Adding Actuarial Estimates of Defined Benefit Pension Plans and Social Security to National Accounts

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Actuarial estimates are needed to provide a full picture of the operations of defined benefit pension plans in the national accounts. This paper develops such estimates for the US along with actuarial estimates of social security for the US and for France. Compared with the current cash measures, the actuarial measures reduce volatility of household income from private DB pension plans, and they raise the estimates of household income from government pension plans substantially. They also change the estimates of the composition household income from government plans, and for Federal plans the downward revision in the estimate of annual compensation income amount to more than $20,000 per active employee. The actuarial measures of social security make possible an international comparison of the US and France. This comparison shows that including actuarial pension income narrows the large gap between the saving rates of the US and France, but the harmonized measures still show that French households save more and have higher ratios of wealth to income.

The paucity of data that might have revealed growing risks to the financial system during the run up to the financial crisis of 2007-2008 has highlighted the need for better data on the entities classified in the financial corporations sector in the System of National Accounts (SNA). For countries with high levels of participation in employer-sponsored defined benefit (DB) plans, national accounts will take an important step toward this objective with the introduction of the new actuarial measures of DB pension plans that are recommended in the 2008 SNA (European Commission, *et al.* 2009). The 2008 SNA (17.191-17.206) also calls for a supplementary table showing actuarial measures of government-sponsored plans that will allow comparisons between countries where employer-sponsored DB pension plans have a major role in providing retirement income and countries where government-sponsored plans predominate. For both kinds of countries the new measures will provide a more complete picture of saving and wealth of households, and of pension expenses and pension liabilities of employers.

In many countries, including the US and France, social security provides a base level of retirement income, with an overlay of a supplementary system of government-sponsored or employer-sponsored pension plans. Social security plans generally differ from other government-sponsored plans in the main features of their benefit formulas (the social security formula may have a benefit ceiling and may consider earnings over virtually the entire working age portion of the life cycle, for example), but the two types of plans have some critical similarities that allow us to treat government-sponsored pension plans as a form of social security. Three noteworthy features of social security and government-sponsored pension plans separate them from employer-sponsored DB pension plans:

(1) Payment of benefits that have been accrued under existing plan rules is not a contractual obligation, so retroactive reductions in the generosity of the benefit formula are possible.[1]

(2) Mandatory participation for broad segments of the population and the negligible chances of a plan freeze or plan termination allow the plan to rely on contributions from future participants to help fund accrued benefits.

(3) Contribution rates are usually fixed by law rather than adjusted as needed to maintain plan funding levels.

Because of the second and third features, analyses of the sustainability of government-sponsored plans must be based on open group projections, where an open group includes future participants in the plan. In particular, the ability to rely on contributions from future participants to pay accrued benefits allows government-sponsored plans covering a growing population of participants to operate on a pay-as-you-go (PAYGO) funding basis, so many of these plans are, or at least once were, PAYGO plans.

The measures of households' actuarial pension wealth used in national accounts will, however, be based on projections for the *closed group* comprising only the current participants in the plan (which include persons currently in covered employment or who are entitled to receive benefits). These measures will allow international comparisons of income, wealth and saving, and for

[1] Based on this criterion, pension plans for general government employees will be treated as government-sponsored plans when member countries of the European Union start to include supplementary actuarial measures of social security and other government-sponsored plans in their national accounts (Eurostat-ECB, 2011, p. 27).

countries with well-developed systems of employer-sponsored DB pension plans, they will also be useful as sustainability indicators. Open group projections are rarely used to measure the sustainability of employer-sponsored DB pension plans because expected contributions from future cohorts of participants are too uncertain to count as an implicit asset. Also, the case of projected benefits that exceeded projected contributions for a cohort of future participants in an employer-sponsored plan would be handled by changing the assumed contribution rate for that future cohort. [2] Because transactions with future cohorts of participants are out of scope, an employer-sponsored DB plan needs to have assets equal to the actuarial value of the benefit claims of the current plan participants to be considered fully funded.

A challenge in developing a single set of international standards for actuarial measurement in national accounts was the diversity of pension institutions that exist in different parts of the world. To explore the implications of institutional diversity, in this paper we develop actuarial measures of pension and social security plans for national accounts for countries that represent the two poles of this institutional diversity, the US and France. In the US, benefit entitlements from employer-sponsored pension plans are a major source of retirement wealth for households and only one industry has a government-sponsored pension plan, but in France DB pension benefits come almost entirely from government-sponsored plans. We therefore develop comparable measures of actuarial values of benefits from social security and government-sponsored pension plans for the US and for France, and for the US we also estimate actuarial values of household's income and wealth from employer-sponsored DB plans. Using these measures, we consider the kinds of international comparisons that are made possible by the new actuarial measures called for in the 2008 SNA.

A warning to bear in mind in using actuarial estimates of DB pension and social security plans, including ours, is that actuarial measures depend on assumptions about interest rates, mortality rates, separation rates and future rates of increase in wages and prices. Also, the pension actuary must choose between an approach that seeks to smooth over the career the accretion of the projected pension wealth at retirement, or an approach that measures the present value of accrued-to-date benefits, which are sometimes defined as the benefits that would be due to plan participants if the plan were to be frozen or replaced with a different plan. In contrast, cash accounting measures, such as the value of the assets in the trust fund or the employer's contribution to the plan, require no assumptions. The objective nature of cash measures is an attractive feature for national accounts purposes. Nevertheless, the ambiguities and uncertainties entailed in actuarial measurement are unavoidable if we want a full picture of the operations of social security plans and pension plans.

1. The Retirement Income Systems of the US and France

1.1 The United States

DB pension and social security are important elements of the retirement income system of the US, but they are not the only important elements. The U.S. retirement income system has four components:

- tax-advantaged accounts not sponsored by an employer, such as Individual Retirement Accounts (IRAs) and annuities purchased from life insurers;

[2] An exception might be made for a pension plan that uses flawed actuarial methods or assumptions that can be projected to result in inadequate contributions for future participants. For example, state and local government plans often use a high interest rate to discount benefit payments, which leads to underestimation of service costs.

- employer-sponsored defined contribution (DC) pension plans, which provide resources in retirement based on the value of the assets in plan;
- employer-sponsored DB pension plans; and
- government social insurance plans, which include a social security plan for the general population, a government-sponsored pension plan for the employees of the railroad industry, and the Pension Benefit Guarantee Corporation (PBGC), which insures the receipt of benefits that have been accrued in private DB pension plans up to a ceiling.

The pension plan components of the system are needed because earnings replacement rates from social security are low for middle and higher earners. Social security has a highly progressive benefit formula and an earnings ceiling ($8,900 per month in 2010) above which earnings are not replaced at all, and it also reduces benefits for retiring before the full retirement age (presently 66 but scheduled to rise to 67). For example, the projected replacement rates in the 2009 Social Security Trustees' Report for prototypical low, middle, and high earners retiring at age 65 in 2010 are 54, 40 and 33 percent of averaged indexed monthly earnings, respectively. Nevertheless, pension plan coverage is far from universal. About half the jobs in the private sector and virtually all government jobs come with a pension plan. In the 2007 Survey of Consumer Finances, 57.7 percent of households had a either a DB or a DC pension plan from a current or former employer (Bucks, Kennickell, Mach and Moore, 2009, p. A24).

Looking at assets held by retirement plans in the US (table 1), in the government sector, DB pension plans predominate, with 4.321 trillion dollars in assets in 2007, compared with just 1.137 trillion in DC plans. For the economy as a whole, DB plans are also more important, with about 7 trillion in assets, compared to about 5 trillion for DC plans. Over the past two decades, however, in the private sector newly established pension plans have been predominantly structured as DC plans, and many DB plans have also been frozen or terminated and replaced with DC plans. As a result, in the private sector, DC plans are now more important than private DB plans. Combining SEP and SIMPLE IRAs (which should be classified as DC pension plans because they are employer-sponsored) with ordinary DC plans gives a total of 3.866 trillion dollars in assets for private DC plans in 2007, compared with 2.646 trillion dollars in private DB plans.[3]

Furthermore IRAs and annuities not held in IRAs rank ahead of DC plans in importance as measured by assets. Much of the money in these vehicles comes from rollovers of amounts that were originally saved in DB or DC pension plans, however. For example, from 1990 to 2009, there were about 66,000 standard terminations of private DB plans (PBGC Pension Insurance Data Book 2009, table S-3). In these terminations, the plan sponsor purchased group annuities to provide the benefits that were accrued prior to the termination date, or gave the plan participant a lump sum that could be rolled over into an IRA.

In 2007 social security had 162.3 million participants with covered earnings, compared with almost 42 million participants in private DB plans and about 70 million active participants in DC plans (US

[3] Railroad Retirement includes a component ("Tier II") that functions like a DB plan even though it is a government social insurance program. If we add this part of Railroad Retirement to private DB pension plans, the total assets in private DB plans or plans that substitute for them is 2.747 trillion.

Dept. of Labor, 2010, table A1).[4] Yet despite its much larger number of participants than private pension plans, the social security trust funds for the old age and survivors insurance and for disability insurace had only 2.2 trillion in assets in 2007, compared with about 2.6 trillion for private DB plans, 3.6 trillion for private DC pension plans. The relative paucity of assets in the social security trust can be attributed to its late start on asset accumulation, which only began after the reforms of 1983, and to gaps between the present values of lifetime benefits and lifetime contributions for past participants. Had social security operated on a fully funded basis from its inception in 1935, the trust funds would have held 17.4 trillion in assets in 2007 (Board of Trustees of Social Security, 2008, p. 62). This figure is much larger than the 6.6 trillion that was projected to be sufficient to keep social security solvent for 75 years (table IV.B.5, row e), in part because future participants will have greater contributions than benefits measured in terms of present values.

1.2 France

The retirement income system of France consists of a general social security plan, known as "Caisse nationale d'assurance vieillesse des travailleurs salariés" (CNAVTS) or now just as CNAV, and a network of 35 compulsory industry-specific "complementary" pension plans. Like Tier II of Railroad Retirement in the US, these complementary plans are government-sponsored plans. Despite some diversity in retiree and survivor benefit formulas, they are almost all converging to the same set of legal requirements for their main parameters, such as the required length of a full career and the minimum retirement age.[5] They are recorded in the social security sector in the national accounts of France with the exception of the State civil servant plan. That plan is included in the central government sector, but in the future this may change, as the 2010 pension law requires a report on the creation of an explicit plan for State civil servants.

The complexity of the French pension system derives from its history. The CNAVTS plan was created just after the end of World War II as a PAYGO social security plan, and a 1946 law was supposed to extend its coverage to the whole population. This plan provided wage-earners a basic pension equal to 50% of the reference salary up to a ceiling, adjusted by the ratio of the actual length of the career to the required length of a full career.[6] The ceiling in CNAVTS was low, however, so there was a need for complementary pension plans. Managers started the first of these (AGIRC) in 1947 with an inter-professional agreement, and a plan for non-supervisors (ARRCO) followed in 1961. Participants in these pension plans accrue points as they and their employers make contributions during their working years, and benefits during retirement equal the number of points accrued during the career times an annually published value of a point. Independent social security plans were also created in 1948 and 1952 for own account workers, with their own complementary pension plans.

Finally, even though CNAVTS was supposed to cover the whole employed population, some previously existing pension plans (e.g. State civil servants, miners, sailors, railway, public utilities, central bank, national opera and theater) never joined the system. These plans, which are known as the "special regimes", offered benefits that were generally high enough so that an additional benefit

[4] Note that some employees have both a DB plan and a DC plan, so adding together then number of participants in each type of plan overstates the total number of employees who have a private pension plan.
[5] The military and some other types of workers are still allowed to retire at earlier ages.
[6] Before 1971, the reference salary was defined as the final salary and the required number of years was 30. After this date, the reference salary was the average of the 10 best years and the required number of years was 37.5.

from CNAVTS was unnecessary. For example, the State civil servant plan, which many of the special plans resemble, provides a pension equal to 75% of the final salary excluding bonuses times a ratio equal to the actual length of the career divided by the required length of a full career. The relative size in terms of numbers of contributors and amounts of benefits paid of the various types of retirement plans in France is shown in table 2. The benefits row of the table also includes assistance provided by the general government and privately purchased supplementary annuities from life insurance companies.

All of the basic and complementary pension plans are classifiable as government social insurance. A 1972 law mandated participation of all wage-earners in a complementary pension plan and established the principle of inter-professional solidarity. As a result, the plans are interconnected by financial interchanges in which "younger" plans with relatively high numbers of contributors help the older ones. Furthermore, integration of the special regimes into the CNAV is always a possibility if their finances become too out of balance; for example, the public utilities plan, the clergymen plan, and some smaller plans were absorbed into the CNAV in 2005 or 2006. Furthermore, despite the diversity of the plans, the solidarity principles of social security are respected, thanks to rules that specify a uniform set of policies regarding minimum benefits, the supplements for children, and the non-contributive periods included in pension calculation. Contributions to the plans during periods of unemployment, maternity leave, illness, and disability are financed by general tax revenue channeled through the "Fonds de solidarité vieillesse", or FSV. Changes in laws applying to social security are also applied to all the compulsory plans (though, with such a large number of them, achieving universal compliance is not necessarily easy!)

The compulsory pension plans have little or no income from assets and receive only a limited amount of external funding from general tax revenue via the FSV, so their finances can be approximated by the equation that links the outlays of a PAYGO plan to its income:

$$\textit{average contribution} \times \textit{no. of contributors} = \textit{average benefit} \times \textit{no. of beneficiaries.}$$

The three "internal" parameters of the above equation are: the contributor-beneficiary ratio, the contribution rate, and the replacement rate (i.e. average pension/average salary). Unfortunately, declines in birth rates (and, to a lesser extent, rising longevity) have resulted in a downward trend in the contributor-beneficiary ratio. It was 4 in 1960, 1.8 in 2008, and it would have fallen to around 1.2 in 2040 if not for the increase in the retirement age in the 2010 reform of the retirement system.

To cope with the imbalances created by the downward trend in the contributor-beneficiary ratio, a series of pension reforms has been undertaken. Because the plans are not organized as American-style employer-sponsored pension plans, cuts to existing benefit entitlements are possible, and indeed, only those who were already retired at the time of the reform have been spared from sacrifice. A 1993 reform of private sector pensions changed indexation from wage growth to prices and increased the minimum length of career for a full pension from 37.5 to 40 years for people reaching 60 in 2008, or to 41 years for people reaching 60 in 2012. The 1993 reform also increased the number of years for calculation of the reference salary for social security from 10 to 25. In 2003, the extension of the required length of career was also applied to the special regimes, and additional benefit reductions were imposed on early retirees in all types of plans. The 2003 reform also provided for regular reviews of the plans' finances (the next of which will occur in 2018), with measures taken as necessary to correct imbalances. There was also a reform of AGIRC and ARRCO in 1994 that increased the cost of a point and changed the indexation of the value of a

point. Another step to cope with future declines in contributors was the creation in 1999 of a buffer fund (the "Fond de réserve des retraites" or FRR) to close the financing gap of the CNAV after 2020. At end 2009, its assets amounted to 1.75% of GDP.

Unfortunately, the financial crisis of 2007-2008 deepened the structural imbalances of the French retirement system. The combined deficits of the CNAVTS and FSV grew to 13.8 billion euros in 2010. With the system's annual deficits projected to reach about 2% of GDP by 2020, the government decided to undertake another reform. The minimum retirement age was raised for most people, including the government's own employees, from 60 to 62 starting in 2018, and the full retirement age was also raised from 65 to 67.[7] Also, the required length of career was extended to 41.25 years in 2013. However, this last reform is projected to have a limited impact on the financing gap. This is confirmed by the authors' estimates with PROST (see annex 3).

The past rounds of pension reforms have highlighted for French households the lack of certainty of the benefits that are currently scheduled to receive when they retire. In response, many households have begun to invest in private, funded retirement accounts. A popular vehicle for this is investments with the life insurance industry, whose technical reserves have grown at the average pace of 12% a year since 1993, double the growth rate of total financial assets in general. (Life insurance represents 36% of households' financial assets in 2009 but only 12% of total assets, as real estate play a major role in households' wealth in France.) Yet pension plans sponsored by employers still have a very limited place in France. Apart from book reserve plans, which are difficult to estimate, they consist of DB plans managed exclusively by insurance corporations and, since 2003, defined contribution plans known as "PERCO" (*plan d'épargne pour la retraite collectif*) plans, which resemble the 401(k) plans of the US. Providing for only 2.3% of retiree benefits in 2008, the employer-sponsored plans comprise between 64 billion euros of entitlements in defined contribution plans (of which 2 billion in PERCO) and 43 billion euros of benefit entitlements in defined benefit plans (table 3).[8] All together, they amount to 12% of technical provisions in life insurance, but just 1.3% of total household sector assets. The total pension wealth held in these plans is about 5.5 percent of GDP, compared with DB and DC plan pension wealth of about 90 percent of GDP in the US.

2. Measurement of Social Security Plans in National Accounts

Like Tier 2 of Railroad Retirement in the US, the 35 government-sponsored pension plans of France meet the SNA criteria to be classified as social security (SNA 2008, 4.124). Even though all the plans, including the CNAVTS, are managed by representatives of the employers and the employees, they are subject to detailed regulation and to oversight by State auditors, they receive government subsidies, and the State has the ability to reduce the value of benefits that have already been earned and bears ultimate responsibility for shortfalls in plan funding. They are all recorded in the social security sector in the national accounts of France, except for the State civil servant plan. At present this plan is included in the central government sector because of its lack of existence as a distinct institutional unit, but in the future this may change, as the 2010 pension reform law requires a report on the creation of an explicit plan for State civil servants in the interest of financial transparency.

[7] The minimum age for claiming benefits had been reduced from 65 to 60 in 1982.
[8] Personal retirement accounts have an additional 28 € billion.

Accounting for social security plans (and other government social insurance programs) in the core national accounts is very straightforward. Neither the social security trust fund nor the actuarial value of scheduled future benefits is treated as part of households' net worth. Household income from social security is therefore recorded when benefits are paid, and contributions to social security are excluded from household income.

A new supplementary table that shows benefit entitlements for all pension and social security plans is recommended in the 2008 SNA (17.191-17.206). The measures of social security plans in this table will be similar to the measures that are used for employer-sponsored DB pension plans, but with some differences in nomenclature. In particular, the gap between the actuarial value of benefits accrued during the year and actual contributions during the year will be labeled "employer imputed social contributions" in the case of DB employer-sponsored pension plans, whereas for social security plans this gap will be labeled "Other (actuarial) accumulation of pension entitlements."

3. Measurement of Employer-sponsored Pension Plans in National Accounts

The French national accounts do not, as yet, include a pension plan sector. The PERCO plans are included in the mutual fund sector and pension plans managed by insurance corporations are in the insurance sector. According to SNA 2008 (4.116) "The pension fund subsector consists of only those social insurance pension funds that are institutional units separate from the units that create them". The status of these plans as social insurance is clear, but it is less obvious that they qualify as independent institutional units. PERCO are collective agreements and not institutional units. Funds are managed by investment fund managers and kept with a custodian, but they are owned by the beneficiaries. As defined contribution schemes, returns net of the managements fees go entirely to beneficiaries. In addition, the plans that are managed by insurance companies are not isolated from other life insurance contracts unless the insurance company decides to ring-fence such collective contracts and the corresponding assets under the 2008 law on supplementary pension institutions. As at end 2009, none of the life insurance plans had such a ring-fencing. Nevertheless, even if it is decided that a separate pension fund sector is unnecessary for these employment-related pension plans, a change in the treatment of employer contributions to be part of compensation of employees will still be appropriate.

In contrast to France, the US has a well-developed system of employer-sponsored pension plans. These plans are currently accounted for in the US national accounts in accordance with the recommendations of the 1993 SNA. In the comprehensive revision of the US national accounts that is scheduled for 2013 the treatment of DB pension plans will change, however. The new treatment will be consistent with the measurement goals of the new recommended method for measuring DB pension plans in 2008 SNA. However, it will depart from the detailed guidelines of the 2008 SNA in some notable ways.

3.1 The Approach of the 1993 SNA

In the 1993 SNA funded DB pension plans are accounted for in the same way as DC pension plans in measuring household saving. In a DC pension plan, the participants' pension wealth consists of the assets held in the plan, so employer contributions to DC plans represent compensation income to the plan participants. Benefit payments from those plans do not represent income flows because they merely move participants' wealth from one location to another.

Similarly, treating the assets of funded DB pension plans as the property of the plan participants means that compensation income for households should be recorded when employers make contributions to these plans, and that the investment income from the plan assets should be included in the property income of households. In addition, under this approach payments of benefits to retirees, along with contributions made by employees are purely financial transactions. Finally, the plans' administrative expenses are included in household consumption expenditures.

In the US national accounts, this approach is currently used both to measure household saving and to measure household income. In this paper, we will also measure employer-sponsored pensions in just one way, using the kind of approach that the SNA recommends for measuring household saving for purposes of measuring both household income and household saving. However, to avoid confusion, we acknowledge that the SNA (in both its 1993 and 2008 versions) treats pension plans differently when measuring household income from the approach that we take in this paper. In particular, the SNA places employer-sponsored pension plans outside the boundary of the household sector when measuring household income, and inside that boundary when measuring household saving. With the plans outside the boundary of the household sector, payments of benefits represent flows of income to households, so in measuring household saving, the original measure of household income in the SNA is adjusted by adding saving by pension plans, or, in the language of the SNA, "adjustment for the change in pension entitlements." This has the effect of removing benefit payments from household income and replacing them with pension contributions plus investment income earned by the pension plan's assets because saving by a funded DB plan equals the plans' income from employer contributions, employee contributions and investment returns less the plans' expenses for benefit payments and administration. [9]

3.2 The Approach of the 2008 SNA for Purposes of Measuring Household Saving

A key innovation in the 2008 SNA is actuarial measurement of employer-sponsored DB pension plans, including ones that are unfunded. This will allow the national accounts to move from a cash approach to an accrual approach to measuring DB pension plans. The most straightforward way to implement the actuarial approach for a DB plan is to treat the actuarial value of the benefit entitlement as the sole pension asset of the plan participants, and this is the approach that the 2008 SNA (17.151-17.176) recommends. Also, the new measure of compensation income is to be the present value of the claims to benefits earned by active participants through service to the employer. The new accrual approach therefore avoids the arbitrariness in the timing of the recording of compensation income that occurs under the cash accounting approach when employers defer their actual contributions and then later make extra contributions to catch up with funding targets. [10]

[9] The NIPA tables published by BEA do not report saving by defined benefit pension plans, but estimates of saving by DB pension plans are occasionally published as part of a set of alternative measures of personal saving. See Reinsdorf and Perozek, 2002, Reinsdorf, 2004, and Reinsdorf, 2006.

[10] Under an idealized set of assumptions, cash accounting would provide a complete picture of the operations of a defined benefit plan. In particular, the assets in a defined benefit plan will measure the wealth of the plan's participants in the form of accrued benefit entitlements and the employer's contribution to the plan will measure the income of the participants in the form of benefit accruals if there are no deviations of: (a) realized investment returns from the assumed interest rate, (b) employer contributions from benefit accruals net of any required employee contributions, (c) outcomes for salary increases, separations and mortality from previous assumptions, and (d) plan features from those in effect at the time of plan inception. These assumptions may not be even approximately true in practice.

In the new table on the transactions of DB pension plans that is recommended in the 2008 SNA, the cash measure of employee compensation from participation in DB pension plans will still be shown, but it will be labeled as "employer actual contributions". The difference between the actuarial value of benefits earned through service to the employer plus the administrative expenses of the plan minus employee contributions to the plan will be also shown with the label "employer imputed contributions." Total employer contributions then equal the amount that employers need to contribute to cover the cost of claims to benefits arising from covered employment and the administrative cost of running the plans. It represents the compensation income that employees receive in the form of rights to pension benefits.

In addition, rather than measuring property income of the households participating in DB plans by the income generated by plan assets, the 2008 SNA measures household property income by the interest accruing on households' benefit entitlements. The sum over the lifetime of a participant in a DB plan of the actuarial value of the benefit entitlements earned through service to the employer and the interest on already accumulated benefit entitlements equals the sum of the benefits paid if the assumptions used in the actuarial calculations are all realized. Thus, the accrual measure of household income of the 2008 SNA from actual and imputed employer contributions and from interest accruing on households' benefit entitlements is predictive of the future cash flows to households in the form of benefit payments. Furthermore, the SNA 2008 measure of household income from participation in DB plans is consistent with the growth in household wealth as measured by the benefit entitlement. It equals the growth in pension wealth as measured by the actuarial value of the benefit entitlement, plus the benefits paid (which increase the cash wealth of plan participants), plus the plan administrative expenses (which provide in-kind income to the plan participants), plus the net effect of extraordinary changes in the value of benefit entitlements from things like changes in assumptions regarding interest rates and mortality or changes in plan rules.

Nevertheless, the recording scheme for DB pension plans of 2008 SNA has an implication that users of the national accounts may find paradoxical: the saving of the DB plans themselves will generally be non-zero. Although non-zero saving by DB plans can be explained, in the institutional setting of the US, it may seem as though a discrepancy exists between the sources and uses of income of DB pension plans. Negative saving by DB plans implies that households are accruing claims on the plans that exceed the income received by the plans.

The income received by the DB plans comes from property income from plan assets, the actual contributions of employers and employees, and imputed employer contributions. Total contributions (actual plus imputed) equal the value of the benefit entitlements being accrued by active participants in the plans plus the value of the pension plan administrative services that they receive. A similar balance between the plans' receipts and expenses does not occur in case of property income, however. As a result, saving by DB plans equals the difference between the property income that the plans receive on their assets and the imputed interest on benefit entitlements that they pay to households. This difference is likely to be negative for plans that invest in assets such as equities that are expected to generate holding gains. Investors in equities treat holding gains as a substitute for dividends, and over the long run investment returns on equities often come more from holding gains than from dividends. Holding gains on plan assets are commonly relied upon by DB pension plans as a source of funding for their benefit obligations. Yet they are excluded from the definition of income in national accounts because holding gains and losses arise from changes in the price of assets that already exist, not economic production. In the

full sequence of accounts that is recommended by the SNA, holding gains and other changes in assets are shown in accounts that appear below those showing income and saving.[11]

The argument for allowing saving by DB plans to be negative if the plans invest in assets that are expected to provide investment returns in the form of holding gains is as follows. When DB pension plans use holding gains to fund benefit payments, national saving is reduced because changes in price of existing assets are converted into cash that is distributed to households to use for spending purposes. Thus, depicting DB pension plans that hold assets that are supposed to generate holding gains as having negative saving is justifiable. If the prices of those assets rise sufficiently to bridge the gap between the plans' property income and the interest cost of their actuarial liability, the change in the plans' net worth will not be negative.

On the other hand, shortfalls in property income can also be caused by shortfalls in plan assets due to insufficient past contributions. Delays in making the contributions needed to cover the cost of newly accrued benefit entitlements result in a funding gap for the DB pension plan because they deprive the plan of the opportunity to earn property income. For the plan to have the means to pay the benefits when they fall due, the property income that the plan would have earned had the contributions been made on time will eventually have to be replaced by someone.

If the lack of property income is caused by plan underfunding and the sector responsible for replacing the plans' missing property income can be identified, it is appropriate to record a flow of imputed interest income from that sector to the DB plans, thereby preventing the saving of the plans from being negative. In some institutional settings, however, whether the cost of filling pension plan funding gaps will ultimately be borne by employers, future employees, the government, or future retirees may be impossible to know. Showing underfunded pension plans as having negative saving may then be a reasonable solution provided that documentation is provided that explains that negative saving by pension plans that is not offset by holding gains or capital transfers represents a cost that will eventually have to be borne by someone.

3.3 Measuring the DB Plans of the US in a Way that Makes their Saving Zero

In the institutional setting of the US employers are generally legally or contractually responsible for ensuring the payment of the benefits due to the participants in the DB plans that they sponsor. The measurement framework that is recommended in the 2008 SNA is not well-suited for handling underfunded pension plans in this kind of institutional setting.[12] In particular, to reflect the growth

[11] In France, the INSEE publishes the current account showing saving and investment, and the Banque de France publishes the financial accounts. In the latter, the change in the balance sheet from one period to the next is decomposed through three sets of accounts: the transaction accounts (where new issues, redemptions, acquisitions and sales are traced and balanced with net lending/borrowing), the valuation accounts for holding gains and losses, and the other changes in assets accounts for reclassifications. In the US statistical system, BEA publishes estimates of saving and capital transfers in the NIPAs, and the Federal Reserve Board publishes estimates for the personal sector of net acquisitions of assets, holding gains and losses, and change in wealth in the Flow of Funds accounts (FFAs). Finally, BEA brings together information from the NIPAs and the FFAs in a set of Integrated Macroeconomic Accounts.

[12] The 2008 SNA (paragraph 17.165) does provide for a special treatment of DB plans in the case when employers are contractually liable to a third party for the funding gaps of their plans, recommending that in this case a claim of the plans on the employers should be recorded such the plans have a net worth of zero at all times. The implications of

in employers' obligations to make additional pension fund contributions when plans lack property income as a result of lack of assets, interest charges on the claim of the DB plan on the employer for the contributions needed to cover the unfunded actuarial liability (UAL) must be imputed. In effect, failure to make actuarially required contributions when they are due is treated as borrowing from the pension plan, with an associated interest expense for the borrower.

Counting imputed interest on the UAL as an income source for DB plans may, however, not be enough to prevent a negative estimate of saving by these plans if the interest accruing on the total benefit entitlement is used to measure the property income that households receive from the plans. Suppose that we measure households' property income in this way for a plan that has a positive UAL. Then the imputed interest received by the plan from the employer in connection with the UAL cancels the imputed interest paid by the plan on the unfunded portion of benefit entitlement, so saving by the plan equals the plan's property income from interest, dividends and rental income earned by its assets less its interest expense calculated by multiplying the rate of interest assumed in the actuarial calculations by the value of the plan assets. Multiplying the interest rate assumed in the actuarial calculations by the value of the plan assets implies a predicted value for the returns on the plan investments. If the plan invests in equities and other assets are expected to provide some of their returns in the form of holding gains, the interest, dividends and rental income generated by the plan assets are likely to be lower than this predicted value. The holding gains needed to make up for this shortfall in property income can then be treated as a measure of the value of the holding gains implied by the interest rate assumption, as shown in the following set of equations:

$$\begin{aligned}\text{Saving by DB pension plans} &= \text{Property income from plan assets} + \text{Imputed interest on claim on the employer for the UAL} - \text{Interest payable on benefit entitlements}\\ &= \text{Property income from plan assets} - (\text{Interest rate} \times \text{plan assets})\\ &= -(\text{Implied holding gains on plan assets}).\end{aligned}$$

Using holding gains to help fund benefit payments that retirees use for spending does lower national saving, so showing the DB plans that do this as having negative saving is a reasonable way to portray the economic effect of their funding model. Furthermore, if the assumption that the plan assets will generate holding gains is reasonable, then the only way to estimate correctly both the expense to employers of sponsoring pension plans and the income that the plans provide to households is to allow the DB plans to have negative saving.

Nevertheless, accounting for DB pension plans in a way that allows them to have non-zero saving also has disadvantages. First, allowing projecting holding gains on assets held in DB pension plans to enter household income would create a difference in the treatment of holding gains on assets in DB plans from those on assets in DC plans, which do not add to household income. Second, because negative saving of DB pension plans results in household interest income that is not paid by business or government, the decomposition of national income by sector will no longer add up to

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doing this closely resemble the approach that we recommend here, so the main difference between our approach and the 2008 SNA is that we treat employers as liable for plan funding shortfalls under a broader range of circumstances. Indeed, it could be argued that these circumstances are overly broad because state and local government employers do sometimes respond to pension funding gaps by shifting some of the burden of closing those gaps to their employees via increases in contribution rates. Adjusting our estimates to allow for this would, however, be practical.

the correct total unless an adjustment for saving by DB pension plans is somehow incorporated. To be consistent with the framework recommended by the 2008 SNA this could be done by adding the negative saving of DB pension plans to the profits of a financial corporation sector, but this decomposition would be hard to follow for most users of the US national accounts.

To avoid these disadvantages, we will account for the DB pension funds of the US in a way that makes their saving identically zero. We define the property income received by the households that participate in DB pension plans as equal to the sum of the property income that the plans obtain from their assets and the imputed interest that the plans receive on their claims on employers for the funding of their UAL. If the plan assets include equities, the property income from the plan assets will usually be less than the income that the assets would earn if they paid the rate of interest assumed in the actuarial calculations by an amount that can be viewed as the holding gains implied by the interest rate assumption. In effect, we exclude expected holding gains used to fund benefit payments from the measure of household income and treat these instead as an implied holding gains component of the change in households' DB pension wealth. This reduces the measure of household saving compared to the one that would result from treating the implied holding gains as the negative saving by DB pension plans.

4. Choice of Actuarial Method for Measuring the DB Plans of the US

4.1 Alternative Treatments of Effects of Salary Growth

Two general approaches are possible for estimating the actuarial value of benefit entitlements. Unfortunately, no consensus exists concerning which should generally be used in practice, though there is some agreement among national income accountants about the principles that can guide the choice between these approaches. To understand the practical implications of these approaches, it is helpful to consider a typical traditional DB plan benefit formula that makes the benefit equal to final pay (or average pay in the last few years of the career) times the length of the career times a fixed percentage replacement rate. With this kind of formula, salary increases raise the value of the pension, and we can either account for this salary growth effect on an *ex post* basis, or attempt to incorporate the effect of projected future salary increases into the value of the benefits being earned today.

The *ex post* approach focusses on the accrued benefit obligation or ABO, which equals the present discounted value of the benefits that would be due to participants if the plan were to be frozen on the valuation date. This approach adheres strictly to the definition of an accrued liability because it excludes benefits that are contingent on future actions by the employer. Under the ABO approach, the value of the benefits earned in a given year ("service cost" or "normal cost") is measured as the increment to the value of benefit entitlements that results from working that year, including both the effect of credit for an additional year of service and the effect of pay raises received during the year. Assuming that the benefit level depends on final pay, the effect of a pay raise on the value of the benefit entitlement will be large for participants who have accumulated credit for many years of service. As a result, the ABO approach tends to produce relatively high estimates of normal cost in the last years of the career and relatively low estimates of accumulated pension wealth in the early and middle stages of the career. The average *level* of normal costs over the course of the career must be higher if their profile is tilted so that estimates of normal costs are high in the last years of the career, because the backloading of normal costs implies that less time is available to accumulate

property income. In other words, the ABO approach will tend to produce relatively high estimates of compensation income and relatively low estimates of imputed property income for households.

An alternative to focusing on the accrued-to-date benefit entitlement (as defined by the present value of the benefits that would be due if the plan were to be frozen) is to focus on the benefits that are expected to have been accrued at the time of retirement. To do this, a participant's ultimate level of benefits is projected on the assumption that the plan continues in its present form and that the participant will receive future salary increases.

The projected unit credit (PUC) method applies an expected salary growth rate to the benefits earned to date, so in effect its main difference from the ABO method is that it discounts projected benefits by a real rate of interest equal to the assumed nominal rate minus the assumed salary growth rate, not by the nominal interest rate itself. In financial accounting used by private business, this method is often known as the projected benefit obligation (PBO) approach. Allowing for projected future pay increases produces higher estimates of normal cost for employees in the early part of their career than under the ABO approach, and it also produces higher estimates of the value of the benefit entitlement for employees not at the end of the career. (At the end of the career, all the methods agree.) This means that over the career as a whole, more household income from participation in DB plans is attributed to interest and less is attributed to compensation than under the ABO approach.

On the other hand, government sector employers often want a method that yields an even smoother profile of normal costs over the career than occurs with the PUC method. Most government plans in the US use the entry age normal (EAN) method, which solves for the constant percent of pay that must be contributed to the plan over the course of an employee's career to accumulate the necessary assets at the time of retirement. The EAN method generally implies higher values of pension wealth for participants early in their career than the PUC method, so it is viewed as a conservative funding standard. Yet for national accounts purposes, a key implication of higher measures of pension wealth is that more of the income of the plan participants is attributed to imputed interest income, leaving less to be attributed compensation. Indeed, if employers actually follow the EAN funding schedule, with plan assets earning the assumed rate of return, their contributions can have a lower average over the course of the career than if they use a more delayed schedule for making contributions.

The ABO, PUC and EAN methods for measuring benefit entitlements are illustrated in the box 1 at the end of this section. A number of elaborations of these methods also exist, along with methods that use a different kind of approach that effectively counts projected future increases in contributions as current assets.

4.2 Possible Decision Criterion

A criterion for determining whether an ABO approach or a forward-looking approach is more appropriate is whether employees effectively have a secure right to accrue benefits under the plan formula in future years. Models of the option value of pensions developed by Lazear and Moore (1988) and Stock and Wise (1990) imply that besides the benefits that have already been accrued, the right to accrue future benefits is also a valuable asset if the probability of a plan freeze or plan termination is low. This option value is part of the buy-out that would be necessary to induce an employee covered by a defined benefit pension plan to take early retirement. To agree to retire

early, the employee would have to be compensated both for the loss of projected future wages net of the opportunity cost of the employee's time and for the forfeited option to accrue additional benefit rights. (If the employee has reached the point in the life cycle where the value of leisure exceeds the wage, the minimum buy-out necessary to induce the employee to retire early would just be the value of the employee's option to accrue additional benefits.) Because the option value is part of the pension wealth of participants that have the right to accrue future benefits under the existing plan rules, the ABO understates their pension wealth. Smoothing the profile of their wealth accumulation over the career, as is done by forward-looking methods, is therefore reasonable.

In the US, many private sector sponsors of DB plans have frozen or terminated their plans, depriving participants of the opportunity to accrue additional benefit entitlements. Because neither law nor custom obligates the plan sponsor to give participants future opportunities to accrue benefits, the ABO approach is appropriate for measuring the current pension wealth of private plan participants in the US. Current government employees in the US were, on the other hand, traditionally treated as having the right to continue in the same plan until retirement, under the so-called "California rule" (Monahan, 2012). Yet in recent years, the taboo against stripping current employees of future opportunities to earn benefits has begun to disappear. In particular, many state and local governments have raised employee contribution rates, and some have announced plans to force their employees into less generous pension plans. In other cases, state and local governments have significantly cut their workforce, so loss of employment has become an additional threat to the opportunity to accrue additional benefit rights for some employees. The facts that once favored a forward-looking approach for state and local government plans have therefore become more ambiguous. Nevertheless, a forward-looking approach using either the EAN or PUC method remains justifiable for plans for Federal government employees. In addition, the PBO approach is recommended for government employees plans in Europe by the Eurostat-ECB technical compilation guide (2011, p. 85).

Box 1: Example of ABO Approach and Two PBO Methods

In this box a simple hypothetical pension plan illustrates some of the differences between the possible ways of calculating pension benefit liabilities. Three methods are considered: the accrued benefit obligation (ABO) approach, and the projected unit credit (PUC) version of the projected benefit obligation (PBO) approach, and the constant percent of pay variant of the entry age normal (EAN) version of the PBO approach. Participants in this pension plan work for 3 years, retire in the 4^{th} year, and die in the 5^{th} year. Their salary grows 5 percent per period from a starting level of $25,000. Vesting is immediate, there are no breaks in service, and there is no early retirement. The accrued retirement benefit equals 10 percent of salary times the number of periods worked times final salary. The interest rate is 15 percent.

Table A1 follows a single participant through the career and retirement. For simplicity, we assume that normal cost is measured as of the beginning of the year, so that year 1 normal cost equals the year 2 opening liability discounted back by one year. Table 1 shows that the PUC and EAN measures of the future benefit liability are higher than the ABO liability except at retirement, when they equal the ABO measure. The PUC and EAN normal cost measures are higher than the ABO one at first, but are much lower in the last year of the career.

Table B1 follows a plan that starts with 10 newly hired participants, and adds 10 new hires in each of the next two years. Hiring then ceases. As the workforce ages, the ABO measure of normal cost rises faster than the PUC measure. The EAN measure using the level percent of pay version of the entry age normal method does not rise at all. If the distribution of ages in the workforce is uniform, the ABO measure of normal cost is higher than the PUC and EAN ones, so on the whole the ABO approach tends to attribute the growth of pension wealth more to compensation in the form of imputed contributions (and the other methods tend to it attribute it more to property income in the form of imputed interest earned on the plan's benefit liability).

Table A1: Plan's Benefit Liability and Service Cost for a Single Employee using the ABO Approach and Two PBO Methods

Assumptions				Liability for Future Benefits			Service Cost			Service Cost as Pct of Salary		
Age	Salary	Benefits Paid	Accrued Benefits	ABO	Projected Unit Credit	Entry Age Normal	ABO	Projected Unit Credit	Entry Age Normal	ABO	Projected Unit Credit	Entry Age Normal
1	25,000	0	0	0	0	…	1644	1812	1979	6.58	7.25	7.92
2	26,250	0	2500	1890	2084	2276	2079	2084	2078	7.92	7.94	7.92
3	27,563	0	5250	4565	4793	5008	2625	2397	2182	9.52	8.70	7.92
4	0	8269	8269	8269	8269	8269	0	0	0	NA	NA	NA
5	0	0	0	0	0	0	NA	NA	NA	NA	NA	NA

Table B1: Plan's Benefit Liability and Service Cost from Plan Inception to Termination using the ABO Approach and Two PBO Methods

(dollar amounts in thousands)

Assumptions				Future Benefit Liability			Service Costs			Service Costs as Pct of Payroll			No. of Participants	
Year	Payroll	Benefits Paid	Accrued Benefits	ABO	Projected Unit Credit	Entry Age Normal	ABO	Projected Unit Credit	Entry Age Normal	ABO	Projected Unit Credit	Entry Age Normal	Active	Retired
1	250	0	0	0	0	…	16.4	18.1	19.8	6.6	7.3	7.9	10	0
2	513	0	25	18.9	20.8	22.8	37.2	39.0	40.6	7.3	7.6	7.9	20	0
3	788	0	78	64.6	68.8	72.8	63.5	62.9	62.4	8.1	8.0	7.9	30	0
4	788	83	160	147.2	151.5	155.5	63.5	62.9	62.4	8.1	8.0	7.9	30	10
5	788	83	160	147.2	151.5	155.5	63.5	62.9	62.4	8.1	8.0	7.9	30	10
6	538	83	160	147.2	151.5	155.5	47.0	44.8	42.6	8.7	8.3	7.9	20	10
7	276	83	135	128.3	130.6	132.8	26.3	24.0	21.8	9.5	8.7	7.9	10	10
8	0	83	83	82.7	82.7	82.7	0	0	0	NA	NA	NA	0	10

5. Estimates of Income and Saving from DB Pension Plans in the US

5.1 Private Plans

Our measures of US household income and saving from participation in private DB plans are calculated from a data base of pension plan tax returns (IRS Form 5500). In this data base missing values are common for some variables (particularly dividend and interest income on plan assets), and comparisons of the population of filers in successive years imply that significant numbers of plans are missing in 2000-2002 even though the data are supposed to be a census of all private plans in the US. We therefore include imputations for missing values of key variables and for missing plans in 2000-2002 in our estimates of national totals, as described in Reinsdorf and Lenze (2009, p. 55).

Under the cash approach, households' compensation income from participation in DB plans is measured by employer contributions, and their property income is measured by the interest, dividends and rental income earned by plan assets. On average over the years 2000-2007, employer contributions are almost 80 billion per year and property income is almost 58 billion per year, so the cash measure of household income is 137.6 billion. After subtracting administrative expenses of around 8 billion the cash measure household saving averages almost 130 billion per year (table 4). The accrual measure of household saving from participation in these plans averages just 8 billion more, with employer imputed contributions averaging about 2 billion and employer imputed interest payments on the UAL averaging about 6 billion. Using actuarial measures therefore has a trivial effect on the average level of household income and saving in the case of private plans.

On the other hand, using the actuarial approach greatly reduces the volatility of household income from employer contributions and also from all sources combined. For example, after including employer imputed contributions, the accrual measure of compensation income from participation in private DB plans rises from 73.1 billion in 2000 to 81.9 billion in 2002. Yet in 2000, a nearly unprecedented streak of five good years of stock market returns had left many plans overfunded, so employer contributions to private DB plans were only 32.8 billion.[13] Two years later, after the dot-com stock market crash and bear market, beginning-of-year assets were down by over 250 billion dollars and contributions rebounded to 100.2 billion.

The current change in household wealth equals employer contributions plus the interest on the benefit entitlement minus plan administrative expenses. As was explained in section 3.3, the difference between the interest on the benefit entitlement and the property income received by the plans (both imputed and actual) represents implied holding gains on plan assets. These implied holding gains average about 62 billion, about the same as the change in benefit entitlements. Because the private DB plans tend be offered by established businesses with stagnant or shrinking workforces, a large fraction of their participants are retired. Benefit payments are thus so high that virtually all of the plans' accrued property and contribution income is used for benefits or administrative expenses. Indeed, on a cash basis, saving of the pension plans themselves averages –9 billion per year.

[13] Reinsdorf (2007, p.9) finds that before the bull market of 1995-2000, cash saving by private and government DB pension plans was adding about 1.6 percentage points to the personal saving rate, compared with zero in 2000.

On the other hand, holding gains, which range from –142.6 billion in 2001 to 279.6 billion in 2004, are sufficiently positive on average to bring the average growth in plan assets up to about 80 billion per year. (If holding gains for 2007, which were estimated based on EBSA Bulletins, are excluded the average is 66 billion per year.) Although average holding gains would have been lower had 2008 been included, at least for the years covered by table 4, holding gains contributed even more to asset growth than the holding gains implied by the calculation of the change in the benefit entitlement.

Households are often found to have low marginal propensities to consume out of holding gains (3 percent is a typical estimate), but in the case of private DB plans, holding gains are a close substitute for ordinary income as a source of funding for benefits. Indeed, government regulations against both deliberate overfunding and underfunding of DB pension plans tend to cause employer contributions to vary inversely with holding gains. Thus holding gains on the assets are much more used to fund consumption expenditures of US households when the assets are held by a DB pension plan than when the assets are held by households directly.

5.2 State and Local Government Plans

DB plans for employees of state and local governments cover fewer active participants than private plans (14.3 million in 2007, compared with 18.5 million in non-frozen private DB plans) but, they generate about the same amount of income for households as the private DB plans if income is measured on a cash basis. The cash measure of household income (employer actual contributions plus property income from plan assets) averages 136.4 billion for state and local government plans over the years 2000-2007 (table 5). One reason for this seeming generosity of the state and local plans is that several million of the participants in these plans are not covered by social security, so their benefits have to be high enough to make up for the lack of social security benefits. Another is that retirement eligibility occurs at younger ages (often in the late 50s) for many state and local government employees in jobs such as police, firefighter or teacher. However, the effects of high benefits and early retirement ages on employer pension expenses are partly offset by relatively large employee contributions, which average over 30 billion per year.

On the whole employer actual contributions to state and local government do not respond as dramatically to changes in plan funding status as is the case for private plans, though when the plans become underfunded in 2003 actual employer contributions do increase. Thus, in this instance, imputed contributions thus have a more modest effect on the volatility of household income. Another noteworthy effect of the 2003 drop in plan assets is a 26.9 billion rise in imputed interest on the UAL that is offset by a 24.4 billion dip in implied holding gains. Household income is actually more volatile in 2003 under the actuarial approach than under the cash approach because imputed interest on the UAL is included in household income, but not implied holding gains. This source of volatility is avoided by the SNA 2008 approach, which includes in interest income of households the amounts that we treat as implied holding gains.

Yet the most important finding in table 5 is that imputed employer contributions have a large effect on the level of household income. Imputed contributions average over 107 billion in 2000-2008 and account for nearly half of the average level of household saving from participation in these plans, which is 236.6 billion. The weak response of employer

contributions to plan funding shortfalls and the low level of these contributions compared to the actuarial estimates of employer service costs is possible because they plans are not subject to the same tax and regulatory constraints as private plans. Another factor that helps to keep the level of actual contributions low is that state and local government plan actuaries tend to assume a high rate of interest, often 8 percent. For example, Moody's (2012, p. 6) estimates that lowering the discount rate assumption from 8 percent to its preferred assumption of 5.5 percent would increase a representative plan's accrued actuarial liability by 35.6 percent.

The financial soundness of DB pension plans sponsored by state and local governments has recently become a topic of controversy, with arguments that these plans are assuming rates of interest that are too high featuring prominently in this debate. The state and local government plans justify their high interest rate assumptions as the expected rate of return on the stocks that they hold, but Brown and Wilcox (2009) argue that using expected rate of return of risky assets to discount plan liabilities is inappropriate and prefer to use Treasury bond interest rates. Treasury bond rates are too low for actuarial purposes, however, as these bonds are sometimes held for liquidity or collateral requirement reasons rather than for their yield. Also the actuarial liabilities of state and local government plans no longer seem as risk free as they seemed to be when Brown and Wilcox wrote their paper. One alternative is to use the interest rate assumptions that the PBGC uses to value its benefit obligation, which are based on surveys of rates offered on annuities purchased from life insurers. Those rates allow the PBGC to calculate market values of annuities equivalent to the benefits due to DB plan participants, and are typically slightly higher than Treasury bond rates. However, for US national accounts purposes, adoption of the mean interest rate that the private plans are required to use for tax and regulatory purposes on Schedule B of Form 5500 has the advantage of a unified approach to state and local government and private DB plans. This interest rate is based on high grade corporate bonds. Our interest assumption for actuarial estimates of the state and local government plans is therefore 6 percent in 2000-2004 and 5.5 percent thereafter.[14]

Using these rate assumptions, employer expense for imputed interest on the UAL averages about zero, but that is because the plans were overfunded on an ABO basis (though not using the EAN method) in 2000-2002. The financial crisis caused an extremely large holding loss in 2008, and property income from assets also declined in that year. At the same time, the ABO grew by 226.6 billion, and the gap between the change in assets and the change in the ABO resulted in an increase in the UAL of 1.1 trillion. Thus, employer interest on the UAL will likely be positive and substantial going forward. The large capital loss of 2008 also changed the average level of holding gains over a period starting in 2000 from +96 billion per year to –12.6 billion per year. In contrast, the change in the value of the benefit entitlement attributed to implied holding gains averages 60 billion per year over 2000-2007 and 65 billion per year over 2000-2008. In most years, virtually all of the change in plan assets comes from holding gains and losses, as the cash

[14] On July 2, 2012, Moody's Investors Service also announced a plan to use interest rates on high grade corporate bonds to value actuarial liabilities of state and local government plans. Novy-Marx and Rauh (2010) find in a study of state government plans that replacing the plans' interest rate assumptions with tax-adjusted interest rates on state general obligation municipal bonds raises the estimate of the aggregate ABO in 2009 from 2.76 trillion to 3.20 trillion. Using Treasury bond rates raises the estimate to 4.43 trillion. The EAN method estimate using the interest rate assumption of 8 percent is 3.15 trillion, so in this particular case the effect of adopted the ABO approach instead of the EAN method used by the plans is about the same as the effect of using the states' tax-adjusted borrowing rate.

inflows to the state and local government plans from contributions and property income on assets barely exceed the cash outflows for benefits and administrative expenses.

5.3 Federal Government Employee Plans

Except for some inflation-indexed "TIPS" bonds bought by the military plan, the main DB plans for Federal government employees do not invest in assets that generate holding gains. We therefore exclude implied holding gains from our treatment of these plans. In addition, our estimates cover only the two main Federal DB plans (CSRS and FERS) and the main military plan. The excluded smaller Federal plans account for less than 5 percent of the total DB pension benefit payments of the Federal government. We account for the Federal plans using the EAN method for actuarial calculations because the available actuarial reports for this plans use the EAN method. The nominal interest assumptions used by the Federal plan actuaries are high compared with our assumptions in tables 4 and 5 of 6 percent of 2000-2004 and 5.5 percent thereafter (bottom panel of table 6). The Federal actuaries' salary growth and inflation assumptions are also high, however, and it is the real interest assumption (generally around 2.5 percent) that drives the Federal actuarial estimates.

For the main Federal plans, employer contributions per active participant are quite high, with a range from 16 to 28 thousand dollars per year, or roughly 33 percent of covered payroll. Higher benefit levels to compensate for the lack of social security in the older civilian retirement plan and the military plan and the early retirement ages of the military plan explain some of the difference between these employer contributions and those for private DB plans (which are typically around or below 5 thousand dollars). Yet the large employer contributions per active employee for the federal plans are primarily an example of what happens when an underfunded DB plan reaches maturity. Federal employee plans have high numbers of retired participants, so their benefit payments, which average 91.4 billion over the years covered by table 6, are much higher than employer normal cost for benefits earned by active participants, which average only 34.7 billion. Returns on assets would fund most of the benefit expenses of a fully funded, mature plan with a high ratio of retired to active participants, but the Federal plans are only about 40 percent funded because they have never been able to close the funding gap inherited from their historical operation as pay-as-you-go plans. As a result, only 45 percent of employer actual contributions are used to cover normal cost for active employees. This means that the cash approach to measuring DB pension plans overstates current employee compensation by an average of 44.8 billion over the period covered by table 6, as shown by averaging the employer imputed contributions and reversing the sign.

The largest component of the actual Federal contributions is amount paid towards the cost of interest on the UAL. Paying a large fraction of the interest accruing on the UAL keeps it from growing rapidly. However, the interest cost of the UAL exceeds employer imputed contributions by an average of about 36 billion. Household income from participation in Federal DB plans is therefore higher under the actuarial approach than under the cash approach even though compensation income is lower.

5.4 Combined Actuarial Estimates for the All DB Plans

Expressing the combined figures for private, state and local government and Federal government plans as a percent of personal disposable income (DPI) from the NIPAs shows that participation in DB plans provides income to households falling between 6.1 and 6.3 percent of DPI in most years (table 7). From an accounting point of view, these plans therefore add 6.1 percentage points to the personal saving rate on average. However subtracting benefits payments net of employee contributions shows that personal saving in the form of growth in pension plan equity amounts only 2.3 percent of DPI on average. In addition, the imputed portion of employer pension expenses averages 1.7 percent of DPI, so the cash measure of personal saving from participation in DB plans averages just 4.4 percent of DPI and the cash measure of growth in pension plan equity averages just 0.6 percent of DPI. Finally, the SNA 2008 measure of household saving would count the amount that we treat as imputed holding gains as part of household imputed interest income, which would raise the measure of household saving from participation in DB plans to an average of 7.5 percent of DPI, and raise the measure of growth in DB plan equity including in household saving to an average of 3.7 percent of DPI.

Employer imputed expenses for contributions and interest subtract the same amount from saving by employers as the 1.7 percent of DPI that they add to household saving. Most of the subtraction comes from imputed employer contributions for state and local government plans, and the total average subtraction from saving by state and local governments (which have average saving of about zero in the present version of the national accounts) amounts to 1.2 percent of DPI. Imputed interest paid by the Federal government to its DB plans averages 0.9 percent of DPI, which is partially offset by imputed employer contributions averaging –0.5 percent of DPI. Finally, imputed pension plan expenses for private employers are a relatively trivial 0.1 percent of DPI.

5.5 Social Security in the US

Sections 5.1 to 5.4 have illustrated the changes that the US may make in its presentation of employer-sponsored DB plans. The US has not yet developed a plan to publish supplementary actuarial information on social security, but US Social Security Administration actuaries calculate three kinds of actuarial measures of social security's benefit obligation. The "open group" unfunded liability is a measure of the plan's long run solvency. The "closed group" liability is useful for analyzing inter-generational burden sharing. The "maximum transition cost" is useful for analyzing the cost of proposals to replace social security with some other system, such as individual accounts, while letting participants keep the social security benefits that they have already earned (Schultz, Jason and Daniel Nickerson, 2010). It is therefore an ABO type measure of benefit entitlements.

Even though ABO measures are well-suited to measuring employer-sponsored pension plans for national accounts purposes, their meaningfulness is less clear when it comes to social security. In sharp contrast to most traditional DB pension plans, for social security the ABO measure of benefit entitlements tends to rise quickly in the early part of the career because social security's benefit formula is highly progressive and uses of career average pay instead of final pay. Thus even if lifetime contributions equal lifetime benefits in present value terms for every participant, social security would look underfunded using an ABO approach. Furthermore, active

participants cannot easily escape from future obligations to contribute, so an evaluation of their position that includes projected future benefits but not projected future contributions is of limited usefulness. This suggests that the closed group liability would be better suited for national accounts purposes than the other measures produced by the social security actuaries.

6. Alternative Measures of Household Saving in France based on the SNA Treatment of Pensions and Social Security

The particular changes that a country will need to make in its national accounts to implement the SNA 2008 recommendations depend on its economic institutions. France has some private retirement plans that are managed by life insurance companies as social insurance. To comply with the 2008 SNA, these plans may be treated as employer-sponsored DC pension plans. We show the current treatment of these plans and the possible new treatment of these plans Appendix A (table A1). In the new treatment, employer contributions to these plans are recorded as compensation rather than as purely financial transactions, which raises the measure of household saving in 2007 by 10.3 billion euros.

By far the largest component of the French retirement system is, however, social security and the web of government-sponsored plans that are linked to social security. For these plans, the new actuarial measures of the 2008 SNA will be shown as part of a supplementary table that shows benefit entitlements in all pension and social security plans, not in the core accounts. In Table A2 in appendix A we illustrate the differences between the core accounts and the supplementary table using data for France and estimates of benefit entitlements from social security and government-sponsored pension plans that we calculated using PROST, a social security modeling program of the World Bank that calculates accrued-to-date liabilities. Because the treatment of social security in the supplementary table is supposed to parallel the treatment of DB pension plans in the core accounts, in this table we call the difference between the actuarial value of benefits accrued through service and actual contributions "employer imputed social contributions". In addition, we record the interest accruing on the social security benefit entitlement as household contribution supplements and as negative saving by the plan. Recording negative saving by the plan is appropriate because a social security plan with a funding gap does not have a claim on employers to cover this gap.

In the core accounts, saving by households equals the benefits received net of employee contributions, or 159 billion euros, but in the supplementary table, household saving equals the sum of employer contributions (126 billion), imputed contributions (31 billion) and imputed interest on the benefit entitlement (287 billion), or 444 billion. This amount can also be decomposed into net benefits and the change in the benefit entitlement ("hh reserves in pension funds") of 285 billion.

International Comparison of France and the US

The new supplementary table of the 2008 SNA will give users of the national accounts the information required to calculate comprehensive measures of disposable income and saving that permit comparisons of countries with different retirement systems. To make such a comparison of the US and France, we estimated benefit entitlements from social security using PROST, a

social security modeling program of the World Bank that calculates accrued-to-date liabilities. For the sake of comparison, we used the same nominal discount rate, 4 percent, for both countries. (See appendix B for more details).

Before these estimates of social security can be used for an international comparison, two preliminary steps are necessary, however. First we must adjust official measures of household disposable income to include the value of social transfers in kind from government to households for individual consumption purposes (see Audenis, Gregoir and Louvot, 2002), because such publically provided goods have different roles in the US and France. Second, the "adjusted" values must be "corrected" to those that result from implementing the recommendations of the 2008 SNA for employer-sponsored pensions in the core account. In the case of the US the correction consists of adding the imputed employer contributions, imputed interest on the claim of the plans on the employer for unfunded benefit entitlements, and the implied holding gains of plan assets. Adding imputed interest and the implied holding gains to the property income from plan assets that is currently included in household income in the US accounts brings the value of property income from participation in DB pension plans up to the value recommended in the 2008 SNA, which equals the entire amount of the interest accruing on the benefit entitlement. In the case of France, the "correction" consists of adding actual employer contributions to DC pension plans administered by life insurance companies.

Using the corrected measures of household income and saving, we can calculate "harmonized" measures of disposable income and saving by replacing the measures of household disposable income from social security and similar government employee pension plans from the core accounts with actuarial measures from the supplementary table. Household disposable income from social security in the core effects equals benefits paid less employee contributions, while the actuarial measure in the supplementary table equals the sum of actual employer contributions, imputed contributions, and property income. The difference between the measures therefore equals total contributions and property income minus benefits.

In our international comparison year of 2007, imputed income from DB pension plans adds 2.8 percentage points to the corrected household saving rate for the US (top panel of table 8). On the other hand, for France, the impact of the reclassification as social insurance of pensions currently recorded in life insurance is modest, because the value of these pensions is small (1.3 percent of households' total assets). The corrected household saving rate in France is only 0.6 percentage points higher than the baseline rate. Thus correcting the measurement of household saving arising from participation in employer-sponsored pension plans helps to close the very large gap between household saving rates of the US and France.

The harmonized saving rates are, however, much higher than the corrected saving rates in both the US and France because the interest income on the value of the benefit entitlement is very large. In the US, the "harmonized" saving rate with an actuarial treatment of social security is 16.4 percent. The amounts of social security benefit entitlements (including those of civil servants) in France are even larger than in the US, and the property income accruing to households at our assumed 4 percent rate amounts to 15.5 percent of their "harmonized" disposable income. This helps to bring the harmonized household saving rate for France up to 26.4 percent, so the harmonized gap between saving rates is slightly wider than the corrected gap, at 10 percentage points.

The higher saving rate of French households is also reflected in higher levels of wealth relative to income, but in the case of wealth (which is heavily influenced by holding gains) the difference is less dramatic. Before the downturn of 2008 the total assets of US households recorded in the flow of funds accounts amounted to around 5.6 years' worth of disposable income, compared with assets worth 5.8 years of disposable income for French households (bottom panel of table 8). In the US, the financial assets are larger and the amounts are more volatile, while French households rely more on real estate, which in France has tended to be relatively stable. Subtracting liabilities implies a net worth figure for US households before benefit entitlements of 4.6 years of income, compared 5.2 years of income in France.

To arrive at corrected and harmonized measures of household wealth we add the value of unfunded benefit entitlements from the DB pension plans of the US, and total value of benefit entitlements from social security in the US and in France. We also deduct an allowance for the financing gaps of the social security plans. The funding gaps arise because the future income that we project that the plans will receive given unchanged contribution rates is insufficient to pay currently scheduled future benefits. We resolve the inconsistency between the present values of the projected sources and uses of income by the social security plans by excluding unfunded benefits from social security wealth. The funding gap is a measure of the reductions in benefits and increases in contribution rates that may be necessary to keep the system solvent. In assigning the responsibility for closing the funding gap to households that currently exist we are making a conservative assumption: future generations could shoulder a significant part of the burden of closing this gap, particularly if the adjustment occurs on contribution rates side. We also note that for France, our estimates of the benefit entitlement and the funding gap include the effect of the 2010 reform increasing the minimum retirement age to 62. That reform brought the present discounted value of the financing gap down from 29 percent of benefit entitlements to 26 percent.[15]

In the US, unfunded DB benefit entitlements amount to 0.1 years' worth of harmonized disposable income in 2007 and the value of benefit entitlements in social security is equivalent to 1.5 years of income. In France benefit entitlements in social security are worth 3.1 years of harmonized disposable income. After subtracting liabilities and the social security financing gap we find that households in France have a comprehensive wealth-to-income ratio of 8.2, compared to 6.2 years' worth of income for US households.

The higher harmonized saving rate and wealth-to-income ratio of France partly reflect the fact that French people need to save more because they retire at younger ages and have slightly longer life expectancies. (In 2010, the average retirement age in France was 61.5, compared with an average age for claiming social security benefits in the US of 63.6.) The saving rate of US households may also be lower because US households rely more on holding gains as a means of building wealth (documented in Durant and Reinsdorf, 2008, though of course in the years after the financial crisis that strategy did not work so well). Accessibility of credit may also play a role in the lower saving rate of the US: easy access to credit for US households can substitute for precautionary balances and reduce the precautionary motive for saving.

[15] We have not taken the partial reversals in 2012 of the 2010 reforms into account, however. See annex B table B2 for estimates of the future net cash flows of social security in France as percentages of GDP.

In addition, the need for saving is greater when risks are higher, and French households probably perceive their retirement wealth as riskier than American households do. Participants in the DB pension plans of the US generally have property rights to the benefits that they have accrued, and in private sector benefits are insured by the PBGC. Furthermore, almost 30 years have passed since the one and only reform of social security in the US, and in that reform the benefit cuts only affected those who were more than twenty years away from the normal retirement age. In contrast, France has had three major retirement reforms since 1993, and the benefit cuts have affected employees nearing retirement and encompassed both pension plans and social security. And the most recent reform does not look likely to be the last one, as the funding gap of French social security remains large.

In France, in the years after World War II the generations who reached retirement age had lost most of their savings in war. A delay in the start of benefit payments while the social security system built up the reserves required to operate as a funded plan was therefore impossible. Rather than building up a trust fund, the contributions of the active participants had to be used to fund current benefit payments. The system continued on in this way, based on a kind of inter-generational lending where people hope to obtain from the younger what they gave to the older. Yet the "rate of return" of such a pay-as-you-go system depends on the ratio of contributors to beneficiaries adjusted for increases in labor productivity. When the demographic return from population growth decreases, as nowadays with the so-called "pappy boom", the implicit rate of return of social security must fall, necessitating reforms. It is thus rational for French households to save more, as their main asset, consisting of social security benefit entitlements, is risky. To be sure, reforms will also be needed to keep the US social security solvent over the long run, but the relative size of the social security financing gap is smaller in the case of the US, and the importance of social security wealth in household's comprehensive net worth is also smaller.[16]

[16] Romig (2008) projected that if no reforms of US social security are enacted, currently scheduled benefits will automatically be cut by 22 percent in 2041, rising to a cut of 25 percent in 2082. She was unsure whether monthly benefits will be reduced or whether payments will be delayed until enough funds are available to pay the full amount of a scheduled monthly benefit, resulting in fewer payments per year. Recently the projections have worsened. According to the 2012 Social Security Trustee's Report, funds will only be available to pay 75 percent of scheduled benefits beginning in 2033.

7. Conclusion

A full picture of the operations of pension and social security plans has become a critical part of understanding the economic situation in many countries experiencing population aging or growing ratios of retirees to active participants in DB pension plans that may not be fully funded. New actuarial estimates of benefit entitlements called for in the 2008 SNA, which supplement the cash measures that national accounts have traditionally used, will provide the additional information on DB pension plans that is needed for national accounts purposes. The corresponding actuarial measures of social security will permit international comparisons of countries that have different systems for providing retirement income. Two caveats are, however, important to bear in mind in interpreting the new actuarial measures. First, these measures depend on assumptions because they rely on projections about the future, so to achieve greater relevance for key questions about the income, saving and wealth of households that participate in DB pension plans and about the saving by and net position of the employers that sponsor these plans, we must sacrifice the objectivity of the cash approach to measurement of DB pension plans. Second, the actuarial measures of social security that match the ones used for employer-sponsored DB pension plans are not well-suited for use as sustainability indicators because "open group" measures, which take into account the contributions of future plan participants, are needed to answer sustainability questions about social security.

Employer-sponsored DB pension plans play a major role in the US retirement income system. By developing actuarial estimates for these plans, this paper demonstrates the feasibility and usefulness of the new approach called for by the 2008 SNA. For example, funding gaps of social security plans in many of the world's advanced economies have long been a topic of discussion, but more recently in the US questions have arisen about the DB pension plans of state and local governments (Novy-Marx and Rauh, 2009, 2010 and 2011, and Rauh, 2010). We find that adopting the actuarial approach called for in the 2008 SNA will result in much lower estimates of saving by these governments in recent years; for example, the current estimate in the NIPAs of saving of 12.2 billion in 2007 would be revised down to –116.6 billion, and the current estimate of saving of –72.2 billion in 2008 would be revised down to –206.4 billion.

The actuarial approach will also provide more meaningful measures of saving by households and of the composition of the income that households receive as participants in DB pension plans. In the case of the private DB plans of the United States (which are supposed to be fully funded) the cash measure of compensation has exhibited only a small downward bias in its average level over the long run, but estimates for individual years have occasionally suffered from a problem of spurious volatility as plan sponsors take contribution holidays or race to close funding gaps. On the other hand, cash measures of household income from participation in pension plans for government employees in the US have been too low in recent years. In 2002-2007 applying the actuarial approach that we propose to government DB plans raises the overall estimate of the household saving rate from 2.9 percent to 4.6 percent, an increase of 1.7 percentage points.

The source of the understatement of household income depends on the type of government sponsoring the DB plan. For state and local government plans in 2000-2008, the underestimation is mainly in the compensation component of income, as the actuarial value of the benefits earned through service to the employer exceeds actual employer contributions. In contrast, in recent years the Federal government has included in its actual contributions a component to cover a

conservative of estimate of the interest cost of the plans' unfunded actuarial liabilities. The cash approach mischaracterizes this payment of interest on benefit claims earned by former employees as compensation of current employees, and the overstatement of Federal compensation income has exceeded $20,000 per employee since 2006.

This paper also demonstrates the usefulness of the actuarial measures of social security and government-sponsored pension plans that are included in a supplementary table the 2008 SNA for international comparisons of saving rates and wealth of countries with different kinds of retirement systems. The large gap between the high saving rate of households in the French national and their low saving rate in the US national accounts narrows when actuarial measures are introduced, but we find that even with comparable actuarial measures of benefit entitlements (with the social security financing gap deducted), French households have higher saving rates and higher wealth-to-income ratios.

This paper also makes methodological contributions by modifying the actuarial measures introduced in the 2008 SNA to provide a more accurate or more complete picture of the operations of DB pension plans. In institutional settings where employers are responsible for ensuring the solvency of the DB plans that they sponsor, recording underfunded pension plans as receiving imputed interest on their claim on the employer is necessary for an accurate picture of plan operations, but the SNA omits this flow. When an employer delays making an actuarially required contribution, the pension plan is deprived of the opportunity to earn property income, so interest on delayed contributions reflects amounts that the plan must receive from the employer if it is to have sufficient funds to pay the benefits that it owes to the plan participants.

Our proposal for providing a more complete picture of the operations of DB pension plans involves the treatment of holding gains that help to fund benefit expenses. If a plan holds assets that normally generate holding gains, such as common stocks, the property income from its assets is likely to be smaller than the interest accruing on funded portion of its actuarial liability. In the framework of the 2008 SNA, this kind of gap is recorded as negative saving by the plan because the plan pays more property income to households than it receives from its assets. Instead, we handle this gap by identifying the holding gains on plan assets that are implicit in the interest rate assumption as implied holding gains received by households and showing the saving of the DB pension plan as zero.

We also have a proposal for providing a more complete picture of the operations of DB pension plans. The actuarial measures in the supplementary table on social security called for in the 2008 SNA have limited usefulness as sustainability indicators because they are designed to be comparable with the measures provided in the core accounts for employer-sponsored DB plans. We provide a sustainability indicator within a statistical framework that treats social security similarly to employer-sponsored DB plans by including an allowance for the social security funding gap in our calculation of households' social security wealth. Excluding risky claims to social security benefits from our measure of social security wealth gives a conservative measure of the wealth of the households that currently exist, as the reductions in benefits and increases in contributions that will eventually be required to keep the plan solvent may not fall entirely on them.

Table 1: Retirement Assets of Households in the US by Type of Plan, 2007

(Billions of dollars)

Type of Plan	Assets
Defined benefit pension or functional equivalent	**7067.8**
Defined benefit pension	**6966.9**
Private[1]	2646.3
Government sector	4320.6
State & local government	3368.9
Federal government employees	945.1
Federal Reserve system	6.6
Government social insurance that replaces DB plans	**100.9**
Pension Benefit Guarantee Corporation (single employer)	68.4
Railroad Retirement, tier 2	32.5
Defined contribution	**5003.0**
Private	3866.0
Private plans[1]	3537.0
SEP and SIMPLE IRAs	329.0
Government sector	1137.0
State & local government[2] (403(b) and 457 plans)	904.0
Federal government (Thrift Savings Plan and FDIC plan)	233.0
Self-funded and rollover funded	**6047.0**
Traditional and Roth IRAs	4455.0
Annuities from life insurance companies	1592.0
Total Pension and Self-funded	**18177.8**
Social security trust funds	**2238.5**
TOTAL	**20359.0**
***Memo*: Disposable Personal Income**	**10423.6**

Sources: Private DB and DC plans: EBSA Private Pension Plan Bulletin 2007, table A1; State and local government DB plans: 2007 Census of Governments; Federal government: Sept. 2007 Treasury Monthly Statement; PBGC: PBGC 2008 Annual Report; Federal Reserve System: Federal Reserve System Thrift & Retirement Plans, 2007 Annual Report; Social security: Social security 2009 statistical supplement, table 4A1; IRAs, State and local government DC plans and annuities: Investment Company Institute *Research Fundamentals*, August 2010; Federal TSP: ICI *Research Fundamentals*, July 2008, footnote 21; disposable personal income: national income and produce accounts as released in July 2010.

1. Filers of IRS Form 5500. Excludes plans with only one participant, and funds held by life insurance companies under allocated group insurance contracts for payment of retirement benefits, which amount to 10 to 15 percent of total private pension fund assets.
2. Includes plans sponsored by nonprofit educational institutions serving households.

Table 2: Relative Size of the French Retirement Regimes as Measured by Contributors and Benefits Paid, 2009

(Percentages of national total)

	Private Wage Earners		State civil servant	Other "special regimes"	Self-Employed	Assistance	Supplementary Annuities from Life Insurers
	Basic	Complementary					
Contributors	71.7	71.7	9.3	9.3	9.7	N.A.	N.A.
Benefits	33.9	24.1	14.9	12.4	9.7	4.6	2.3

Table 3: Private Pension Plans in France by Type of Plan

(Amounts in € billion)

nature		sources	type	status in fin. accounts	reserves	contributions	pensions
social insurance in life insurance	*collective insurance contracts with employer contribution*						
	defined contribution (art 82 CGI)	DREES	dc	life insurance reserves	2,9	0,3	0,2
	defined contribution (art 83 CGI)	DREES	dc		42,0	2,9	1,2
	individual workers (Madelin)	DREES	dc		16,2	2,2	0,4
	farm workers	DREES	dc		2,7	0,2	
	defined benefit (art 39 CGI)	DREES	db	life insurance reserves	31,5	3,6	2,8
	retirement lump sum	FFSA	db		9,7	0,9	1,1
social insurance in pension funds	*collective employment related schemes*						
	PERCO	AFG	dc	mutual funds shares	1,9	0,9	
life insurance	*individual pension plans*						
	PERP	DREES	dc	life insurance reserves	4,1	1,0	
	other individual plans	DREES	dc		24,5	1,0	0,5
employer sector	*book reserves*						
	companies net liabilities	Mercer	?	not yet recorded	27,0	?	?

Table 4: Household Income, Saving and Wealth from Private Defined Benefit Pension Plans: ABO Actuarial Approach

(*Billions of US Dollars except as noted; Years defined by Plan Year Ending Date*)

	2000	2001	2002	2003	2004	2005	2006	2007
Household income	**122.1**	**130.6**	**143.0**	**156.5**	**143.8**	**150.6**	**152.7**	**165.7**
Employer contributions to DB Plans	73.1	77.0	81.9	82.8	78.8	82.9	85.6	89.3
Actual contributions	32.8	52.2	100.2	100.8	95.4	92.7	89.2	74.8
Imputed contributions	40.3	24.8	-18.3	-18.0	-16.6	-9.8	-3.6	14.5
Employer imputed payment of interest on UAL	-14.3	-4.4	12.0	24.8	11.2	10.6	3.4	7.4
Property income from plan assets	63.3	58.0	49.1	48.9	53.8	57.1	63.7	69.0
LESS: Plan Administrative Expenses	**7.3**	**7.2**	**6.9**	**7.4**	**8.3**	**8.6**	**9.2**	**9.9**
Household saving	**114.8**	**123.4**	**136.1**	**149.1**	**135.5**	**142.0**	**143.5**	**155.8**
Implied holding gains on plan assets	**57.4**	**57.1**	**56.2**	**50.6**	**62.9**	**69.2**	**71.4**	**71.9**
Current change in household wealth	**172.2**	**180.5**	**192.3**	**199.7**	**198.4**	**211.2**	**214.9**	**227.7**
Benefits and withdrawals	118.2	124.5	134.8	135.7	141.9	139.8	152.7	161.5
Change in benefit entitlements	54.8	56.7	58.6	64.9	57.3	72.4	63.2	67.2
Less: Employee contributions	0.8	0.7	1.1	0.9	0.8	1.0	1.0	1.0
Employer expenses	**58.8**	**72.6**	**93.9**	**107.6**	**90.0**	**93.5**	**89.0**	**96.7**
Of which, imputed expenses	26.0	20.4	-6.3	6.8	-5.4	0.8	-0.2	21.9
ABO, BOY	**1773.9**	**1844.6**	**1954.4**	**2071.3**	**2130.9**	**2282.0**	**2309.1**	**2472.4**
Plan net assets, BOY	**2011.7**	**1918.4**	**1755.0**	**1657.6**	**1944.7**	**2105.8**	**2249.7**	**2474.3**
Unfunded actuarial liability	**-237.8**	**-73.8**	**199.4**	**413.7**	**186.2**	**176.2**	**59.4**	**-1.9**
Change in ABO at 6% rate	**70.7**	**109.8**	**116.9**	**59.5**	**151.1**	**27.1**	**163.3**	**NA**
Of which, changes in assumptions and plan rules	15.9	53.1	58.3	-5.4	93.8	-45.3	100.1	
Change in plan net assets	**-93.3**	**-163.4**	**-97.4**	**287.1**	**161.1**	**143.9**	**224.6**	**178.5**
Of which, holding gains, capital transfers and other changes in volume of assets	-64.7	-142.6	-106.1	279.6	161.3	141.5	232.6	205.1
Change in unfunded actuarial liability	**164.0**	**273.2**	**214.3**	**-227.6**	**-10.0**	**-116.8**	**-61.3**	**NA**

Source: Authors' estimates from IRS form 5500 data, except change in plan assets in 2007, which comes from *Private Pension Plan Bulletin Historical Tables and Graphs*, Employee Benefits Security Administration, March 2102.

Table 5. Household Income, Saving and Wealth from State and Local Government DB Pension Plans using the ABO Approach[1]

Flows are measured for years ending on December 31; stocks are measured as of December 31.
Billions of dollars (or as noted)

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Household income	**183.3**	**188.1**	**209.1**	**244.2**	**246.2**	**265.0**	**287.2**	**297.0**	**294.0**
Employer contributions to DB Plans	136.2	143.9	147.9	148.4	161.9	171.2	179.3	193.7	202.2
Actual contributions	39.6	39.2	42.1	56.4	55.8	61.9	67.2	75.2	82.5
Imputed contributions	96.5	104.8	105.9	91.9	106.1	109.3	112.2	118.5	119.7
Employer imputed payment of interest on UAL	-37.9	-26.8	-9.0	17.9	1.7	10.2	17.8	10.3	14.5
Property income from plan assets	85.1	71.0	70.2	77.9	82.6	83.6	90.1	93.0	77.4
LESS: Plan Administrative Expenses	**4.8**	**7.2**	**7.8**	**7.7**	**7.9**	**10.3**	**10.2**	**15.3**	**13.8**
Household saving	**178.6**	**180.9**	**201.3**	**236.6**	**238.3**	**254.7**	**277.0**	**281.8**	**280.3**
Implied holding gains on plan assets	**56.5**	**69.5**	**64.9**	**40.5**	**49.2**	**60.6**	**61.9**	**80.6**	**104.0**
Current change in household wealth	**235.1**	**250.3**	**266.2**	**277.0**	**287.4**	**315.3**	**338.9**	**362.3**	**384.2**
Benefits and withdrawals	100.3	110.0	121.3	132.6	141.7	151.0	162.1	174.0	186.1
Change in benefit entitlements	160.5	167.4	173.4	174.5	176.7	196.2	210.2	223.8	236.2
Less: Employee contributions	25.7	27.1	28.5	30.1	30.9	31.8	33.4	35.5	38.1
Employer expenses	**98.3**	**117.1**	**139.0**	**166.3**	**163.6**	**181.4**	**197.1**	**204.0**	**216.6**
Of which, imputed expenses	58.6	77.9	96.9	109.9	107.8	119.6	129.9	128.8	134.2
ABO, BOY	**1,728.4**	**1,892.8**	**2,100.7**	**2,272.6**	**2,426.3**	**2,807.5**	**3,086.6**	**3,344.5**	**3,560.8**
Plan net assets, BOY	**2,360.2**	**2,340.3**	**2,250.3**	**1,973.5**	**2,396.0**	**2,621.3**	**2,763.4**	**3,156.6**	**3,297.9**
Unfunded actuarial liability	**-631.8**	**-447.4**	**-149.5**	**299.0**	**30.3**	**186.2**	**323.2**	**187.9**	**262.8**
Change in ABO	**164.5**	**207.9**	**171.8**	**153.7**	**381.2**	**279.1**	**257.9**	**216.3**	**226.6**
o.w, changes in assumptions and plan rules	4.0	40.5	-1.6	-20.8	204.6	82.9	47.7	-7.5	-9.6
Change in plan net assets	**-20.0**	**-90.0**	**-276.7**	**422.4**	**225.3**	**142.2**	**393.1**	**141.4**	**-883.3**
o.w, holding gains, capital transfers and OCVA	-65.3	-110.0	-288.4	398.2	205.6	126.1	374.8	127.0	-881.3
Change in unfunded actuarial liability	**184.4**	**297.9**	**448.6**	**-268.7**	**155.9**	**136.9**	**-135.2**	**74.9**	**1,109.9**

1 Assumed interest rate in actuarial calculations is 6 percent from 2000-2004 and 5.5 percent thereafter.

Table 6. Household Wealth and Income from the Main Federal Government DB Pension Plans
PBO Approach using Interest, Inflation and Salary Growth Rates Assumed in Plans' Actuarial Reports

(Billions of dollars, except as noted)

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Household income	**143.9**	**149.0**	**151.1**	**157.1**	**162.9**	**171.3**	**173.7**	**180.1**	**185.2**
Employer contributions to DB Plans	28.2	28.8	31.5	33.0	34.1	37.7	37.7	39.3	42.3
Actual contributions	64.2	65.8	69.7	68.1	74.4	81.1	85.8	91.4	114.9
Imputed contributions	-36.0	-37.0	-38.2	-35.1	-40.3	-43.4	-48.1	-52.1	-72.6
Employer imputed payment of interest on UAL	69.2	71.7	71.2	77.1	82.9	86.5	87.2	93.1	90.0
Property income from plan assets	46.5	48.5	48.5	47.0	45.9	47.1	48.9	47.6	52.9
LESS: Plan Administrative Expenses	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.2**	**0.2**
Household saving	**143.8**	**148.9**	**151.0**	**157.0**	**162.8**	**171.2**	**173.6**	**179.9**	**185.0**
Benefits and withdrawals	78.0	81.2	83.7	85.5	88.8	93.2	98.6	104.4	109.0
Change in benefit entitlements	70.6	72.1	71.5	75.8	78.2	82.1	78.9	79.3	79.8
Less: Employee contributions	4.7	4.3	4.2	4.3	4.2	4.1	3.9	3.8	3.7
Employer expenses	**97.4**	**100.5**	**102.6**	**110.1**	**117.0**	**124.2**	**124.8**	**132.5**	**132.3**
Of which, imputed expenses	33.2	34.7	32.9	42.0	42.6	43.1	39.0	41.1	17.4
PBO, BOY	**1,800.8**	**1,871.4**	**1,943.5**	**2,015.0**	**2,090.9**	**2,169.1**	**2,251.2**	**2,330.1**	**2,409.4**
Plan net assets, BOY	**642.8**	**684.2**	**717.4**	**756.0**	**789.7**	**825.1**	**863.8**	**903.3**	**924.6**
Unfunded actuarial liability	**1,158.0**	**1,187.2**	**1,226.1**	**1,259.0**	**1,301.2**	**1,344.0**	**1,387.4**	**1,426.8**	**1,484.8**
Change in PBO	**70.6**	**72.1**	**71.5**	**75.9**	**78.2**	**82.1**	**78.9**	**79.3**	**79.8**
o.w., assumption changes or other changes in plans	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Change in plan net assets	**41.4**	**33.2**	**38.6**	**33.7**	**35.4**	**38.7**	**39.5**	**21.3**	**62.2**
o.w, capital transfers and timing differences	**4.1**	**-4.1**	**0.0**	**-0.1**	**-0.2**	**-0.3**	**-0.4**	**-16.9**	**-0.1**
Change in unfunded actuarial liability	**29.2**	**38.9**	**32.9**	**42.2**	**42.8**	**43.4**	**39.4**	**58.0**	**17.6**
Assumptions:									
Interest rate assumption, civilian plans	7.00%	6.75%	6.75%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%
Inflation assumption, civilian plans	4.00%	3.75%	3.75%	3.25%	3.25%	3.25%	3.50%	3.50%	3.50%
Rate of salary growth, civilian plans	4.25%	4.25%	4.25%	4.00%	4.00%	4.00%	4.25%	4.25%	4.25%
Interest rate assumption, military plans	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.00%	6.00%	5.75%
Inflation assumption, military plans	3.00%	3.50%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Rate of salary growth, military plans	3.50%	3.50%	3.50%	3.75%	3.75%	3.75%	3.75%	3.75%	3.75%

Note: Estimates exclude smaller Federal plans and the plan for employees of the Board of Governors of the Federal Reserve.

Table 7. Household Income from DB Pension Plans: US Totals using Actuarial Approach[1]

(Percentages of disposable personal income)

	2000	2001	2002	2003	2004	2005	2006	2007
Household income	**6.1**	**6.1**	**6.3**	**6.7**	**6.2**	**6.3**	**6.2**	**6.2**
Employer contributions to DB Plans	3.2	3.3	3.3	3.2	3.1	3.1	3.1	3.1
Actual contributions	1.9	2.1	2.6	2.7	2.5	2.5	2.4	2.3
Imputed contributions	1.4	1.2	0.6	0.5	0.6	0.6	0.6	0.8
Employer imputed payments of interest on UAL	0.2	0.5	0.9	1.4	1.1	1.2	1.1	1.1
Property income from plan assets	2.7	2.3	2.1	2.1	2.1	2.0	2.0	2.0
LESS: Plan Administrative Expenses	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**
Household saving	**6.0**	**5.9**	**6.1**	**6.5**	**6.0**	**6.1**	**6.0**	**5.9**
Implied holding gains on plan assets	**1.6**	**1.7**	**1.5**	**1.1**	**1.3**	**1.4**	**1.3**	**1.5**
Current change in household wealth	**7.5**	**7.6**	**7.6**	**7.6**	**7.3**	**7.5**	**7.3**	**7.4**
Benefits and withdrawals	4.0	4.1	4.2	4.2	4.2	4.1	4.2	4.2
Less: Employee contributions	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Change in benefit entitlements	3.9	3.9	3.8	3.8	3.5	3.8	3.6	3.6
Employer expenses	**3.5**	**3.8**	**4.2**	**4.6**	**4.2**	**4.3**	**4.1**	**4.2**
Of which, imputed	**1.61**	**1.74**	**1.54**	**1.89**	**1.63**	**1.76**	**1.70**	**1.84**
Private plans	0.35	0.27	-0.08	0.08	-0.06	0.01	0.00	0.21
State & local government plans	0.80	1.02	1.21	1.31	1.21	1.29	1.31	1.24
Federal plans	0.45	0.45	0.41	0.50	0.48	0.46	0.39	0.39
Addendum:								
Household income--cash approach	**4.5**	**4.4**	**4.7**	**4.8**	**4.6**	**4.6**	**4.5**	**4.3**
Household benefit entitlement, BOY	**72.4**	**73.3**	**74.9**	**75.9**	**74.8**	**78.2**	**77.1**	**78.2**
o.w. changes in assumptions or plan rules and OCVA	**0.3**	**1.2**	**0.7**	**-0.3**	**3.4**	**0.4**	**1.5**	**0.0**
Plan net assets, BOY	**68.4**	**64.6**	**59.0**	**52.4**	**57.7**	**59.8**	**59.3**	**62.7**
o.w. holding gains/losses, capital transfers and OCVA	**-1.7**	**-3.4**	**-4.9**	**8.1**	**4.1**	**2.9**	**6.1**	**0.0**
Unfunded actuarial liability	**2.2**	**7.1**	**14.3**	**21.5**	**15.1**	**17.2**	**16.9**	**15.2**
Change in benefit entitlement	**4.2**	**5.1**	**4.5**	**3.5**	**6.9**	**4.2**	**5.0**	**2.8**
Change in plan net assets	**-1.0**	**-2.9**	**-4.2**	**8.9**	**4.8**	**3.5**	**6.6**	**1.6**
Change in unfunded actuarial liability	**5.2**	**7.8**	**8.3**	**-5.5**	**2.8**	**0.9**	**-0.9**	**1.5**
Memo: Disposable personal income	**7327**	**7649**	**8010**	**8378**	**8889**	**9277**	**9916**	**10424**

1. Smaller Federal government plans and terminated private DB plans are excluded.

Table 8. Household Saving and Wealth including the Measures of DB Pensions and Social Security from Supplementary Table of the 2008 SNA: Comparison of the US and France in 2007[1]

(Billions of local currency unless otherwise stated)

	US	France
Household disposable income and saving		
Adjusted household disposable income[2]	**11912**	**1552**
Household saving as percent of adjusted disposable income	**1.8**	**12.4**
"Correction" of treatment of pension plans	**345**	**10**
Imputed employer contributions to DB pension plans	81	
Imputed property income and implied holding gains, DB plans	264	
Actual employer contributions to DC pension plans		10
Corrected household income	**12257**	**1562**
Corrected household saving as percent of corrected income	**4.6**	**13.0**
Effect of actuarial treatment of social security[3]	**1738**	**285**
Actual employer contributions	307	126
Actual contributions from employees and self-employed persons	350	72
Imputed contributions from government	–146	31
Actual and imputed property income	1803	287
LESS: Benefits	576	231
Harmonized household disposable income	**13995**	**1847**
Household saving as percent of adjusted disposable income	**16.4**	**26.4**
Balance sheet, in years of harmonized disposable income		
Core accounts, current methods:		
Assets	**5.6**	**5.8**
Nonfinancial assets	1.8	3.8
o.w. real estate	1.5	3.4
Financial assets	3.8	2.0
o.w. from life insurers	0.1	0.1
o.w. pension funds, including annuities from life insurers	1.0	0.6
Liabilities	**1.0**	**0.6**
Adjustments to harmonized balance sheet	**1.6**	**3.1**
Unfunded benefit entitlements in DB pension plans	0.1	
Benefit entitlements in social security plans	1.6	4.0
LESS: Financing gap of social security	0.1	0.9
Total harmonized assets	**7.2**	**8.9**
Total harmonized net worth	**6.2**	**8.3**

1. Baseline income and saving estimates reflect national accounts data as published in 2010.
2. Nonprofit institutions serving households are included with households in estimates for the US.
3. Social security includes civil servant pension plans in the case of France.
4. Employee contributions include contributions from the self-employed.

Appendix A: Comparison of current sequence of accounts and that one in the SNA 2008

Table A1 - SNA 2008 Treatment of Employer-Sponsored Pensions Purchased from Life Insurers compared with Current Treatment in Economic Accounts of France

(Billions of euros; data from 2007)

		SNA 2008						current accounting					
		Pension scheme	households	employer	Pension scheme	households	employer	Pension scheme	households	employer	Pension scheme	households	employer
		uses			resources			uses			resources		
P1	output				0,5						0,5		
D121	employer actual social contributions			10,3		10,3							
D122	employer imputed socialcontributions												
D44	investment income	4,2				4,2		4,2				4,2	
D611	employer actual social contributions		10,3		10,3								
D612	employer imputed social contributions												
D613	households actual social contributions												
D614	households pension contribution supplement		3,8		3,8								
D62	social benefit	4,3				4,3							
P3	consumption		0,5						0,5				
D8	adjust. for change in hh reserves in pension funds	9,8				9,8							
B8	Saving				-3,8	14,1	-10,3				-3,8	3,8	
Beginning of the year balance sheet		assets			liabilities			assets			liabilities		
F2	deposits												
F611	life insurance technical reserves								85,9		85,9		
F612	hh reserves in pension funds		85,9		85,9								
F79	other account payable/receivable												
B90	net worth				-85,9	85,9					-85,9	85,9	
Financial account													
F2	deposits	6,5	3,8				10,3	6,5	3,8				10,3
F611	life insurance technical reserves								9,8		9,8		
F612	hh reserves in pension funds		9,8		9,8								
F79	other account payable/receivable										0,6	9,8	-10,3
B9	net lending/borrowing				-3,3	13,6	-10,3				-3,9	3,8	
Revaluation account													
F2	deposits												
F611	life insurance technical reserves												
F612	hh reserves in pension funds		-1,2		-1,2				-1,2		-1,2		
F79	other account payable/receivable												
B10.3	change in net worth due to revaluation				1,2	-1,2					1,2	-1,2	
End of the year balance sheet													
F2	deposits	6,5	3,8				10,3	6,5	3,8				10,3
F611	life insurance technical reserves								95,7		95,7		
F612	hh reserves in pension funds		94,5		94,5				-1,2		-1,2		
F79	other account payable/receivable										0,6	9,8	-10,3
B90	net worth				-88,0	98,3	-10,3				-88,6	88,5	

Table A2 - Comparison of Social Security Accounting in Core National Accounts and supplementary table of SNA 2008 for France in 2007

(billions of euros; estimated by the authors from PROST)

	Supplementary table SNA 2008						core accounts SNA 2008					
	Pension scheme	households	employer	Pension scheme	households	employer	Pension scheme	households	employer	Pension scheme	households	employer
	uses			resources			uses			resources		
output												
employer actual social contributions			126		126				126		126	
employer imputed social contributions			31		31							
investment income	287				287							
employer actual social contributions		126		126				126		126		
employer imputed social contributions		31		31								
households actual social contributions		72		72				72		72		
households pension contribution supplement		287		287								
social benefit	231				231		231				231	
consumption												
adjust. for change in hh reserves in pension funds	285				285							
Saving				-287	444	-157				-33	159	-126
ning of the year balance sheet	**assets**			**liabilities**			**assets**			**liabilities**		
deposits												
life insurance technical reserves												
hh reserves in pension funds		7035		7035								
other account payable/receivable												
net worth				-7035	7035							
cial account												
deposits		231		105		126		231		105		126
life insurance technical reserves												
hh reserves in pension funds		285		285								
other account payable/receivable												
net lending/borrowing				-389	516	-126				-105	231	-126
uation account												
deposits												
life insurance technical reserves												
hh reserves in pension funds		74		74								
other account payable/receivable												
change in net worth due to revaluation				-74	74							
the year balance sheet												
deposits		231		105		126		231		105		126
life insurance technical reserves												
hh reserves in pension funds		7394		7394								
other account payable/receivable												
net worth				-7498	7625	-126				-105	231	-126

Appendix B: Using PROST to estimate accrued-to-date pension entitlements on social security

PROST is a generational model developed by the World Bank [Holzmann and alii, 2001]. It is mainly used here to calculate accrued to date entitlements on social security, which are not available from official data sources. In order to assess the quality of the estimates, the financing gap produced by PROST have been compared to official estimates (OASDI report in the US, "Conseil d'Orientation des retraites" 2010 report in France). For the sake of comparison between the two countries, the nominal discount rate has been fixed to 4%, which with effective inflation, makes a variable real discount rate.

PROST calculates the accrued to date entitlements with the projected benefit obligation method that is taking into account the future increase in salary until retirement date. The exact formula adds accrued-to-date entitlements of present retirees (1) to accrued to date entitlements of future ones (2).

$$(1)=\sum_{t=1}^{T}(number\ of\ new\ retirees\ by\ age, gender, salary\ cluster) \times (present\ value\ of\ future\ pension\ paid\ by\ age, gender, salary\ cluster\ conditional\ to\ being\ in\ life)$$

(2)=(1) for current contributors by age, gender, salary cluster × number of years already worked/total career

Data needed are the following:

- Population, number of contributors and beneficiaries by gender and age
- Salaries and pensions (amount) by age and decile of revenue
- Contribution rate, under ceiling and without ceiling, with indexation rule for ceiling
- Legal retirement age, with possible discount for early retirement
- Maximum replacement rate and number of years needed to attain it
- Indexation on pension on inflation or wage growth
- Invalidity and widows pensions
- GDP growth, real wage growth, inflation rate, discount rate

For France, the model was applied to all contributors and retirees, except the State civil servants. The model has been originated in 1993, in order to capture the evolution entailed by the reforms of required length of career and number of years used to calculate the reference salary depending on the age of the retiree. The data were benchmarked on the "Conseil d'orientation des retraites" (COR), a board of experts and social partners that was created in 2000 in order to provide analysis on the evolution of the pension system. These analyses are the basis for the discussions organized at the "meeting points", were decision and laws are to be taken in order to restore the long term balance of the pension system.

Data sources were the following:

- Population: INSEE projection
- Contributors= active population less State civil servants × activity rate by age from the INSEE
- Unemployment rate by age from INSEE and decrease of 2% from 2015 onward for people under 50 and from 1% onward for people after 50, due to the increase in retirement age
- Combined contributions to CNAVTS and AGIRC-ARRCO with a distinction between contribution under social security ceiling (2.3% from 2006 onwards) and contribution above ceiling (21.7%)
- Legal retirement age: 60 and 62 after 2010 after reform
- Maximum replacement rate of 95% attainable in 37.5 years in 1993 up to 41.75 years in 2020. This lead to an incremental replacement rate of 2.53 in 1993 going down to 2.28 in 2020
- Number of years used to calculate the reference salary form 10 in 1993 to 25 in 2008 onwards
- Inflation, GDP growth, labor productivity growth are updated up to 2009. Afterwards, inflation rate is set at 2% and other variables are aligned on COR C scenario.

Table B1: macroeconomic parameters used by the COR and in PRST estimates

	2009-2013	2014-2020	2021-2050
Scenario B			
unemployment rate	8,4	7,7	4,5
GDP real growth	1,3	2,2	1,6
labour productivity growth	1,4	1,8	1,6
Scenario C			
unemployment rate	8,4	7,7	7
GDP real growth	1,3	2	1,6
labour productivity growth	1,4	1,8	1,6

Figure B1: Ratio of contributors to retirees in France

(based on PROST using benchmarks from the COR)

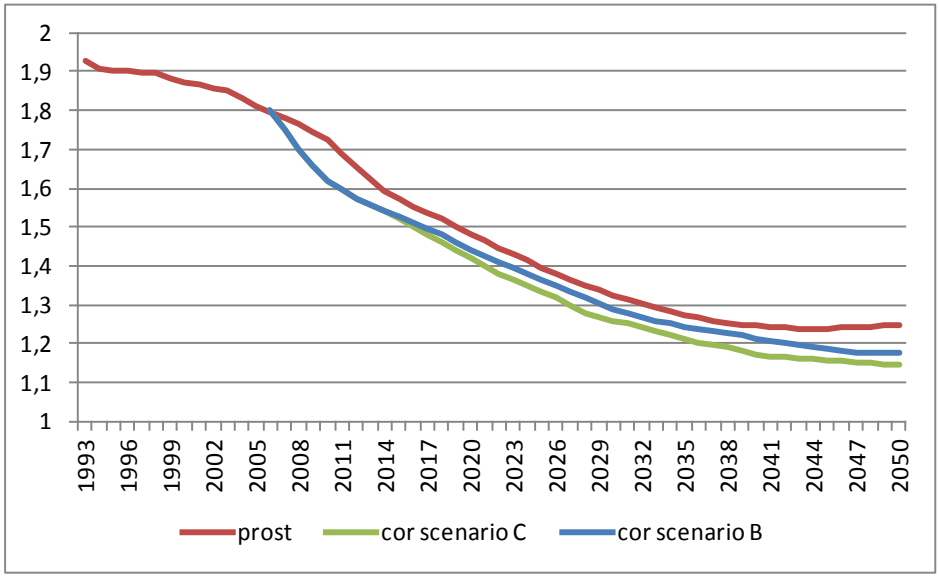
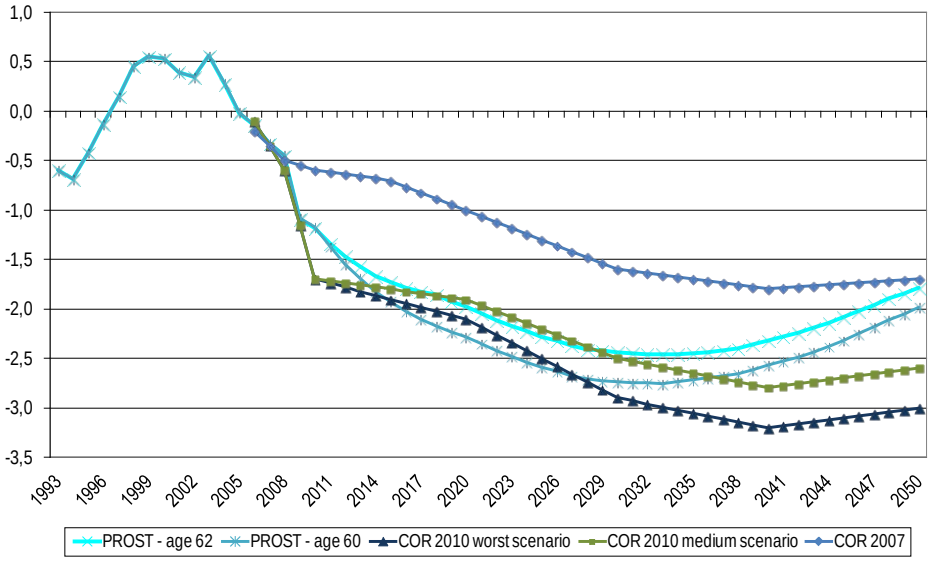


Figure B2: Projected net cash flow for social security in France, as a percent of GDP

(based on the authors' simulations using PROST and the COR)

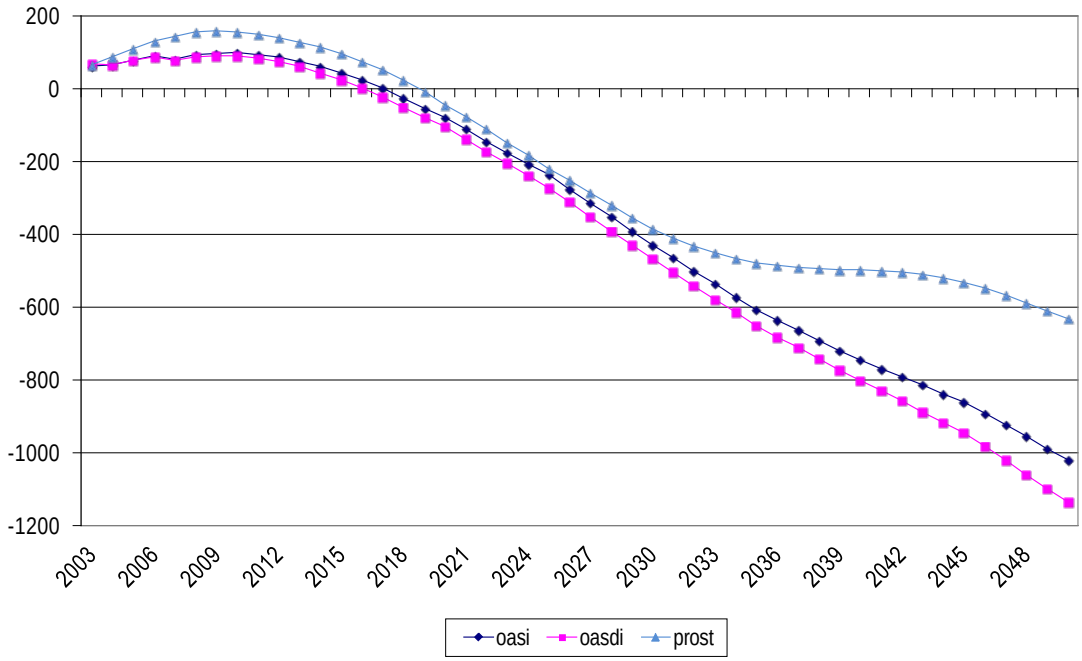


For the **United States** the model was applied to the entire population. The model was started in 2003. Data sources were the following:

- Data from the Census bureau regarding population
- Data from the bureau of labor regarding wages
- Data from OASDI trustee report regarding social security
- Contribution rate was fixed to 6.2% under ceiling and 6.2% above ceiling
- Maximum replacement rate was fixed to 64% after 45 years of contribution, which lead to an incremental replacement rate of 1.43% a year
- The minimum retirement age is put to 65 in 2002, 66 in 2006, 67 in 2027

Figure B3: Projected net cash flow for social security in the US

(billions of dollars)



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