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SM/97/250

CONTAINS CONFIDENTIAL INFORMATION

October 6, 1997

To: Members of the Executive Board

From: The Secretary

Subject: **France—Selected Issues**

The attached paper provides background information to the staff report on the 1997 Article IV consultation discussions with France, which was circulated as SM/97/231 on September 12, 1997.

Mr. Habermeier (ext. 38857), Mr. Doré (ext. 34021), or Mr. Lenseigne (ext. 36038) is available to answer technical or factual questions relating to this paper prior to the Board discussion.

Unless the Documents Preparation Section (ext. 36760) is otherwise notified, the document will be transmitted, in accordance with the procedures approved by the Executive Board and with the appropriate deletions, to the WTO Secretariat on Wednesday, October 15, 1997; and to the European Commission (EC), the Food and Agriculture Organization (FAO), the Organisation for Economic Cooperation and Development (OECD), and the World Food Programme (WFP), following its consideration by the Executive Board.

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INTERNATIONAL MONETARY FUND

FRANCE

Selected Issues

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Approved by European I Department

October 2, 1997

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Executive Summary

Recent years have seen a growing recognition of the burden that will be placed on the public finances by aging populations—with most industrial countries facing serious pressures on social spending over the coming decades. This outlook, moreover, needs to be faced in many cases with tax burdens and debt ratios that are already high. France is no exception: official projections signal a sustained rise in the dependency ratio, which will begin within a decade and entail, on present policies, a substantial rise in spending on pensions and health care.

The papers presented here seek to shed further light on the long-term fiscal outlook, using two approaches that are complementary and, in both cases, novel in the literature on France. The first paper employs the generational accounting technique to illustrate the imbalance between the net tax burden on generations now living and that—significantly heavier—on future generations, in the absence of policy changes to address unfunded pension liabilities. The second paper, on similar policy assumptions, explores the long-term fiscal outlook in a dynamic, rather than a static framework: it simulates the impact on economic performance of the higher taxes required to finance entitlement spending, and incorporates these feedback effects into projections of the public finances. The analysis in both papers underscores the case for public spending restraint—and notably early pension reforms—to safeguard core social security, preserve fiscal sustainability, and underpin a continuing rise in living standards.

The ***generational accounting study*** presents the first set of fiscal accounts for France to illustrate the impact on different generations of current policy settings. It was developed using age profiles of taxes and transfers drawn from a 1990 survey and other official sources, as well as demographic projections prepared by the authorities; and it takes into account the impact of demographic changes on both public spending and labor force participation. The results reported, while subject to many methodological caveats (including the convention that older generations are protected from policy changes in the future), suggest that current policy rules imply a net tax burden on those now in their early twenties that is more than one and a half times as large as that on the "baby boom generation"—those born around 1950.

The study also reports the now "standard" measure of generational imbalance, defined as that between newborns in the base year (1995) and subsequent generations. On this measure also, later generations are found to face, on average, a significantly higher tax burden than those born recently. Results for other countries on broadly similar methodology are derived from a recent OECD survey of generational accounting studies: this shows, with similar economic assumptions, somewhat smaller imbalances in Germany and Sweden than in France, which may reflect later retirement ages and lower public pension spending. On the other hand, larger imbalances are found for Italy and the United States—the former reflecting in part the fact that the study predated the 1995 pension reform, but also the high initial debt ratio; and the latter stemming essentially from the rapid growth of medical spending that was projected at the time the study was prepared.

The paper also illustrates the extent to which policy reforms can affect the fiscal outlook. It emerges from the projections that the generational imbalance in France would have been almost twice as large in the absence of key pension changes designed in the early 1990s and implemented in 1993. Moreover, alternative scenarios are developed to illustrate how additional reforms—such as longer pension contribution periods and a later retirement age—could further reduce the generational imbalance in France.

The second paper presented here, which examines the ***feedback effects of high entitlements and taxes on economic performance***, develops as a point of departure a conventional set of public expenditure projections for France, based on current social security policies. These projections—unlike generational accounts—allow the sequential development of the public finances, including the public debt, to be traced from one fiscal year to another. The paper confirms the main conclusion reached in other such studies: without steps to restrain the growth of spending, public outlays on pensions and health care will rise very substantially, beginning early in the next decade, as the French population ages. The ratio of general government expenditure to GDP increases by about ½ percent of GDP per year, each year, for at least the next 30 years. Keeping the general government deficit within Maastricht bounds, under these circumstances, would require the adoption of substantial adjustment measures at regular intervals.

Building on this conventional projection, the paper then seeks to extend earlier studies by embedding the fiscal accounts in a model of aggregate supply in which fiscal policy can affect the prospects for economic growth. The object in this is to gain insights for policy redesign aimed at safeguarding the core elements of the social security system, preserving fiscal sustainability, and allowing a continuing rise in prosperity. While the modeling of such feedbacks from fiscal policy to economic performance inevitably involves some degree of conjecture, the order of magnitude of the feedback effects appears plausible in light of the relevant literature and of estimates for France that are presented in an appendix to the study.

The long-term projections developed with such feedback effects suggest that financing existing entitlements by a steady increase in taxation over the coming decades would adversely affect investment, labor market performance, and economic growth. In turn, revenue buoyancy would be dampened, and tax rates again would need to be raised. This cumulative process would worsen seriously the overall economic outlook. Not only would public revenue and expenditure rise to levels that appear unsustainable, but the prosperity enjoyed by future generations would be sharply curtailed—much more so than in the generational accounting projections discussed above, in which such feedbacks were not incorporated.

Finally, the paper enquires what light such a framework can shed on the viability of different reform options. The key is confirmed to lie in restraining the growth of pension outlays, by extending contribution periods and raising retirement ages. Given the projected pressure on the public finances from demographic trends over coming years, another conclusion is the desirability of developing a strategic plan to contain the overall growth of public spending, thus further limiting the risk of a damaging runup in public sector deficits, debt, and taxation.

I. GENERATIONAL ACCOUNTING FOR FRANCE[1]

A. Introduction

1. This paper presents a set of generational accounts to contribute to the assessment of France's long-term fiscal position. Understanding the sustainability of fiscal policy in France from a generational perspective is important in many respects. France has one of the most extensive social security and welfare system among the large industrialized countries; public expenditure on health as a share of GDP is the highest in Europe; and compared to other OECD countries, its pension system is relatively generous (Table I-1). Not only are benefits high, but so is the level of taxation; taxes needed to finance social security funds have risen from less than 15 percent of wage income in 1950 to almost 50 percent in 1996. In recent years, there have been mounting concerns regarding the continuing viability of such an extensive social security system in general, and its unfunded pay-as-you-go pension schemes and its universal health care in particular. Slower rates of economic growth and the prospective aging of the population have led to further concerns that the implied taxation burden on younger (working) generations in the future will be too high, assuming the continuation of the general thrust of current policy settings. Projected trends of changes in the age structure reveal that an increasing number of retirees must be supported by a declining number of workers, with the old-age dependency ratio likely to rise from 0.35 to 0.60 by 2030 (Tables I-2 and I-3).

2. Behind concerns about the sustainability of the welfare system and the current real level of public consumption expenditures looms the fundamental question of how fiscal policy affects the distribution of income between generations. In general, fiscal settings which imply markedly increased burdens on some generations relative to other generations, constitute a cause for concern. As pointed out by Kotlikoff (1992), the standard measure of the budget deficit cannot appropriately address this question. In contrast, generational accounting provides a tool for the investigation of the intergenerational distributional effects of fiscal policy. The purpose of this paper is thus to use this technique to determine whether current fiscal policies in France can be sustained without requiring future generations to pay higher net taxes over their lifetimes than current generations pay.

3. Our calculations indicate that France's generational policy is imbalanced against future generations. In spite of the substantial fiscal consolidation projected to take place in the next five years in order to align the fiscal stance in France with the pattern envisaged by the "Stability and Growth Pact", social benefits (in particular pensions) imply a projected net tax burden adjusted for income growth on future French citizens that is about **one and a half times** as large as that facing current young generations. While the precise size of this

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[1]Prepared by Joaquim Levy and Ousmane Doré. Mr. J. Accardo (Division *revenues et patrimoine des ménages*, INSEE) is thanked, without implication, for providing the necessary data. Excellent research assistance by B. Casabianca (BCS) is also acknowledged.

Table I-1. France: Comparative Fiscal Indicators, 1994
(In percentage of GDP)

	France	United States	Japan	Germany	Italy
General Government					
Tax revenue	43.0	30.1	30.6	38.1	37.8
Spending	53.9	33.4	37.4	49.1	52.7
Deficit	5.0	1.8	4.1	2.3	7.8
Gross public debt	59.5	63.0	88.9	62.5	122.1
Public pensions	13.5	7.1	5.7	12.3	14.2
Public health	7.2	6.5	5.1	6.1	6.3
Education	5.0	5.4	2.8	3.1	4.3

Source: OECD (1995)

Table I-2. France: Comparative Demographic Factors, 1990-1995

	France	USA	Japan	Germany	Italy
Population (1994)	57,960	260,651	124,960	81,407	57,190
Fertility rate 1/	1.8	2.1	1.5	1.3	1.3
Life expectancy at birth	77.2	76.6	79.1	75.8	77.4
Net migration rate 2/	1.2	2.5	0.0	5.6	1.0
Participation rate	66.7	76.0	76.1	69.7	58.2

Source: Bos et al., 1994
1/ Number of children per woman of child bearing age.
2/ Number of net immigrants per 1000 people.

Table I-3. France: Demographic Transition

	1995	2000	2010	2020	2030	2050
Population (thousands)	58,048	59,425	60,993	62,121	62,661	62,120
Elderly dependency ratio 1/	22.1	23.6	24.6	32.3	39.1	43.5
Very elderly dependency ratio 2/	39.2	43.4	49.6	41.9	48.8	56.6
Total dependency ratio 3/	52.2	52.8	51.2	59.6	67.9	73.6

Source: Bos and other (1994)
1/ Population aged 65 and over as a percent of the population aged 15-64.
2/ Population aged 75 and over as a percent of the population aged 65 and over.
3/ Population aged 0-14 and 65 and over as a percent of the population aged 15-64.

generational imbalance depends on a number of assumptions, including the rates of discount and productivity growth, the direction of the imbalance is unmistakable, as it holds under alternative assumptions about these parameters. These projections do not build in feedback effects from policies that may be necessary to ensure the "balancing" in the future of the government's intertemporal budget constraint, such as increases in taxation, which could significantly weaken the underlying growth of income, thereby amplifying the imbalance. Comparing with the situation in other countries for which generational accounts have been computed (OECD, 1995), the size of the generational imbalance reported here for France is larger than that of Germany and Sweden, while smaller than that reported for Italy—before the 1995 reform—and the United States.

4. This paper departs from the standard presentation of generational accounting—which is based only on remaining future net tax payments—in that it provides an indication of the size of generational imbalance existing between currently living generations (old versus younger ones) taking into account the net tax paid by current adults in the past. On this basis, the calculations show that protecting the "Babyboom" generations from any change in fiscal policy (thus leaving to young and future generations the full responsibility to redress any fiscal imbalance) would imply a projected net tax burden on those now aged less than 25 that is more than **one and a half times** as large as that facing those born around 1950.

5. The paper is organized as follows. The generational accounting framework is outlined, followed by a discussion of its major limitations in Section B. The specific case of France, including the construction of the accounts, a discussion of key parameters used, and the main findings is presented in Section C. The next section (Section D) places France's generational policy in an international perspective. In Section E, the lifetime net tax payments of current adults are calculated and compared with those of younger living generations. Alternative scenarios on policies aimed at redressing the generational imbalance are discussed in Section F. The final section summarizes these findings and concludes. Appendices provide details on the calculation of the accounts, including the data used, and sensitivity analysis with respect to key parameters.

B. The Generational Accounting Framework

6. Government deficits, taxes, transfer payments, and other expenditures affect the distribution of income and wealth among members of both the same generation and different generations. Conventional deficit accounting provides little information regarding either distribution. Take for example the case of a change in an unfunded pay-as-you-go social security system which lowers the net taxes of the old while increasing those of the young by an equal amount, but avoiding the need for government borrowing at any date. Despite the complete absence of any change in government deficit, the introduction of this social security scheme has generational effects, in that the generational account of the current old falls, while that of every younger generation rises. Standard generational accounts provide estimates of the remaining lifetime net taxes of persons born at different times under certain economic and demographic assumptions. Therefore, they not only provide a new perspective for the study of

the distributional effects of fiscal policy, which has traditionally been focused on intragenerational aspects,[2] but they can be a useful tool in assessing the sustainability of government accounts. In recent years, generational accounts have been computed for more than a dozen of countries, including Germany, Italy, Norway, Sweden, and the United States.

The methodology

7. Generational accounting is a new technique developed by Auerbach, Gokhale, and Kotlikoff (1991), and Kotlikoff (1992) that can be used to study the effects on different generations of the government's fiscal policy. In this framework, the explicit analysis of the impact of fiscal policy on the welfare of different generations starts out by computing generational accounts, which simply show the present value of the expected net tax payments of a representative individual of a given generation, where "net taxes" refers to taxes paid less transfers received and a "generation" is defined as a cohort of individuals of the same age and sex.

8. Generational accounts are based on the premise that all government purchases must be paid for, i.e., for a given path of government spending, a reduction in one generation's account can only be achieved through expanding other generations' accounts in a way that respects the government's intertemporal budget constraint. The budget constraint implies that the government's current net wealth plus all future taxes paid to the government minus all transfers paid by the government (future net taxes) must cover all future government spending on goods and services. In order to compare the intergenerational burden, the sum of future net taxes is split into an amount paid by all existing generations from the base year onwards to the end of their lives, and the remaining amount which has to be paid by all future generations during their lives. Hence, more formally, the government's intertemporal budget constraint can be written as:

$$\sum_{s=0}^{D} N_{t,t-s} + \sum_{s=1}^{\infty} N_{t,t+s} + W_t = \sum_{s=t}^{\infty} G_s \prod_{j=t-1}^{s} \frac{1}{1+r_j}$$

9. The first term on the left hand side of this equation adds together the present value of the net payments of existing generations. The expression $N_{t,k}$ {k=t,t-D} stands for the present value of net remaining lifetime payments to the government of the generation born in year k discounted to year t. The index of this summation runs from age 0 to age D, the maximum length of life. Hence, the first element of this summation (s=0) is $N_{t,t}$, which is the present value of net payments of the generation born in year t; the last term (s=D) is $N_{t,t-D}$, the present

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[2]See for example Dossiers de la DARES (1996), INSEE Economie et Statistique No. 296–297, 1996, for detailed discussions of intragenerational income distribution in the case of France.

value of remaining net payments of the oldest generation alive in year t, namely those born in year t-D. The second term on the left hand side of (1) adds together the present value of remaining net payments of future generations. The third term on the left hand side W_t denotes the government's net wealth in year t. The right hand side of (1) expresses the present value of government consumption. In the latter expression, G_s stands for government consumption expenditure in year s. All future flows are discounted to year t at the pretax rate of return r_j.

10. The term $N_{t,k}$ is defined more explicitly as follows:

$$N_{t,k} = \sum_{s=\max(t,k)}^{k+D} T_{s,k} P_{s,k} \prod_{j=t+1}^{s} \frac{1}{1+r_j}$$

In this expression $T_{s,k}$ stands for the projected average net payment to the government made in year s by a member of the generation born in year k. The term $P_{s,k}$ stands for the number of surviving members of the cohort in year s who were born in year k. For generations who are born in year k, where k>t, the summation begins in year k.

11. Generational accounts are defined simply as a set of values of $N_{t,k}$, one for each existing and future generation, with the property that the combined total value adds up to the right hand side of the intertemporal equation. This formulation makes clear the implications of the government budget constraint; holding the right hand side of the equation fixed, increased (decreased) government payments to (receipts from) existing generations mean a decrease in the first term on the left hand side of the equation and requires an offsetting increase in the second term on the left hand side; i.e., this requires reduced payments to, or increased payments from, future generations.

12. This framework can be used easily to make two types of comparison. First, through the use of lifetime net tax rates, it can be used to compare the lifetime net taxes of future generations, of the generation of people just born, and of different generations born in the past, i.e., it can be used to determine how much future generations are likely to pay in net taxes as compared to generations alive today. Second, generational accounting can be used to compare the effects of actual or proposed policy changes on the remaining lifetime net tax payments of generations currently alive and on future generations.

Limitations of generational accounting

13. Advocates of generational accounting argue that conventional fiscal deficits are essentially meaningless, as gauges either of macroeconomic policy or of intergenerational fairness of government policy, and should be replaced by generational accounts.[3] Although

[3]In pointing out the virtue of generational accounting, Kotlikoff (1997) has gone as far as

(continued...)

these claims have some merits, they have met with a number of criticisms recently (Muellbauer (1992), Haveman (1994), Buiter (1996)). On the one hand, given the importance of old-age entitlement programs in the industrial world, it is certainly true that conventional deficit measures miss a major part of the action in fiscal policy in the long run, by just providing a snapshot of the present situation without clarifying future trends. On the other hand, there are some practical obstacles to making a wholesale switch to a newer, untested measure of fiscal policy. As with most tools of policy analysis, generational accounting offers a useful perspective, but serves as an imperfect indicator. The accounts often suggest a rough magnitude and general pattern of results, which may be ambiguous and subject to uncertainty as regards future demographic changes and future growth. Apart from the heavy data requirement, the implementation of generational accounting requires specific assumptions on a number of difficult conceptual and theoretical issues, which often raise questions about their ultimate usefulness. Indeed, generational accounts as usually constructed suffer from a number of limitations.

14. First, generational accounts say nothing about the intergenerational distribution of public consumption. They do not impute to any particular generation the value of the government purchases of goods and services. Therefore, they do not show the full net burden that any generation receives from government fiscal policy as a whole. This reflects mostly difficulties in empirical implementation. There is no clear method of allocating the benefits of government purchases such as defense, highways, research, across generations. The reason is that most government purchases are made to provide public services that are used collectively rather than individually.

15. Second, generational accounts do not allow for the general equilibrium repercussions of alternative budgetary policies. In addition, generational accounts ignore all changes in before-tax income and relative prices caused by alternative budget programs. As demonstrated by Buiter (1996), these general equilibrium responses of pre-tax, pre-transfer and pre-subsidy factor incomes and rate of return may reverse, counteract, or reinforce the impact of budgetary policy changes. For example, policies that decrease the net tax payment by existing generations and increase the net tax payment by future generations are likely to stimulate more current consumption and thereby reduce the saving available to finance investment. This, in turn, will lower productivity and real wage growth and raise real interest rates, which on balance can harm future generations.[4]

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[3](...continued)
suggesting that membership in the EMU should be predicated on the degree of a country's generational imbalance as opposed to its debt to GDP ratio.

[4]Recently, there have been attempts to address some economic effects of tax incidence through the use of general equilibrium models, but problems in modeling taxes and benefits and calibrating the model have limited their usefulness for policy discussion. See (Perraudin, 1997) and a forthcoming accompanying staff paper (1997).

16. Third, generational accounts do not incorporate intergenerational transfers taking place outside the public sector: altruism and bequest motives may raise the possibility of private intergenerational transfers offsetting government transfers. Indeed, the usefulness of generational accounts is closely tied to the strict life-cycle model of household consumption (Buiter, 1996). In addition, for generational accounting to provide useful additional information (relative to standard budget accounting), consumers are required to be forward-looking with perfect foresight, and not subject to liquidity constraints.

17. Fourth, the computation of generational accounts is highly sensitive to assumptions on the future growth of productivity and population, which are subject to considerable uncertainty. Moreover, the choice of discount rate needed to carry out net present value calculations is also difficult; while the absence of liquidity constraint implies that all generations are supposed to have a similar cost of waiting regardless of their age, the riskless setting in which generational accounts are computed implies that the correct discount rate cannot be easily derived from observed long-term interest rates.[5]

18. Finally, generational accounts as usually presented include only future net tax payments and exclude past net payments. Therefore, they cannot be used to address the politically relevant question of how current younger generations fare compared to their elders based on relative lifetime net tax burdens under current policies.

19. Some of these problems can be minimized, and the use of sensitivity analysis provides some help in forming judgments. For instance, increasing the share of government expenditure that is assigned to individual cohorts will reduce the arbitrariness of the distribution of the fiscal burden, because a smaller part of total taxes becomes diverted toward undifferentiated "government consumption." Estimation of private intergenerational transfers can also shed some light on the generational stance of fiscal policy, and retrospective calculations can widen the scope of the policy implications (see Kotlikoff, 1994). In this paper these problems are in part dealt with by a careful assignment of government expenditures based on well established concepts of national accounts, as well as by the computation of retrospective generational accounts that permit to compare the lifetime net tax burden of some adult cohorts with that of younger and future generations.

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[5]A distinction should be made between the assumptions of: (i) no individual and aggregate liquidity constraints and (ii) government solvency. The first implies that, as long as the government is solvent, the interest rate at which the public debt is financed is the discount rate, regardless how large the public deficit may be at any given moment (which explains why interest payments wash out when net present values are computed). The second presumes that the debt inherited by future generations is lower than the present value of their wealth. Therefore, it is important that, after the burden on future generations is computed, the postulated solvency of the government be verified; a simple comparison of the generational accounts between current and future generations does not permit verification as to whether this assumption is satisfied or not. In the generational accounting framework, insolvency is the only circumstance in which the debt would "explode."

C. The Construction of Generational Accounts for France

Generational profiles and benchmarking aggregates

20. The construction of generational accounts necessitates first projecting each currently living generation's average taxes less transfers for each future year during which at least some members of the generation will be alive, and then converting these projected net tax payments by individuals into an aggregate present value. This requires projections of population by age and sex, as well as a discount rate to convert flows of net taxes into present values. In the case of France, projections of average future taxes and transfers by age and sex start with the 1995 aggregate taxes and transfers, as well as medium-term projections of transfers and taxes for all levels of government. These aggregate taxes and transfers are distributed across the population by age and sex in each year according to the age and sex pattern observed in 1990 from official survey data. The primary sources for these distributions are the "1990 *enquête sur les revenus fiscaux des ménages,*" the "1991–92 *enquête sur les actifs financiers,*" and the "1990 *enquête sur les budgets des familles.*" A detailed account of the construction of these profiles can be found in Appendix I.

21. The resulting age and sex profiles (i.e., the relative tax weight of different living cohorts) are assumed constant through time, except for adjustments reflecting projected changes in the participation rate of women.[6] The actual value of individuals' taxes and payments in the medium term are found by scaling individuals' payments to achieve aggregate values consistent with taxes in 1995 and the medium-term fiscal projections, which assume inter alia that the economy returns to its "potential" level by the year 2002. For years beyond 2002, it is assumed that all taxes and transfers increase at the same rate as productivity growth.[7] Five categories of taxes are distinguished: income tax, property tax, value-added tax, social security contributions, and taxes based on individual wealth (including corporate income taxes, the incidence of which was shifted to asset holders). Transfer payments are categorized into pensions, health, education, and unemployment benefits. For each of these items, the aggregate amounts are allocated according to the existing profiles; all other categories of transfers were included in government consumption. Charts I-1 and I-2 present the distribution of taxes and benefits in the base year 1995.

22. The next step in the construction of France's generational accounts involves an estimation of the initial stock of government net wealth and projections of future government consumption. Government consumption is determined by a projection over the medium term (see Appendix I), then by a rule that assumes that spending grows over time from its 2002

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[6]The profile for pensions also varies over time, as explained below.

[7]For example, the projected distribution of taxes and transfers by age and sex, for say year 2017 would be equal to the 2002 distribution multiplied by $(1+n)^{15}$ where n is the rate of productivity growth.

level to keep pace with population and productivity growth. This amounts to assuming that per capita consumption rises at the productivity growth rate. Our estimate of spending includes both government spending on goods and services (excluding health and education spending) as well as public investment, netted by those taxes and receipts not included in the five categories described above. For government net wealth, estimates computed by INSEE (1993) are used. In 1995, the consolidated net wealth of the general government is estimated to be F 800 billion (about 10 percent of GDP), reflecting the 1993 estimate, adjusted for the growth in government debt and the sale of government assets through privatization in the intervening period. The net financial wealth, which is used for the baseline calculation was negative, with net liabilities amounting to F 2,800 billion, obtained by netting off from the general government debt (estimated at F 4,059 billion in 1995), the financial asset of the general government.

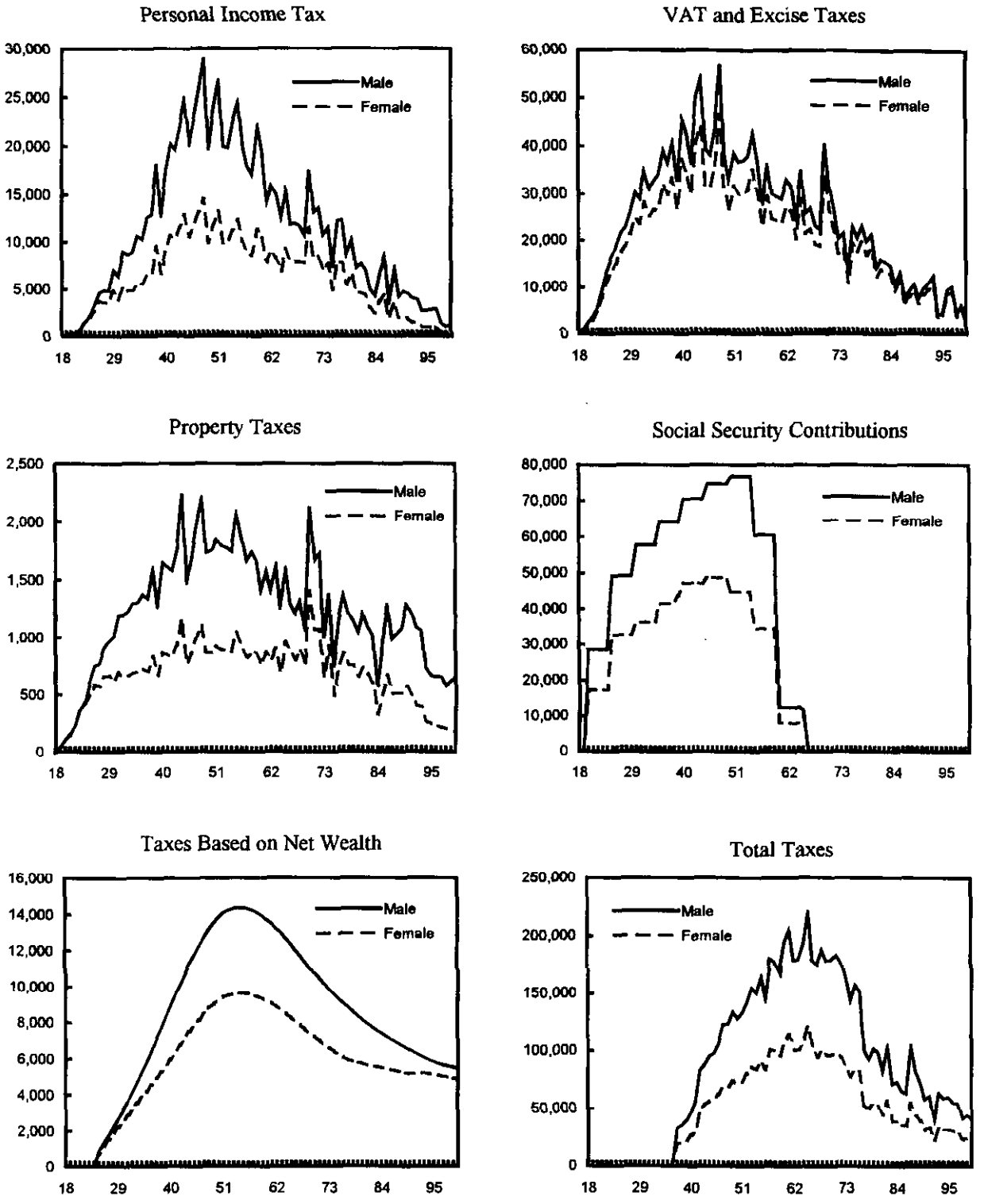
23. Using the government intertemporal budget constraint given above, the average present value lifetime net tax payment of each member of each future generation was then determined as a residual under the assumption that the average lifetime tax payment of successive generations rises at the economy's rate of productivity growth.

24. The procedure followed in this study was aimed at minimizing the arbitrariness in the labeling of taxes and transfers, by making sure that all flows are fully taken into account on a national accounts basis e.g., by recovering the government deficit figure after all flows are considered (Table I-4). The age and gender distribution of the net tax burden was allocated as large a fraction as possible to individual cohorts, so as to minimize the problem that the generational accounts do not recognize the intergenerational distributional implications of the government consumption program (see Buiter (1995), and Section B above).

Key assumptions and other technical aspects

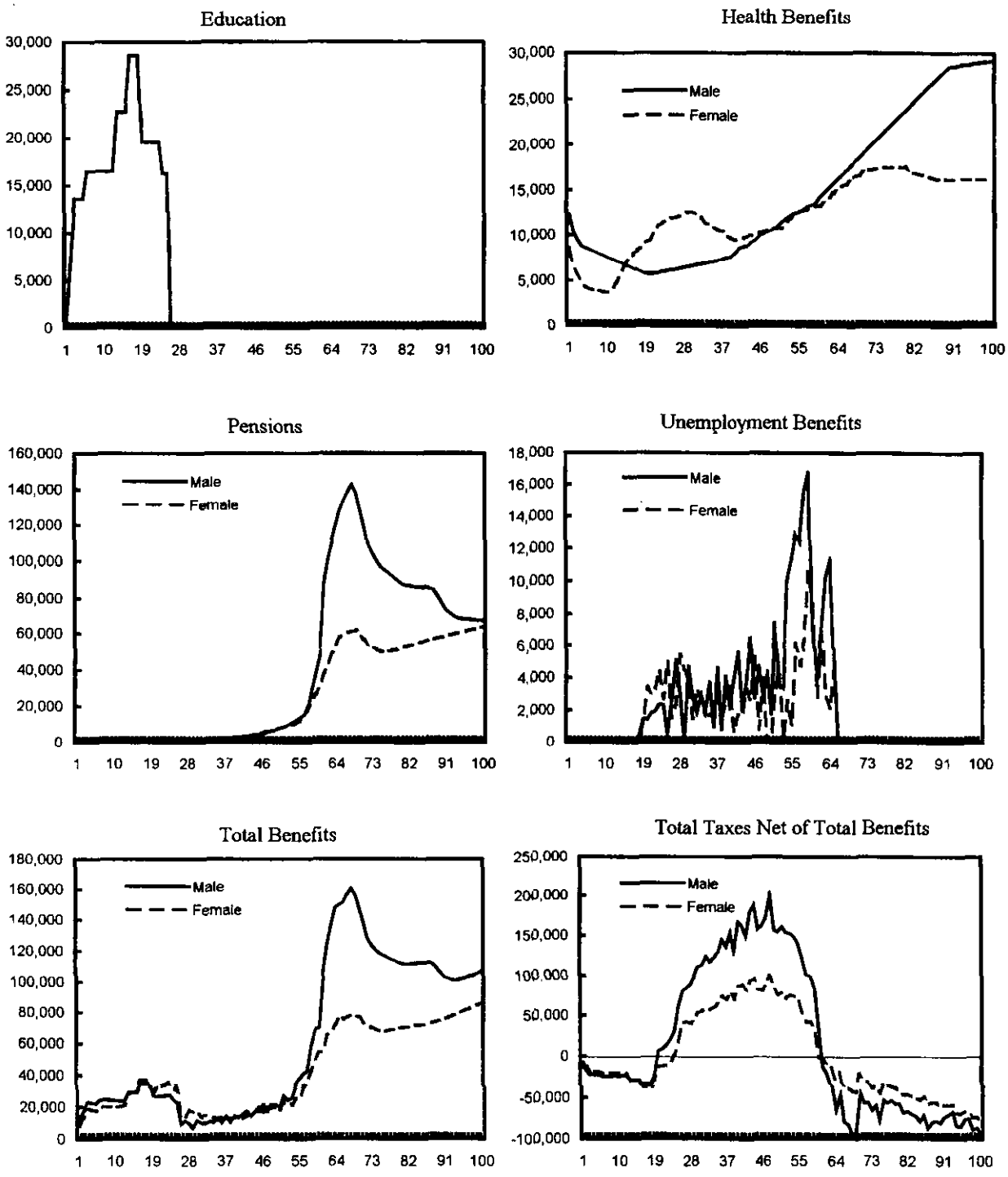
25. A key ingredient in the calculation of generational accounts is the economic and demographic assumptions needed in order to extend and discount the components of the zero-sum equation. They are the rate of productivity growth, the discount rate and the rate of population growth. For present purposes, the average annual growth of productivity is assumed to be constant at 1.0 percent per year over the long run (baseline case). A discount rate of 3 percent is assumed; this is midway between the average yield on government bonds and the real rate of return to private sector capital, and thus provides a reasonable indicator of society's trade-off between present and future consumption. Alternative values of 4 percent and 5 percent are also used to gauge the sensitivity of the results to this particular parameter.

Chart 1-1
France: Profiles of Tax Incidence



Source: Data provided by Insee; and Staff calculations.

Chart I-2.
France: Profiles of Government Transfers



Source: Data provided by Insee; and Staff calculations.

Table I-4. France: Accounts of the General Government (1995)
(In millions of francs)

		INCOME	EXPEND.	NET TAXES	as % of GDP	Incidence
Current Account						
Operational Income	n2	160,512		160,512	2.09	Government Consumption
Subsidies	r30		127,910	-127,910	-1.67	Government Consumption
VAT	r21	533,338		533,338	6.94	Consumption Based Tax
Other Taxes on Goods and Services	r22	563,061		563,061	7.33	Consumption Based Tax
Customs Taxes	r29	177		177	0.00	Consumption Based Tax
Corporate Income Tax	r611	121,219		121,219	1.58	Net-wealth Based Tax
Income Tax	r612	398,392		398,392	5.19	Income Tax
Other Income & Wealth/Property Tax	r613					
Property Taxes (Taxe d'habitation)		40,017		40,017	0.52	Income Based Tax
Other Income & Wealth Taxes		168,754	3,314	165,440	2.15	Net-wealth Based Tax
Soc Security Contributions	r66	1,479,788		1,479,788	19.27	Wage Based Tax
Social Security Transfers	r641					
Pensions			741,094	-741,094	-9.65	Pensions
Health			406,937	-406,937	-5.30	Health Expenditure
Unemployment			98,430	-98,430	-1.28	Unemployment Benefits
Others, including family allowances			162,717	-162,717	-2.12	Government Consumption
Gov. Pensions and other Entitlements	r642		152,453	-152,453	-1.98	Pensions
Other Social Transfers	r643		220,277	-220,277	-2.87	Government Consumption
Gov Soc Sec Contr.(contrib fictives)	r63+r65	350,931	205,770	145,161	1.89	Government Consumption
Transfers to Private Agen	r66		15,695	-15,695	-0.20	Government Consumption
Other Domestic Transfers	r69	63,626	102,722	-39,096	-0.51	Government Consumption
Intern. Official Transfers	r67	20,171	78,383	-58,212	-0.76	Government Consumption
Interests	r41	38,299	309,487	-271,188	-3.53	Debt Service
Income from land	r43	3,763	151	3,612	0.05	Neutral
Dividends	r44	17,078		17,078	0.22	Neutral
Income of "quasi-societes"	r45	0		0	0.00	Neutral
Insurance Premiums	r51	1,960	2,063	-103	0.00	Neutral
Insurance Payments	r52	933	1,060	-127	0.00	Neutral
Total Income		3,962,019				
Total Non-discretionary expenditure			2,628,463			
Disposable Income	n3	1,333,556				
Final Consumption	p30		1,480,894			
Education	f1		380,000	-380,000	-4.95	Education
Culture	f2		47,000	-47,000	-0.61	Government Consumption
Health	f3		258,000	-258,000	-3.36	Health Expenditure
Social Interventions	f4		112,000	-112,000	-1.46	Unemployment Benefits
Other			683,894	-683,894	-8.90	Government Consumption
Capital Account		-43,589	360,189			
Gross Savings	n4	-147,338				
Fixed Investment	p41		240,321			
Stockbuilding	p42		-1,538			
Purchase of land	p71		5,213			
Purchase of non-material assets	p72		443			
Subsidies to Investment	r71	49,343	92,945			
Taxes in capital	r72	47,336				
Other Capital Transfers	r79	7,070	22,805			
Capital Expenditure on						
Education			36,019	-36,019	-0.47	Education
Culture			23,412	-23,412	-0.30	Government Consumption
Health			25,213	-25,213	-0.33	Health Expenditure
Social Interventions			18,009	-18,009	-0.23	Unemployment Benefits
Other			257,535	-257,535	-3.35	Government Consumption
Capital Income		103,749		103,749	1.35	Government Consumption
Net Borrowing Requirements		-403,778			-5.26	
Flows By Category (in francs)					7.68E+06	

Source: Insee, Rapport sur les Comptes de la Nation. 1995; and Staff calculations.

The projection of population by age and sex for 1995-2050 provided by INSEE corresponds to the **high growth** case (i.e., a fertility rate of 2.1 percent and no immigration) found in Dinh (1995). This trend is extrapolated through 2200 by assuming that the birth rate stabilizes after 2050.

26. Other technical assumptions made in this paper concern participation rates, the growth rate of medical expenditure, and pension indexation. As regards the rate of participation, a number of studies point to past and projected increases in the participation of women in the labor force.[8] This trend is captured in the implementation presented here by incorporating the observation that this increase has taken place through two mechanisms. First, women who have entered the labor force when young, have, in their majority, remained active until retirement. Therefore, the future participation rate of cohorts aged 50–60 is likely to approach that of cohorts aged 40–50 (adjusted for some early retirement). Second, there has been a gradual, albeit small, rise in the participation rate of women in their 20s, which is expected to continue (at a decreasing pace) until about 2020.[9]

27. The current profile of pension payments reflects several influences, among which the growth of real wages in the past and the indexation of benefits. This profile, however, is bound to change over time. Since 1993, and following the proposals in the "*Livre blanc sur les retraites*," pension benefits (in the *régime général*) have been adjusted in line with the CPI, instead of according to wages. Accordingly, baseline projections assume that pensions will continue to be indexed to the CPI (although the 1993 Pension Reform leaves the door open for a change in this rule) and that wages will rise in line with productivity growth.

28. In the medium term, the aggregate health care expenditure as a proportion of GDP is assumed to fall marginally, while beyond the year 2002, individual health care spending is assumed to rise in line with productivity. This assumption contrasts markedly with the experience of the 1980s and early 1990s, when per capita real public health expenditures after adjustment for demographic changes rose faster than labor productivity. However, to the extent that the reform of public health care announced in 1995 will take its full effect in the coming years, it may not appear implausible.[10]

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[8]See for example DARES (1997).

[9]Using the participation rate as a measure of economic activity is akin to assuming that the unemployment rate is constant in the long run; in the baseline, this rate is assumed to correspond to the current NAIRU.

[10]Although it is reasonable to assume that total health care expenditure will increase faster than labor productivity because health is a superior good, *public* expenditure on health care need not grow as fast, in view of quantitative constraints. For example, the growth in expenditure on hospitals in France has moderated substantially since global budgets were introduced in the 1980s. One of the main objectives of the 1995 reform was to introduce

(continued...)

Main results

29. **The baseline case** compares the generational accounts of males and females born in 1995 with the average of those born after 1995 (Table I-5). The projections reflect policies that were in place or had been announced as of 1995; therefore it takes into account the medium-term fiscal plans contained in the convergence program presented by the previous government. In the baseline scenario (and except where indicated otherwise), the participation rate of women is projected to rise, while that of men is projected to remain constant, and a zero-indexation rule is assumed for pension expenditures, reflecting the fact that accounts are computed in constant prices.

30. The baseline generational accounts for male and female cohorts for the base year 1995 are presented in Table I-6 under the assumptions of a 1 percent productivity growth and discount rates of 3, 4, and 5 percent. A negative value means that the generation is projected to receive more in transfers than it will pay in taxes over its remaining lifetime. Not surprisingly, a life-cycle pattern emerges with working-age generations having the higher tax burden and older generations being net recipients (working-age generations face many years of paying taxes before starting to receive pensions, while some of the benefits they indirectly receive, such as free education for their children, are rather assigned to younger generations).

31. For males in the baseline case (with a 3 percent discount rate), the generational account (i.e., the remaining net tax payments) is about US$145,000 for newborns in 1995,[11] rising to a peak of US$330,000 for those who turned 25 in 1995 (who have thus completed their education and have to wait yet some 35 years before retiring). Thereafter the account falls, becoming negative for those aged 50 in 1995, individuals approaching retirement, and thus a reduced level of income taxes and the receipt of public pension benefits. For females, the lifetime pattern is similar but the accounts at each age are generally much lower than for males. For example, newborn females in 1995 face a net lifetime fiscal burden of some US$115,000, which peaks at US$273,000 at age 25. The fact that accounts for females are lower than males, reflects first, the lower female participation rate and lower pay scale, so that their lifetime gross taxes (mainly labor income and social security taxes) are lower; and second, greater longevity, which tends to increase the present value of their pension receipts.

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[10](...continued)
controls and incentives to reduce the growth of other components of public expenditure on health care (such as reimbursements of ambulatory services and laboratory exams). For a full discussion of these issues see Chapter 1 of IMF Staff Country Report No. 97/19, March 1997.

[11]The results are presented in 1995 U.S. dollars for ease of comparison with other country cases.

Table I-5. France: Baseline (Standard) Generational Accounts1/

	Males	Females
Newborn in 1995 (in $)	144,380	114,132
Future generations (in $)	235,332	186,029
Generational imbalances (% difference)	63	63

Source: Staff calculations.

1/ Present value of lifetime net tax payments as of 1995 assuming productivity growth rate of 1 percent and a discount rate of 3 percent.

Table I-6. France: Baseline Generational Accounts

	Remaining Net Tax Payments (in 1995 U.S. Dollars)					
	Discount Rate					
	3%		4%		5%	
Age in 1995	Male	Female	Male	Female	Male	Female
0	144,380	114,132	114,444	68,057	74,899	34,100
5	181,889	144,389	158,789	98,421	118,889	62,058
10	223,387	178,850	208,862	135,118	171,151	98,081
15	260,593	207,943	254,327	169,607	221,657	134,665
20	312,309	250,303	313,862	219,673	288,647	189,357
25	331,838	272,427	341,750	251,912	327,020	228,877
30	291,367	247,649	308,475	238,412	305,839	224,498
35	227,156	206,821	248,583	207,895	257,446	202,969
40	140,690	150,190	163,514	160,041	182,301	163,406
45	45,062	84,690	66,311	100,729	91,786	110,490
50	-48,644	20,261	-29,270	39,182	-1,409	52,609
55	-175,725	-68,041	-156,185	-48,754	-128,515	-33,780
60	-221,021	-124,506	-207,258	-106,734	-188,542	-92,403
65	-217,883	-126,368	-207,740	-112,508	-193,887	-100,970
70	-163,808	-106,164	-156,823	-96,278	-147,504	-87,808
75	-173,388	-115,251	-166,762	-107,469	-159,106	-100,594
80	-99,638	-74,534	-96,250	-70,305	-92,425	-66,506
85	-107,900	-78,326	-104,879	-75,155	-101,693	-72,233
90	-98,822	-76,170	-95,995	-73,824	-93,438	-71,618
>95	-103,223	-75,965	-101,138	-74,452	-99,131	-72,997
Fut. Generations	235,332	186,029	169,454	100,770	111,975	50,980
Percentage Difference	**63**	**63**	**48**	**48**	**50**	**50**

Source: Staff calculations

32. In the baseline scenario, the average net payment burden of future generations is somewhat **over one and a half times** higher than that faced by the youngest generation alive in 1995 (represented by the 0–4 year old cohort of 1995). If all generations born before 1995 are protected from any change in their lifetime net-tax profile, future generations will have to pay on average about 63 percent more than the youngest "protected" generations, in order to guarantee the ultimate solvency of the government. Assuming that the tax burden of future generations[12] will be shared by men and women proportionally to the net-tax burden faced by men and women belonging to the 1995 newborn generation, the lifetime net tax paid by males in future generations would amount to US$235,000, while women would pay US$180,000 over their lifetime.[13]

33. Generational imbalances are, however, sensitive to the discount and productivity growth rates assumed, as well as to the accounting conventions adopted. Appendix II shows the impact of varying these parameters in the range of 3 percent and 5 percent, and 0.75 percent and 1.5 percent respectively. Increasing the discount rate to 5 percent, for instance, would reduce the imbalance by 20 percent, while raising productivity by 0.5 percentage points would cut the imbalance by some 10 percent. Although the net present value of all net taxes decreases monotonically with higher interest rates, the change in the imbalance needs not, owing to the uneven distribution of taxes over the lifetimes of current generations (e.g., the impact of a higher discount rate is more marked for women than for men). By contrast, for parameters in the range chosen, the imbalance always decreases when productivity growth increases (mainly because pensions are indexed to CPI and not to wages).[14] Changes in the rules regarding the accounting of government wealth or the incidence of corporate income taxes, can also lead to changes in the imbalance of the order of 15–50 percentage points (see Appendix II). Although these figures illustrate the magnitude of the uncertainty associated with any computation of generational accounts, they all point to a worsening of the net tax burden on future generations in France.

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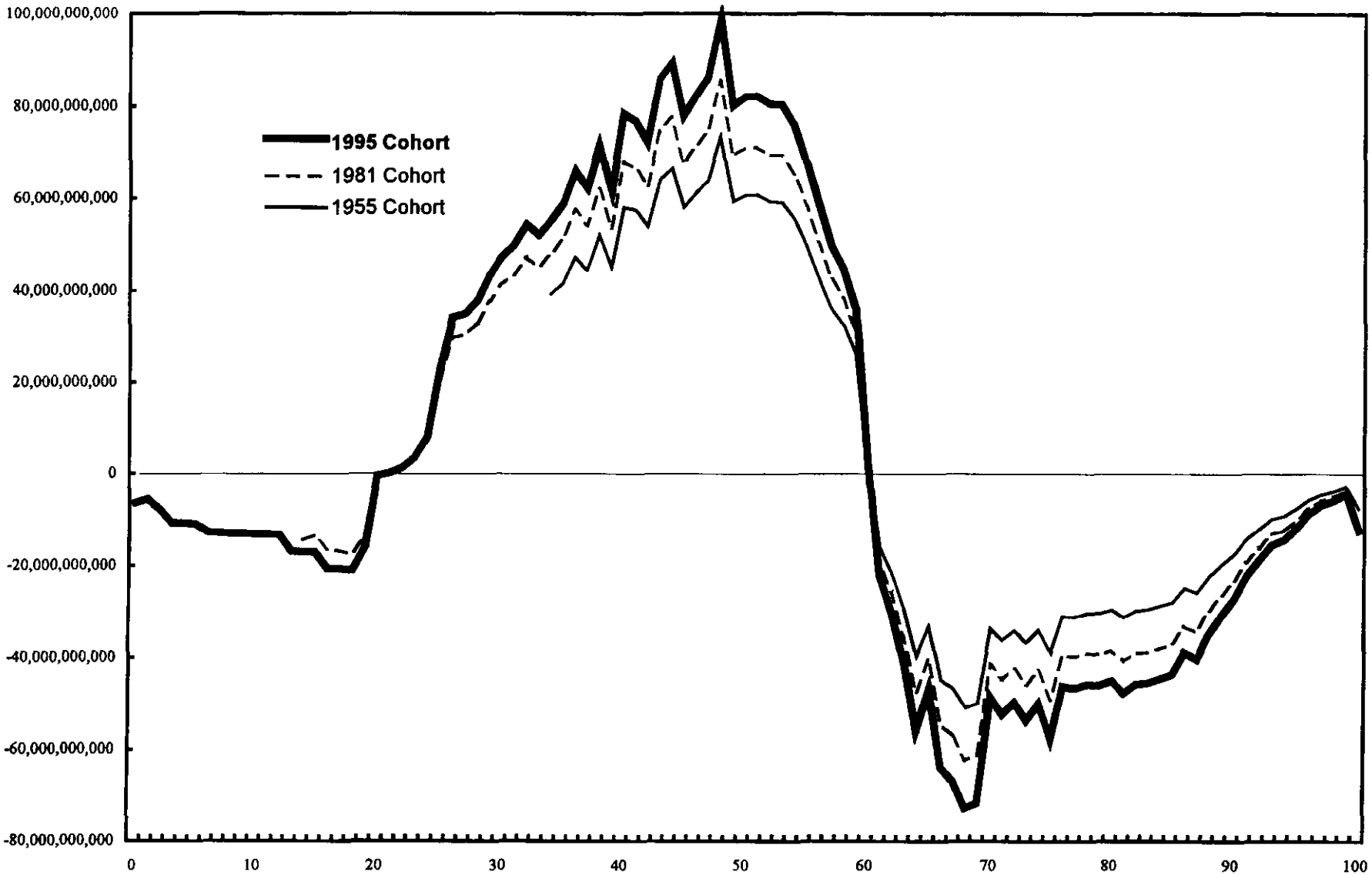
[12]Total net tax payments by all future generations derived as residuals from the intertemporal budget equation, amounted to F 60,555 billion.

[13]The lifetime net present value of labor income for someone earning the 1995 minimum wage is of about US$300,000 (taking into account pension payments, which are deferred labor income and using a 3 percent discount rate), while that of the average worker is around US$700,000. Therefore, for average workers, the present value of **net** tax payments will correspond to about one third of their lifetime labor income adjusted for productivity growth, thus ensuring the solvency of the government accounts.

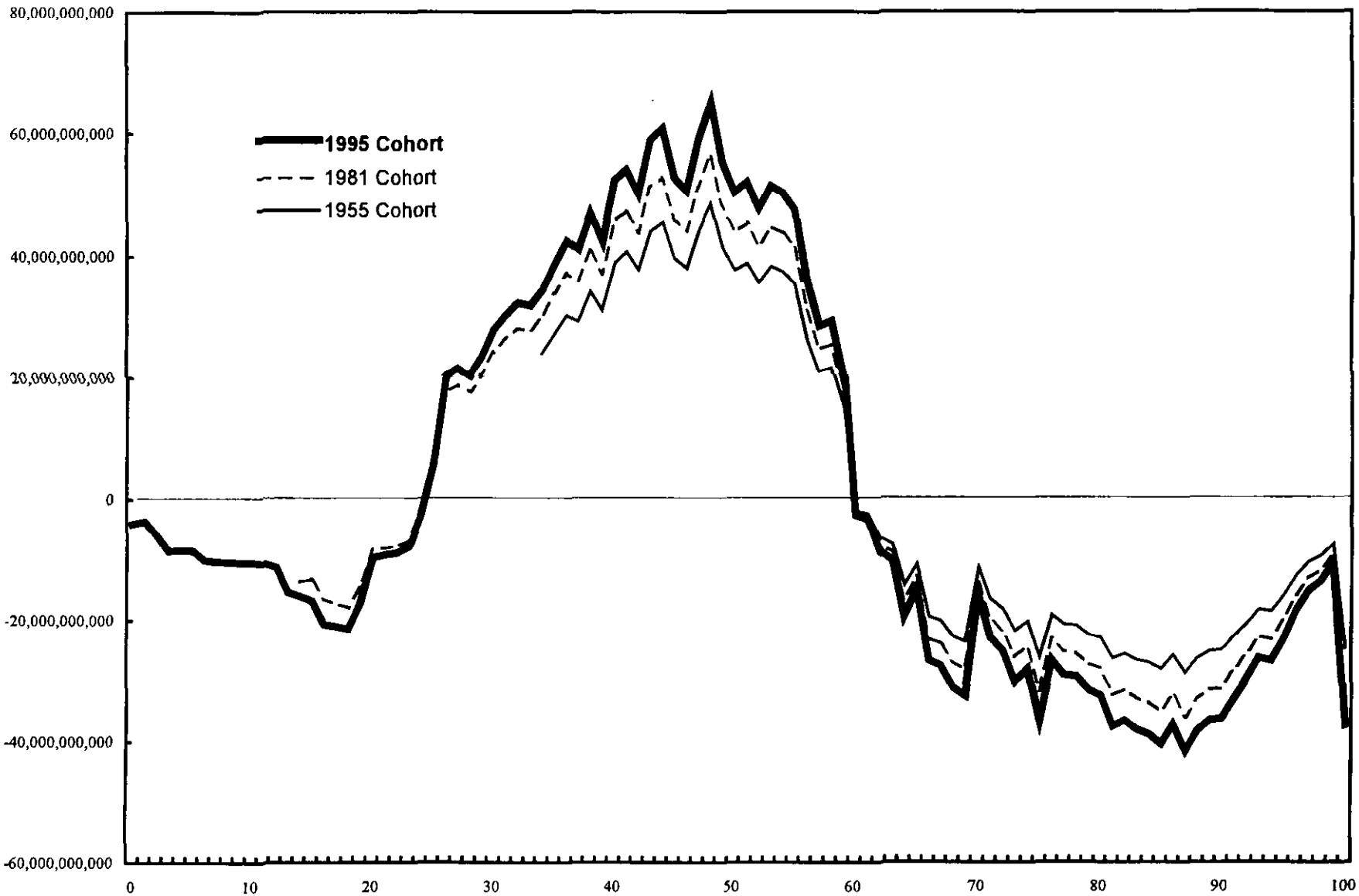
[14]Sensitivity analysis with respect to another source of uncertainty—the demographic assumptions—was not performed, but as shown below, a less optimistic assumption about the demographics in France, e.g., using Dinh (1995) "central" projection of 1.8 fertility rate, would tend to worsen the imbalance.

Chart I-3
France: Male Net Tax Profile



Source: Staff calculations

Chart I-4
France: Female Net Tax Profile



Source: Staff calculations

D. International Comparisons

34. An interesting question is how France compares with other countries for which there have been standard generational accounting studies. Table I-7 from the OECD (1995) presents comparative generational accounts for other industrial countries: Germany (Raffelheuschen and Walliser, 1995), Italy before the 1995 reform (Franco et al., 1994), Sweden (Hageman and Christoph, 1995), and the United States (Auerbach, Gokhale, and Kotlikoff, 1993). International comparisons of generational accounts require a great deal of caution because the technical and policy assumptions are different across studies (e.g., while figures provided in Table I-7 were based on similar discount and productivity growth rates, accounting conventions including the classification of tax incidence were by no means homogenous). Nonetheless, some interesting patterns emerge. Measured in absolute 1995 U.S. dollars, newborn males in France appear to be facing a lower net tax burden than their counterparts in the United States, Germany, Sweden, and Norway, and a higher one than that facing Italian newborn males before the implementation of the 1995 pension reform; newborn women, by contrast, appear to bear a heavier burden in France than in the United States, Norway, and Italy, while bearing an approximate equivalent burden than their counterparts in Germany and Sweden. With respect to the United States, the higher average net tax burden of newborn generations can in part be attributed to the smaller proportion of public spending directed to social transfers vis-à-vis France. While in France the overall level of taxation, including social contributions, is considerably higher than in the United States, this difference tends to be offset in the calculation of the net tax burden by the counterpart of those contributions (i.e., large social transfers)[15] and a relatively large outlay related to public hospitals and higher education.

35. In all four countries, there is a generational imbalance against future generations implied by prevailing fiscal policies. The imbalance (measured in percentage differences) appears to be much lower in France than in Italy (326 percent difference before the 1995 pension reform) and the United States (100 percent), but somewhat larger than in Sweden (23 percent) and Germany (25 percent). As noted above, differences in methodology and assumptions could partly explain these differences. Nevertheless, the relatively smaller generational imbalance compared to Italy can be attributed somewhat to, among other factors, a higher debt to GDP ratio in Italy and a more marked demographic change (which prompted a deepening of the reform of the pension system in 1995). The relative imbalance vis-à-vis the United States (a country with a less generous social security system) and Sweden (a country with a larger welfare system) on the other hand, does not appear quite intuitive.

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[15]In 1994, social transfers as a percentage of GDP amounted to 23.3 percent and 13.2 percent in France and the United States, respectively.

Table I-7. France: International Comparison of Generational Accounts1/
(In thousands of dollars) 2/

	USA	Italy	Germany	Sweden	Norway
Males					
New borns in 1993	191	102	311	272	181
Future generations	384	433	390	333	299
Generational imbalance (in % difference)	102	326	25	23	64
Females					
New borns in 1993	92	19	133	134	42
Future generations	186	79	166	165	70
Generational imbalance (in % difference)	102	327	26	23	66

Source: OECD (1995)

1/ Present values of future net tax payments per capita as of 1993, assuming productivity growth of 1 percent, a a discount rate of 3 percent.

2/ In constant prices, adjusted for income growth, converted to US dollars using 1993 nominal exchange rates.

36. The larger imbalance reported in the study on the United States in fact stems largely from the assumption made on the growth of health care expenditure, which indicates that real medical costs per recipient will grow much faster than productivity through the year 2020, in line with early projections from the Health Care Financing Administration. In a revised version of their study of generational accounts for the United States, Auerbach, Gokhale and Kotlikoff (1994) reckoned that if the growth in health care outlays were 2 percentage points lower than assumed in their baseline case over the next 10 years, future generations of Americans will incur lifetime net tax burdens that are 64 percent larger, on average, than those facing current newborns—a finding broadly in line with the present case for France. The larger imbalance reported vis-à-vis Sweden and Germany, on the other hand, may be reflecting, inter alia, the lower public pension expenditure and higher retirement ages in those countries.[16] In the case of Sweden, it also reflects the substantial fiscal consolidation that was envisaged in the government's medium term plan in the aftermath of the 1992–93 financial crisis (this plan has actually been followed through, with the general government deficit narrowing from about 12 percent GDP in 1993 to a projected near balance in 1998).

E. Generational Accounts of Babyboomers

37. The standard practice of generational accounting includes only future net tax payments, and does not incorporate past net payments of currently living generations. Therefore, the only meaningful comparison of generational accounts is between those of newlyborn generations in the base year and those of future generations, for which lifetime net tax payments are available. Although this way of presenting generational accounts yields insightful results regarding intergenerational imbalances, its interpretation may have a lesser policy relevance than measures aimed at comparing the accounts of those presently living. Indeed, by comparing only the tax burden of unborn generations with that of current children, standard generational accounts fail to address the real political dilemma, which involves a trade off among living generations. To address this kind of question, it is rather more interesting to compare the net tax burden of, say, current adults (e.g., some cohort of babyboomers), with that of young generations (e.g., those under age 25, who have not fully entered the labor force yet) under the assumption that young generations will bear the same tax burden as all future generations (the standard assumption that all generations alive in 1995 will be "protected" for their whole lifetime is somewhat implausible, given that owing to demographic changes evident already in the early decades of the next century, the heavier burden on future generations will start to be apparent at a relatively early date, implying heavy pressures for policy changes).

38. As a yardstick, the generation born in 1950-55 was chosen to represent adult living generations in the computation of the imbalance between "protected" adult generations and

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[16]Public pension expenditure as a percentage of GDP amounted to 13.3 percent in France compared to 12.3 percent in Germany and 11.3 percent in Sweden. Statutory retirement ages as of 1995 was 60 in France, and 65 in both Germany and Sweden.

young and future generations.[17] For this purpose, not only future net transfers were projected (as it is done in the standard exercise), but a retrospective account of past net transfers of adult generations was computed.[18]

39. The calculations reported in Table I-8 indicate that under the present system of taxes and benefits, the projected net tax burden on generations currently aged less than 25 is on average between **one and a half and two times** as large as that faced by those born around 1950, depending on the rate of productivity growth used for comparing the burden on current adult generations. If generations are put on equal footing by assuming a 1 percent productivity growth rate, the imbalance is of the order of 65 percent. However, like in many other industrialized countries, productivity growth in France was much higher in 1950-70 than in recent years. Thus, an "historical" measure should weigh early benefits differently from later tax payments, and net taxes instead of being measured in constant francs and later adjusted by a constant rate of growth of productivity, should reflect the size of the economy at different times (i.e., past net taxes should be deflated by nominal GDP, instead of by the CPI). Computing the generational imbalance in this way reveals that future generations would bear a much larger burden than current adult generations; for interest rates in the range of 3–5 percent, the imbalance appears to be close to 100 percent.

F. Redressing the Generational Imbalance

40. Undoubtedly, the pending demographic transition, with the projected increase in the dependency ratio, is the root cause of most of the intergenerational imbalance. Were the demographic structure to remain unchanged, a significant imbalance would not emerge (Table I-9). In face of the demographic changes, however, delaying changes in the status quo (e.g., regarding that of current adult generations, and in particular concerning pensions) would

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[17]This generation, born at the beginning of what became to be known as the "30 glorious" years of economic growth, has played a key role in national life, since attending university in the late 1960s and early 1970s.

[18]Details of the computation of the past net tax burden can be found in Appendix I. Kotlikoff (1994) also presents retrospective accounts for the United States.

Table I-8: Generational Accounts of Living Generations 1/
(In US dollars)

Productivity growth	1%			Historical Rate		
Discount rates	3	4	5	3	4	5
Current generations 2/						
Males	128,552	87,115	57,852	106,566	74,404	51,630
Females	103,103	69,066	43,837	80,252	54,956	36,252
Average	115,828	78,091	50,845	93,409	64,680	43,941
Future generations 3/						
Males	213,771	160,414	114,871	213,771	160,414	114,871
Females	168,985	95,394	52,298	168,985	95,394	52,298
Average	191,378	127,904	83,585	191,378	127,904	83,585
Generation imbalance 4/						
Males	66	84	99	101	116	122
Females	64	38	19	111	74	44
Average	65	64	64	105	98	90

Sources: Staff calculations.

1/ Lifetime net tax payments of presently-living generations converted into 1995 present values.
2/ Refer to current adult age of 25 or more (represented by the 1950-55 chart).
3/ Refer to current youngsters (under 25 years of age).
4/ Percentage reference between the lifetime net tax payments of young and adult generation in 1995

Table I-9. France: Generational Accounts

With Unchanged Population Profile

	Remaining Net Tax Payments (in 1995 U.S. Dollars)					
	Discount Rate					
	3%		4%		5%	
Age in 1995	Male	Female	Male	Female	Male	Female
0	241,472	173,074	180,497	105,056	118,504	58,237
5	285,067	205,905	232,469	138,904	169,914	89,792
10	325,760	237,912	284,660	175,656	225,785	127,248
15	383,143	279,509	351,011	221,994	295,771	174,686
20	378,429	276,778	359,413	235,636	319,466	199,813
25	396,529	294,219	386,956	264,104	357,772	236,145
30	346,413	259,013	345,198	241,283	329,068	223,210
35	277,616	215,027	281,541	207,724	277,206	198,430
40	189,597	158,360	196,551	159,600	201,941	157,998
45	84,108	88,226	92,864	95,934	105,421	100,448
50	-35,969	20,290	-23,148	35,287	-1,531	46,255
55	-139,175	-50,615	-125,350	-35,898	-104,397	-24,198
60	-185,644	-99,124	-175,281	-86,930	-161,726	-76,861
65	-180,647	-100,225	-173,159	-90,850	-163,418	-82,901
70	-126,611	-79,424	-122,020	-72,883	-115,820	-67,213
75	-159,962	-117,209	-153,403	-108,939	-145,731	-101,586
80	-104,806	-74,362	-101,434	-70,858	-97,939	-67,664
85	-94,747	-68,408	-92,283	-65,977	-89,796	-63,722
90	-83,771	-65,449	-81,675	-63,647	-79,755	-61,946
>95	-149,770	-64,408	-143,664	-63,198	-133,916	-62,033
Fut. Generations	205,548	147,326	99,215	57,747	35,588	17,489
Percentage Difference	1	1	1	1	0	0

Source: Staff calculations

only increase the cost of adjustment borne out by subsequent generations.[19] The recognition of the need for an early adjustment motivated the pension reforms designed in the early 1990s and partially implemented in 1993 (mainly affecting the "*régime général*") and 1996 (with respect to supplementary mandatory pension schemes)—most notably **the indexation of pensions to the CPI** instead of wages. Table I-10 shows that, were pensions still indexed to wages, e.g., increasing at real rates of 1–1.5 percent a year, the intergenerational imbalance would be almost twice as large, raising to more than 100 percent. This illustration underscores the intergenerational redistribution of resources implied by major pension reforms. Together with that in Table I-9, it suggests that creating incentives so that projected increases in life expectancy are accompanied by longer working lives and contribution periods for a full pension could eliminate most of the problem that is manifested in current projections.

41. **Increasing the participation rate** (through tightening eligibility requirements for benefits and increasing the taxation of replacement income, including from early retirement) would thus appear to be a policy that could contribute to improve the generational stance of fiscal policy: a higher participation rate not only widens the tax base by raising labor income and GDP, but also reduces pension expenditure as a percent of GDP. A characteristic of the French labor market since the mid-1980s is the relatively low level of labor participation, particularly for people aged 55–65, while life expectancy continued to increase. As the participation rate of this group of people declined from 31.5 to 16.5 percent, despite a significant increase in the participation rate of women, its proportion in the active population fell from 18.7 percent in the 1960s to 9.4 percent in 1995 (Dares, 1997). Between 1968 and 1995, participation rates for males aged 60–65 dropped from 68 percent to about 15 percent with virtually no change for those aged 55–59. For females aged 60–65, there was a decline from 35 percent to about 13 percent, whereas those in the age group of 55–59 experienced an increase in participation rates from 42–55 percent during the same period. Table I-11 shows that by inducing a gradual rise in the participation rate of those aged 60–65 in 2005–2015 to 40 percent, the imbalance between newborn and future generations is reduced dramatically (vanishing for a discount rate of 4 percent).

42. Although representing an improvement, the lower imbalance reflected in this scenario is achieved mainly by increasing the burden on current young generations. This points to the need for an early increase in the participation rate for people aged 55–65. Table I-12 shows

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[19]It should be noted that generational accounts are silent about how the adjustment will be effected. On the one hand, changes that formally affect only future generations' accounts can have an impact on the welfare of current generations. For instance, a cut in public expenditure on education for future generations, while not directly affecting the tax profile of current generations, would likely reduce their actual net income to the extent that parents would have to shoulder the cost of educating their children. On the other hand, differences in the treatment of taxpayers based on specifics characteristics (e.g., senior citizens often pay lower health contributions than working-age persons, couples and large families tend to benefit from income tax deductions), while marginal today, could become more prominent in the future.

Table I-10. France: Generational Accounts

Without Pensions Indexed to CPI 1/

	Remaining Net Tax Payments (in 1995 U.S. Dollars)					
	Discount Rate					
	3%		4%		5%	
Age in 1995	Male	Female	Male	Female	Male	Female
0	125,563	101,236	104,509	62,059	69,939	31,257
5	161,632	130,500	147,564	91,635	113,008	58,681
10	201,587	163,814	196,180	127,407	164,180	94,054
15	236,908	191,559	239,873	160,796	213,324	129,841
20	286,492	232,768	297,314	209,766	278,632	183,662
25	303,949	253,468	322,986	240,668	315,109	222,097
30	261,659	227,444	287,490	225,829	291,863	216,534
35	195,507	185,333	225,101	193,837	241,037	193,633
40	107,150	127,426	137,372	144,387	163,128	152,490
45	9,080	60,367	36,897	83,155	69,179	97,629
50	-86,702	-5,207	-61,743	19,966	-27,467	37,945
55	-214,809	-93,699	-190,806	-68,946	-157,371	-49,820
60	-234,424	-132,032	-219,741	-113,036	-199,648	-97,721
65	-227,561	-132,176	-216,832	-117,480	-202,088	-105,254
70	-170,064	-110,113	-162,734	-99,724	-152,893	-90,830
75	-178,201	-118,255	-171,319	-110,165	-163,327	-103,025
80	-101,603	-75,913	-98,111	-71,551	-94,150	-67,637
85	-109,477	-79,293	-106,384	-76,062	-103,111	-73,086
90	-99,925	-77,002	-97,041	-74,616	-94,433	-72,373
>95	-104,297	-76,877	-102,174	-75,332	-100,132	-73,847
Fut. Generation	263,378	212,351	205,398	121,967	149,506	66,817
Percentage Difference	**110**	**110**	**97**	**97**	**114**	**114**

Source: Staff calculations

1/ Pensions indexed to wages in early years, and to 1.2 percent rate (+ inflation) thereafter.

Table I-11. France: Alternative Policy Scenario
Change in Male and Female Participation Rates1/

	Remaining Net Tax Payments (in 1995 U.S. Dollars)					
	Discount Rate					
	3%		4%		5%	
Age in 1995	Male	Female	Male	Female	Male	Female
0	163,614	130,450	126,369	77,191	81,826	39,265
5	202,634	162,097	172,290	108,825	127,116	68,231
10	245,786	198,040	224,160	146,947	180,929	105,439
15	284,906	228,675	271,742	183,004	233,322	143,394
20	339,104	272,639	333,979	234,794	302,758	199,668
25	361,071	296,559	364,747	269,022	343,909	241,085
30	323,134	273,613	334,657	257,691	325,967	238,889
35	261,904	234,982	278,597	229,808	281,614	220,101
40	178,825	181,067	198,055	185,247	211,448	184,068
45	76,121	110,716	95,766	122,951	117,806	129,545
50	-32,011	35,632	-13,574	52,706	12,795	64,568
55	-173,906	-65,343	-154,529	-46,552	-127,107	-31,972
60	-219,768	-122,548	-206,099	-105,097	-187,536	-91,025
65	-217,204	-125,219	-207,106	-111,534	-193,330	-100,141
70	-163,489	-105,577	-156,523	-95,774	-147,239	-87,373
75	-173,255	-114,981	-166,636	-107,235	-158,994	-100,390
80	-99,593	-74,437	-96,207	-70,220	-92,387	-66,431
85	-107,887	-78,298	-104,866	-75,130	-101,682	-72,211
90	-98,822	-76,170	-95,995	-73,824	-93,438	-71,618
>95	-103,223	-75,965	-101,138	-74,452	-99,131	-72,997
Fut. Generation	193,658	175,797	117,008	92,733	58,244	43,137
Percentage Difference	**18**	**35**	**-7**	**20**	**-29**	**10**
	26		3		-16	

Source: Staff calculations

1/ The participation rate of men aged 60-65 gradually increases from 15 percent to 40 percent in 2005-2015; that of women ages 60-65 raises from 13 percent to 40 percent.

Table I-12. France: Alternative Policy Scenario
With Early Change in Participation Rates 1/

	Remaining Net Tax Payments (in 1995 U.S. Dollars)					
	Discount Rate					
	3%		4%		5%	
Age in 1995	Male	Female	Male	Female	Male	Female
0	179,304	145,199	136,179	85,370	87,582	43,853
5	219,563	178,084	183,400	118,130	133,955	73,706
10	264,076	215,361	236,756	157,521	189,061	111,960
15	304,760	247,387	286,084	194,978	243,028	151,127
20	360,992	292,791	350,558	248,312	314,515	208,813
25	384,998	318,399	383,743	284,376	358,018	251,962
30	349,108	297,102	356,271	274,999	342,783	251,732
35	290,354	260,631	303,416	249,640	301,842	235,533
40	203,337	204,496	330,209	203,996	230,153	199,157
45	100,824	131,757	118,570	140,407	137,699	144,096
50	-15,304	43,142	2,185	59,478	26,930	70,720
55	-160,512	-60,606	-141,944	-42,286	-115,459	-28,102
60	-214,222	-120,151	-200,907	-102,934	-182,711	-89,059
65	-216,289	-124,420	-206,250	-110,836	-192,558	-99,526
70	-162,982	-105,124	-156,046	-95,370	-146,803	-87,011
75	-172,935	-114,678	-166,335	-106,959	-158,716	-11,138
80	-99,467	-74,321	-96,088	-70,112	-98,276	-66,331
85	-107,817	-78,224	-104,800	-75,061	-101,620	-72,147
90	-98,789	-76,127	-92	-75,784	-93,407	-71,580
>95	-103,223	-75,965	-101,138	-74,452	-99,131	-72,997
Fut. Generation	171,067	154,298	88,582	69,913	28,323	20,859
Percentage Difference	**0**	**0**	**-28**	**-28**	**-63**	**-63**

Source: Staff calculations

1/ The participation rate of men aged 60-65 gradually increases from 15 percent to 40 percent starting in year 2000; that of women aged 60-65 raises from 13 percent to 40 percent; a 3-5 percentage increase in the participation rate of men aged 55-60 is also allowed.

that bringing forward the process, and allowing for a small increase in the participation rate of males aged 55–60, would lead to a greater reduction of the imbalance, with a decline in the burden on future, as well as current young generations. Indeed, Table I-13 shows that such an early action would also sharply reduce the imbalance between "babyboomers" and young generations (virtually eliminating it for the case of 1 percent productivity growth adjustment).

43. An increase to 40 percent in the participation rate of those aged 60–65 is consistent with both a three-year increase in the retirement age, or a five-year increase in the retirement age with fewer working hours in later years—thus leaving ample room for a variety of policy alternatives.[20] However, a key measure to achieve this objective would be to consider increasing the number of years required for retiring with a full pension to 45 (adjusting at the same time the formula for computing benefits and the minimum contributive pension). While the 1993 reform included a gradual increase in the number of years from 37 to 40, it fell short of the increase to 42 proposed in the *Livre blanc*. Its potential effect is thus projected to be quite limited, because more than half of the workers already retire with 40 years of contributions, while the effective pension for those with less than 32.5 years of contributions is determined by the relatively high level of the minimum pension (Briet, et. al, 1995). The increase in the number of years of contributions (if accompanied by an adjustment of the minimum contributive pension) would not require the abolition of the right to retire at 60, while it would create incentives for longer careers and enhance economic activity.[21] From a fiscal point of view, the increase in the number of years should be accompanied by a change in the formula for computing benefits (i.e., the number of years of contributions used in the denominator of the formula should increase accordingly).

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[20]While increasing the proportion of people younger than age 65 who work, could lead to a surge in output and taxes (even under the assumption of a constant share of labor in GDP) and reduced pressures on pensions, achieving this goal would require that both labor supply and demand be stimulated. In this regard, calibration of the wages and working hours to ensure that the labor market clears for older workers is also likely to be required at an early stage.

[21]In principle, working at an increasingly older age should become less of a burden, as intellectual work tends to be increasingly substituting for repetitive manual work. In this context, increasing the number of years of contribution, instead of the minimum retirement age, protects those who have entered the labor force at an early age, while being fair to those who entered later. In particular, given that education in France is free, it is equitable to require from those who received more benefits to stay much longer in the labor force. Moreover, if greater wage differentiation is allowed, increasing the number of years of contribution would not create disincentives to accumulating greater human capital.

Table I-13. France: Generational Accounts of the Babyboomers 1/
With Early Increase of Participation Rate

Productivity growth	Discount Rate of 3%	
	1%	**Historical Rate**
	Slow Increase	
Babyboomers 1/		
Males	166,017	129,235
Female	129,622	97,976
Average	147,819	113,605
Future generations 2/		
Males	171,067	171,067
Female	154,298	154,298
Average	162,683	162,683
Imbalance		
Males	3	32
Female	19	57
Average	10	43

Source: Staff calculations.

1/ Lifetime net tax payments for the 1950-55 cohorts.

2/ Including generations born after 1970

G. Conclusions

44. This paper attempts to contribute to ongoing discussions about the long-run sustainability of fiscal policy in the face of an aging population in France using a framework designed to capture the intergenerational aspect of the problem. It presents for the first time a set of generational accounts for France with a view to assessing the implications for future generations, given current fiscal rules, of the growth in government spending and debt taking into account the effects of demographic projections and other factors such as the anticipated change in labor force participation rates. The calculations reported in this study indicate that the present system of benefits and taxes, if continuously maintained for current adults, is out of balance in the long run from a generational perspective.

45. The size of the standard generational imbalance implies that a lack of fiscal policy adjustment will leave future generations of French citizens facing a lifetime net tax burden that is more than one and a half times as large as those confronting current adult generations based on existing policies. Fortunately, policies can be specified that could help alleviate such an imbalance, in particular those aimed at fostering higher employment and later retirement among the cohorts aged 55–65. The paper has presented such a policy scenario, indicating that an early, but gradual, increase to 40 percent in the participation rate of people aged 60–65—combined with longer pension contribution periods—would sharply reduce the generational imbalance between young and future generations, as well as the imbalance between current adult and young generations, with a decrease in the absolute net tax burden on future generations.

46. A number of caveats call for a careful interpretation of the results presented here. First, the accounts do not reflect private intergenerational transfers, which could contribute to lowering the size of the imbalance. Second, as this is a pure accounting model, no behavioral responses on the part of economic agents are built into the present framework. Finally, the results are sensitive to the long-term economic and demographic assumptions underlying this kind of study. Nonetheless, if interpreted with care, the generational accounts for France as presented in this paper can be used to gauge the extent of direct intergenerational redistribution implied by changing fiscal policies and thereby assist public decision-making in this area.

SOURCES AND DATA CONSTRUCTION

47. As explained above, average net tax payments for each generation were calculated by distributing aggregate taxes and transfers across population of cohorts according to the age/sex profiles of payments and benefits observed. This required first an estimation of a generational profile (i.e., by individual cohorts of age and gender) of different taxes and benefits in some base year. This was done principally using the 1990 data from surveys conducted by the tax administration department of the Ministry of Finances and INSEE. In a second step, the aggregate weight of each tax or benefit was computed using information in the annual national accounts published by INSEE.

Computation of profiles

48. Chart I-1 presents the age/sex profiles for the five categories of tax considered (personal income tax, property tax, wealth tax, social security tax, and consumption tax). The profiles corresponding to **personal income taxes, property taxes, and consumption taxes** were based primarily on data from a tax survey conducted by the Ministry of Finance (*Enquête sur les revenus fiscaux des ménages*, 1990). INSEE provided a break down of the results of the 1990 tax survey on these taxes according to the age of the head of households surveyed, but a disaggregation by gender was necessary for the study at hand and was thus inferred from additional sources. This disaggregation is not trivial because the differences in income between men and women vary over the life cycle according to marital status, childbearing, etc. Therefore, in order to take these factors into account, a more detailed disaggregation of the 1984 and 1990 tax surveys (Canceill, 1989, and Campagne, et. al, 1996) and data on the number of individuals at each age living in different types of households (from the 1990 population census) were also used. Canceill (1989) provides several tables showing the average income and personal income tax payments of different types of households (e.g., persons living alone, couples without children, couples with one, two, or three children, households headed by single parents, etc.). Crossing this information with census data on the population living in different types of households (*individus selon le sexe, l'âge et le mode de vie*; INSEE, 1990), permitted to disaggregate by gender the figures by household in the original survey.[22] The disaggregation of VAT, and other indirect taxes, was computed by assuming similar consumption profiles for men and women (i.e., assuming that for each age cohort, individuals of both genders pay the same amount of consumption-based taxes).

49. The profiles corresponding to **social security contributions** were based primarily on the distribution of wages and employment. They were estimated using the age profiles of wages computed by INSEE (Colin, 1995 and Perotin, 1989), and the average proportion

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[22]Of course, this is an approximation based on a number of assumptions (e.g., that in a household comprising a couple but headed by a man, both adults would have the same age), as well as some judgment about the tax incidence on certain populations (e.g., retired couples, which comprise the majority of the childless couples for which Canceill has information on). The overall impact of the imprecisions arising from these assumptions would appear minor.

between the wages received by men and women found in Bayet (1996).[23] The average individual contribution to the social security system was then computed by adjusting the average contribution paid by employed persons to the employment rate of different age and gender cohorts estimated using data in DARES (1997).[24]

50. The profile corresponding to **corporate income taxes and wealth taxes** was based on the distribution of financial assets across ages (*Enquête sur le patrimoine des familles*). This, along with the profile of other taxes related to wealth and income (*autres impots sur le revenue et le patrimoine*) were computed using the age distribution of net wealth found in Lolliviet and Verger (1996), adjusted for the distribution among genders based on figures in Sturrock (1995) and Franco et al. (1993). Following the tack taken in the U.S. Congressional Budget Office study (Sturrock, 1995), incidence of corporate income tax was assumed to be related to net wealth of individuals.

51. The profiles of individualized transfers comprising pensions, health benefits, public expenditure on education, and unemployment benefits (in addition to minimum income benefits, typically the RMI) are shown in Chart I-2. The profiles for **expenditure on education** were based on the average cost per student (in 1988) for different school ages (Ministère de l'Education Nationale, 1990), attendance rates, and the assumption that these costs were the same for students of both genders. The profiles for **expenditure on health care** were computed using the chart found in Caussat and Glaude (1993), and data in Mizrahi and Mizrahi (1995). The profile of expenditure on **pensions** and **unemployment benefits** were based on figures provided by INSEE (Accardo, 1996).[25] The age and gender distribution of pension expenditure found there was smoothed, permitting the elimination of some outliers, especially for old and young ages. Expenditure on **minimum support income and other specific social transfers** was distributed according to the profile of unemployment benefits.[26]

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[23] Age profiles for men and women in different professions shown in Colin (1995) do not provide a full coverage of the working population, and had to be marginally adjusted according to the full-coverage profiles provided in Perotin (1989); for the same reason, the overall average men-to-women wage ratio was taken from Bayet (1996).

[24] "*La population active devrait encore augmenter pendant une dizaine d'années*" DARES 97.02-No.07.

[25] The profile of unemployment benefits reflects the increase in unemployment in the years before the minimum retirement age (60 years) and before the standard retirement age (65 years). While the first peak is easy to understand, the causes of the concentration of unemployment benefits close to 65 years of age are not obvious.

[26] Ideally, these should be allocated according to the distribution of RMI. However, given the relatively small magnitude of these categories of transfers (about 0.3 percent of GDP in 1995), changing the profile from unemployment benefits to RMI is unlikely to change the results

(continued...)

Computation of the relative tax weights

52. The assignment of the actual weight of individual taxes and benefits was based on national accounts figures (INSEE, 1996) and followed closely the taxonomy perfected by the French statisticians, which guarantees the internal consistency of fiscal magnitudes. General government *resources and uses* (see Table I-4) were taken from the national accounts yearbook "*Comptes et Indicateurs Economiques*" (Tableau 10.17, *Administrations publiques, S60*). They were classified as much as possible according to the groups of taxes and transfers listed above, with those items which could not be assigned to any group being lumped into the general government net consumption (see Hagemann and John, 1995 for a rationale behind this choice of aggregation). Government expenditures on services for which beneficiaries could be identified, but which are usually included in government consumption in the sense of the national accounts (e.g., payment of hospital personnel and teachers) were lumped with transfers. This breakdown of government consumption[27] and investment was computed based on figures in tables 10.07 and 10.08 of the national accounts yearbook (*ventilation fonctionelle de la consommation et de la formation brute de capital fixe des administration publiques*). Finally, payments of pensions to government employees were lumped with the pensions to private sector workers, although the contributions which fund them were left at the charge of the government and not shifted to government employees (in the case of the private sector both employers and employees' contributions are shifted to employees).[28]

53. The taxes and transfers identified in Table I-4 were grouped together in Table I-A1 to show the weight of individual taxes and transfers and of government consumption as percent of GDP for the period 1995–2002. The aggregates taxes and transfers for 1996–2002 reflect inter alia the changes in taxation occurred since 1995, and the government goals for 1997–2002. In particular, it assumes a fiscal rule consistent with the government's convergence targets of a general government deficit below 3 percent after 1997. This fiscal consolidation was assumed to be achieved chiefly through a compression in net government consumption, together with a curbing in health expenditure and unemployment benefits, and a constant tax pressure, except for the gradual reduction in personal income tax included in the 1997 budget (which envisaged a reduction in income taxes totaling 0.8 percent of GDP by the year 2001).

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[26](...continued)
obtained thus far.

[27]Found in the P30 line in the national accounts.

[28]This problem can be dealt with by including government pensions in the government consumption, or by distributing the "contributions fictives" made by the government to itself on behalf of its employees according to the age profile of public workers.

Table I-A1. France: Medium-term Fiscal Projection
(In percent of GDP)

	1995	1996	1997	1998	1999	2000	2001	2002
Personal income tax	5.3	5.3	5.0	4.8	4.7	4.6	4.5	4.5
Property taxes	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Taxes related to consumption	14.6	14.8	15.0	15.0	15.0	15.0	15.0	15.0
Taxes related to individual net w	3.8	3.8	3.8	3.7	3.7	3.7	3.7	3.7
Social Security Contributions	19.3	19.3	19.3	19.2	19.2	19.2	19.2	19.2
Total Taxes	43.6	43.7	43.6	43.2	43.1	43.0	42.9	42.9
Expenditure on pensions	11.6	11.6	11.5	11.5	11.5	11.5	11.5	11.5
Health Care Expenditure	9.0	8.9	8.8	8.8	8.7	8.6	8.5	8.5
Unemployment Benefits								
(narrow sense)	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.6
(large sense)	2.7	2.7	2.5	2.4	2.2	2.1	2.1	2.1
Expenditure on Education	5.5	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Transfers	28.8	28.2	27.8	27.7	27.4	27.2	27.1	27.1
Government Consumption	16.3	16.1	15.5	15.5	15.1	14.7	14.6	14.5
Interest Payments	3.5	3.5	3.3	3.2	3.2	3.2	3.2	3.2
Primary Balance	-1.5	-0.6	0.3	0.0	0.6	1.1	1.2	1.3
Overall Fiscal Balance	-5.0	-4.1	-3.0	-3.2	-2.6	-2.1	-2.0	-1.9
Memorandum Item:								
Real GDP growth (in percent)		1.5	2.4	3.0	3.0	3.0	3.0	3.0

Source: Staff projections based on the authorities' Convergence Plan.

54. The actual average tax payment and transfer receipts of individuals in each age cohort can then easily be computed by scaling the age and gender profiles of individual taxes and transfers such that the respective figures aggregated by cohorts are made consistent with the aggregate weight of the corresponding tax or transfer for a given year.

Computation of generational profiles for the 1950–55 cohorts

55. To compute the past net tax burden of the 1950–55 cohort, national account flows covering the resources and uses of the public administration in the 1970–95 period were distributed over individual net payment profiles based on the profiles derived for 1995. The main adjustments on these profiles comprised changes in the age distribution of health expenditure, VAT, and social security taxes (based on Mizhari and Mizhari (1994), and INSEE sources).[29] To compare the net payment of the 1950 and 1995 generations, the present value of net taxes paid by the 1950 generation was computed as of 1950 (i.e., flows in 1990 francs were discounted back to 1950), and then adjusted for productivity growth. Adjusted flows using a 1.0 percent and 1.5 percent productivity growth rates (and varying growth rate reflecting historical values) were also computed (see Table I-8).

[29] Changes in the distribution of income taxes were not pursued, because for 1970 only the distribution of taxable income was available. While the distribution of taxable income, does not permit an easy estimate of the distribution of taxes, owing mainly to changes in the effective marginal tax rates, it shows however a clear concentration of those paying income taxes; as fewer and fewer households were subjected to the income tax over the years, those liable to any tax started to be concentrated in the cohorts of 40–55 years.

SENSITIVITY ANALYSIS

56. The calculation of the generational accounts is quite sensitive to the assumptions made about economic and demographic projections. Tables I-A2 and I-A3 report the estimated accounts for males and females under alternative assumptions about the parameter values. For a given productivity growth, a higher discount rate tends to lower the generational imbalance as measured by the percentage difference in the present value of taxes paid by future generations and newly born, since it gives a lower weight to future payments.[30] On the other hand, the effect of rising productivity is ambiguous, lowering the relative burden of future generations for sufficiently high discount rates, and increasing it for low discount rates. (Indeed, when the generational imbalance is expressed as a ratio of the present value of lifetime incomes, the effect of change in productivity can be reversed.) The intuition for this result is that higher productivity increases the present values of both taxes and transfers. However, because of the life-cycle pattern of consumption and the discounting factor, when the discount rate is sufficiently high, the increase in the present value of taxes (which are paid much early in life), outweighs the increase in the present value of benefits. For low enough discount rates, the increase in benefits (which come later in life), together with higher government consumption (which also grows at the productivity rate forever), implies a higher burden on future generations (even after adjusting for "effective" labor).

57. Although one of the main objectives of generational accounting is to free the analysis of public finances from labels that can be misleading, some conceptual problems remain when accounts are actually implemented. The same way standard "deficit" account can be highly misleading when not done according to the principles of national accounts, alternative assumptions regarding inter alia tax incidence can changes results quite substantially. Because generational accounts deal with net flows, differences on how some taxes or benefits are classified do have an impact on the results. These problems are illustrated by adopting alternative assumptions about incidence of particular taxes, as well as regarding the treatment of selected sources of government income associated to its net wealth. To shed some light on the first problem, generational accounts were recalculated under the assumption that corporate income taxes are netted off government consumption (as was done in Hageman and John, 1995) instead of being lumped with other capital income taxes, which incidence was assumed to be proportional to the net wealth of individuals (corporate income tax amount to about 2 percent of GDP). Under this alternative hypothesis, the relative additional burden on future generations vis-à-vis the newly born for the 3 percent discount rate increases from 56 percent to 73 percent (Table I-A4).

58. The second issue is illustrated by considering the whole net wealth of the government (instead of only the financial net wealth), but classifying the operating income of the government (*excedent d'exploitation*) as the return on the universe of assets owned by the

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[30]The decline needs not be monotonic, although the net cashflow of both newborn and future generations will fall with higher discount rates, the ratio between them can increase.

Table I-A2. France: Generational Accounts

With Productivity Growth of 0.75 Percent a year

	Remaining Net Tax Payments (in 1995 U.S. Dollars)					
	Discount Rate					
	3%		4%		5%	
Age in 1995	Male	Female	Male	Female	Male	Female
0	134,410	102,665	104,608	59,400	66,866	27,837
5	173,656	134,047	149,867	90,105	111,088	55,679
10	217,450	170,187	201,554	127,677	164,243	92,040
15	257,422	201,497	249,291	163,603	216,316	129,485
20	312,001	246,291	311,403	215,479	285,294	185,468
25	334,207	270,762	341,908	249,600	325,862	226,441
30	295,750	247,908	310,848	237,780	306,704	223,457
35	232,717	208,383	252,516	208,530	259,903	203,070
40	146,336	152,289	168,023	161,355	185,577	164,212
45	49,712	86,560	70,301	102,068	94,920	111,461
50	-45,860	21,339	-26,812	40,017	623	53,269
55	-175,370	-68,227	-155,964	-48,917	-128,341	-33,919
60	-218,566	-121,997	-205,163	-104,770	-186,809	-90,854
65	-216,476	-124,726	-206,540	-111,187	-192,882	-99,901
70	-163,084	-105,224	-156,220	-95,501	-146,993	-87,163
75	-173,086	-114,756	-166,552	-107,056	-158,934	-100,248
80	-99,539	-74,340	-96,192	-70,140	-92,381	-66,367
85	-107,925	-78,293	-104,929	-75,131	-101,746	-72,217
90	-98,893	-76,215	-96,095	-73,870	-93,535	-71,665
>95	-103,327	-76,042	-101,240	-74,528	-99,233	-73,071
Fut. Generation	224,091	171,165	159,477	90,556	104,764	43,615
Percentage Difference	**67**	**67**	**52**	**52**	**57**	**57**

Source: Staff calculations

Table I-A3. France: Generational Accounts

With Productivity Growth of 1.5 Percent a year

	Remaining Net Tax Payments (in 1995 U.S. Dollars)					
	Discount Rate					
	3%		4%		5%	
Age in 1995	Male	Female	Male	Female	Male	Female
0	164,316	139,022	135,142	87,108	92,176	47,983
5	197,695	166,322	177,064	116,323	135,279	75,893
10	234,078	196,797	223,363	150,810	185,327	110,929
15	265,389	220,930	263,836	182,006	232,304	145,482
20	311,216	258,082	317,914	228,134	295,011	197,334
25	325,433	275,318	340,427	256,393	328,795	233,753
30	281,160	246,652	302,755	239,434	303,502	226,471
35	214,937	203,298	239,911	206,385	251,983	202,626
40	128,697	145,738	153,951	157,246	175,352	161,684
45	35,415	80,846	58,049	97,981	85,302	108,500
50	-54,319	18,099	-34,272	37,514	-5,536	51,293
55	-176,467	-67,660	-156,650	-48,418	-128,879	-33,494
60	-226,156	-129,818	-211,640	-110,885	-192,161	-95,669
65	-220,808	-129,807	-210,236	-115,271	-195,974	-103,201
70	-165,300	-108,112	-158,068	-97,887	-148,561	-89,141
75	-174,010	-116,271	-167,199	-108,320	-159,463	-101,305
80	-99,843	-74,931	-96,372	-70,642	-92,520	-66,791
85	-107,853	-78,394	-104,781	-75,206	-101,590	-72,269
90	-98,680	-76,081	-95,799	-73,734	-93,245	-71,527
>95	-103,016	-75,813	-100,934	-74,303	-98,931	-72,849
Fut. Generation	258,919	261,982	172,279	139,514	104,677	78,370
Percentage Difference	**58**	**58**	**42**	**42**	**39**	**39**

Source: Staff calculations

Table I-A4. France: Generational Accounts
With Different Tax Incidence 1/

	Remaining Net Tax Payments (in 1995 U.S. Dollars)					
	Discount Rate					
	3%		4%		5%	
Age in 1995	Male	Female	Male	Female	Male	Female
0	123,273	95,188	100,124	56,562	65,662	26,930
5	159,088	123,847	142,549	85,339	107,895	53,498
10	198,688	156,557	190,391	120,219	158,030	87,855
15	233,810	183,937	233,359	152,814	206,068	122,610
20	283,016	224,740	289,957	200,976	270,102	175,341
25	300,128	245,134	314,868	231,043	305,284	212,538
30	258,308	219,629	279,589	216,195	281,685	206,497
35	193,643	178,764	218,591	184,952	231,664	183,848
40	108,276	122,979	133,969	137,193	156,334	143,904
45	14,268	58,699	37,821	78,362	66,247	90,971
50	-76,877	-3,768	-55,710	18,063	-25,514	33,828
55	-197,934	-87,100	-177,141	-65,669	-147,787	-48,943
60	-238,867	-139,904	-224,222	-120,587	-204,314	-104,966
65	-232,044	-138,672	-221,284	-123,742	-206,616	-111,291
70	-174,258	-115,376	-166,864	-104,806	-157,030	-95,740
75	-183,572	-123,884	-176,583	-115,609	-168,528	-108,293
80	-104,610	-79,124	-101,065	-74,663	-97,068	-70,656
85	-112,598	-82,548	-109,448	-79,217	-106,129	-76,147
90	-102,822	-79,815	-99,887	-77,361	-97,231	-75,053
>95	-106,875	-79,130	-104,716	-77,554	-102,639	-76,037
Fut. Generation	219,965	169,851	164,558	92,963	113,800	46,673
Percentage Difference	**78**	**78**	**64**	**64**	**73**	**73**

Source: Staff calculations

1/ Capital income tax and per capita government consumption are both reduced by 2 percent of GDP.

government (e.g., owing to fees and charges on services provided by the government). In this case, the 1995 net wealth of the government would be positive, but the general income of the government would be reduced by about 2 percent of GDP (i.e., net government consumption would be increased by an equivalent amount). As table I-A5 indicates, treating the government wealth and income this way would substantially increase the relative intergenerational imbalance.

Table I-A5. France: Generational Accounts
Including All Government Assets 1/

	Remaining Net Tax Payments (in 1995 U.S. Dollars)					
	Discount Rate					
	3%		4%		5%	
Age in 1995	Male	Female	Male	Female	Male	Female
0	144,380	114,132	114,444	68,057	74,899	34,100
5	181,889	144,389	158,789	98,421	118,889	62,058
10	223,387	178,850	208,862	135,118	171,151	98,081
15	260,593	207,943	254,327	169,607	221,657	134,665
20	312,309	250,303	313,862	219,673	288,647	189,357
25	331,838	272,427	341,750	251,912	327,020	228,877
30	291,367	247,649	308,475	238,412	305,839	224,498
35	227,156	206,821	248,583	207,895	257,446	202,969
40	140,690	150,190	163,514	160,041	182,301	163,406
45	45,062	84,690	66,311	100,729	91,786	110,490
50	-48,644	20,261	-29,270	39,182	-1,409	52,609
55	-175,725	-68,041	-156,185	-48,754	-128,515	-33,780
60	-221,021	-124,506	-207,258	-106,734	-188,542	-92,403
65	-217,883	-126,368	-207,740	-112,508	-193,887	-100,970
70	-163,808	-106,164	-156,823	-96,278	-147,504	-87,808
75	-173,388	-115,251	-166,762	-107,469	-159,106	-100,594
80	-99,638	-74,534	-96,250	-70,305	-92,425	-66,506
85	-107,900	-78,326	-104,879	-75,155	-101,693	-72,233
90	-98,822	-76,170	-95,995	-73,824	-93,438	-71,618
>95	-103,223	-75,965	-101,138	-74,452	-99,131	-72,997
Fut. Generation	100	100	98	98	132	132
Percentage Difference	**100**	**100**	**98**	**98**	**132**	**132**

Source: Staff calculations

1/ Government net wealth is estimated at $800 billion French francs by considering non-financial government assets. Imputed yield (excedent net d'exploitation) of non-financial assets is netted out from government revenues, increasing per capita net government consumption by 2 percentage points of GDP in 1995-2002.

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II. France: Public Finances - Long-Term Prospects and Reform Options[1]

A. Introduction

59. Recent years have seen a growing recognition of the burden that will be placed on the public finances by aging populations. Most industrial countries can expect serious pressures on public expenditure in the early decades of the next century. Moreover, this outlook needs to be faced, in many cases, with public debt ratios and tax burdens that are already at a high level. On average, the European G-7 countries had a debt-to-GDP ratio of over 70 percent in 1996, and public revenue equivalent to some 45 percent of GDP.

60. France is no exception to this general situation. Projections by INSEE, among others, confirm that the population over 60, relative to the population of working age, is likely to double over the next few decades. The impact of this needs to be assessed against the background of a public debt ratio that has risen to 55 percent of GDP, a primary general government surplus that currently is too low to stabilize the debt ratio even at 60 percent of GDP, as well as a revenue burden that, at 50 percent of GDP, is the highest among the seven major industrial economies.

61. Assessing the macroeconomic consequences of an aging population is inherently difficult. Obvious uncertainties exist, for example, in extrapolating costs of medical care or the age at which people will want to retire. Moreover, small changes in assumptions about economic performance make a substantial difference to fiscal outcomes over the period under consideration.

62. These uncertainties are especially pronounced when one takes into account the feedback between social and fiscal policies and the determinants of long-run economic growth, such as incentives for work, investment, and innovation. Two types of feedback are likely to be the most important. First, persons of working age will be obliged to pay an ever greater proportion of their income to finance social security; and the extent to which they participate in the formal labor market could decline—an unwelcome development against a background where the number of persons of working age is already shrinking. Second, higher taxes and public deficits will distort the allocation of resources in other ways, dampening investment and leading ultimately to a slowing of productivity growth in the economy. As the economy slows or even begins to contract, the difficulty of providing social security to the aged and infirm will become ever greater; and the financial position of the public sector becomes increasingly precarious.

63. This paper aims to contribute to an assessment of these issues, under alternative assumptions about parameters and policies, by analyzing the problems relating to population aging within a model of macroeconomic growth. The insights gained in this way may in turn

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[1]Prepared by Karl F. Habermeier and Fabrice Lenseigne.

open the door to designing policy approaches that can help to secure more satisfactory outcomes in terms of social security integrity and fiscal sustainability.

64. The plan of the paper is as follows. The next section briefly summarizes the standard view of how demographic forces will drive public expenditure over the coming decades. This is followed by a discussion of the principal interactions between public expenditure policies and economic performance in the long run. Quantitative scenarios are then used to illustrate the possible implications of these linkages for the future course of the economy and the public finances. The final section discusses some reform options, again supported by quantitative scenarios. An Appendix provides further detail on the model and simulation methods used in the paper.

B. Demographic Developments and Long-Run Expenditure Trends

65. Over the next 50 years, the population in France, as in most other advanced countries, is likely to age significantly. Official demographic projections (taking into account the trend decrease in mortality) show the following profile for the old-age dependency ratios:

Dependency ratio	2000	2010	2020	2030	2040	2050
20–60/over 60	2.62	2.32	1.88	1.58	1.43	1.21
20–65/over 65	3.66	3.50	2.74	2.23	1.91	1.83

Source: INSEE.

66. Thus, at the current retirement age of 60, there will be 2.6 persons of working age for every person of retirement age in 2000, but only 1.2 persons in 2050. The change is still pronounced, albeit significantly less so, if the dividing line between working age and old age is drawn at 65 instead of 60.

67. The well-known implication of these demographic developments is that spending on pensions is likely to rise markedly, and that—because relatively fewer people will be working—the contribution rate to pay-as-you-go pension systems would need to increase even more. Health care spending is also likely to increase sharply, owing to the fact that older people consume significantly more health services per capita than do younger people.

Pensions

68. Despite the reforms undertaken in recent years, the pension system in France remains one of the most generous in the industrial countries. The standard retirement age is 60, and the replacement rate of pensions in the principal schemes for private sector employees is equivalent to 70 to 80 percent of the last wage. The 1993 reform of the *régime général*

(which provides basic pensions for private sector employees) comprised, among other things, a lengthening of the contribution period from 150 to 160 quarters over 10 years, an extension of the period over which the reference wage is calculated (from the 10 best years to the 25 best years), and a shift in indexation from gross wages to the CPI. The 1996 reform of the supplementary pension schemes increased the contribution rate and indexed payments to the CPI less 1 percentage point; the financial impact of this reform will be relatively small when measured against the outlays of the pension system as a whole.

69. Available studies of the pension system, which take into account the reforms through 1993, suggest that their long-term financial prospects remain problematic. The most recent official French study (*Perspectives à long terme des retraites*, 1995) shows that the average contribution rate needed for financial balance rises from 18.9 percent of labor income in 1990 to 48 percent in 2040. With labor income amounting to about 60 percent of GDP, the share of pension expenditure in GDP would increase by 17½ percentage points over the same period. The study by Chand and Jaeger (1996) finds that the net present value of pension liabilities in France amounts to 114 percent of 1995 GDP, the highest in the sample of countries examined (Table II-1).

70. The studies cited above, and most others, use what may be termed an "accounting" methodology in which the main macroeconomic variables are exogenous. Given any set of rules governing a pension program, it is possible to derive the time path of expenditure for the program. Typically, studies of this type are carried out using a variety of demographic scenarios, and several different assumptions about the rate of increase in labor productivity. As indicated earlier, a central purpose of this paper is to explore the implications of endogenizing macroeconomic developments by introducing feedback from fiscal to real variables.

Health care

71. Future increases in health care expenditure are more difficult to project. Unlike pension entitlements, where benefits are clearly defined in terms of well-understood and easily measured economic variables such as prices, wages, and years of contribution, the consumption of health benefits is driven to a considerable extent by the choices of individual consumers, health care providers, and insurers.[2] These choices are strongly influenced by advances in medical technology, which have often been accompanied by significantly and unpredictably higher unit costs of treatment. Moreover, decisions on the consumption of medical services are typically made in an environment of incomplete information and one in

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[2]See "Health Expenditure", Section I of France - Selected Issues (SM/96/249) for a detailed discussion of these issues.

Table II-1. Net Pension Liabilities and Sustainability of Fiscal Stance
(In percent of GDP)

	Net Public Debt at end 1994 1/	Net Pension Liability, 1995-2050 2/	Combined Net Debt Liability	Primary Balance 1995 3/	Sustainable Primary Balance Required to		Adjustment Needed in Primary Balance for Fiscal Sustainability 6/
					Stabilize net public debt in 1995 4/	Stabilize net public debt and prevent buildup of pension debt 5/	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Major industrial countries	57.2	60.0	117.2	0.7	1.0	2.9	2.2
United States	63.3	25.7	89.0	0.4	1.1	1.9	1.5
Japan	33.2	106.8	140.0	-0.2	0.3	3.6	3.8
Germany	52.5	110.7	163.2	2.4	1.1	4.5	2.1
France	42.4	113.6	156.0	-0.3	0.7	4.0	4.3
Italy	112.9	75.5	188.4	3.3	2.1	4.6	1.3
United Kingdom	37.7	4.6	42.3	0.4	0.7	0.8	0.4
Canada	71.6	67.8	139.4	0.2	2.7	4.7	4.5
Sweden	54.5	20.4	74.9	-5.1	0.1	1.0	6.1

Source: Chand and Jaeger (1996).

1/ Adjusted for net assets of public pension fund at the end of 1994. Estimate of net public debt for Germany includes unification debt as of the end of 1994.

2/ Net present value of difference between projected primary expenditure and revenue of public pension fund during 1995-2050, adjusted for net asset position of public pension systems at the end of 1994.

3/ May 1995 WEO projections of structural primary balance of general government.

4/ Primary balance required to stabilize net public debt in 1995.

5/ Sustainable primary balance in column (5) plus contribution gap from column (4) of Table 9.

6/ Difference between columns (6) and (4).

which neither consumers nor providers are internalizing the full costs of their choices, leading to overconsumption.[3]

72. In France, health care expenditure since 1980 has increased at an annual rate 0.7 percentage points greater than that of nominal GDP. The OECD estimates that about 0.4 percentage points of this excess can be attributed to population aging. Cumulatively, aging by itself would tend to increase the share of health expenditure in GDP by about 3 percentage points by 2050. However, the increase could amount to 5 percentage points or more if spending continues to develop in line with historical trends.[4]

C. Entitlement Expenditure, the Public Finances, and Economic Performance

73. An important disadvantage of the "accounting" approach to assessing the long-term fiscal outlook is that it neglects the interactions among entitlement expenditure, the public finances as a whole, and economic performance. This section traces out some of these interactions, considers their empirical and policy relevance, and lays the basis for the long-term fiscal scenarios presented in Section D.

Analytical framework

74. As outlined above, the share in national income of pension and health care expenditure will rise markedly over the coming decades, not just in France, but in most of the advanced economies. In analyzing the macroeconomic impact of these developments, one would in principle want to consider their effect on saving, investment, and economic growth in a global context using an intergenerational general equilibrium model. Key parameters in such an analysis would be the degree to which higher entitlement spending reduces domestic saving, the extent to which foreign saving can substitute for domestic saving, and the responsiveness of investment and labor supply to the higher taxes or deficits needed to finance entitlement spending.

75. Most previous work on the macroeconomics of population aging and pension reform has focused on the implications for saving, though mostly in a closed-economy context (see

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[3]Indeed, it is difficult to explain satisfactorily even past developments in health care spending. While factors such as population aging, greater insurance coverage, and higher real income play a role, there is also a substantial residual (or trend) item, which reflects a variety of technological and institutional factors.

[4]On the other hand, future generations may be healthier and consume relatively fewer health care services at the same age than earlier generations.

OECD 1997 for a survey).[5] The tentative conclusion of this line of inquiry has been that a reduction in the generosity of the public sector pension system would increase national saving and hence future potential output, though the estimated size of the effects has tended to be small. Some of these studies have also suggested that it matters little or not at all whether the generosity of entitlement programs is reduced through increases in taxation or cuts in benefits (though it does matter whether such programs are pre-funded or pay-as-you-go).

76. The approach in this paper differs from previous work on the macroeconomics of population aging in that it focuses on investment and labor supply as the prime movers of long-run economic growth. It takes as its point of departure the commonly held view that the long-run increase in real per capita GDP reflects the accumulation of capital, the expansion of the labor force in both numbers and skills, and technological change. Against this background, it marshals research suggesting that long-run economic growth, and the factors determining it, are strongly affected by economic policies or institutions, and in particular by the share of taxation and public spending in the economy.[6]

Taxation and economic growth - theoretical considerations

77. How will the higher taxes needed to finance mounting pension and health care spending affect economic growth? The answer to this question depends on many factors, including the type of taxes being increased, the type of expenditure being financed by those taxes; but also on how high the overall tax burden is before the increase.

78. A simple model presented by Barro and Sala-i-Martin (1996) may help to illustrate the last point. In this model, capital has a constant social marginal product, but a diminishing private marginal product; and public goods (such as the maintenance of law and order) raise aggregate productivity, but with diminishing marginal returns. Government spending on public goods is financed by a flat tax on gross output; and the government runs a balanced budget. It is shown that under these conditions, the rate of economic growth is an inverse u-shaped

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[5]Very little work has been done so far on the consequences that population aging and entitlement reform would have on the balance of payments and net foreign asset positions of countries. One important question would be whether in the absence of pension reform, the net foreign asset position of the aging advanced economies should be expected to deteriorate in the course of coming decades.

[6]Other variables have also been shown to have an influence on long-run economic growth, notably public sector deficits, inflation, educational policy, political stability, political and civil liberties, the rule of law, the exchange market regime, and trade protection. Barro and Sala-i-Martin (1996) provide an overview, both of theory and the empirical evidence.

function of the tax rate.[7] For low tax rates, the benefit of additional public goods outweighs the distortionary effect of the tax. However, beyond a certain point, the negative effect of taxation on the after-tax marginal product of capital is larger than the positive effect of additional public goods on productivity, and the growth rate begins to decline. These results also hold in a more realistic model in which public goods are not entirely non-rivalrous in consumption, but subject to congestion.

79. Different types of taxes will of course have somewhat different effects on economic growth. Milesi-Ferretti and Roubini (1995), building on work by Jones, Manuelli, and Rossi (1997), use a model in which the growth process is driven by the accumulation of human and physical capital to examine the channels through which income and consumption taxes are transmitted to the economy. They show that income taxes are unambiguously growth-reducing, as such taxes discourage the accumulation of human and physical capital. The effect of consumption taxation is indeterminate and depends critically on the elasticity of labor supply, and hence on the labor-leisure tradeoff. When labor supply is sufficiently elastic, a consumption tax reduces time spent on education and work. Other authors, for example Stokey and Rebelo (1995) have found possible positive effects of consumption taxes on economic growth. However, Stokey and Rebelo also conclude that restructuring the tax system (toward a greater emphasis on flat rate income and consumption taxes) would have only relatively small positive effects on economic growth.

80. As indicated above, the adverse effects of taxation on economic growth can be offset, at least in part, by the productive effects of spending on public goods. Of course, the provision of directly productive public goods accounts for only a small part of overall government outlays: social transfers of many kinds make up the largest part of public spending in France and most other advanced economies. A critical question is then how economic growth is affected by the government's combined tax and expenditure policies; and in particular, how it is affected by social transfer payments.

81. The effects of social spending on economic growth are complex and highly differentiated. The traditional viewpoint is that transfer payments have no effect on incentives and rests on the assumption that such transfers typically take the form of pure lump-sum redistribution.[8] Another argument for the neutrality of social transfers stresses substitution: if the public sector were not providing pensions, for instance, individuals would be obliged to

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[7]Profit maximization by firms in this model implies that the wage rate is set equal to the after-tax marginal product of capital, and that the rental rate of capital is set equal to the after tax-marginal product of capital.

[8]In general equilibrium theory, a pure lump-sum transfer is defined as a (one-time) redistribution of initial endowments of goods, before markets open.

accumulate greater retirement savings of their own.[9] Much recent work, by contrast, has emphasized the incentive effects of government transfer payments. For example, OECD (1996) notes that there is a negative relationship between job search and the replacement rates for unemployment insurance and minimum social benefits. It has also been argued that social transfers to the poor may reduce the incentive of poor persons to engage in criminal or other destructive activities (Sala-i-Martin 1996).

82. In conclusion, the theoretical literature suggests a number of channels through which public revenue and expenditure policies can influence long-run economic growth, mainly by way of investment and productivity, but also by way of the labor market. However, the size and direction of the net effect cannot be determined on theoretical grounds alone, but must be established empirically.

Empirical evidence from cross-country studies

83. Empirical studies of differences in economic growth across countries have typically considered a wide range of policy and institutional variables. As most of the theoretical models predict that countries at an earlier stage of development would grow more quickly than more advanced countries (other things remaining equal), real per capita GDP in a base period is routinely included as an explanatory variable. In many of these studies, the regressions are estimated using instrumental variables to allow for the possible endogeneity of the explanatory variables.

84. The key question for the purposes of this paper is whether an increase in pension and health care spending financed by higher taxes has a negative effect on investment, labor supply, and thereby on economic growth. The available empirical studies have not addressed precisely this question. However, studies have found a negative association between the aggregate tax burden and economic growth. Many studies have also found a negative relationship between the share of public spending in GDP and economic growth. The latter result should not be too surprising given that the shares of revenue and expenditure in GDP are closely correlated.[10]

85. The most directly relevant results from the empirical literature include the following:

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[9]The work surveyed in OECD (1997), however, suggests that the substitution of private old-age saving for public pensions is not one-for-one, but considerably less.

[10]It is interesting that expenditure tends to be correlated somewhat more strongly and robustly with economic growth; possibly, this reflects the fact that expenditure is the sum of revenue and deficits, and may reflect the negative effects of both better than either variable alone.

• Cashin (1995), in a panel data set of 23 countries and four multi-year time periods, finds that taxation exercises a strong negative influence on growth, which is partly offset by positive effects of government spending, for an overall effect that is negative.

• Easterly and Rebelo (1993), using a data set comprising some 50 countries, estimate regressions that, in addition to standard conditioning variables (the level of per capita income in a base period, school enrollment, political stability), include a variety of fiscal variables. They find that growth is negatively correlated with government consumption, overall government expenditure, government deficits, and marginal tax rates. The size of the coefficients ranges from a low of 0.05 for the marginal tax rate to 0.24 for overall government expenditure.[11]

86. Though the following two studies do not directly address the effect of taxation on economic growth, they do provide an indication of how strongly growth is affected by the size and composition of the public sector:

• Sala-i-Martin (1996), in a cross section of 75 countries covering 1970-95, finds that both government consumption and government investment have a negative effect on economic growth (0.1 and 0.2 percentage points), but that social security spending has a positive effect (0.1 percentage points), for an overall effect that is still negative.

• Barro and Lee (1994), using a sample of 87 countries for 1965-75 and 97 countries for 1975-85, find that a 1 percentage point increase in the ratio of government consumption to GDP reduces real GDP growth by 0.1 percentage points.[12] Their regressions also include a wide variety of other indicators of political and economic structure.

87. The empirical work cited above deals with the effect of public revenue and expenditure on the growth rate of real per capita GDP. Considerably less systematic attention has been given to the channels through which fiscal variables exercise their effect on growth. Studies that consider these channels include Easterly and Rebelo (cited above), who report that private investment is negatively correlated with government consumption, domestic taxes, and total government expenditure.[13] Some work has also been done on the relationship between

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[11]Thus, a 1 percentage point increase in the share of government expenditure to GDP would reduce the long-run growth rate by ¼ percentage point.

[12]This result is consistent with the theoretical view, articulated in Barro (1990), that a considerable fraction of government consumption spending is directly unproductive.

[13]Fischer (1993) examines the transmission of a wide variety of macroeconomic policies to growth by way of investment, productivity growth, and labor supply. However, the budget

(continued...)

tax and spending policies and labor market performance, though without examining the implications for economic growth. For example, Layard, Nickell, and Jackman (1994) have found that unemployment in the industrial countries is related, among other things, to the replacement ratio of social benefits, as well as to the duration of unemployment benefits. Several of the papers collected in Henry and Snower (1996) have found a negative effect of the tax wedge and other measures of the size of the public sector on employment, as well as indirect effects of higher taxes (through the net wage) on labor force participation.[14]

88. The results obtained in the labor market literature are not directly transferable to the model used in this paper, which expresses labor market performance in terms of the broader concept of the employment rate.[15] The cross-section regression presented in the Appendix addresses this issue (Table II-A4). On the basis of data for 18 industrial countries, it shows that the employment rate depends negatively on the overall tax burden in the economy, and positively on the degree of wage differentiation and the share of women in the workforce. Ceteris paribus, a 1 percentage point increase in the ratio of general government revenue to GDP would decrease the employment rate by between 0.3 and 0.5 percent.

89. To summarize, empirical work provides support for the view that higher shares of government revenue or expenditure in the economy (as well as higher fiscal deficits) have a negative effect on long-run economic growth, by dampening investment, productivity growth, and employment. As a broad quantitative approximation, the empirical studies as a whole suggest that, controlling for the influence of other policy variables, a 1 percentage point increase in the ratio to GDP of government revenue (or government expenditure) would reduce the growth rate of real per capita GDP by about 0.1 to 0.2 percentage points.

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[13](...continued)
deficit is the only fiscal variable considered in this study.

[14]Another strand of the literature is concerned with the impact of marginal income tax rates on hours of work; for a recent assessment, see MaCurdy (1992). Many of these studies find that higher marginal rates have a fairly small effect. However, as was pointed out more than a decade earlier by Rosen (1980), the effects on the labor market of tax and spending policies are by no means fully captured by relationships between hours of work, income, and after-tax wages. Social security provisions, the overall tax burden, and other variables are likely to be important as well.

[15]The employment rate is defined as the ratio of employment to population aged 15 to 64. The non-employment rate, defined as 1 less the employment rate, takes account of both measured unemployment and non-participation in the labor force.

Application to France

90. In analyzing the macroeconomic consequences of rising entitlement spending related to population aging in France, it is necessary to parametrize a growth model for France in a manner that is broadly consistent with the cross-country empirical results discussed above. As is standard, a production function relates real GDP to inputs of labor and capital, and to total factor productivity. The production function is assumed to have the Cobb-Douglas form, so the shares of capital and labor in GDP are constant over time. Feedback from the rising share of revenue on growth are transmitted through their effects on labor supply and investment; moreover, the accumulation of capital is related to the growth of total factor productivity.

91. A simple investment function is estimated in which the change in the capital stock depends on the marginal product of capital adjusted for taxation. A critical assumption in this function is how to set the level of the tax/GDP ratio beyond which net investment becomes negative. Estimates of this threshold value derived from French time series data range from a low of 50 percent to a high of 100 percent of GDP (see the discussion in the Appendix). An intermediate value of 80 percent was adopted for the simulations in this paper. The chosen calibration implies that a 1 percentage point increase in the general government revenue ratio would reduce the growth rate of the capital stock by 0.1 percentage points (from an initial rate of 2.5 percent annually). Such a slowdown in the growth of the capital stock would, ceteris paribus, directly reduce the annual growth rate of real GDP by 0.04 percentage points.

92. Furthermore, the model assumes that the contribution of capital to aggregate output consists of two parts: one which is appropriated by (or internal to) business enterprises, and another that is not appropriated (external). The analytical foundations for this approach were developed by Romer (1986) in his seminal article on endogenous economic growth. In calibrating the model in this paper, measured total factor productivity is related to the capital stock. The estimation yields an external production elasticity of capital of about 0.4; adding this to the internal production elasticity derived from the share of capital income in GDP yields an overall (social) production elasticity of 0.8. Combined with the investment equation discussed above, the conclusion is that a 1 percentage point increase in the general government revenue ratio would slow the growth of real GDP by 0.08 percentage points.

93. In addition to the investment and productivity channels, the model also allows for the transmission of tax and spending policies to economic growth via the labor market. In light of the estimation results obtained in Tables II-A4 and II-A5 in the Appendix, the effect of a 1 percentage point increase in the general government revenue ratio on the employment rate is set, rather conservatively, at ¼ percentage point. Thus, a 1 percentage point increase in the revenue ratio would lower the level of real GDP by about 0.18 percent. If the revenue ratio were increasing by ½ percentage point per year, the drag on the growth rate coming from the labor market would amount to about 0.09 percentage points.

94. It is important to emphasize that this is a highly stylized representation of the feedback from fiscal policy to real economic activity, i.e., one that does not take into account the

composition of public revenue and expenditure. However, the overall magnitudes involved are not implausible when seen against the background of the extensive cross-country studies of fiscal policy and economic growth that were reviewed earlier. Moreover, in light of the results obtained by Stokey and Rebelo, the role of compositional effects seem to be relatively minor, at least for public revenue.

D. Model Simulations of the Long-Term Fiscal Outlook

95. The model of economic growth outlined above was combined with projections of public expenditure and revenue to assess the long-term fiscal outlook. Two versions of the model were used: one without feedback from fiscal to real variables, and one with feedback. In the version without feedback, labor supply and total factor productivity are exogenous, with the former being a fraction of the population that is not retired, and the latter growing at a constant rate throughout the simulation period. In the investment equation, the tax variable is held constant at its base year level. By contrast, the version of the model with feedback from fiscal to real variables uses the investment, total factor productivity, and labor supply equations discussed in the previous sub-section.

96. The fiscal accounts in the model disaggregate expenditure into four categories: pensions, health, interest payments, and other.[16] In order to capture the effect of population aging, health expenditure in turn is divided between young and old persons. Revenue is not disaggregated by category.

97. Pension spending is computed on the basis of annual cohort data drawn from official demographic projections through 2050, and the path of wages and prices generated in the model. Using disaggregated demographic data makes it possible to account precisely for the effects of changes in key parameters of the pension system, such as replacement rates, retirement ages, and indexation rules.[17] Health spending in each demographic group (young, old) grows in proportion to gross wages and an additional factor which captures the historical excess in the growth of health care spending over what can be explained by income and demographics. Interest payments are related to average of the beginning-of-period and end-of-period stocks of debt.

98. The fiscal accounts are closed by introducing an exogenous target for the ratio of the general government balance to GDP, and by rules for adjusting revenue and primary

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[16]All public finance variables are expressed in current price terms to facilitate inflation accounting and ensure continuity with historical series.

[17]This type of accounting is particularly important in representing changes in the effective retirement age, discussed in the following section. With a standard retirement age of 60, there is a distribution of ages at which individuals retire, ranging from 55 to 65. An increase in the retirement age gradually shifts this distribution upwards.

expenditure other than on pension, health care, and debt interest. These adjustment rules are such that the actual deficit moves toward the target but only reaches it in the course of time. The parameters that govern the speed of the adjustment are a measure of the strength of the adjustment effort and of its composition. In the model, and broadly in line with historical experience, it is assumed that adjustment equivalent to about one-quarter of the deviation from the deficit target is undertaken each year, and that the bulk of the adjustment is achieved by increasing revenue. The values of these parameters were set so as to avoid an excessive accumulation of debt (which would have made it necessary to model inflation); consequently, the ratio of public revenue to GDP increases very markedly by the end of the simulation horizon.

Baseline simulations under certainty

99. The baseline scenario assumes that policies affecting the pension system are unchanged, and that health spending develops in accordance with demographics and past trends. When the scenario was run without feedback between fiscal and real variables, the results were similar to those obtained by the most recent official study (discussed in Section B).[18] Real GDP grows by about 2 percent in the long run, pension spending increases by about 6 percentage points of GDP by 2020 and 13 percentage points by 2050 (Chart II-1), while health care spending increases by 1½ and 4 percentage points, respectively, over the same periods. Mild expenditure restraint in other areas allows the share in GDP of non-pension, non-health care primary expenditure to decline somewhat, thus holding down slightly the rise in overall general government outlays, which increase to over 60 percent of GDP by 2020 and to just under 70 percent by 2050.[19] Even so, general government expenditure increases at a steady and rapid pace—more than ½ percentage point of GDP per annum—right from the beginning of the simulation period. Unless offset by measures to contain expenditure, or new revenue measures, the structural deficit would also increase by this amount every year.

100. Strikingly different results obtain if feedback from rising taxes and deficits on labor force participation and productivity growth is included in the model. Even if the feedback effects are quite mild, they set in motion a cumulative process that causes the growth of real GDP to slow markedly during the first two decades of the next century, with a contraction beginning around 2035 (Chart II-1). In these circumstances, pension expenditure would rise to

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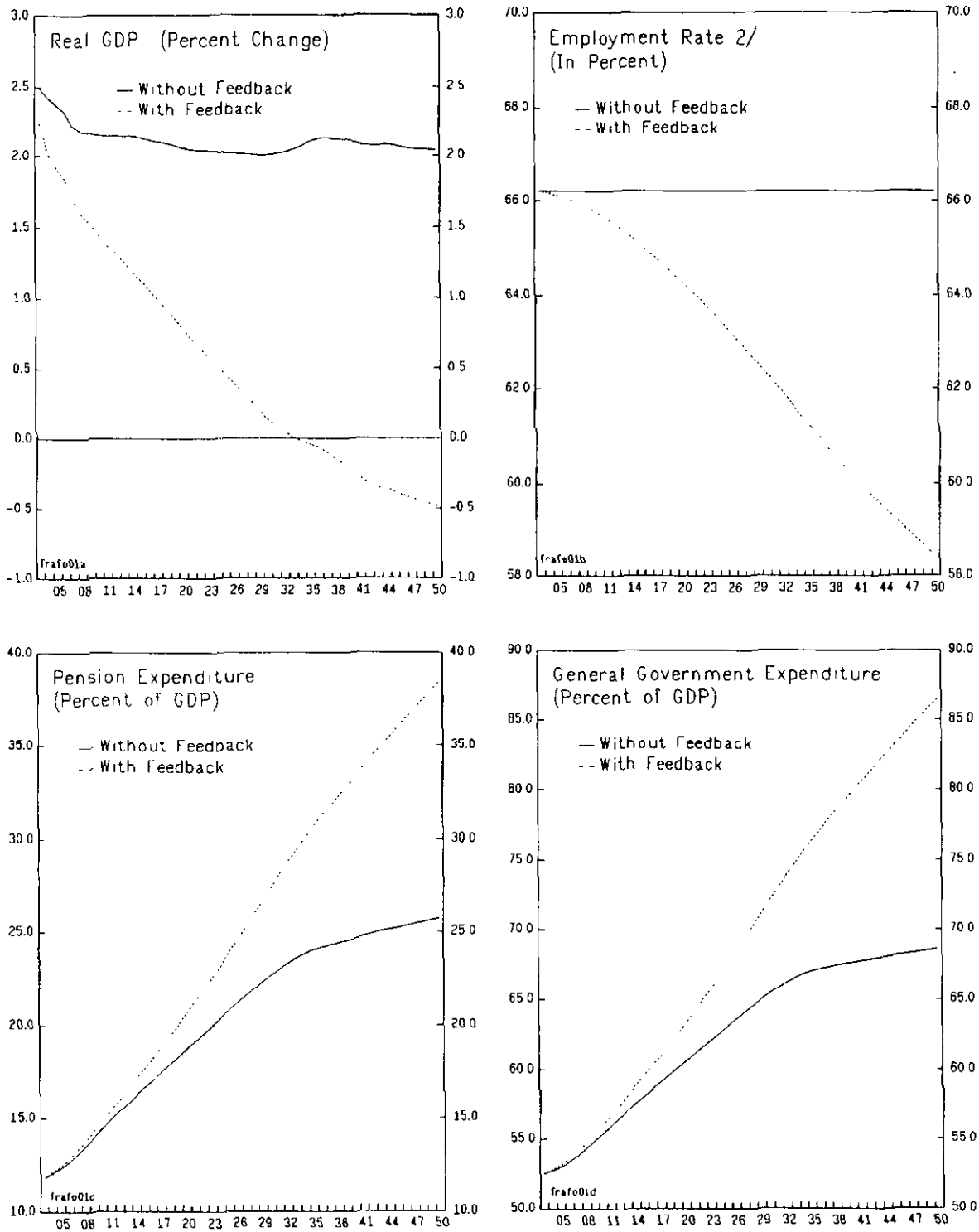
[18]It should be noted that even though the results are similar, the model used in this paper endogenously generates the rate of economic growth over time, rather than assuming it to be exogenous as is done in accounting-type studies.

[19]The average annual growth rate of real non-pension, non-health primary expenditure amounts to about 1¾ percent. This reflects the operation of the expenditure adjustment mechanism described in the Appendix.

CHART II-1
FRANCE

Baseline Scenarios With and Without Feedback 1/



Source: Staff calculations
1/ Assuming unchanged policies
2/ Employment as a percent of working-age population.

almost 40 percent of GDP in 2050, and general government expenditure to almost 90 percent of GDP. The speed at which general government expenditure increases in the absence of policy action is substantially higher—about ¾ percentage point of GDP per year. In contrast to the scenario without feedback, this rate of increase does not level off once the worst of the demographic shock is past, around 2030. Rather, the accumulated damage to the real economy continues to take its toll.

101. In assessing the credibility and policy relevance of these results, it may be helpful to consider three issues. First, as a general rule, projections looking 50 years into the future (or even 10 years, for that matter) need to be treated with caution. There is no crystal ball in economics. Second, the severity of the impact that is envisaged would doubtless trigger policy reactions. Thus, the projections are not forecasts. Third, the model does show that on current policies, demographic developments are likely to exercise considerable pressure on the public finances by the end of the present decade. Given the compounding effects of the feedbacks among taxation and economic growth, early action to contain expenditure would be very effective, while delay is likely to cause harm.

Stochastic simulations

102. Adding random shocks (to productivity, investment, and health care spending) provides additional insights into the range of outcomes that the model is capable of generating if current entitlement policies are not reformed. The methodology employed allows for an assessment of the entire probability distribution of outcomes for all variables in the model.[20] The relevance of the results will of course depend on whether the means and standard deviations of the random variables were chosen appropriately; and whether the model used for the simulations adequately represents the economic process being examined.

103. The main sources of uncertainty in the stochastic simulations are annual shocks to total factor productivity, investment and health care spending, and uncertainty about the magnitude of certain key parameters (in particular about those governing the strength of the feedback from taxation to investment and labor supply). A sample size of 1000 was chosen for the simulations to allow adequate convergence. Summary statistics of the distributions for some key variables are shown in Table II-2.

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[20]All random variables were assumed to be normally distributed with means and standard deviations derived from regressions on historical data. For the sake of simplicity and tractability, it was assumed that the various sources of uncertainty are statistically independent of one another. However, this assumption also motivated the decision to limit, to just a few key variables, the sources of uncertainty in the model.

Table II-2. France: Long-Run Effect of Current Policies - Stochastic Simulations

	Minimum	Maximum	Mean	Standard Deviation	Lower quartile 1/	Upper quartile 1/
Without fiscal-macro feedback						
Real GDP						
Average growth rate						
1997-2050	1.9	2.6	2.2	0.1	2.1	2.2
2040-2050	1.5	3.0	2.1	0.2	1.9	2.2
Level in 2050 2/	10395	14928	12234	608	11822	12602
Present value 3/	145.0	166.1	155.4	3.2	153.1	157.6
Employment rate in 2050 4/	66.2	66.2	66.2	0.0	...	...
General government expenditure 5/	63.7	77.8	68.6	2.0	67.3	69.7
of which: Pensions 5/	23.3	27.3	25.7	0.5	25.4	26.0
Health 5/	7.1	19.3	11.1	1.8	9.8	12.1
Public debt 5/	44.5	85.8	62.0	5.7	58.3	65.4
Unfunded pension liability 6/	246.6	263.2	254.5	2.7	252.6	256.2
With fiscal-macro feedback						
Real GDP						
Average growth rate						
1997-2050	0.3	1.2	0.8	0.1	0.7	0.9
2040-2050	-1.2	0.5	-0.3	0.3	-0.5	-0.1
Level in 2050 2/	4550	7223	5813	449	5493	6112
Present value 3/	120.9	139.9	129.6	3.4	127.2	131.9
Employment rate in 2050 4/	54.7	60.3	58.4	0.8	58.0	59.0
General government expenditure 5/	76.4	104.2	86.3	4.0	83.5	88.5
of which: Pensions 5/	34.1	43.5	38.1	1.5	37.1	39.1
Health 5/	8.1	23.5	12.6	2.1	11.2	13.8
Public debt 5/	111.3	240.7	159.5	18.9	146.6	170.9
Unfunded pension liability 6/	255.4	276.5	265.5	3.6	263.0	267.8

Source: Staff calculations. Sample size was 1000.

1/ 25 percent of the simulation results lie below (above) the lower (upper) quartile.
2/ In billions of 1980 francs. For purposes of comparison, the 1997 figure is F 3800 billion.
3/ In trillions of 1980 francs. Discounted using a real rate of 3.5 percent per annum.
4/ In percent of working-age population.
5/ In 2050, percent of GDP. The ratios to GDP in 1996 are 54.5 percent for total expenditure, 12.5 percent for pensions, and 6.9 percent for health.
6/ In percent of 1996 GDP; discounted at a real rate of 3.5 percent per annum.

104. In the absence of feedback between real and fiscal variables, the outcomes in the stochastic simulations tend to fall in a relatively narrow range. For example, in 50 percent of all cases, the annual growth rate of real GDP toward the end of the period under consideration is between 2.1 and 2.2 percent, while the share of pension expenditure in GDP lies between 25 and 26 percent.[21] With the rather rigorous deficit target (1 percent of GDP) and high revenue adjustment parameter, the public debt ratio rarely exceeds 65 percent of GDP, and the average over time of the growth rate of real GDP almost always remains positive.

105. As in the non-stochastic simulations, the results are rather different when allowance is made for feedback between real and fiscal developments. In more than half of all cases, the economy is shrinking toward the end of the forecast horizon; and general government expenditure becomes very high, relative to GDP. The elevated levels of taxation also induce a considerable fraction of the available workforce to opt out of the labor market.

106. It is conceivable that there might be resistance to the tax increases needed to hold the deficit and public debt to an acceptable level. This can be modeled by assuming that a relatively smaller fraction (one-eighth) of deviations from the deficit target are eliminated in any given year.[22] [23] Though employment is almost 10 percent higher than in the basic scenario with feedback (as taxes are lower), there is a 25 percent probability that the public debt would exceed 180 percent of GDP, and a 10 percent probability that it would exceed 220 percent of GDP. While the model does not endogenously model inflation, there would be pressure to dissipate by one means or another the real value of obligations at the very high levels of public debt that could well arise as a result of resistance to ever-higher taxation.

107. The risks outlined in this section argue for strong efforts to contain the growth of entitlement spending. The following section outlines some of the possible reform options and discusses their likely economic consequences.

E. Options for Reform

108. Against the background of the baseline simulations, the control of pension and health care entitlements appears as an important condition for maintaining incentives for work, investment, and innovation; and indeed as necessary for the preservation of effective social security. Needless to say, they may be usefully complemented by objectives for the general government balance that promote a sustainable debt trajectory, and by labor and product market policies that favor a more robust growth of incomes and employment.

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[21]Compared with Chand and Jaeger (1996), the unfunded pension liability is considerably higher, at 250 percent of GDP.

[22]Compared with about one-quarter in the basic scenario.

[23] One could also assume that the deficit target gradually drifts upward.

109. As illustrated in the previous section, the problems caused by aging are most pronounced in the area of pension expenditure. Pension reform is consequently given the most attention in what follows. With higher life-expectancy and adverse demographics, pension systems will need to lower the implicit rate of return they offer to their participants. This can be achieved in many different ways, for example by raising the contributions paid by those who are working, increasing the age or contribution period needed to obtain a full pension, cutting the replacement rate of current or future recipients, or reducing the indexation of pensions. For the sake of tractability, only two basic types of pension reform are examined in what follows: (1) a change in indexation rules and (2) an increase in the age of eligibility for a full pension from 60 to 65 years, and a corresponding increase in the period of contribution, spread over a period of 10 years.

110. Consideration is also given to the potential impact of health care reform, though this is more difficult to quantify. As was noted earlier, health care expenditure had tended to rise more quickly than GDP, even once the effect of population aging has been allowed for. Viewed this way, the objective of health care reform would be to reduce the excess in the growth rate of health care spending.

Pension indexation

111. Different indexation rules for pensions have rather different implications for the fiscal accounts, generational fairness, and incentives. In terms of fiscal consequences, indexation on prices is usually considered to be the most economical. However, indexation well below the CPI could prove unsustainable if the standard of living of retired vis-à-vis active workers deteriorates too much over time—a development that could be seen as breaking the intergenerational commitment between generations.[24] Indexation on gross wages tends to be both the most costly and least fair: not only do workers have to support significantly higher pension expenditure, but there is a second-round increase in pensions when contribution rates are raised; thus, the standard of living of workers is decreasing over time vis-à-vis retirees. Finally, indexation on net wages results in greater burden sharing between retirees and active workers and helps to maintain the balance in the standards of living balance between working and retired persons.

112. Currently, indexation rules in France vary from scheme to scheme. Pension schemes for the private sector now index pensions on prices (in the *régime général*) or to prices less 1 percentage point (in the complementary schemes ARRCO and AGIRC since 1996). By

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[24]A system in which a pensioner would experience an erosion, in real terms, of his initial pension by 2 percent per year for, on average, 20 or 25 years may lack credibility. Questions have also been raised about sustained indexing to retail prices only, because of the very wide income differentials that develop among different cohorts of pensioners. In this context, it should be noted that the shift from gross wage to price indexation introduced in 1992 in the *régime général* must be re-examined in 1999.

contrast, public sector pension schemes are indexed on gross wage increases; and there are no explicit rules for the pension schemes of the self-employed.

113. The most recent official report on the pension system (*Perspectives à long terme des retraites*) assesses the savings generated through 2010 by the 1993 reform of indexation in the *régime général*. It is noteworthy that this change was the most important feature of the 1993 reform, as shown below (figures in billions of 1993 francs):

Change in indexation (from gross wages to prices)	128
Extend averaging period for pension base	25
Increase in duration of contributions (from 37.5 to 40 years)	11

114. It should be pointed out that the other two measures will bear most of their fruits well beyond 2010, as the grandfathering of current workers gradually expires.

115. Model simulations were used to assess the effect of changes in indexation rules on the trend of pension expenditure and on macroeconomic performance. Two indexation rules were considered: (1) indexing all pensions on CPI less ½ percentage point; and (2) indexing all pensions on net wages.

116. In the absence of fiscal-macro feedback, the ratio of pension expenditure to GDP in 2050 is about 1 percentage point lower in the first case, and 5 percentage points higher in the second case (Chart II-2). The latter result reflects the fact that net real wages continue to increase.

117. When there is fiscal-macro feedback, reduced inflation indexation generates substantially larger savings, with a ratio of pension expenditure to GDP in 2050 some 4 percentage points lower than in the baseline. This outcome is attributable mainly to the relatively greater importance of scaling back acquired nominal entitlements in a shrinking real economy, but it also reflects the positive feedback effect on growth of lower taxes (Chart II-3). Indexation on net wages is an even more effective cost-saving measure than reduced indexation; it lowers the pension expenditure ratio in 2050 by some 7 percentage points. This result stands in marked contrast to the outcome in the model without feedback, and is explained by the decline in net real wages when there is feedback (the marked increase in taxes that is needed to finance pension spending reduces the growth of both output and gross wages). GDP growth and the employment rate are marginally higher with net wage indexation than with CPI-less-½-percentage-point indexation.

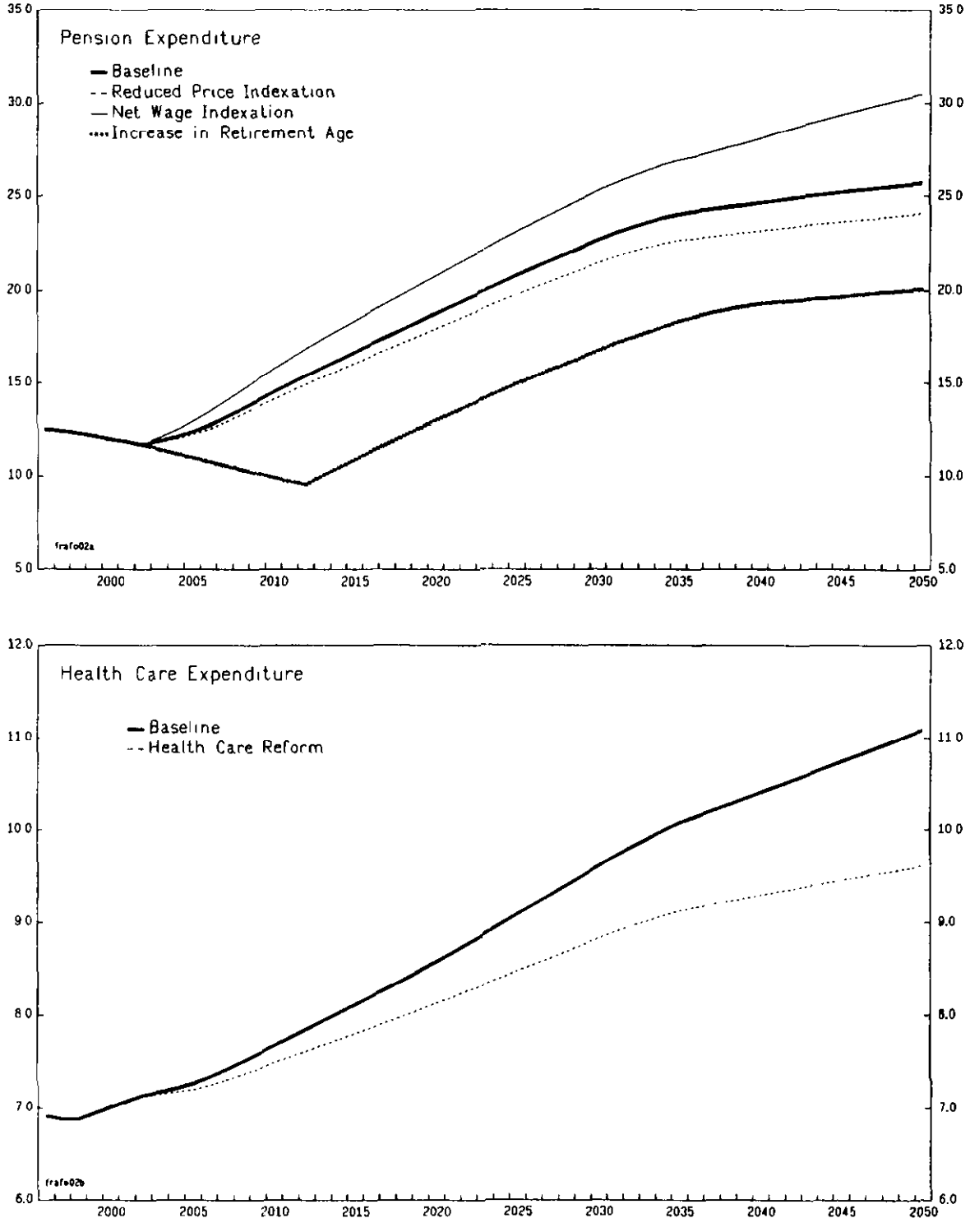
Increase in the retirement age

118. An increase in the retirement age (defined as the age of eligibility for a full pension) has four principal effects: it delays, on average, the time at which a pension begins to be paid; it increases the average time during which contributions are paid; it reduces the average length

CHART II-2
FRANCE

Projected Expenditure, Without Feedback

(In percent of GDP)

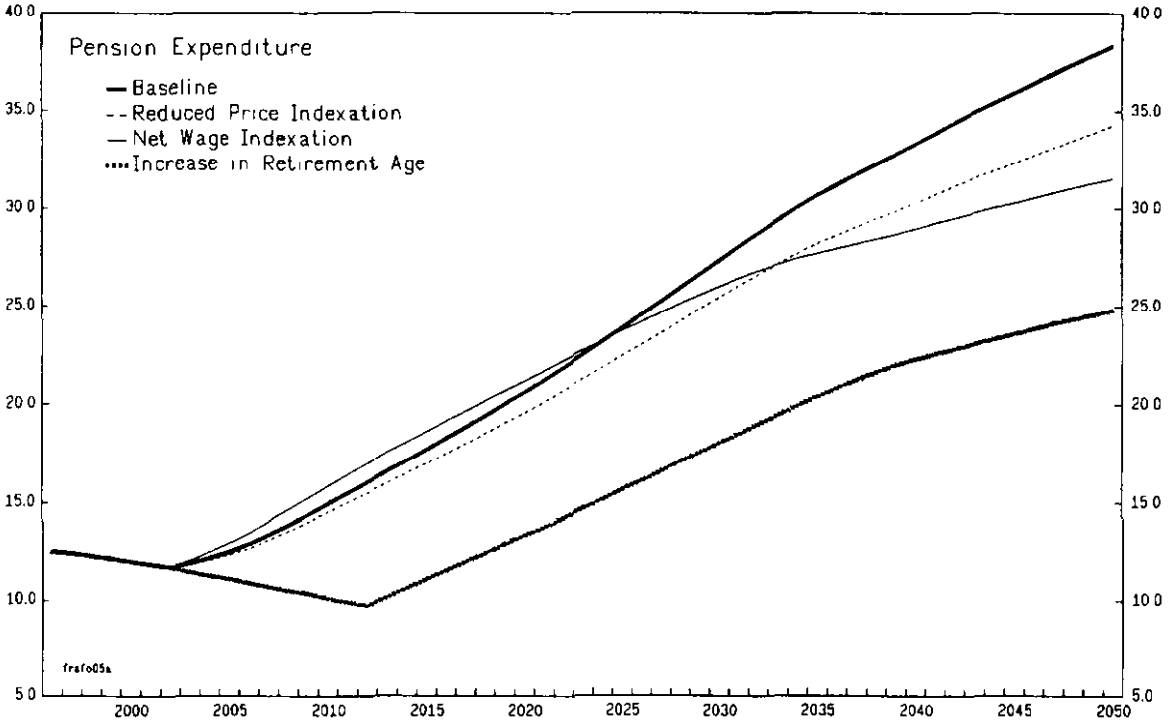


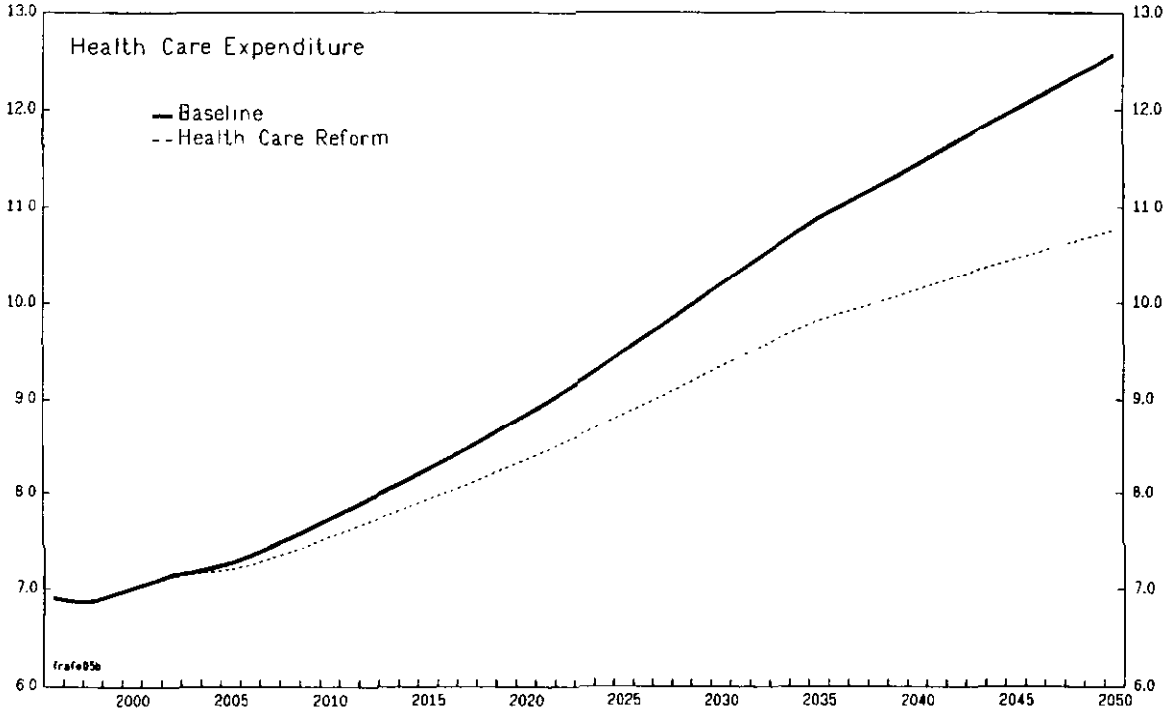
Source: Staff calculations.

CHART II-3
FRANCE

Projected Expenditure, With Feedback

(In percent of GDP)





Source: Staff calculations.

of time for which a pension is paid; and it increases the supply of labor in the economy. It also tends to shift the political balance of power away from interest groups representing retirees and toward taxpayers.

119. Conceptually, the effective retirement age is distinct from the legal retirement age, which is only one of the factors by which it is determined. Other influences on the effective retirement age include (1) the replacement rate of pensions and the way in which it depends on age and length of service, (2) the extent and generosity of pre-retirement schemes (which may cause moral hazard and reduce the employment of older workers), (3) rules under which firms manage the work force (relying more or less on elder workers), and (4) the average age at which persons enter the labor market.

120. Over the last two decades, France has experienced a marked decline in the effective retirement age, a development that can be attributed largely to changes in policy: the lowering of the legal retirement age in the early 1980s (for the most part to 60, and currently one of the lowest among the industrial countries), the development of extensive pre-retirement schemes as a means of reducing measured unemployment, and a growing reluctance to use older workers (owing mainly to their relatively lower level of education and pay systems based on seniority).[25] Together, these policies have contributed to a strong withdrawal of workers aged 55 and above from the labor market. Moreover, this withdrawal took place against the background of an ongoing increase in life expectancy. Altogether, France now exhibits one of the highest non-employment rates among the major industrialized countries, especially among the young and the old:[26]

Non-employment Rates - International Comparison

	15 to 24	25 to 54	55 to 64
Canada	47	24	56
France	78	23	66
Germany	52	23	62
Italy	74	35	73
Japan	55	21	36
United Kingdom	55	23	52
United States	42	20	45

Source: OECD Employment Outlook, July 1996. Figures refer to 1995.

[25]The various early and pre-retirement schemes, including DRE provisions in unemployment benefits and arrangements for an early pension in the *régimes spéciaux*, pose a serious moral hazard problem, as they allow firms to eliminate older workers at virtually no cost to themselves (or to the workers).

[26]Among the young, the high non-employment rate has been caused mainly by a minimum wage that is in excess of the productivity of many inexperienced workers.

121. Policies to foster an increase in the rate of employment in France to the same level as in the United States or the United Kingdom (around 55 percent for young persons and 50 percent for old persons) would raise the active population by some 3 million in 1995, an increase of well over 10 percent.

122. A change in policy would also be needed to reverse the decline in the effective retirement age. One possibility would be to raise the legal retirement age, say from 60 to 65 in the course of 10 years, or possibly further.[27] Another possibility would be to take a more "actuarial" approach and increase the duration and amount of contributions needed for eligibility for a full pension (a first step was already made in the reform of the *régime général* in 1993), dropping any reference to a legal retirement age.

123. Indeed, the latter may be preferable by allowing for greater flexibility in the transition between labor and retirement and reducing the incentives workers have to withdraw prematurely from the labor market.[28] Indeed, should it become necessary to broaden the tax base by encouraging labor force participation, workers up to a certain age (perhaps as high as 70) might be rewarded with a higher than actuarially balanced pension if they chose to postpone retirement (while there would be a penalty for choosing early retirement). Another advantage of basing pensions on the length of contributions is that it results in a fairer distribution between workers who entered the labor market early (and who have a lower life expectancy) and those who delayed their entry into working life (and who acquired more human capital and increased their life expectancy).[29] It may also be argued that working until a

[27] An interesting calculation is to adjust the retirement age so that the old-age dependency ratio remains constant at its 1995 level (for this purpose, one calculates the ratio of people from 20 to retirement age to people above retirement age). The results are the following:

Year 2000: retirement age stabilizing the "dependency" ratio= 61
Year 2010:- -= 62
Year 2020:- -= 65
Year 2030:- -= 68
Year 2040:- -= 69
Year 2050:- -= 70

[28] A fixed retirement age may also reduce the employability of older workers by signaling to employers that investments in on-the-job training and experience may not be worthwhile, raising the risk of a vicious circle: dropping older workers creates pressures to institutionalize a lower effective retirement age, which in turn leads employers to drop workers even earlier.

[29] Life expectancy at the time of retirement is still increasing and entry into the labor market is being further and further delayed by schooling (taking into account unemployment and participation by age, the duration of work over the life cycle for an average wage-earner in

(continued...)

higher age imposes fewer hardships than in the past owing to the progressive disappearance of heavy physical labor.[30]

124. Simulations illustrate the effect of an increase in the effective retirement age from 60 to 65 over the course of 10 years, beginning in 2002 (Charts II-2 and II-3). Such an increase would have a considerably larger effect on the growth of pension spending than the changes in indexation contemplated earlier. In the absence of fiscal-macro feedback, the ratio of pension spending to GDP would be almost 6 percentage points lower than in the baseline. The effects are even more pronounced once the second-round effects on labor supply and economic growth are taken into account: real GDP growth remains substantially stronger, most notably during the transition to the higher retirement age but also thereafter; and the employment rate is significantly higher (this translates into an even bigger increase in the absolute value of employment as the working-age population is gradually redefined to allow for the increase in the effective retirement age).

A comprehensive adjustment package: pensions and health care

125. Thus far, the effects of different reform options have been examined separately. None of the possibilities examined was by itself sufficient to produce satisfactory outcomes. Moreover, in a context where there is feedback between real and fiscal variables, the beneficial effects of policies to restrain expenditure and deficits are more than the sum of their parts.

126. Against this background, a comprehensive reform package was examined, consisting of the following elements: (1) an increase in the retirement age from 60 to 65 years, phased in over a decade; (2) indexation on prices less ½ percentage point; and (3) a health care reform package that reduces the non-demographic annual trend rate of growth in spending by 0.3 percentage points.[31]

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[29](...continued)
France ranks ninth out of 14 among the principal OECD countries, largely owing to low participation rates for both young and old persons).

[30]Even so, many older people may not be able to work productively at a full-time job, or at the most demanding jobs. Allowing older people to draw a partial pension while continuing to work part-time (and continuing to contribute to the pension system) could be a remedy. It will also be important to reform labor market institutions to facilitate part-time work by older persons, for example by providing fiscal incentives for training of older persons (possibly financed by the elimination of pre-retirement schemes), and stronger laws against age discrimination in employment.

[31]The last objective could presumably be achieved by implementing some or all of the following measures: (1) closing underutilized hospitals; (2) creating regional medical centers

(continued...)

127. The consequences of implementing such a package appear beneficial (Charts II-4 and II-5). When there is feedback from fiscal to real variables, the ratio of general government expenditure to GDP is some 22 percentage points lower at the end of the simulation period, the level of real GDP is more than 60 percent higher, and the employment rate improves by some 5 percentage points. Nonetheless, the expenditure ratio, at over 60 percent of GDP, is still very much on the high side; and the employment rate is substantially lower than in 1997. A possible conclusion is that the effective retirement age would need to rise further, to 67 years or more. In addition, if there is sufficiently strong negative feedback from taxation to economic growth, pensions might be indexed to net wages instead of prices.

128. Moreover, it would appear that every effort will need to be made to hold down the growth of other public expenditure, to perhaps one-half the rate of real GDP. To achieve this, public employment would need to be reduced substantially over time, for example through attrition. By contrast, prolonged public sector wage restraint would probably not contribute much to reducing personnel outlays, as it could lead to the emergence of differentials between public and private sector pay that cannot be credibly sustained.

129. Stochastic simulations were carried out in order to gain a better understanding of the sensitivity of this projection to changes in parameter assumptions and random shocks. Compared to the unchanged policy scenario with feedback (Table II-2), the outcome is unambiguously improved (Table II-3). Notably, the growth rate of real GDP is ½ percentage point higher, and even more so toward the end of the period under consideration. Almost as importantly, the standard deviation of many variables declines markedly, implying that adjustment also reduces the riskiness of the outlook.

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[31](...continued)
to improve capacity utilization for expensive equipment and improve health outcomes by allowing staff to gain greater experience in difficult procedures; (3) making more use of generic medicines (this presupposes strict quality standards to maintain confidence); (4) periodically reinforcing the controls imposed by the 1996 health care reform on the practices of individual physicians; (5) limiting the number of university places and licenses for new physicians; and (6) subjecting new medical technology to a strict cost-benefit analysis, with public financing being made available only for the adoption and use of technology that meets this test. See "Health Expenditure", Section I of France - Selected Issues (SM/96/249) for a detailed discussion of these issues.

F. Conclusions

130. This paper has examined some of the possible implications of population aging for the public finances. It has extended earlier studies by embedding the fiscal accounts in a model of aggregate supply in which fiscal policy can affect the prospects for economic growth. A review of the theoretical and empirical literature on long-run economic growth suggests that distortions created in financing rising entitlement spending can have a negative and cumulatively significant effect on economic prosperity.

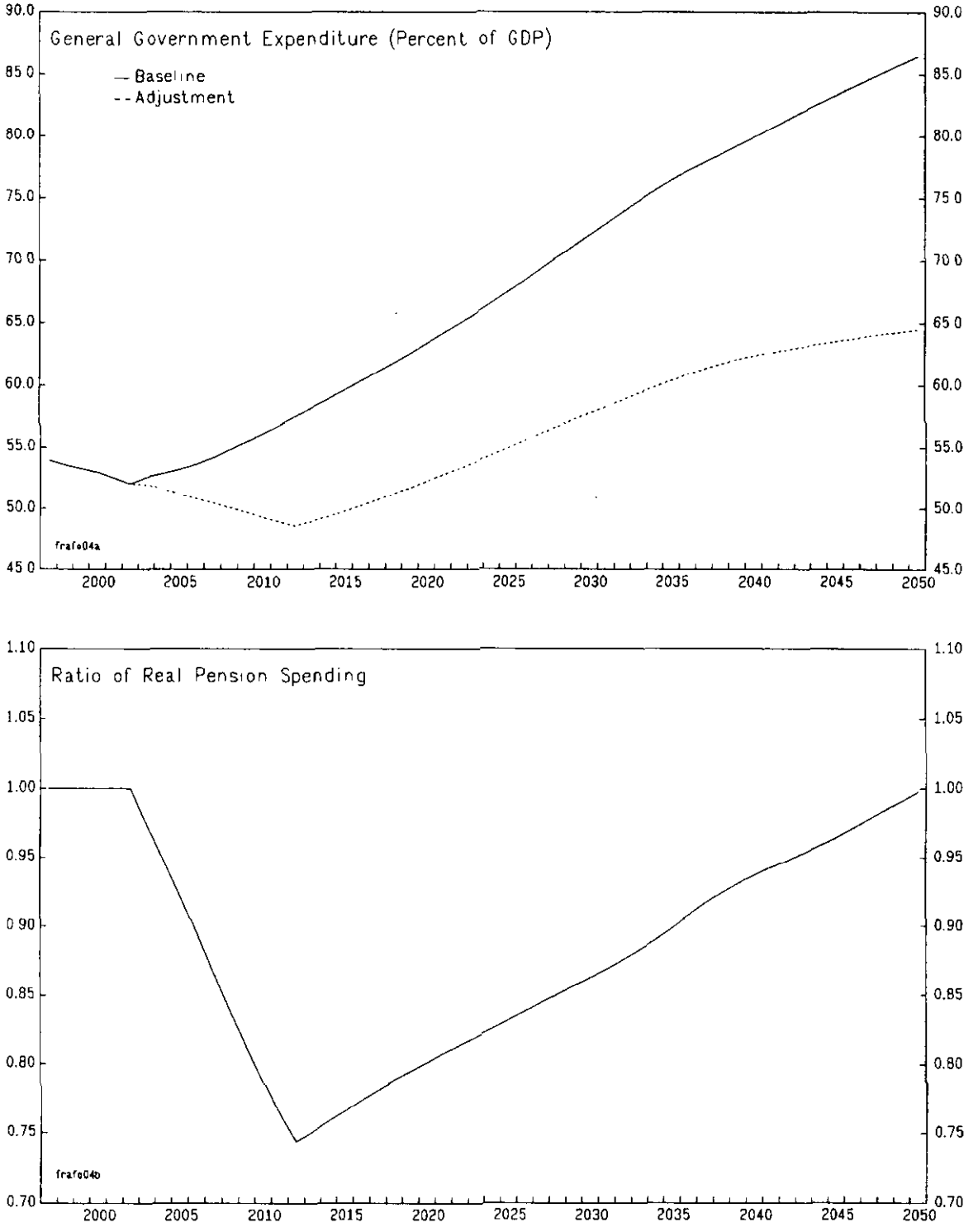
131. The paper begins by confirming the conclusion reached in other studies: absent measures to restrain the growth of spending, public outlays on pensions and health care would rise very substantially by the end of the present decade, owing to the anticipated aging of the population. When there is no feedback from the fiscal burden to long-run economic growth, the ratio of general government expenditure to GDP increases by about ½ percent of GDP per year, each year, for at least the next 30 years. Thus, keeping the general government deficit within Maastricht bounds would require the adoption of substantial adjustment measures at regular intervals.

132. If the needed adjustment were to rely primarily on raising the ratio of revenue to GDP in order to match the increase in pension and health outlays, negative feedback from higher taxes to investment, labor market performance, and economic growth could well come into play. This feedback would worsen the overall outlook, not merely because public revenue and expenditure might rise to unsustainable levels, but because it would curtail long-run economic growth and reduce the prosperity that future generations are able to achieve.

133. Possible reforms would need to focus on restraining the growth of pension outlays, which account for the bulk of the likely increase in public expenditure. One way or another, it will be necessary to reduce the implicit rate of return that pension systems offer to their participants; this should probably be done in a way that takes account of intergenerational equity. Given the constant pressure that demographic developments will in the next few years begin to put on the public finances, another conclusion would be that a strategic plan to contain the growth of expenditure is needed to limit the risk of a damaging runup in public sector deficits, debt, and taxation.

CHART II-4
FRANCE

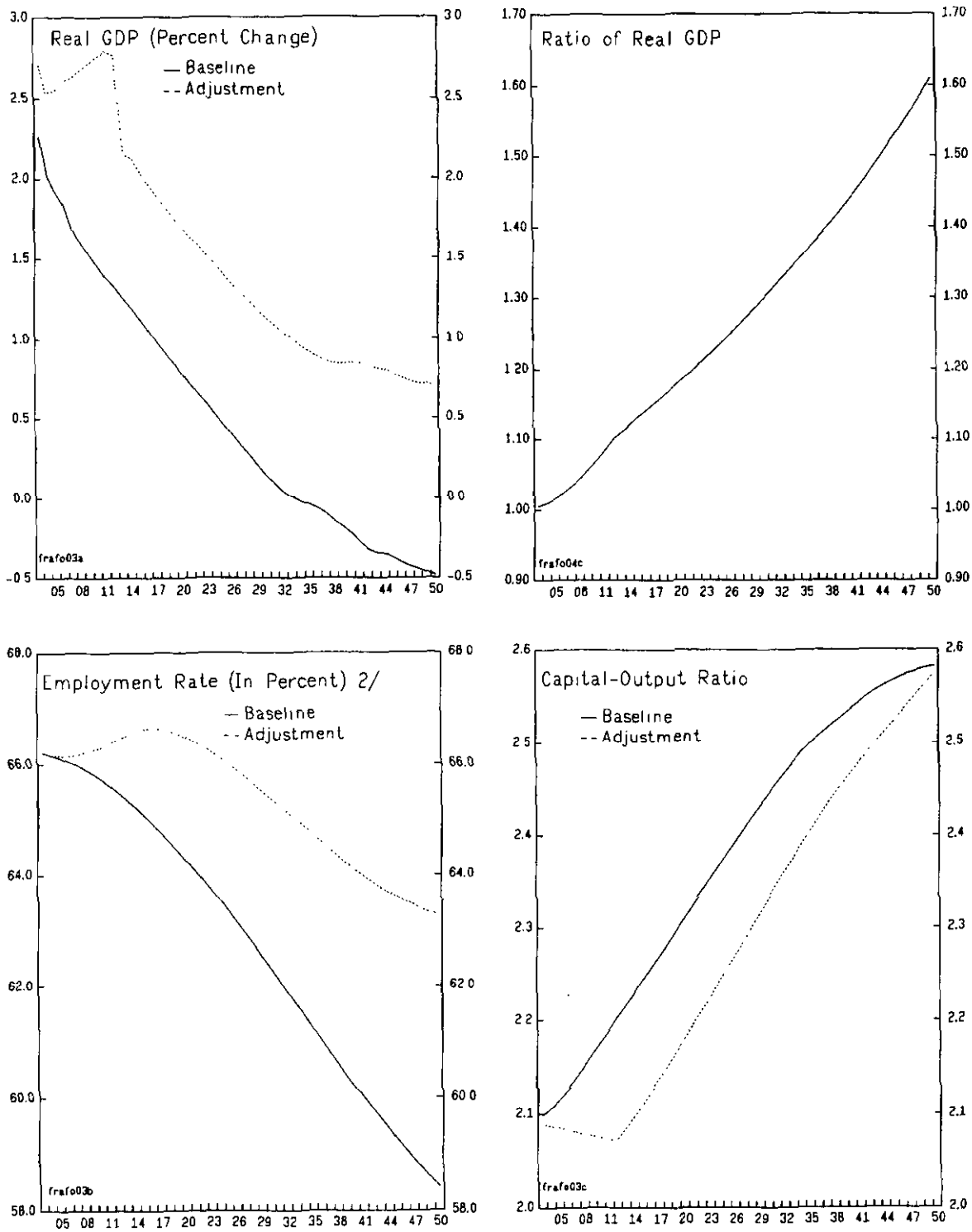
Effects of Comprehensive Adjustment on Public Finance 1/



Source: Staff calculations
1/ With feedback from fiscal to real variables

CHART II-5
FRANCE

Effects of Comprehensive Adjustment on Real Economy 1/



Source: Staff calculations
1/ With feedback from fiscal to real variables.
2/ Employment as a percent of working-age population.

Table II-3. France: Long-Run Effects of Pension and Health Care Reform - Stochastic Simulations 1/

	Minimum	Maximum	Mean	Standard Deviation	Lower quartile 2/	Upper quartile 2/
Comprehensive adjustment package 3/						
Real GDP						
Average growth rate						
1997-2050	1.2	2.3	1.7	0.2	1.6	1.8
2040-2050	0.0	1.8	0.8	0.3	0.6	1.0
Level in 2050 4/	7315	12834	9340	832	8759	9868
Present value 5/	137.1	167.7	151.1	5.1	147.5	154.3
Employment rate in 2050 6/	61.0	64.4	63.3	0.5	63.0	63.6
General government expenditure 7/	60.3	75.9	64.4	2.2	62.9	65.7
of which: Pensions 7/	20.2	25.0	22.5	0.7	22.0	23.0
Health 7/	6.0	16.5	9.0	1.4	8.0	9.8
Public debt 7/	55.8	125.3	78.3	8.7	72.3	83.2
Unfunded pension liability 8/	73.5	88.7	81.5	2.3	80.1	83.1
Differences from baseline						
Real GDP						
Average growth rate						
1997-2050 9/	0.9	1.1	0.9	0.1	0.9	0.9
2040-2050 9/	1.2	1.3	1.1	0.0	1.1	1.1
Level in 2050 4/	2765	5611	3527	383	3266	3756
Present value 5/	16.2	27.8	21.5	1.7	20.3	22.4
Employment rate in 2050 6/	6.3	4.1	4.9	-0.3	5.0	4.6
General government expenditure 7/	-16.1	-28.3	-21.9	-1.8	-20.6	-22.8
of which: Pensions 7/	-13.9	-18.5	-15.6	-0.8	-15.1	-16.1
Health 7/	-2.1	-7.0	-3.6	-0.7	-3.2	-4.0
Public debt 7/	-55.5	-115.4	-81.2	-10.2	-74.3	-87.7
Unfunded pension liability 8/	-181.9	-187.9	-184.0	-1.3	-182.9	-184.7

Source: Staff calculations. Sample size was 1000.

1/ Including feedbacks between fiscal and macroeconomic variables.
2/ 25 percent of the simulation results lie below (above) the lower (upper) quartile.
3/ Increase in the standard retirement age to 65 years, reduction in pension indexation by 1/2 percentage point annually, and health care reform.
4/ In billions of 1980 francs. For purposes of comparison, the 1997 figure is F 3800 billion
5/ In trillions of 1980 francs. Discounted using a real rate of 3.5 percent per annum.
6/ In percent of working-age population.
7/ In 2050; percent of GDP. The ratios to GDP in 1996 are 54.5 percent for total expenditure, 12.5 percent for pensions, and 6.9 percent for health.
8/ In percent of 1996 GDP; discounted at a real rate of 3.5 percent per annum.

STOCHASTIC SIMULATIONS OF LONG-TERM FISCAL OUTLOOK

134. This appendix first describes the structure of the model, then its calibration to the data, and finally the methods used to carry out the stochastic simulations. A key feature of the model is the interaction between developments in the public finances and the real economy.

Structure of the model

135. The model has two interrelated blocks dealing with the real economy and the fiscal accounts. The key relationship on the ***real side*** is the production function

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}$$

where A_t is total factor productivity, L_t is labor input, and K_t is the capital stock. Total factor productivity (TFP) grows at an exogenous rate γ in the version of the model without feedbacks from fiscal to real variables. When there are such feedbacks, it develops in accordance with

$$\Delta \ln A_t = \beta \Delta \ln K_t + \epsilon_t^A$$

136. Thus, TFP depends on the capital stock, an effect that is considered to be external to firms, as is standard in models of endogenous growth.[32] The stochastic shock is assumed to be i.i.d. with mean zero. As indicated above, the estimation of the parameters is discussed in the following section.

137. The capital stock, and by implication investment, is determined by

$$\Delta \ln K_t = \phi \alpha \frac{Y_t}{K_t} (\theta_0 - S_t^{rev}) + \epsilon_t^K$$

where S_t^{rev} is the share of general government revenue in GDP. The stochastic shock is assumed to be i.i.d. with mean zero. The equation says that the increase in the capital stock depends on the marginal product of capital, adjusted for the excess aggregate tax burden. The critical parameter is θ_0, which determines the threshold level of the tax burden beyond which the capital stock begins to decline. This functional form captures the behavior of the capital

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[32]Growth models with endogenous productivity increase became widely accepted following the publication of Romer (1986). A detailed discussion may be found in Barro and Sala-i-Martin (1996).

stock quite well and is broadly consistent with the predictions of models of capital formation in which there is an adjustment cost to the capital stock.[33]

138. Labor input is by definition equal to $L_t = \lambda_t PNR_t$ where λ_t is the employment rate and PNR_t is the population that is not retired. When there are no feedbacks from fiscal to real variables, the employment rate is assumed to remain constant at its level in 2002 throughout the simulation period. When there is feedback, the employment rate would in principle depend on gross wages, the tax burden borne by non-retired persons, and the design and level of unemployment and other social benefits available to non-retired persons. As discussed below, empirical estimates reveal all of these factors besides the aggregate tax burden to be statistically insignificant, so the functional form used is the following:

$$\Delta\lambda_t = \eta \ \Delta S_{t-1}^{rev}$$

139. The production function and the equations for TFP, the capital stocks, and labor input constitute the real side of the model. Several additional indicators can be derived from the production function. First, the real gross wage is determined by marginal productivity conditions, i.e.,[34]

$$w_t = (1-\alpha) \ \frac{Y_t}{L_t}$$

and the real net wage as

$$w_t^{net} = (1 - S_t^{rev}) \ w_t$$

where S^{rev} is the share of general government revenue in GDP. This implictly assumes that the tax system is balanced between taxes on labor and capital income. The real interest rate may also be related to marginal productivity conditions

$$r_t = \mu \ \alpha \ \frac{Y_t}{K_t}$$

[33]The Annex provides some background on the microfoundations of this equation.

[34]In this model, unemployment is not modeled explicitly. However, the non-employment rate, which is a composite of labor force non-participation and unemployment, is.

where μ is a coefficient needed to calibrate the marginal productivity of capital to the observed real long-term rate of interest.[35] The nominal rate of interest can, of course, be calculated as $i_t=(1+r_t)(1+\pi_t)-1$, where π is the rate of inflation (assumed to be constant and exogenous to the model).

140. The ***fiscal side*** of the model disaggregates expenditure into four categories: interest, health, pensions, and other.[36] In order to capture the effect of population aging, health expenditure in turn is divided between young persons and old persons. Revenue is not disaggregated; this entails no loss of generality as the shares of capital and labor income in the economy are constant with a Cobb-Douglas production function. Thus, overall expenditure is given by

$$E_t = E_t^{interest} + E_t^{health} + E_t^{pension} + E_t^{other}$$

141. Interest payments are calculated on the average of beginning-of-year and end-of-year debt stocks

$$E_t^{interest} = i_t \frac{D_{t-1} + D_t}{2}$$

142. As indicated above, health spending is disaggregated by demographic group

$$E_t^{health} = E_t^{health,\ young} + E_t^{health,\ old}$$

143. In each group i, per capita spending grows in proportion to gross wages and an additional factor b_t which captures the historical excess in the growth of health care spending over what can be explained by growing income and by demographics:

$$E_t^{health,\ i} = E_{t-1}^{health,\ i} (1 + b_t) \frac{w_t^{nom}}{w_{t-1}^{nom}} \frac{Pop_t^{i}}{Pop_{t-1}^{i}}$$

144. For the purposes of the simulations, b_t is in general taken to be a random variable.

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[35]The two may differ because of taxes and other elements of the cost of capital.

[36]All public finance variables are expressed in current price terms to facilitate inflation accounting and continuity with historical series.

145. The computation of pension spending is accomplished in several steps. First, the relevant demographic profiles are established. It is assumed that at any point in time t, a fraction of the population of a given age a is not retired. Thus, the non-retired population at t is given by

$$PNR_t = \sum_{a=0}^{100} w_{ta} P_{ta}$$

146. For example, for an unchanged standard retirement age of 60, the coefficients w_{ta} at each point in time are unity up to age 54, and zero for age 65 and above; and they assume the following values for ages 55 to 64:

Age	55	56	57	58	59	60	61	62	63	64
w_{ta}	0.90	0.80	0.70	0.60	0.50	0.20	0.10	0.07	0.04	0.02

147. Of course, when an increase in the retirement age is being modeled, this profile would shift over time.

148. Using the coefficients $r_{ta}=(1-w_{ta})$, it is also possible to calculate the gross flow of new retirees of each age in each period:

$$R_{ta}^{new} = (r_{ta} - r_{t-1,\, a-1}) P_{ta}$$

Then, the total number of persons of all ages beginning to draw a pension in period t is

$$R_t^{new} = \sum_{a=0}^{100} R_{ta}^{new}$$

149. On the assumption that all persons entering retirement at a given time receive the same pension (this is approximately true now given the prevalence of early retirement schemes), the pensions paid to the cohort of persons retiring at time c are (for the case of pensions indexed on prices)

$$E_{tc}^{pension} = R_c^{new} s_{tc} \omega_c \rho_c w_c^{nom} \frac{p(t)}{p(c)}$$

where ρ_c is the effective replacement rate of pensions, ω_c is the ratio of wages at retirement age to average wages, and s_{tc} is the survival rate table for the (mixed-age) cohort c.[37] Total pension expenditure at time t is then given by:

$$E_t^{pension} = E_{0,init}^{pension} \frac{p(t)}{p(0)} s_{t,init} + \sum_{c=1}^{t} E_{tc}^{pension}$$

i.e., the sum of initial pensions (adjusted for indexation and the survival of recipients) and the sum of pensions paid to persons who have retired between periods 1 and t. Note that in modeling an increase in the retirement age, one is obliged to use the corresponding profiles of cohort survival and availability in the labor force.

150. The fiscal accounts are closed by defining the general government financial balance:

$$B_t = R_t - E_t$$

and the law of motion for the public debt

$$D_t = D_{t-1} + B_t$$

151. What remains to be determined are fiscal policy rules for adjusting revenue and other public expenditure. For the sake of simplicity, it is assumed that these variables are adjusted to approximate an exogenously given target for the fiscal balance, in percent of GDP. Thus, for public revenue, one has:

$$\frac{R_t}{Y_t^{nom}} = \frac{R_{t-1}}{Y_{t-1}^{nom}} - \theta_R \left(\frac{B_t}{Y_t^{nom}} - \kappa_t\right)$$

152. An analogous equation can be written for other government expenditure. The parameter θ_R measures the speed with which fiscal adjustment is undertaken—it can be interpreted as a measure of the "strength" of the adjustment effort, or of the "credibility" of the deficit target. Typically, this parameter will lie between 0 and 1.

Calibration of the model

153. This section provides further information on the estimation of parameter values in the model. The baseline values are summarized in Table II-A1.

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[37]The calculation of the mixed-age survival tables is technical and not described here in full detail.

154. In the *production function*, one sets α=0.4 in accordance with the approximate historical share of labor in GDP. As usual, total factor productivity is calculated as a residual.

155. Estimation of the equation for *total factor productivity* (TFP) began by rewriting it in distributed lag form:

$$\ln A_t = \sum_{k=1}^{n} a_k \ln A_{t-k} + \sum_{k=0}^{n} b_k K_{t-k} + \epsilon_t$$

156. Using the ADF test, unit roots could not be rejected for the levels of the capital stock and total factor productivity; however, unit roots were rejected for the first differences of both of the variables. The model was estimated with n=2 lags using annual data; the test statistics show that the second lag of total factor productivity is not significant. The estimation results are shown in Table II-A2; the model passes the other standard statistical tests (notably those for autoregressivity and normality of the residuals). The long-run elasticity of total factor productivity on the capital stock is about 0.4. Thus, the social production elasticity of capital is close to 0.8, almost double its private value.[38] A unit root was rejected for the error-correction term, showing that the variables are cointegrated. The model was re-estimated in error-correction form, which shows that the short-run elasticity of TFP on the capital stock is close to unity, as would be expected given that measured TFP responds strongly to fluctuations of investment over the business cycle.

157. The *capital stock* equation was estimated in two stages. First, a linear distributed lag model with θ_0=1 was estimated after confirming that a unit root is rejected for all of the variables:

$$\Delta \ln K_t = \sum_{k=1}^{n} a_k \Delta \ln K_{t-k} + \sum_{k=0}^{n} b_k MPK_{t-k}^{net} + \eta_t$$

[38]The social production elasticity in this model falls significantly short of unity, indicating that it would not generate permanent self-sustaining growth (though the transition to the steady state would take quite a long time). The model was re-estimated with a trend term to allow for the possibility that there might be an autonomous element to the growth of TFP; the trend term turned out to be insignificant (p=0.59), and the other parameters were virtually unchanged.

Table II-A1. France: Baseline Model Parameters

Name	Value	Description
α	0.4	Production elasticity of capital
β	0.39	Elasticity of TFP on capital stock
γ	.013	Growth rate of TFP in scenario without fiscal-macro feedback
γ_{min}	0.0	Floor for growth rate of TFP in scenarios with feedback
θ_0	0.8	Threshold level of taxation in investment equation
η	-0.25	Coefficient on taxation in employment equation
ρ	0.52	Effective replacement ratio of pensions
ω	1.25	Ratio of average wage at retirement age to economy-wide average wage
ζ	0.004	Non-demographic excess of health care growth over GDP growth
b_{targ}	-0.01	Target for general government balance/GDP
θ_R	0.2	Revenue partial adjustment coefficient
θ_E	0.02	Other expenditure partial adjustment coefficient
π	0.02	Rate of inflation in long term
υ	0.035	Real rate of time discount

Sources: Staff calculations; data provided by the authorities.

Table II-A2. France: Equation for Total Factor Productivity

(Sample: 1973 to 1996)

(1) Equation in levels

Variable	Coefficient	Std.Error	t-value	t-prob	PartR²
Constant	-0.35959	0.27682	-1.299	0.2103	0.0857
LTFP_1	0.45688	0.17244	2.650	0.0163	0.2806
LTFP_2	0.019480	0.15839	0.123	0.9035	0.0008
LKAP	3.2391	0.47779	6.779	0.0000	0.7186
LKAP_1	-5.2360	0.85978	-6.090	0.0000	0.6732
LKAP_2	2.1968	0.51326	4.280	0.0005	0.5044

R^2 = 0.994249 F(5, 18) = 622.4 [0.0000] σ = 0.00583529 DW = 2.67

(2) Solved static equation in levels

	LTFP =	-0.6867	+0.3817 LKAP
(SE)		(0.2893)	(0.03108)

(3) Other tests

AR 1- 2F(2, 16) =	3.5795	[0.0519]
ARCH 1 F(1, 16) =	0.50458	[0.4877]
Normality $Chi^2(2)$=	1.5403	[0.4629]
X_1^2 F(10, 7) =	0.46441	[0.8689]
RESET F(1, 17) =	1.4723	[0.2416]

(4) Error-correction model

Variable	Coefficient	Std.Error	t-value	t-prob	PartR²
DLTFP_1	-0.019480	0.13735	-0.142	0.8886	0.0010
DLKAP	3.2391	0.40385	8.020	0.0000	0.7628
DLKAP_1	-2.1968	0.39793	-5.520	0.0000	0.6038
ecmkap_1	-0.52364	0.15030	-3.484	0.0023	0.3777

R^2 = 0.866224 σ = 0.00553584 DW = 2.67

(5) Solved static equation for error-correction model

	DLTFP =	+1.022 DLKAP	-0.5136 ecmkap
(SE)		(0.2393)	(0.1934)

(6) Unit root test on error-correction term

Critical values: 5%=-1.957 1%=-2.67

	t-adf	σ	lag	t-lag	t-prob
ecmkap	-2.0398*	0.010644	2	0.12569	0.9012
ecmkap	-2.1118*	0.010392	1	0.22186	0.8266
ecmkap	-2.2013*	0.010165	0		

Source: staff calculations. LTFP and LKAP are the natural logarithms of total factor productivity and the capital stock; the operator D denotes first differences.

158. The equation was initially estimated with n=2 lags, but reduced to the form reported in Table II-A3 after tests showed that neither the second lags, nor the constant term, were statistically significant.

159. In a second stage, non-linear least squares estimation was used to estimate the more general form actually used in the simulations (see above). When no lags of the dependent variable were included, this yielded θ_0=0.51, and 0.3 for the standard error. Taken at face value, this would imply, rather implausibly, that the capital stock in France should begin to decline once the general government revenue ratio reaches 51 percent of GDP. When one lag of the dependent variable was included, an estimate θ_0=1.0 was obtained, with a similar standard error. Based on this, a judgement was made to set θ_0=0.8, a level of taxation which has given rise to serious macroeconomic problems in several other countries.

160. The *employment rate* was modeled in a cross-sectional regression using 1994 data covering 18 industrial countries (Table II-A4). Explanatory variables included the ratio of general government revenue to GDP, the share of women in the labor force, the replacement ratio of social benefits for unemployed persons, and a measure of wage dispersion.[39] [40] The results show that the only statistically significant variables were the general government revenue ratio and the share of women (at the 5 percent and 1 percent levels if the insignificant variables are omitted). The parameters had the expected sign, with higher relative female labor market participation associated with a higher overall employment rate, and a higher tax burden associated with a lower employment rate.

161. These results were confirmed by estimating the regression with the 10-year changes in the employment rate, revenue ratio, and female labor force share. Over this period, the employment rate, the share of women in the labor force, and the tax burden have all increased (on average for the countries in the sample). The coefficients once again had the expected signs and were significant at the 10 percent level. The wage dispersion measure also had some explanatory power, with greater wage dispersion associated with a higher employment rate.

162. An equation for the employment rate was also estimated on the basis of time-series data for France. The equation was tested down from a general distributed lag model involving,

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[39]Differences in the share of women in the overall labor force are seen as primarily reflecting exogenous differences across countries in social attitudes toward and legal institutions affecting female participation in the labor market. The share of women in the labor force is highest in the Nordic and Anglo-Saxon countries, and lowest in Southern Europe and Japan. Of course, differences in economic conditions (such as relation between the market wage available to women, and the shadow wage of household work) may also play a role in explaining differences in female labor force shares.

[40]The wage dispersion measure is intended to capture the effect of minimum wage laws and other policies (including toward competitive bargaining) that affect the wage structure.

Table II-A3. France: Equation for the Capital Stock

(Sample: 1972 to 1996)

(1) Equation in levels

Variable	Coefficient	Std.Error	t-value	t-prob	PartR²
DLKAP_1	0.90905	0.075655	12.016	0.0000	0.8730
MPKNET	0.28317	0.086149	3.287	0.0035	0.3397
MPKNET_1	-0.27325	0.088099	-3.102	0.0054	0.3142

R^2 = 0.994513 σ = 0.00248288 DW = 1.99

(2) Solved static long-run equation in levels

DLKAP = +0.1091 MPKNET
(SE) (0.02599)

(3) Tests on the significance of each variable

variable	F(num,denom)	Value	Probability	Unit Root t-test
DLKAP	F(1, 21) =	144.38	[0.0000] **	-1.2022
MPKNET	F(2, 21) =	6.8554	[0.0051] **	1.1183

(4) Other tests

AR 1- 2F(2, 19) =	0.57892	[0.5701]
ARCH 1 F(1, 19) =	0.048928	[0.8273]
Normality Chi²(2)=	1.5809	[0.4536]
X_i^2 F(6, 14) =	1.679	[0.1987]
X_i*X_j F(9, 11) =	1.901	[0.1564]
RESET F(1, 20) =	1.1495	[0.2964]

Source: staff calculations. DLKAP is the first difference of the natural logarithm of the capital stock; MPKNET is the output-capital ratio multiplied by one less the ratio of general government revenue to GDP.

Table II-A4. France: Cross-Section Regression for the Employment Rate

	ER94	ER94	DER	DER
Constant	0.385 (3.72)	0.384 (1.92)	-0.033 (-0.917)	-0.133 (-1.08)
GY94	-0.338 (-1.84)	-0.283 (-1.07)		
FEM94	0.559 (4.31)	0.572 (3.76)		
DGY			-0.555 (-1.65)	-0.549 (-1.72)
DFEM			0.491 (1.69)	0.397 (1.41)
RR94		-0.557E-03 (-0.326)		-0.207E-03 (-0.226)
D5D1		0.452E-02 (-0.059)		0.076 (1.606)
R^2	0.554	0.559	0.441	0.562
F	9.32	4.11	5.91	4.17
SSR	0.0538	0.0533	0.0316	0.0248

Source: Staff calculations. Values in parentheses are t-statistics. The regression included 18 industrialized countries (the G-7 plus Australia, Austria, Belgium, Denmark, Finland, Netherlands, Norway, Portugal, Spain, Sweden, and Switzerland). ER94 is the employment rate (employment relative to population aged 15 to 64) in 1994; DER is its ten-year change. GY94 is the general government revenue ratio in 1994 and DGY is its 10-year change. FEM94 is the share of females in the labor force and DFEM is its 10-year change; YP is per capita GDP in 1985 (converted into dollar at purchasing-power exchange rates) drawn from Barro and Lee (1994). RR94 is the replacement ratio of social benefits for unemployed persons; and D5D1 is the ratio of wage earnings of persons in the fifth decile relative to persons in the first decile. The last two variables were drawn mainly from OECD (1996).

in a variety of combinations, benefit and tax ratios, the female labor force share, wage indicators, and so forth. It was found that most of the explanatory variables were highly collinear, and that only the net real wage and the general government revenue ratio had significant explanatory power, but only when one of these variables, not both, were included in the model. Given this choice, it was decided to use the general government revenue ratio (Table II-A5). A long-run coefficient of about -0.5 was found.

163. In both sets of cross-country regressions, and in the time series estimates, the parameter on the tax variable ranged from about -¼ to -½. In parametrizing the model, the lower value was chosen, both out of general caution but also to guard against possible omitted-variable bias. In particular, it is conceivable that the effective retirement age in various countries is related to both the measured employment rate and to the general government revenue ratio: earlier retirement would lower the employment rate while increasing pension expenditure and the taxes needed to finance it. Consistent data on the effective (as opposed to the legal) retirement age in various countries is not readily available.

164. The parameters for the *pension system* were based largely on information found in the official study *Perspectives à long terme des retraites* (see notably Table 41 in that publication for the replacement ratio). Data on health consumption by age were drawn from the *Enquête santé 1980* (summarized in Economie et Statistique), which suggest that older persons (60 years and above) consume about 1.6 times more health care services per capita than younger persons. This implies that in the second half of the 1990s, older persons account for about 30 percent of all health care spending, and younger persons for 70 percent.

165. The coefficient μ, which links the marginal productivity of capital with the *real interest rate*, was chosen to smoothly splice the two series in the year 2003, which is the first year of the model simulations.

Stochastic Simulations

166. To conduct the stochastic simulations, uncertainty was introduced by means of the shock terms in the total factor productivity and investment equations, and by allowing for parameter uncertainty in those equations. Uncertainty was also allowed for in the trend term in the health insurance equation; it will be recalled that this term captures that part of the longer-term increase in health care costs that cannot be attributed to demographics. All random variables were assumed to be normally distributed.

167. By and large, the estimates of the means and variances of the distributions used were derived from the regression estimates. The standard deviations used are summarized in Table II-A6. One methodological issue that arises is whether there is a non-zero covariance between any of the random variables being considered. For the sake of simplicity and tractability, it was assumed that the various sources of uncertainty are statistically independent of one another. However, this assumption also motivated the decision to limit, to just a few key variables and parameters, the sources of uncertainty in the model.

Table II-A5. France: Equation for the Employment Rate

Dependent variable: ER
(Sample: 1972 to 1996)

(1) Equation in levels

Variable	Coefficient	Std.Error	t-value	t-prob	PartR²
Constant	0.26025	0.059901	4.345	0.0003	0.4618
ER_1	0.73122	0.063189	11.572	0.0000	0.8589
GGRY	-0.21041	0.048984	-4.296	0.0003	0.4561

R^2 = 0.980392 F(2, 22) = 549.99 [0.0000] σ = 0.00379638 DW = 1.41

(2) Solved static long-run equation in levels

ER = +0.9683 -0.7829 GGRY
(0.04049) (0.0882)

(3) Equation in first differences

Variable	Coefficient	Std.Error	t-value	t-prob	PartR²
DER_1	0.45687	0.15897	2.874	0.0086	0.2642
DGGRY	-0.24825	0.10087	-2.461	0.0218	0.2085

R^2 = 0.487207 σ = 0.00414737 DW = 2.11

(4) Tests of equation in first differences

AR 1- 2F(2, 21) =	1.5385	[0.2380]
ARCH 1 F(1, 21) =	0.034249	[0.8550]
Normality Chi^2(2)=	2.0938	[0.3510]
X_i^2 F(4, 18) =	1.2811	[0.3141]
X_i*X_j F(5, 17) =	2.3761	[0.0828]
RESET F(1, 22) =	4.028	[0.0572]

Source: staff calculations. ER is the ratio of employment to working-age population (in percent); GGRY is the percentage share of general government expenditure in GDP; the operator D denotes first differences.

Table II-A6. France: Standard Deviations for Stochastic Simulations

Standard Deviation of	Value	Description
β	0.03	Elasticity of TFP on capital stock
θ_0	0.1	Threshold level of taxation in investment equation
η	0.2	Coefficient on taxation in employment equation
ϵ_t^A	0.006	Error term in TFP equation
ϵ_t^K	0.005	Error term in investment equation
b_t	0.022	Error term in health care equation

Source: Staff calculations.

168. The simulations take as their point of departure the macroeconomic and fiscal outlook as published in the May 1997 WEO. This scenario ends in 2002; the model is used to simulate developments for the period 2003–2050. A sample size of 1000 was chosen for the simulations to allow adequate convergence of the distributions. In essence, the procedure draws the random variables from a distribution with parameter means given in Table II-A1 and the standard deviations reported in Table II-A6.

A MODEL OF INVESTMENT

169. This annex explains why one might expect virtually all types of taxation to have a negative influence on investment. The point of departure is the standard profit-maximization problem of a representative competitive firm where there is a quadratic adjustment cost to changes in the capital stock

$$J = \max_{\langle K_t, L_t \rangle} \sum_{t=0}^{\infty} \beta_t \left[(1-\theta_t^P)\, F(K_t,L_t) - w_t(1+\theta_t^L)L_t - r_t(1+\theta_t^K)K_t - \delta K_t - \frac{\phi}{2}(K_{t+1}-K_t)^2\right]$$

and where β is the discount factor, K is the capital stock, L is labor, w is the wage, r is the real interest rate, δ is the rate of depreciation of capital, ϕ is an adjustment cost parameter, and the various θ's are tax rates on output, capital, and labor. One obtains the first-order conditions

$$\frac{\partial J}{\partial L_t} = \beta_t \left[(1-\theta_t^P)\, F_L(K_t,L_t) - w_t\,(1+\theta_t^L)\right] = 0$$

which implies that the marginal product of labor is equal to the wage adjusted for taxation, and

$$\frac{\partial J}{\partial K_t} = \beta_t \left[(1-\theta_t^P)\, F_K(K_t,L_t) - r_t\,(1+\theta_t^K) - \delta + \phi\,(K_{t+1}-K_t)\right] - \beta_{t-1}\,\phi\,(K_t-K_{t-1}) = 0$$

170. Noting that $\beta_t = \beta_{t-1} / (1+r_t)$, this first-order condition may be rewritten as

$$I_{t+1} = (1+r_t)\, I_t - \frac{1}{\phi}\left[(1-\theta_t^P)\, F_K(K_t,L_t) - (r_t\,(1+\theta_t^K) + \delta)\right]$$

which is simply the usual partial adjustment model: the change in the capital stock depends on (1) its lagged value and (2) the difference between the marginal product of capital net of product taxes (the first term inside the square bracket) and the interest and depreciation cost of capital including taxes (the second term inside the square bracket). The equation used in the paper attempts to capture key aspects of this equation in a much simpler and more stylized form.

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