	67.8	48.7	18.1	14.4	5.9
1973-1977		77.00	76.91	73.09	58.44	21.44	17.34	7.33

Sources: Vallin, Jacques. "Tendances recentes de la mortalite francaise." Population, no. 1, 1983.

Netter, Francis. "Reflexions suggerees par l'experience francaise." From the Atti della II Conferenza internazionale degli Attuari e Statistici della Sicurezza Sociale, Rome, October 1959.

growth in unnatural causes of death, especially automobile accidents. More interesting from a demographic point of view, however, is the evolution of the infant mortality. During the first part of this century, up to World War II, infant mortality fell from 165 to 70 per 1000 births, or a decrease of around 2% per year. After the war, the rate of improvement accelerated, attaining a near-constant 6% per year. It was thus that the rate fell from 78 per 1000 births in 1946 to 10 per 1000 in 1979. What is important is that this rate of increase has continued even at the very low levels now being experienced. Thus, infant mortality from 1975 to 1979 dropped from 13.7 to 10.0 per 1000, which represents a continued 6% decrease.¹⁸

The strength of this decrease in infant mortality explains to a very large degree the increase in the life expectancy at birth as seen

in Table II. Also important has been the virtual disappearance of infectious diseases in later childhood and young adulthood. This is important for our purposes because we are interested in how this decrease in mortality has affected the population structure and thus the dependency relationship between the active and the inactive populations. As Keyfitz points out, however, mortality improvements have little net effect on the dependency ratio (inactives/actives). Although retired people live longer (and thus draw more social security benefits), and although there are more children to be educated, there is the strong counterbalancing effect of the increase in the active population since more and more people survive infancy and childhood.¹⁹

What really affects the retired to active ratio, according to Keyfitz, are the fertility and fecundity changes of a country. If fertility is defined as the number of births per year for a group of 1000 women, fecundity may be thought of as the average number of children born to a woman during her productive lifetime. These fecundity rates may express the average number of births for a particular group of women (for instance, all those born in the same year within a given country), or for all the women of child-bearing age within a country at a particular time. To insure the continuation of the population at its present level (all other factors held constant), each woman must produce, on the average, 2.1 children. This is, in effect, two children to replace the parents plus an extra one-tenth of a child (on the average, of course!) to account for those children who die before reaching reproductive age.

The fecundity rate, then, expresses an average number of descendants left by each woman before the end of her reproductive life. If we consider the rate by generations in France, we note that for the

decennial groups of women born from 1890 to 1940, the fecundity rate was situated above two children per woman even for the generations affected by the two world wars. Starting with the generation born in 1950, though, the tendency was toward fewer than two children per woman, a tendency which will, if it continues, have the effect of reducing in a real sense the total population of the country.²⁰ Most recently, the rate of fecundity for all women of productive age, as measured in 1983, was a feeble 1.8.²¹ The causes of this decline are cultural as well as technological. The growth of contraception in France has provided the means, while certain social factors such as working women and a changing concept of the "model family" have given the stimulus.

Although those who fear such a drop in fecundity (and the correspondingly lower fertility rates which must eventually follow) may find cause for alarm, the situation does nevertheless possess the ability to reverse itself. Considering a composite fecundity rate by calendar years, we need only go back as far as 1973 to find the 2.1 rate necessary for the renewal of generations.²² In addition, according to certain economic theories, the less numerous generations of the future, when they enter the labor market with their reduced cohort and thus under less demanding competitive conditions, could be encouraged to increase their average family size. In any case, history speaks against the stability of fecundity rates. France in the 1940's appeared also to be aging to a certain extent and was taken by surprise when hit by the post-war baby boom. Additionally, since the beginning of this century, there is no developed country where fecundity has remained at the same level for fifteen or twenty years in a row.²³

Several studies have been made of the French demographic situation, and forecasts are available for both the short and long terms. Two of

the most extensive sets of predictions made within the last few years are those developed by the "Institut National de la Statistique et des Etudes Economiques" (INSEE--National Institute of Statistics and Economic Studies) in conjunction with the 1975 census²⁴, and those published in the national demographic journal, Population, by Le Bras and Tapinos, which emphasize the possible economic implications in the long term of these predictions.²⁵ Both studies rely on similar assumptions and, not surprisingly, arrive at similar results. For the reasons, however, that the latter is of more recent date, that it focuses on a long-term scenario, that it explores the possibility of a fluctuating fecundity rate, and that it emphasizes the economic-demographic interplay that interests us, we shall draw more heavily on its findings and analysis.

As we have said, the most important variable in France's demographic evolution is the fecundity rate. In both the INSEE and the Le Bras-Tapinos studies, the rates of 1.8 and 2.1 were chosen as likely values for the future evolution. The rate of 1.8 would assume, in effect, that the fecundity rate continues its movement downward, finally stabilizing at 1.8. (When the study was published, the fecundity rate was still slightly above the 1.8 which, as we noted, was recorded in 1983.) An assumption of 2.1 supposes that the trend downward will be reversed over a period of years, and that the final "stable" rate will be around the level needed for exact replacement of the generations.

Le Bras and Tapinos also considered two "extreme" possibilities: final fecundity rates of 2.6 and 1.4. These are by no means unreasonable, however, as they are, respectively, the rates of fecundity for French women born in 1930 and for West Germany of today. Also presented are the hypothetical results of an oscillation between these two extreme

values.

It is instructive to examine briefly the assumptions implicit in each of these four models of fecundity. At the low end of the scale is the 1.4 hypothesis which represents a resistance to having a family. The average age at marriage is 25.5 years, even though 7.1% remain unmarried; and 15% of all couples immediately adopt contraceptive methods and will have no children. Among those who have a first child, only 60% will have a second, and then the probability of continuation to each subsequent order is a mere 50%.

The 1.8 hypothesis is, in fact, representative of the "two-child family." That is, the "model family" of two children is chosen by a majority of the couples. The average age at marriage is 22.5 years, with 8.5% unmarried, and only 5% of these couples rely immediately on contraception. After the first child, only 25% practice contraception to avoid a second one. After children of the second order and beyond, however, 60% of the couples turn to birth control.

To achieve the model of a stationary population with a fecundity rate of 2.1, the average age at marriage is 24 years, with 7% remaining unmarried. Immediately after marriage, no couples utilize birth control, and 75% of those who have a first child desire a second one without delay, while 4% of this group adopt contraception as a means of slowing the growth of their family. For all consecutive orders of children, 40% of the couples seek to have an additional child without delay, while 20% utilize birth control for a period of time before trying for one more child. The final result of such a model again produces a dominance of two-child families, but also a greater number of higher-order families, especially those of three children.

An average fecundity rate of 2.6 represents a hesitation between

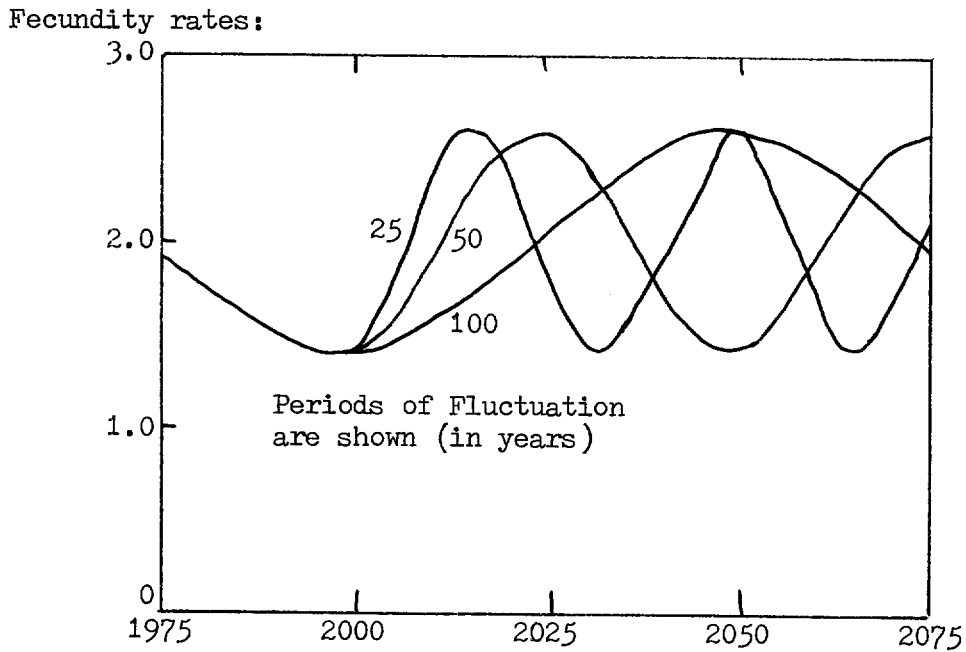
a family of 2 and a family of 3 children. The average age at marriage is 24 with an unmarried rate of 9%. All couples desire a first child, and then 90% of those who produce a first attempt also to have a second. After the second child, 70% continue to the third order, and for all higher orders the proportion is only 50%.

It is easy to notice, then, that only minor adjustments are needed in family attitudes toward children in order to arrive at fecundity hypotheses which vary from 1.4 to 2.6. This is somewhat remarkable when one realizes that such minor adjustments produce extremes which can lead either to a population explosion or extinction if maintained over a long enough period of time: 2.6 corresponds approximately to a 0.7% rate of natural increase and thus a doubling of the population every 100 years, whereas the 1.4 hypothesis produces an annual natural decrease of 1.5% and thus a reduction by half every 50 years.

In the forecasts developed by Le Bras and Tapinos, these fecundity rates are phased in gradually over the period 1978-2000 and then held constant from 2000 to 2075. This stability over a 75-year period may seem ludicrous in light of the fluctuations experienced by developing nations over the past century, and, recognizing this, Le Bras and Tapinos offer four models of sustained fluctuations. In each of these, a decreasing fecundity is realized up until the year 2000 when the lowest level is achieved (1.4 children per woman), then a period of oscillation begins, lasting 25, 33, 50, or 100 years in which the fecundity increases to its highest level before starting back down again. These assumptions are illustrated in Graph II.

In general, it is possible to be more sure about the future evolution of mortality in a country than about the fecundity. It is for this reason that only one mortality hypothesis was retained in

GRAPH II: Three Oscillating Fecundity Hypotheses



both the INSEE and Le Bras-Tapinos studies. In the latter, the assumptions are based on the real evolution since 1946, extrapolated into the future. This does not result in very optimistic projections. Male life expectancy at birth is seen to level off at age 70: a weak improvement in the upper age groups is compensated by an increasing juvenile mortality. For women the forecast is slightly less pessimistic: life expectancy at birth should rise to 80 years and then level off in 2015.

The effects of these assumptions on the total population of France are shown in Table III. Also shown are the composite birth and death rates and the resulting rate of natural increase. It is important to note that until the year 2000, the choice of a fecundity assumption has little effect on the totals, which extend only from 53 to 60 million. There are two reasons for this phenomenon: first, the fecundity rates are all subject to a period of phase-in where their differing

TABLE III: Evolution of the French Population following 4 Fecundity Hypotheses

		1975	1980	1985	1990	1995	2000	2025	2050	2075
Total Population	H1	52.74	53.33	53.67	53.71	53.52	53.11	46.90	35.30	25.01
	H2	52.74	53.41	54.08	54.68	55.17	55.42	53.50	47.03	40.57
	H3	52.74	53.45	54.38	55.42	56.48	57.38	59.86	59.66	59.79
	H4	52.74	53.54	54.87	55.60	58.54	60.37	70.54	83.38	101.08
Birth Rate (per 1000)	H1	14	13	13	12	11	10	8	8	8
	H2	14	14	14	13	12	12	11	11	11
	H3	14	14	15	15	15	15	14	14	14
	H4	14	15	17	18	18	17	18	18	18
Death Rate (per 1000)	H1	11	11	12	12	12	12	15	21	21
	H2	11	11	12	12	12	12	14	17	17
	H3	11	11	12	12	11	11	13	14	14
	H4	11	11	11	11	11	11	11	11	11
Rate of Natural Increase (per 1000)	H1	3	2	1	0	-1	-2	-8	-13	-13
	H2	3	3	2	2	1	0	-3	-6	-6
	H3	3	3	3	3	4	3	0	0	0
	H4	3	4	6	7	7	6	7	7	7

effects are less pronounced, and second, the people who are already born in 1975 represent the greatest majority of the population even as late as the year 2000. In the period from 2000 to 2075, however, the differences are enlarged until the ratio of the largest to the smallest total population is four to one: a population of 25 million recalls the size of the French population around 1750, while 100 million represents a doubling of the population in 100 years. Between these two extremes, the two intermediate totals fall in the vicinity of the present day population.

It is instructive to notice the effect of inertia on population increase and decrease in this example. The phenomenon of inertia explains the increasing rate of separation between the four population totals. In the beginning years, even with a continually decreasing fecundity for the first hypothesis, the total continues to increase. In a similar manner, even if the fecundity rate were reversed at the

end of the 100-year period for this same hypothesis, the population would continue to decrease. Both of these facts are due to the underlying structure of the population, which influences not the fecundity of each individual woman, but rather the number of women of child-bearing age. In the France of today, a decreasing fecundity rate forebodes an eventual decrease in the total population, but for the time being, the strong influence of the baby-boom generation, which is now in its productive years (both economically and demographically), prevents any immediate decrease and thus masks the lower fecundity rate.

It is also interesting to note that from the perspective of population density, these four hypotheses are certainly all within the realm of what is realistic: 45 inhabitants per square kilometer in the first, 73.7, 108.5, and 183 in the others. All these densities are well above present-day concentrations for the United States and the U.S.S.R., but well below those of West Germany, Belgium, and the Netherlands.²⁶

Le Bras and Tapinos also considered the population totals in the event of a fluctuating rate of fecundity. We recall that in all four hypotheses of fluctuation, the extreme levels were 1.4 and 2.6 children per woman, and the oscillations took place over periods of 25, 33, 50, and 100 years, starting in the year 2000. As we see in Table IV, the results of all four assumptions are very similar. It may be somewhat surprising that the overall movement is, nevertheless, one of significant decrease, given that the average fecundity rate would be

$$(1.4 + 2.6)/2 = 2 ;$$

but it is necessary to calculate the children after two generations-- only $1.4 \times 2.5 = 3.4$ instead of 4--in order to see the importance of the population structure in the total population. Thus, although the total population would remain fairly stable in the case of a

TABLE IV: Evolution of the French Population under Fluctuating Fecundity Hypotheses

		1975	1980	1985	1990	1995	2000	2025	2050	2075
Total Population	H1*	52.74	53.33	53.66	53.71	53.52	53.11	48.64	44.15	44.14
	H2*	52.74	53.33	53.66	53.71	53.52	53.11	51.61	46.00	43.38
	H3*	52.74	53.33	53.66	53.71	53.52	53.11	52.40	47.58	43.23
	H4*	52.74	53.33	53.66	53.71	53.52	53.11	51.45	47.41	45.74

fluctuating fecundity, the balance between the age groups would be very unstable. The worse case would be that of rapid oscillation, where the society would not even have time to adjust to differing needs for child care and education, as well as retirement and medical needs.

We have thus examined briefly the possibilities for the evolution of the French population. It seems likely that the actual values would lie within the ranges outlined by the various hypotheses above. The partitioning by age of the population, which is important for our purposes, will be discussed later when we look more closely at the relationship between demographic movements and intergenerational transfers.

The Financial Evolution of the French Social Security System since 1968

Since the reforms instituted by the legislation of 1967, the French social security system has been marked, in general, by financial instability, but this instability has been applied unevenly among the various regimes and among the three major branches within the regimes. Discussions of the overall security of the system have naturally centered on the régime général. Chadelat's analysis is the most extensive.²⁷ He chooses to call the period of 1968-1975 the initial phase of the recent evolution. These years, which included the recession of 1973-1974, were marked by serious shortfalls in the Medical Fund, significant surpluses in the Family Fund, and near-stability in the Old-age Fund. He explains this combination of surpluses and deficits as follows:

- (1) Old-age Fund. The tendency was for a deficit, which was compensated by a series of transfers and increased contributions. The cause for this tendency toward a shortfall was twofold. First, there was a very mild widening of the spread between the average benefit and the average salary. Second, the number of beneficiaries increased by 5 to 6%, while the active contributors increased only by 1.5%. This led to a structural deficit of nearly 5% which required the contributions and fund transfers.
- (2) Family Fund. Here the problem lay in the opposite direction. The benefits were revalued in line with inflation, which was outpaced by the growth in total salaries, such as to create a 2 to 3% surplus. In addition, the falling birth rate marked by the lowered acceptance of a third child contributed to a decrease of eligibles reaching 3%. The spread was thus close to 6%.

(3) Medical Fund. We are faced here with a much more difficult problem. At most, it can be observed that expenses were situated approximately 7 to 8% above salaries, this being as much the result of rising medical costs as of a general increase in the volume of claims which is always extremely difficult to forecast.

During this period two transfers were effected, moving surplus from the Family Fund to the Medical and Old-age Funds. Legislative, revenue-raising measures were also taken to help return the funds to a state of stability. The balances by year for the 3 branches of the general regime show the gradual deterioration²⁸:

1970=+2025	1971=+2025	1972=+1138
1973=+834	1974=-3324	1975=-4569

If we look at the cumulative fund (which increases or decreases from year to year depending on whether there is a surplus or a deficit for the year in question), the cumulative deficit in the Medical Fund was close to 13 billion francs in 1975, while the cumulative surpluses in the Family Fund stood at 14 billion francs and in the Old-age Fund at 1.5 billion. The total surplus, therefore, was on the order of 2.5 billion, a figure which, in comparison to the total yearly contributions of 170 billion, scarcely represents 4 days of expenses.

The outlook at the beginning of 1976 was rather gloomy, especially in light of ever-increasing medical costs. Various reforms were attempted by the government in an effort to increase revenues and control expenditures, but it was finally a more rapid increase in salaries and a strong slowdown in the rate of rising medical costs (as difficult to explain as the fast increases of 1975), that permitted an actual surplus of 5 billion in 1977. Public opinion became less and

less concerned with the financial problems of social security, and people were even heard to comment, "We have lost the social security deficit."

This only marked, however, the end of another phase in the evolution of French social security. Beginning in 1978 there was a reacceleration of medical inflation, and outlays were further increased by numerous improvements in old-age insurance. The result was a huge deficit of 10.8 billion francs and a further increase in contributions effective January 1, 1979.²⁹

More recently, changes in the contribution structure for the Family Fund in 1981 had the effect of throwing that branch of the general regime into deficit, while the deteriorating economic conditions of the country due to the recession contributed to unemployment and thus reduced contributions across the board. The forecasts during the year were for a deficit of 10 billion, but, thanks to various legislative measures, the final balance for the general regime was limited to 6.6 billion francs in the red. Increased contributions and general wage and price controls in 1982 were expected to help the system return slowly to financial health in the period 1982-1983, although we have only estimates from late 1982 at our disposal. These show, nonetheless, the desired improvements.³⁰

What is important to pull from this complicated evolution is the multiplicity of factors which affect the year-to-year financial situation of the system. There are, of course, certain demographic factors to be analysed, such as the increasing proportion of aged persons with its concomitant effects on the Old-age Fund and Medical Fund. It would be naive, however, to ignore the large role played by ever-increasing medical costs, economic fluctuations such as unemployment, and political

changes affecting both contributions and benefits. Since it is, nevertheless, the stated purpose of this paper to examine the relationship between French demographic evolution and the social security system, we shall discuss the financial evolution of the three branches in light of the demographic movements being realized today or expected in the future.

In the medical branch, the analysis is difficult due both to competing factors, whose effects are at least as great as the demographic ones, and to a serious lack of adequate statistical data on the subject, as Chesnais has remarked.³¹ The three groups with the highest medical consumption are (1) infants, (2) the aged, and (3) maternity-age mothers, although to a lesser extent. These three groups account for 41% of all hospital stays, although they represent only 22.5% of the population.³²

The case of the aged is particularly important given the present aging of the French population. The population over the age of 60 represented, in 1970, less than one-fifth of the population; it accounted, nevertheless, for almost one-third of all out-of-hospital expenditures, of which were one-fourth of all visits to physicians and a little more than one-third of all pharmaceutical expenses. In addition, medical expenses are increasing more rapidly for those over 60 than for those under 60. From 1960 to 1970, costs for the former increased by 12.8%, while for the latter, by a more manageable 7.7%.³³

It would then seem that the increasing numbers of aged persons in France would portend increasing burdens on the social security system, but various French observers of the situation have remarked that, in the final analysis, demographic movements are overshadowed by the other factors involved. To quote one team of such observers: "Despite the

very strong influence of age on the level of medical consumption, the deformation of the age pyramid observed or foreseeable in France has not been and will not be, all other things being equal, a perceptible factor in the growth of average medical consumption." It is also noted that, from 1950 to 1970, growth in medical expenses due to such a deformation would have been less than 5% for all types of care, whereas the true growth was close to 300%. Furthermore, it is argued that the changes in the age pyramid are slow, often too slow even to be perceptible.³⁴

If demography thus becomes but a subsidiary instrument in the area of medical cost forecasting, it is still an indispensable tool in planning for retirement systems. As we have observed, in a pay-as-you-go pension system, the equilibrium of the system is based upon the relationship between two populations, that of the contributors and that of the beneficiaries. More precisely, it depends on the three following factors:

- (1) the number, sex, and age of the active contributors;
 - (2) the average retirement age;
- and (3) the number, sex, age, and life expectancy at retirement of the beneficiaries and their survivors.³⁵

Lowering mortality has contributed to the aging of the population, especially the female population, and thus to an increasing mass of outlays for old-age pensions. Its influence is nevertheless not as important in the long term as the evolution of the fecundity rate. In fact, if we isolate the effects of catastrophes, such as wars, the numerical relationships between the various age groups are essentially the result of this evolution. An important ratio, which is strongly tied to changes in fertility, is the ratio of retirees to actives.

This may be called the "demographic pension burden." Taking an average retirement age of 63, we can see the development or projection of this ratio at 10-year intervals since 1955³⁶:

1955: 0.29

1965: 0.33

1975: 0.35

1985: 0.31

The mild regression for the year 1985 is explained by the presence among the retired age group of the numerically depressed cohort born in World War I. Starting in the late 1980's and 1990's, however, a similarly deficient group born after the late 1960's, and especially after 1973, will reach active age; and this will result in an active population which ceases to increase, risking even a slight decrease, while the prodigious generation of the 1920's will reach full retirement age. Except in the case of a significant increase in worker productivity or an increase in feminine activity (which adds workers without greatly increasing benefits), the cost for the active population of such a pay-as-you-go system risks becoming increasingly intolerable. This effect could be made even more significant by a reduction in the average retirement age (which is expected).

Demography also plays a significant role in the area of family benefits in France. As we have noted, French demography is marked by a decreasing birth rate, and thus it should not surprise us that the Family Benefits Fund was traditionally in a state of surplus during the 1970's. Since benefits are awarded only for children of second or greater order in a family, though, we need to examine the evolution of the distribution of present births among the orders. We can see in Table V the increasing proportion of births which represent the first

TABLE V: Comparative Distribution of Legitimate Live Births in 1964 and 1974 (per 1000 births)

Order:	1	2	3	4	5	6	7	8	9	10+	Total
1964	347	265	160	90	53	32	20	13	8	12	1000
1974	469	301	121	51	24	14	8	5	3	4	1000

Source: Chesnais, Jean-Claude. "Fluctuations démographiques et Dépenses de Sécurité sociale." Population, no. 2, 1977.

or second child within a family as well as the decreasing proportion of births of the third or higher order. In addition, we note that the proportion of births of orders greater than 3 has been reduced by more than half (passing from 23% in 1964 to 11% in 1974).

It is important to realize, however, that this does not indicate that there are large numbers of people who remain without children. In fact, France is unique in its near-total absence of families without children.³⁷

With this decreasing percentage of children among the higher orders, family benefits per qualifying family have been decreasing as well. All benefits are calculated by reference to a base figure (632 francs per month, for example, in 1975). No benefits are paid for the first child, while 22% of the base figure is awarded for the second child. This benefit increases by 37% (of the base figure) for the third and fourth child, then by 33% for each additional child. Average benefits paid out for 100 families according to this system were thus 44.14 times the base figure in 1964, as opposed to 40.80 in 1973. Chesnais predicted in 1977 that this figure would be further reduced to 31.60 in 1985.

Table VI shows the method of calculation for these figures.

The present aging of the French population is thus exercising a positive influence on the financing of social security in the area of

TABLE VI: Influence of Changing Family Structure on Benefits Paid Out

Number of Children	Benefit as Percent of Base Figure*	Distribution of Beneficiary Families (per 100 families)			Total Benefits Paid Out As % of Base Figure (per 100 families)		
		1964	1973	1985	1964	1973	1985
1	0	24.3	21.9	25	0	0	0
2	22	36.4	42.1	50	8.01	9.26	11.00
3	59	20.2	20.3	15	11.92	11.98	8.85
4	96	9.9	8.5	6	9.50	8.16	5.76
5	129	4.7	3.8	2.5	6.06	4.90	3.23
6	162	2.4	1.8	1	3.89	2.92	1.62
7	195	1.1	0.9		2.15	1.76	
8+	(261)**	1.0	0.4	0.5	2.61	1.83	1.14
Total		100.0	100.0	100.0	44.14	40.80	31.60

* 632 francs per month, for example, in 1975.

**We assume that for the category of 8 children or more the average is 9.

Source: Chesnais. Population, no. 2, 1977.

family benefits. As we have seen, the opposite is true as concerns old-age and medical benefits. In all cases the effects could be substantial over the long term, but it would be illusory, according to Chesnais, to assume that savings accrued in the Family Fund will be sufficient to insure the financial soundness of the other two branches.³⁸

There remains one significant factor in the recent financial history of the French social security system which deserves mention. This is the fiscal imbalance between the various regimes, especially as concerns old-age pensions. Since some of the regimes, for example the special regimes, consist of the workers and retirees of a particular industry, they are subject to the changing demographic characteristics of that sector of the economy. There has often resulted a serious imbalance in the ratio of retirees to actives, as shown in Table VII. The extreme case is that of the miners' regime, where there are 7.1 retiree pensions to be paid by each worker. In the general regime, the ratio is a mere

TABLE VII: Ratio of Retirees to Actives in Various Regimes

Miners	7.1
Railroad workers	2.1
Salaried Agricultural	1.9
Sailors	1.48
Farmers	1.44
Merchants	1.41
Utility workers	1.26
Artisans	1.23
Government service	0.80
Régime général	0.35
Liberal professions	0.27
Municipal workers	0.24

Source: Chesnais. Population, no. 2, 1977.

0.35 pensions per worker.

The excess costs for the regimes suffering from an unfavorable demographic balance cannot always be borne entirely by the active contributors of that regime. It is for this reason that transfers between the regimes, coming mainly from the régime général, have become common, along with various state subsidies to regimes in deficit. In the end this only points to the problems posed by the fragmented nature of the total system, since it adapts so poorly to demographic shifts within the economy from one sector to another.

Intergenerational Transfer and Social Security Financing

All social security expenditures can be classified as administrative or functional in nature. As we have seen, the former are more or less insignificant in the case of France. The latter represent, to the contrary, an important means of consumption within the country. This consumption indicates the commanding political and social priorities of the nation. These "functional" expenditures can be divided into three groups depending on the nature of the transfer effected:

- (1) Acquisition of goods and services. These are mainly medical benefits and represent goods purchased collectively much as public education is purchased without regard for a strict equivalence between what one pays and what one receives;
- (2) Intergenerational transfers. These are both family and old-age benefits and consist of a direct transfer from the active population to the inactives;
- (3) Reserve payments. These "carry forward" operations would be part of a funded old-age pension system and constitute collective savings to cover future expenses.

Our concern in the final section of this paper will be with the last two of these three categories. We shall thus be considering only family and old-age benefits as provided under social security, even though medical benefits can represent an intergenerational transfer in the sense that inactive older persons tend to consume more than their share. Also, although we shall continue to rely heavily on the French example, our discussion will become more and more general, exploring the question of intergenerational transfer and social security as it could apply to any country.

Our task is complicated by the question of which inactives to include in the inactive-active dependency ratio. Many authors, especially American ones, have emphasized the role of retired persons in this group at the exclusion of children (see Keyfitz or Browning). This is perhaps natural for the U.S. where there are few family benefits offered by social security or government in general, but for France we are forced to consider not only the retiree-active ratio, but also the more complete inactive-active ratio (which counts both youths and the aged among the inactives).

Along the same line of reasoning, it may be necessary for completeness to weigh the costs of state education alongside social security costs when considering the total burden of intergenerational transfers. In any final analysis, it is not the intent of this paper to answer which of these ratios is the more valid measure. Some may argue that children are helpless and must be cared for by the active population as a group, while retirees have had the opportunity to provide for their own retirement and should thus be responsible for themselves. Others may feel that all inactives should be considered in one group and cared for as a whole. Better, more comprehensive arguments are surely possible, but in any case, our purpose is to examine both methods of measuring dependency.

In the simplest terms possible, the burden of the intergenerational transfer can be expressed as a percentage of the average salary. We note that total contributions and total benefits can be expressed as follows:

$$\text{contributions} = \text{percent of salary} \times \text{average earnings} \times \text{active population}$$

$$\text{benefits} = \text{average benefit} \times \text{inactive population}$$

Since contributions must equal benefits (in the absence of inter-fund transfers or government subsidies), we may equate these two equations

and solve for the percent of salary required:

$$h = \frac{\text{average benefits}}{\text{average earnings}} \times \frac{\text{inactive population}}{\text{active population}}$$

This percentage h is thus the product of two important ratios, that of average benefits to average earnings (called the earnings replacement rate in pension schemes) and that of the inactive to the active population. The first is a question of economics and politics; the second, of demography. Both ratios are potentially unstable, though it is the instability of the latter that interests us in this paper. We must not, however, forget the potential importance of the former.

In the area of old-age pension financing, the inactive-active ratio for France can be easily calculated since almost all members of the over-65 age group are covered by a pension scheme. As mentioned earlier, this will soon probably be a question of the over-60 age group, but the majority of our calculations will retain the age of 65. For family benefits, however, the task is not so simple in a country like France where not all children are covered. Benefits, we have noted, become payable for the second and future children. The ratio may thus be manipulated as follows:

$$\begin{aligned} & \frac{\text{all children} - \text{first children}}{\text{active population}} \\ = & \frac{\text{all children} - \text{no. of families with children}}{\text{active population}} \\ = & \frac{\text{all children}}{\text{active population}} \times \left(1 - \frac{\text{no. of families with children}}{\text{all children}} \right) \\ = & \frac{\text{all children}}{\text{active population}} \times \left(1 - \frac{1}{\text{average no. of children in families with children}} \right) \end{aligned}$$

If the average number of children is thus two, the ratio is one-half of the proportion of children within the population. For an average family size of three, the ratio is two-thirds times this proportion.³⁹

Since a decreasing proportion of young people usually also implies a decreasing family size, we can see how this ratio will decrease quickly for a country with an aging population such as France. Actual quantitative use of this ratio, however, would require data on the costs of raising individual children, including separately educational costs which would apply to all children. We shall therefore rely later on the comparative costs of children or aged persons as groups of the population.

If we now return to the work of Le Bras and Tapinos concerning demographic evolution and its economic implications in France, we see in Table VIII that under all four basic hypotheses of fecundity the proportion of actives in the population is fairly constant.

TABLE VIII: Evolution of Actives as Percent of Total Population

Hypotheses:	H1	H2	H3	H4
1975	42.3	42.3	42.3	42.3
1980	43.6	43.5	43.5	43.4
1985	45.0	44.6	44.4	44.0
1990	46.0	45.2	44.6	43.7
1995	46.6	45.2	44.2	42.7
2000	46.9	45.3	43.9	42.0
2025	44.3	43.4	42.4	40.7
2050	41.7	42.5	42.6	41.7
2075	41.7	42.5	42.6	41.7

The same is true under the hypotheses of a variable fecundity rate as we see in Table IX. Any movements within the population between the three age groups must then be a question of balance between the young and old populations. As can be seen in Tables X and XI, these movements would be significant in the extreme cases of fecundity. In the year 2075 under a fecundity hypothesis of 1.4, youths represent only 12.5% of the population while aged persons account for 26.0%. If one retains a hypothesis of 2.6, however, the effect is just the

TABLE IX: Evolution of Actives as Percent of Total Population in the Case of a Fluctuating Fecundity Rate

Hypotheses:	H1*	H2*	H3*	H4*
1975	42.3	42.3	42.3	42.3
1980	43.6	43.6	43.6	43.6
1985	45.0	45.0	45.0	45.0
1990	46.0	46.0	46.0	46.0
1995	46.6	46.6	46.6	46.6
2000	46.9	46.9	46.9	46.9
2025	42.9	40.8	40.7	42.1
2050	38.8	43.0	40.2	40.4
2075	42.3	42.1	44.6	40.7

TABLE X: Evolution of Persons Age 65 and Over as Percent of Total Population

Hypotheses:	H1	H2	H3	H4
1975	13.5	13.5	13.5	13.5
1980	13.6	13.6	13.5	13.5
1985	12.6	12.5	12.4	12.3
1990	13.4	13.2	13.0	12.7
1995	14.2	13.8	13.5	13.0
2000	14.9	14.3	13.8	13.1
2025	21.1	18.5	16.5	14.0
2050	26.0	20.2	16.3	12.1
2075	26.0	20.2	16.4	12.2

TABLE XI: Evolution of Persons Age 15 and Under as Percent of Total Population

Hypotheses:	H1	H2	H3	H4
1975	23.7	23.7	23.7	23.7
1980	22.0	22.1	22.1	22.3
1985	20.3	20.9	21.3	22.0
1990	18.6	20.0	21.1	22.7
1995	17.5	19.9	21.6	24.2
2000	16.5	19.2	21.5	24.6
2025	13.2	17.1	20.3	25.1
2050	12.5	16.7	20.3	25.5
2075	12.5	16.7	20.3	25.4

opposite: 25.4% youths and 12.2% aged.

Le Bras and Tapinos continue their analysis by calculating not

only the number of children below the age of 15, but also the total expected number of people in the educational system. The results, as shown in Table XII, indicate the numbers of young children (not yet of school age), of school-age children, and of retirees to be supported by the average active in the year 2050 (when the system would be stable) under each of the four original hypotheses of fecundity. These are, in effect, the complete inactive-active ratios in a stable population under four different fecundity hypotheses. The important result is that if each inactive presents the same average financial burden regardless of his age or status, the choice of an ideal fecundity hypothesis would be irrelevant as regards the question of intergenerational transfers.

TABLE XII: Breakdown of the Inactive-Active Ratio in Stable Populations

Hypotheses:	H1	H2	H3	H4
Young Children	0.06	0.08	0.10	0.13
School-age Children	0.32	0.41	0.49	0.61
Retirees	<u>0.80</u>	<u>0.64</u>	<u>0.53</u>	<u>0.42</u>
Total Charge per Active	1.18	1.13	1.12	1.16

It would be fallacious to assume, however, that all inactives consume equally. What would be needed would be a ratio of the cost of an aged person to that of a youth. The difficult task of finding just such a ratio has been attempted by Lefebvre and Sauvy.⁴⁰ In fact they have tried to find two such ratios with the goal of considering the cost of inactives to the nation or to the state. The latter would include only those costs, such as education and social security, which are paid by the government or government-controlled organizations. The former would consider all means of support, including family or charity, and thus total consumption, net any production.

They estimated that an aged person consumed, in 1980, 1.50 times as much as a youth, but that when production is subtracted, this ratio becomes 1.23. It would thus appear that an aging population would present increasing costs on the active population as a whole, but that these increases might not be so significant as to present a serious problem. We may develop a modified inactive-active ratio by using the 1.23 ratio as a weight on the aged population. If we group the young children and the school-age children of Table XII into one group, we may define the modified inactive-active ratio in this case to be:

$$\frac{\text{no. of children} + 1.23 \times \text{no. of retirees}}{\text{no. of actives}}$$
$$= \frac{\text{no. of children}}{\text{no. of actives}} + 1.23 \times \frac{\text{no. of retirees}}{\text{no. of actives}}$$

Using the data from Table XII, we thus have the four modified ratios, 1.36, 1.28, 1.24, and 1.26, for the four respective fecundity hypotheses. Since the greatest difference is 0.12, this may be interpreted as saying that, when the total charge for the nation is considered, the greatest variation likely per active would be 12% of the cost of raising a child, over the relevant time period. This could, of course, be compensated for by political changes, or the extra cost might be absorbed by economic growth so that there is no real excess burden placed on the active population.

If we consider only the costs assumed by the state, however, the ratio of consumption by the aged to that of youths becomes more noteworthy. By varying methods, the team of Lefebvre and Sauvy arrives at two such ratios: 2.19 and 2.78 for 1980. We will thus choose 2.50 as a compromise value. The fact that this ratio is higher than the one above indicates the higher proportion of child care accomplished through non-governmental means. In the average family this implies that the

parents spend more money directly on their children than on the grandparents, and that these latter rely more heavily than the children on governmental support. In a very real sense, then, the aging of the French population is expected to result in increases in government-controlled intergenerational transfers.

The modified dependency ratios for the four fecundity hypotheses would be 2.38, 2.09, 1.92, and 1.79. The large difference between the first and the last of these implies that taxes and contributions per active tagged for intergenerational transfers could vary by as much as 59% of an average child's state-sponsored consumption. This amounted to 13,160 francs in 1980, of which 59% would be 7764 francs of increase per active. This would seem to be a not insignificant sum. This is, however, only for the case of going from best to worst within our scheme of four hypotheses and does not represent the possibility for an actual increase of this magnitude. Nevertheless, if one compares the breakdowns of the stable populations of 2050 to that of today's population, it can be seen that today's distribution falls somewhere between that of the third or fourth hypotheses. Thus, if the fecundity rate continues to decrease or remains at its low, present levels, the possibilities for increased state control of intergenerational transfers is imminent. This does not indicate, though, that the total of all such transfers within the nation will significantly increase, as seen above.

To put the effects of this demographic shift into perspective, it would be useful to compare the potential of variations in two other factors, one political and the other social or economic. These would be the legal age of retirement and the rate of female activity in the workforce. For the former Le Bras and Tapinos give the active population as a percent of the total under the four hypotheses, considering

possible changes in the average retirement age of plus 2 years and minus 2 or 5 years. The results, as seen in Table XIII, show that variations in the age of termination of activity have a potential to alter dependency ratios which is greater than that of simple demographic fluctuations. In addition, these influences are very regular for all four fecundity hypotheses.

TABLE XIII: Actives as Percent of Population Given Variations in Legal Retirement Age

Variations in Retirement Age:	Hypotheses:	H1	H2	H3	H4
	In the year 2000:				
+2		48.2	26.5	45.1	43.2
0		46.9	45.2	43.9	42.1
-2		45.5	43.9	42.6	40.8
-5		43.4	41.9	40.7	39.0
	In the year 2025:				
+2		46.4	45.2	44.0	42.1
0		44.6	43.5	42.5	40.8
-2		42.5	41.8	40.9	39.4
-5		39.5	39.1	38.5	37.4
	In the year 2075:				
+2		43.6	44.2	44.0	42.9
0		41.7	42.5	42.6	41.7
-2		39.7	40.8	41.1	40.5
-5		36.8	38.3	38.8	38.6

Just as we cannot ignore the effects of the retirement age on dependency ratios, we must as well weigh the influence of the predicted continued increase in the number of active working women. Le Bras and Tapinos note that, between 1974 and 1977, the gap between the rates of feminine activity and those of the male population closed by close to a third. This movement is more marked at the lower working ages as might be expected, and this would indicate that the trend may continue. Under two scenarios which both show feminine activity rates rising (more or less quickly) until 2010, when they equal those of males, the active population represents a significantly greater proportion of the total

TABLE XIV: Actives as Percent of Population Given Increasing Feminine Activity

Hypotheses:	H1	H2	H3	H4
1975	42.7	42.7	42.7	42.7
1980	45.2	45.2	45.2	45.2
1985	48.5	48.2	48.0	47.6
1990	51.4	50.6	50.1	49.1
1995	54.1	52.6	51.5	49.8
2000	56.2	54.3	52.7	50.5
2025	57.1	55.6	54.2	51.8
2050	53.5	54.4	54.2	52.9
2075	53.4	54.3	54.2	52.9

population than predicted earlier. Table XIV shows the results under one of these two scenarios (since the results are similar, we choose only to display the more conservative hypothesis).

We thus see the importance of factors other than mortality improvements and fecundity fluctuations on the burden presented by the inactive population. Furthermore, whereas the movement of fecundity rates seems elusive, we can be fairly certain of the direction of changes in the retirement age and feminine activity. It is almost certain that the age of 60 will eventually become the normal retirement age in France, and we have good reason to believe that feminine activity in the job market will continue to increase. This latter would be all the more true in the case of a low fecundity rate (the case which theoretically presents the greatest burden on the active population), according to studies which have shown an inverse relationship between family size and feminine activity.

If our concern then is the total intergenerational transfers in a country like France, it is seen that the role of demographic movements will be minimal in the final analysis when compared to other potential changes. If we wish to isolate old-age pensions, however, there is one

final perspective to be considered. It is necessary to compare the two basic means of financing a national retirement scheme. The first of these is the one present in France or the U.S. and is often called the pay-as-you-go system of pension financing. Under this method the active generation pays for the pensions received by the retirees of an older generation. No reserve of capital is built up, and the accounts must be balanced on a year-to-year basis. This is otherwise known as a redistribution system and represents a true intergenerational transfer.

The second system is only theoretical, as it has only been applied in a modified form at a national level. It is, nevertheless, the system used in the area of private pension plans and may be called the funded system. According to the theory, an individual would contribute to social security during his entire active life a certain sum, which would be invested by the system and returned to the individual with interest in the form of a retirement pension. Each generation would thus be entirely responsible for itself in the area of old-age pensions. Otherwise known as a capitalization system, this is an example of the "carry-forward" operations of social security mentioned earlier.

Aside from the relative fairness of the two systems, a comparison of the two must also discuss the nature of the intergenerational transfer in a pay-as-you-go system, the size of the prospective fund in a capitalized system, and the comparative profitability for the insured under either system. For the first of these three, it is instructive to examine the entire life of a redistribution system and the generations which will benefit or suffer the most as a result. For this we draw heavily on the work of Browning⁴¹ and Picot.⁴²

The present French system was developed in a period of high economic and demographic growth which favored rapid increases in benefits and

expectations for what the system could offer. To interrupt today this chain of transfers from one generation to the next would hurt most those who are now reaching retirement age and who have contributed all their active lives in the hope of receiving, in their turn, an old-age pension. Today we are faced with the question of how to divide the charges and burdens placed on the old-age pension system by demographic changes between the generations.

It is necessary to be precise about the nature of past growth in social security outlays in the area of retirement benefits. This growth, when adjusted for inflation, is the result of four factors: the growth of the aged population, the extension of pension rights to all social and professional categories, the gradual lowering of the retirement age, and the growth in the size of the average pension. Table XV illustrates the growth in the population over age 60, in the number of beneficiaries (reflecting both the extension of the system and the decreasing retirement age), and in the average pension. The Table also gives the rate of average annual increase in these three areas, as well as the share represented by each factor in the growth of total outlays over the period 1950-1975.

We thus see the importance of benefit size in the growth of the total system. The increasing average benefit was due in large measure to the maturing of the pension system; there was thus an increasing number of retirement-age persons who had contributed for a large portion, indeed all, of their active lives. The increase also reflects the political currents of the period. There was a move toward favoring the aged through guaranteed minimum income legislation, the extension of mandatory complementary regimes, and the revaluation of old-age pensions.

The choice of a pay-as-you-go system of finance reflects the urgency

TABLE XV: Factors in Growth of Total Retirement Benefits, 1950-1975

Year:	Population over 60 (thousands)	Total Beneficiaries (thousands)	Annual Pensions (average)	
			Actual francs	1978 francs
1950	6764	5100	596	3254
1960	7604	5600	1823	5406
1965	8458	6885	3252	8007
1970	9166	8807	4746	9445
1975	9672	10267	9551	12482
Average Annual Increase:	1.4%	1.5%	--	5.5%
Share of Total Growth:	16%	18%	--	66%

Source: Picot, Michel. "Le Financement des Retraites et le Vieillissement de la Population." Vie et Sciences Economiques, October 1980.

in the construction of the system after the Second World War as well as the expectation of sustained economic and demographic growth. A pay-as-you-go system has the advantage of being quickly implemented and, as we shall demonstrate later, of being the favored system in a period of economic and demographic increase. The problem now is that the aging of the population and the slowed economic growth known through the 1970's and 1980's have reduced the profitability of such a redistribution system. This creates a contradiction in that the system obligates future generations to contribute, even though future generations may realize that savings would be more profitable. This will hopefully be made clear as we attempt to analyze the profitability of a pay-as-you-go system.

A pay-as-you-go system essentially has two redistributive functions. It must first determine how to distribute national income among actives and retirees, and second how to distribute benefits among pensioners and contributions among actives. In France, benefits are determined by the

past contributonal effort of the retirees, based on three variables:

- (1) the level of income submitted to contribution;
 - (2) the duration of the period of contribution;
- and (3) the age at retirement.

By establishing a link between contributonal efforts and benefits received by all retirees at any one time, this creates a certain equity within any one generation (we have noted, however, the contradictions created by the existence of different regimes with varying benefits). Since the contribution rate itself does not enter into the calculation, however, this implies that there is no guaranteed link for any one insured between contributions and futures benefits and creates the potential for inequities from one generation to the next.

To see the relationship among generations we may develop a hypothetical model of a pay-as-you-go system based on the following hypotheses:

- (1) the population is divided into three generations, aged 20-40, 40-60, and 60-80, of which the first two form the active population and the last the retirees;
- (2) the contribution rate in the initial three generations is a constant 20% of total salary;
- (3) the aggregate remuneration begins at 1000 units over the 20 year period and grows by 50% each generation (a growth which may be either economic or demographic in nature).

In Table XVI we can see then that in the initial period contributions from generations B and C total 400, which is received by generation A as a retirement pension. The implicit yield for A is infinite because it has made no contributions to the system. In the second period total contributions grow by 50%, as do benefits received. The rate of return

TABLE XVI: Evolution of a Pay-as-you-go Pension System in Stability

Period:		1	2	3
Contribution Rate:		20%	20%	20%
Growth Rate:		50%	50%	50%
Generation 20-40	Salary:	C 1000	D 1500	E 2250
	Contributions:	200	300	450
Generation 40-60	Salary:	B 1000	C 1500	D 2250
	Contributions:	200	300	450
Generation 60-80	Pension:	A 400	B 600	C 900
Implicit rate of return:		∞	200%	50%

for the generation B is 200% over the original contribution of 200.

In the third period the system is mature and the generation C receives an implicit yield equal to the growth rate of 50% over the intervening period. This is seen to be true in the equation,

$$900 = 200(1.50)^2 + 300(1.50) .$$

The rate of return would remain the same now for all consecutive generations if contributions and growth remained constant. The generations A and B are called the initial generations as they receive benefits without having contributed during two full periods. As a result their rates of return are disproportionately large, and a debt has been created which will be passed forward from generation to generation as long as the system functions. The generation C and those which would follow under stable conditions are called the intervening generations. At a constant rate of contribution, their return is always equal to the growth rate.

Problems may occur when growth slows, whether that be for economic or demographic reasons. Table XVII shows the result of zero growth, given the two possible political responses. The first response is to

TABLE XVII: Evolution of a Pay-as-you-go Pension System in Instability

Hypothesis 1: Constant rate of return of 50%

Period:		4	5	6	7
Contribution Rate:		30%	45%	67.5%	0%
Growth Rate:		0%	0%	0%	0%
Generation 20-40	Salary:	F 2250	G 2250	H 2250	I 2250
	Contributions:	675	1012.5	1518.75	0
Generation 40-60	Salary:	E 2250	F 2250	G 2250	H 2250
	Contributions:	675	1012.5	1518.75	0
Generation 60-80	Pension:	D 1350	E 2025	F 3037.5	G 0
Implicit rate of return:		50%	50%	50%	--

Hypothesis 2: Constant contribution rate of 20%

Period:		4	5	6	7
Contribution Rate		20%	20%	20%	0%
Growth Rate:		0%	0%	0%	0%
Generation 20-40	Salary:	F 2250	G 2250	H 2250	I 2250
	Contributions:	450	450	450	0
Generation 40-60	Salary:	E 2250	F 2250	G 2250	H 2250
	Contributions:	450	450	450	0
Generation 60-80	Pension:	D 900	E 900	F 900	G 0
Implicit rate of return:		13.7%	0%	0%	--

attempt to maintain the previous implicit rate of return on all pensions paid out. This inevitably results in swift increases in the contribution rate to a point which quickly becomes unbearable. Under the second response, the contribution rate is held at a constant 20%, and the implicit yield adjusts quickly to match the growth rate. In both cases we assume that the system is abandoned in period 7, whether because it has become too much of a burden on the active population, or because it is no longer a profitable means of preparing for retirement.

In both cases it is the generations G and H which suffer a loss when the system is abandoned, for these two generations have made contributions throughout all or part of their active lives and will receive nothing in return. If we define the "pension right" as the amount of contributions made, multiplied by the growth rate for the intervening periods, we see that the loss in Hypothesis 2 for G is 900 units, and that of H, 450. This represents the unpaid debt of the pay-as-you-go system and is entirely the result of the pensions paid to generations who had not contributed to the system or who otherwise received a pension in excess of their pension right, as defined earlier. In Hypothesis 2 the calculations are simple. Generation A received 400 units without having made any contributions. This, multiplied by the growth rate for the intervening periods, yields:

$$400 \times (1.50)^2 = 900 .$$

For B the pension right was 200 times 1.50, or 300. The pension received by B in excess of this pension right was thus 300, which when multiplied by the growth rate for the intervening generations, yields 450 units. The unpaid debt is thus 450 plus 900, or 1350, which perfectly matches the total losses for the terminal generations, G and H.

For Hypothesis 1 the calculations are somewhat more complicated, for we must consider all cases where benefits received exceeded the pension right. As above, the debt created by A and B will be 1350 at the time the system terminates. Also, we must count the debt created when the generations D, E, and F receive pensions in excess of their pension rights. For D the pension right is

$$300 \times 1.50 + 450 = 900 .,$$

so the excess is 450 units. Since E and F do not have the benefit of a positive growth rate, their pension rights equal total contributions

made. The excess of benefits for them is thus 900 and 1350, respectively. The total unpaid debt is thus

$$1350 + 450 + 900 + 1350 = 4050.,$$

which equals the total loss of the generations G and H:

$$1012.5 + 2 \times 1518.75 = 4050 .$$

We can thus see the dangers in a system where expectations for the growth of benefits exceed the demographic and economic growth of the country. The inevitable result is that contributions increase as a percent of salary to a point which may become unbearable for the actives of future generations. The inverse danger is that, if growth is so slow as to reduce the profitability of the system, future generations may choose to abandon the system in favor of private savings. In either case there would be generations which would suffer serious losses at the termination of the system. The magnitude of their loss would reflect the years of benefits paid out in excess of the beneficiaries' pension rights. Picot has estimated that the present accumulated debt for the French social security system is around 7 trillion francs⁴³, a sum which reflects not only the potential losses to be suffered by the population of today if the system were abandoned, but also the numerous benefits extended to people who had not earned them through accumulated contributions.

These "unearned" benefits, though, are fundamental to the nature of a redistribution system. Even if benefits for the intervening generations always equaled the pension right, there would still be the debt created by granting pensions to the initial generations who had not contributed to the system. Furthermore, the only alternative to such a system is to have a fully capitalized system where a fund is established from the beginning of the system, from which all pensions will later be paid. In this case benefits would exactly match the pension right under

a capitalized system, which would be the amount of total contributions augmented by interest earnings over the intervening period.

In the consideration of such a fund there are two questions which need to be answered. They concern the size of the reserve fund that would be required and the comparative profitability of such a system for the participants. The pioneer in this area as concerns French social security is Bourgeois-Pichat.⁴⁴ Keyfitz and Gómez de León⁴⁵ have developed alternative methods of calculation for demonstrating the same basic ideas, and we shall at times rely on their methods for the sake of simplicity. In addition, slight alterations are made in order to maintain a certain consistency within our discussion and to illustrate further some of the major themes of this paper.

We start by considering a fully capitalized system with the goal of determining the contribution level as a percent of salary. We take as the unit of calculation one single birth, earning one unit of money per year, and assume that the level of the resulting pension will also be one unit per year. We let k represent the proportion of the salary necessary during the active period to establish a fund which will later provide an old-age pension.

For a new birth, the discounted value of all contributions at interest rate r is

$$k \int_A^B e^{-rx} p(x) dx ,$$

where $p(x)$ is the probability of survival from birth until age x , and A and B are the endpoints of the active life. This sum must be equal to the discounted value of the unit retirement pension:

$$\int_B^W e^{-rx} p(x) dx ,$$

where W is the age limit of life. From these two expressions, we can calculate the contribution factor to be paid by an active worker:

$$k = \frac{\int_B^W e^{-rx} p(x) dx}{\int_A^B e^{-rx} p(x) dx} .$$

For a pay-as-you-go system we consider a stable population where the rate of natural growth is s . There are thus

$$b e^{-sx} p(x)$$

persons alive between ages x and $x+dx$ at any moment in time, where b represents the annual rate of births at that moment. If the contribution factor is h , the total contributions in this population are

$$kb \int_A^B e^{-sx} p(x) dx ,$$

where A and B again represent the limits of the active life, but this time within the structure of the corresponding stable population.

Likewise, total benefits are expressed by

$$b \int_B^W e^{-sx} p(x) dx ,$$

which is simply the total number of retirees at any moment. Since the functioning of the system requires that total contributions equal total benefits at any time, we can calculate the value of h :

$$h = \frac{\int_B^W e^{-sx} p(x) dx}{\int_A^B e^{-sx} p(x) dx} .$$

In comparing the formulae for h and k , we see that $h=k$ whenever the rate of natural growth s is equal to the return r on invested capital. We shall complicate this observation later by allowing for an increasing salary level (with commensurate increases in pensions), but for now the calculations are simpler if we retain the somewhat unrealistic assumption of a constant salary.

We would now like to calculate the sum possessed by the capitalized fund in the case of a fully funded system. The amount theoretically belonging to any one active contributor would reflect contributions made

plus any accumulation for interest or survivorship. Thus the sum possessed by an active contributor age x would be

$$k \int_A^x e^{r(x-u)} \frac{p(u)}{p(x)} du = k \frac{e^{rx}}{p(x)} \int_A^x e^{-ru} p(u) du .$$

There would be

$$b e^{-sx} p(x)$$

persons age x to $x+dx$ who possess this sum, and thus the total sum for all active contributors between ages A and B could be calculated

as follows:

$$\begin{aligned} S1 &= \int_A^B b e^{-sx} p(x) \left[k \frac{e^{rx}}{p(x)} \int_A^x e^{-ru} p(u) du \right] dx \\ &= kb \int_A^B e^{(r-s)x} \left[\int_A^x e^{-ru} p(u) du \right] dx . \end{aligned}$$

This may be integrated by parts to yield:

$$S1 = \frac{kb}{r-s} \left[e^{(r-s)B} \int_A^B e^{-rx} p(x) dx - \int_A^B e^{-sx} p(x) dx \right] .$$

The amount possessed by any one retiree age x would be the present value, discounting for interest and survivorship, of all future benefits:

$$\int_x^W e^{-r(u-x)} \frac{p(u)}{p(x)} du .$$

Summing over B to W and integrating as before, we have the total sum possessed by all present retirees:

$$S2 = \frac{b}{r-s} \left[-e^{(r-s)B} \int_B^W e^{-rx} p(x) dx + \int_B^W e^{-sx} p(x) dx \right] .$$

If we then remember that

$$\int_B^W e^{-rx} p(x) dx = k \int_A^B e^{-rx} p(x) dx ,$$

and that

$$\int_B^W e^{-sx} p(x) dx = h \int_A^B e^{-sx} p(x) dx ,$$

we may write the total sum possessed by the fund:

$$S = S1 + S2 = \frac{b}{r-s} (h-k) \int_A^B e^{-sx} p(x) dx .$$

Since we are interested in this sum as a proportion of the aggregate remuneration, we calculate the ratio

$$\frac{S}{b \int_A^B e^{-sx} p(x) dx} = \frac{h-k}{r-s} .$$

These are then the basic formulae which can be used under our model to compare the profitability of a pay-as-you-go system to a funded one and to calculate the size of the fund needed in the latter case in comparison to the aggregate remuneration. We see that the contribution level under the two systems would be equal if the interest rate were equal to the rate of natural increase of the population (both of which, we recall, are assumed constant). A population which grows quickly will provide for an increasing number of future actives who will share the burden of a pay-as-you-go system. If the population grows slowly, however, so that the rate of growth is exceeded by the long-term interest rate on invested capital, a funded system would be preferable, according to our model.

We shall need to remove one simplification, though, to make our model truly meaningful for the real world. We assumed that the level of pensions received would be the same as that of salaries. Two problems with this assumption are easily removed. The first would be that we have implicitly assumed that all salaries would be equal. This aided in simplifying the calculations and presents no real problem if we choose to speak instead of the average salary level. The second problem is that we have assumed an earnings replacement rate of 100%, which would not normally be the case. Fortunately, this is no problem either, for it is easy to show that if the earnings replacement rate is some percent p of the average salary, the new contribution rates would be p multiplied by either k or h .

The third problem is somewhat more subtle, however. It involves the growth of the average salary over time. This would be irrelevant in the case of a redistribution system, but with capitalization of contributions it becomes extremely important, because interest earnings

have to keep up with inflation. If we let t be the growth rate of the average salary, we may recalculate the contribution coefficient k to take account of this fact. In this case t represents both the inflation of the average salary and increases due to productivity gains. For a new birth, the discounted value of all contributions would thus become

$$k \int_A^B e^{-rx} p(x) e^{tx} dx = k \int_A^B e^{-(r-t)x} p(x) dx .$$

This must equal the present value of the eventual retirement pension,

$$\int_B^W e^{-rx} p(x) e^{tx} dx = \int_B^W e^{-(r-t)x} p(x) dx ,$$

so that we have

$$k = \frac{\int_B^W e^{-(r-t)x} p(x) dx}{\int_A^B e^{-(r-t)x} p(x) dx} .$$

Under these more realistic assumptions, then, the contribution levels of the two systems would be equal if the rate of natural increase of the population equals the interest rate adjusted by the growth rate of the average salary, and in the absence of equality, we could choose the more favorable system accordingly. When the quantity, $r-t$, is greater than s , we would choose a funded system (given that profitability is our only criterion). In the inverse case, where s exceeds $r-t$, we would prefer a pay-as-you-go system.

Returning to the case where contributions under the two systems would be equal, however, we see that we have the equivalence relationship,

$$r - t = s ,$$

which may also be written

$$r = s + t .$$

We discussed earlier the idea of a pension right under a pay-as-you-go system, which implies that a beneficiary would receive a pension equal to contributions made plus a growth factor which reflects increases in

population size and economic productivity over the intervening period. This is essentially the quantity, $s+t$, so that the implicit rate of return for any one participant in such a pay-as-you-go system would be equivalent to the interest rate r . The two systems would again prove to be indistinguishable, except for the presence of the capitalized fund or the debt which is passed from generation to generation.

In considering the size of this fund in comparison to the aggregate remuneration, we shall again have to alter our formula to take account of the growth in the average salary. This can be accomplished by a simple substitution of $r-t$ for r in the original equation, so that we have

$$\frac{h-k}{(r-t)-s},$$

which represents the size of the required fund as a proportion of total salaries paid out in one year.

We need not concern ourselves with the actual calculations of this proportion as it has already been done by other authors (see Bourgeois-Pichat or Keyfitz and Gómez de León). Table XVIII shows various values calculated assuming a level of mortality consistent with a life expectancy at birth of 77.5 years.

Thus, assuming moderate population growth and realistic rates of interest when adjusted for inflation, it would appear that the fund would possess around 4 to 5 times the amount of money paid out each year in salaries. This could present serious problems, given that the total wealth of a developed country is generally assumed also to equal from 4 to 5 times the aggregate annual remuneration.⁴⁶ Bourgeois-Pichat and Chaperon have shown how even the annual interest paid to such a fund would more than double the percent of national revenue which goes for the return on capital investments.⁴⁷ The conclusion of these writers is that a fully-funded pension scheme on a national level would be an

TABLE XVIII: Values of $(h-k)/(r-t-s)$ assuming $e_0=77.5$ years.

r-t:	s: 0.03369	0.01458	0.008539
0.05	5.570	3.463	2.630
0.04	6.315	4.026	3.156
0.03	7.203	4.711	3.681
0.02	8.252	5.588	4.418
0.01	9.501	6.563	5.301
0.00	10.673	7.769	6.375
-0.01	12.743	9.207	7.664

Source: Keyfitz, Nathan and José Gómez de León. "Considérations démographiques sur les Systèmes de Retraite." Population, no. 4-5, 1980.

impossibility due to the magnitude of this fund and the inability of the capital markets of the country to absorb such massive investments.

The only alternative then to a pay-as-you-go system would appear to be a partially-funded scheme, which would essentially combine a redistribution and a funded operation into one overall system. Keyfitz suggests that the funded portion might be feasibly able to represent one-fifth of the total system. This would in a way resemble the earnings-related system Sweden adopted in 1959. By 1978 the fund for this scheme had accumulated some 131.5 billion kronor (about \$30 billion), which accounts for over one-third of the annual GNP of the country.⁴⁸ It is also obviously a major source of capital formation, and it is suggested that its purpose is more to provide a source of investment than for its pension-funding potential.⁴⁹

FOOTNOTES

¹"Dossiers et Documents" (Paris: Le Monde), no. 28, February 1976, p.2.

²Pierre Laroque, "Social Security in France," in Social Security in International Perspective, ed. Shirley Jenkins (Columbia University Press: New York, 1969), pp. 172-173.

³Ibid., p. 174.

⁴Maurice Rustant, "Le Financement de la Sécurité Sociale," Economie et Humanisme, May-June 1977, p. 59.

⁵Laroque, p.179.

⁶Rustant, p. 59-60.

⁷Ibid., p.61.

⁸"Dossiers et Documents," p. 1.

⁹Ibid., p.2.

¹⁰Ministère des Affaires Sociales et de la Solidarité Nationale, Commission des Comptes de la Sécurité Sociale, Rapport présenté à la session du 20 décembre 1982, p.7-8.

¹¹Alain Euzeby, Cours de Mécanismes Monétaires et Financiers, Université de Sciences Sociales de Grenoble, 1982-1983, p. 7-8.

¹²Rustant, p. 63.

¹³"Dossier et Documents," p. 2.

¹⁴Martin B. Tracy, "Flexible Retirement Features Abroad," Social Security Bulletin, May 1978, p. 28-29.

¹⁵Ibid., p. 29.

¹⁶Gilles A. F. Frechet, "The Benefits of Living with Mitterand," Employee Benefit Plan Review, October 1983, p. 70.

¹⁷Jacques Vallin, "Tendances Récentes de la Mortalité Françaises," Population, no. 1, 1983, p. 83.

¹⁸Ibid., p. 84.

¹⁹Nathan Keyfitz, Population Change and Social Policy (Cambridge, Mass.: Abt Books, 1982), pp. 205-206.

²⁰Dinh Quang Chi and Jean-Claude Labat, Projection de Population Totale pour la France 1975-2000, Collection de l'INSEE, May 1979, p. 8.

²¹"La Natalité Continue de Baisser en France" (Paris: Le Monde), October 5, 1983.

²²Ibid.

²³"Les Conséquences du Vieillessement" (Paris: Le Monde), November 1, 1983, p. 23.

²⁴Chi and Labat, see note 20.

²⁵Hervé Le Bras and George Tapinos, "Perspective à Long Terme de la Population Française et leurs Implications Economiques," Population, no. spécial, 1979, pp. 1391-1452.

²⁶Ibid., p. 1411.

²⁷Jean-François Chadelat, "Securité Sociale: Aspects Economiques et Financiers," Revue Française des Affaires Sociales, no. spécial, 1980, pp. 275-294.

²⁸Rustand, p. 64.

²⁹Chadelat, p. 287.

³⁰Ministère des Affaires Sociales, Rapport, pp. 10-11.

³¹Jean-Claude Chesnais, "Fluctuations Démographiques et Dépenses de Securité Sociale," Population, no. 2, 1977, p. 385.

³²Andrée Mizrahi, Arié Mizrahi, and Simone Sandier, "Les Facteurs Démographiques et la Croissance des Consommations Médicales," Consommation, no. 1, 1974, p. 29.

³³Ibid., p. 30.

³⁴Ibid., p. 43-44.

³⁵Chesnais, p. 386.

³⁶Ibid., p. 388.

³⁷Ibid., p. 398.

³⁸Ibid., p. 401.

³⁹International Labor Organization, "Social Security Financing and Demography," International Labor Review, December 1952, p. 471.

⁴⁰Alain Lefebvre and Alfred Sauvy, "Influence de l'Evolution Démographique sur les Charges Sociales," Population, no. 2, 1981, pp. 251-266.

⁴¹Edgar K. Browning, "Social Insurance and Intergenerational Transfers," The Journal of Law and Economics, October 1973, pp. 215-237.

⁴²Michel Picot, "Le Financement des Retraites et le Vieillessement de la Population," Vie et Sciences Economiques, October 1980, pp. 32-42.

⁴³Ibid., p. 39.

⁴⁴Jean Bourgeois-Pichat, "Le Financement des Retraites par Capitalisation," Population, no. 6, 1978, pp. 1115-1136.

⁴⁵Nathan Keyfitz and José Gómez de León, "Considérations démographiques sur les Systèmes de Retraite," Population, no. 4-5, 1980, pp. 813-836.

⁴⁶Bourgeois-Pichat, pp. 1124-1125.

⁴⁷Jean Bourgeois-Pichat and J.-E. Chaperon, "Répartition du Revenu National entre Capital et Travail: Application au Financement des Systèmes de Retraite," Population, no. 1, 1979, pp. 43-64.

⁴⁸Keyfitz, Population Change, p. 208.

⁴⁹Leif Haanes-Olsen, "Social Security Funding Practices in Selected Countries," Social Security Bulletin, May 1976, p. 24.

BIBLIOGRAPHY

- Bourgeois-Pichat, Jean. "Le Financement des Retraites par Capitalisation." Population, no. 6, 1978.
- _____, and J.-E. Chaperon. "Répartition du Revenu National entre Capital et Travail: Application au Financement des Systèmes de Retraites." Population, no. 1, 1979.
- Browning, Edgar K. "Social Insurance and Intergenerational Transfers." The Journal of Law and Economics, October 1973.
- Chadelat, Jean-Francois. "Sécurité Sociale: Aspects Economiques et Financiers." Revue Française des Affaires Sociales, no. spécial, 1980.
- Chesnais, Jean-Claude. "Fluctuations Démographiques et Dépenses de Sécurité Sociale." Population, no. 2, 1977.
- Chi, Dinh Quang, and Jean-Claude Labat. "Projection de Population Totale pour la France 1975-2000." Collection de l'INSEE, May 1979.
- Consael, Robert. "Systèmes de Retraite et Populations Stables." Population et Famille, no. 2, 1977.
- Copeland, Lois S. "France Gradually Lowers Retirement Age." Social Security Bulletin, December 1976.
- _____. "Impact of Recession on Financing of French Program." Social Security Bulletin, July 1976.
- Euzeby, Alain. Cours de Mécanismes Monétaires et Financiers. Université des Sciences Sociales de Grenoble, 1982-1983.
- Frechet, Gilles A. F. "The Benefits of Living with Mitterand." Employee Benefit Plan Review, October 1983.
- Haanes-Olsen, Leif. "Earnings-Replacement Rate of Old-Age Benefits, 1965-75, Selected Countries." Social Security Bulletin, January 1978.
- _____. "Social Security Funding Practices in Selected Countries." Social Security Bulletin, May 1976.
- International Labor Organization. "Social Security Financing and Demography." International Labor Review, December 1952.
- Keyfitz, Nathan. Population Change and Social Policy. Cambridge, Mass: Abt Books, 1982.
- _____, and José Gómez de León. "Considération Démographiques sur les Systèmes de Retraite." Population, no. 4-5, 1980.
- Laroque, Pierre. "Social Security in France," in Social Security in International Perspective, Shirley Jenkins, ed. New York: Columbia University Press, 1969.

- Le Bras, Hervé and George Tapinos. "Perspectives à Long Terme de la Population Française et leurs Implications Economiques." Population, no. spécial, 1979.
- Lefebvre, Alain, and Alfred Sauvy. "Influence de l'Evolution Démographique sur les Charges Sociales." Population, no. 2, 1981.
- Ministère des Affaires Sociales et de la Solidarité Nationale. Commission des Comptes de la Sécurité Sociale. Rapport présenté à la session du 20 décembre 1982.
- Mizrahi, Andrée, Arié Mizrahi, and Simone Sandier. "Les Facteurs Démographiques et la Croissance des Consommations Médicales." Consommation, no. 1, 1974.
- Netter, Francis. La Sécurité Sociale et ses Principes. Paris: Sirey, 1959.
- _____. "Social Security Technique and Demography." International Labor Review, June 1953.
- Picot, Michel. "Le Financement des Retraites et le Vieillissement de la Population." Vie et Sciences Economiques, October 1980.
- Rustant, Maurice. "Le Financement de la Sécurité Sociale." Economie et Humanisme, May-June 1977.
- Tracy, Martin B. "Flexible Retirement Features Abroad." Social Security Bulletin, May 1978.
- Vallin, Jacques. "Tendances Récentes de la Mortalité Française." Population, no. 1, 1983.