# Macroeconomic Effects of Increased Annuitization: A Quantitative Assessment

**Allen Sinai, Cary Leahey, and Chip Curran**
**Decision Economics, Inc.***
**(Version November 2006)**

***Boston, New York, London. Chief Global Economist; Senior Managing Director, U.S. Economy and Public Economics; Managing Director and Director of Macroeconometric Modeling.** **Partial support of the research for this paper was provided by the American Council for Capital Formation (ACCF). Presented at the National Press Club, Washington, D.C., Tuesday, October 10, 2006. Revised November 2006.**

**Macroeconomic Effects of Increased Annuitization: A Quantitative Assessment**
**by Allen Sinai, Cary Leahey, and Chip Curran***

## I. Introduction

Funding the retirement of an aging U.S. population is a pressing national problem.[1] The potential sources of funding are diminishing. The U.S. personal savings rate has fallen steadily, from well over 8% in the 1980s to negative now.[2] The ability of the federal government to provide income support in the future for living expenses (Social Security) and medical care (Medicare, Medicaid) is subject to considerable doubt. Defined benefit (DB) plans are on the decline and defined contribution (DC) plans on the rise. Corporations are cutting pension funding and shifting responsibility for financing to employees. Under current law and prospects, the savings deficit of households, unfunded future retirement needs, and a growing lack of resources from the public and private sectors suggest a looming crisis for the elderly and a significant gap to come between what is available and what is necessary to maintain the standard-of-living of older Americans.

Measured another way, probably more accurately, savings, based on household flows-of-funds and household balance sheets, is positive. But, here, too, there has also been a significant decline in the savings rate. Households have borrowed to finance spending but also by drawing heavily on equity collateral in residential real estate. Debt loads are rising and likely will continue to do so. Household financial positions, though not yet fragile, likely will deteriorate as the population ages and draws down more assets and equity to provide funds for retirement.

* The comments and suggestions of Pinar Cebi and Margo Thorning are gratefully acknowledged; along with the research assistance of Brian Liu and David Metz.

[1] Many others have noted this problem. See, e.g., Ben S. Bernanke (2006).

[2] On the standard National Income Product Account (NIAP) measure, savings is essentially the difference between disposable income and consumption. The personal savings rate is this residual divided by disposable income. Other than disposable income, whatever raises consumption, for example household spending in response to increases in wealth and capital gains realizations or additional funds raised in mortgage financing, will lower the savings rate as calculated. In recent years, much funding of additional consumption has come from increases in real estate wealth, from cash-out mortgage refinancing, and capital gains realized on the sales of homes. More than any other factor, this is probably what has produced an excess of consumption spending over disposable income and a negative personal savings rate.

Individuals appear myopic, focused on current consumption, relying on corporate or public sector pension programs that may, or may not, be in existence to take care of them in later life. Many of these programs do not adjust payments at retirement for inflation and the actuarial payments set may not fully take account of increasing longevity.

The ability of the federal government to provide income support (Social Security) and to support medical care (Medicare, Medicaid), given increasing numbers of beneficiaries and rising retiree living costs, especially for healthcare where costs rise faster than the average rate of inflation, will very likely keep diminishing. Although the federal budget has improved a lot cyclically, longer-run projections of federal budget deficits calculated at full employment remain bleak, principally reflecting growing mandatory entitlements spending, especially for Medicare and Medicaid. Relying on federal government funding for the financial needs of retirement thus appears ill-advised. And, what appears to be increasing practice in the private sector, a shifting of retirement funding onto individuals, very likely will intensify. All this could be made even worse for retirees should there be a cyclical weakening of the U.S. economy, which, after five years of expansion, seems highly likely at some point.

Put simply, under current laws and prospects, the savings deficit of households, likely unfunded future retirement needs, and a growing lack of supporting resources in the public and private sectors suggest a looming crisis for the elderly and a significant, and potentially negative, gap between what is available and what is necessary to maintain older Americans' standard-of-living.

Administration and Congressional efforts to deal with the prospective drain on the federal budget and needs of the private sector in retirement have brought few results. The political process has yet to really confront the problem. No policies nor processes currently appear in prospect to address the household savings imbalance and the financial requirements of an aging

population, suggesting that funding the basic needs of a growing retired population will be very difficult with the future standard-of-living of Americans in jeopardy.

In the context of what could ultimately be a devastating public problem, damaging to the U.S. economy and the well-being of aging families and their descendants, this paper investigates one option to promote saving for retirement—increased use of annuities to help fund, supplement, or supplant other sources of funds and to help provide for a better life in retirement. Even though microeconomic analysis clearly indicates the rationality for increased use of annuities, there is almost no analysis of increased annuitization at the macro, or aggregative, economic level.[3]

This paper assesses the impacts of increased annuitization on the U.S. economy through macroeconometric model simulation of a policy initiative currently in the Congress—The Lifetime Pension Annuity for You Act (Lifetime PAY Bill) introduced by Representative Earl Pomeroy (D-ND). The Sinai-Boston (SB) Large-Scale Quarterly Macroeconometric Model of the U.S. is used to simulate the effects of annuitization on consumption and savings and to analyze how changes in savings might affect households' flows-of-funds and household balance sheets, i.e., the financial position of households. The method used is "counterfactual;" that is, asking of history through model simulation "what would have happened had the program been in place," then comparing the simulated results to the actual historical record where the policy being analyzed was *not* in place. Assessments are made for the directional and qualitative effects of the program on the macro economy as well as approximate magnitudes.[4]

---

[3] See Yaari (1965) and Davidson, Brown, Diamond (2005).

[4] A large-scale macroeconometric model simulation of potential changes in policy provides only one out of a wide distribution of outcomes. Macroeconometric models are stochastic and probabilistic in nature. Presumably, any outcome represents the approximate center of the distribution of possibilities, but there is no guarantee of this. Initial conditions and estimated parameter values, along with the policy, all can affect the simulation path; certainly, so can the structure of the macroeconometric model. Therefore, the results of such analyses should be regarded as only approximate, conditional on the parameters of the model which themselves could change depending on the policy that is implemented. In most econometric models, parameters are *not* changed in response to policy simulations, imparting a possible specification bias into the results. If a policy is very new, that is with few similar changes reflected in historical data, the odds are greater that the simulated results will have some bias or be unreliable. Nevertheless, regarding the effects of policy changes as approximately and directionally "valid" in the context of a well-specified macroeconometric model seems reasonable.

The paper proceeds as follows. Section II discusses the U.S. savings and retirement savings problems. The available evidence shows that retirement funding is inadequate and will become moreso in future years as more and more people reach retirement age.[5] Section III briefly describes the potential role of annuities in supplementing retirement income and increasing the certainty of retirement funding. Increased annuitization can be private-sector driven because of a federal government tax incentive, the case here, or perhaps part of an approach to deal with the larger problem of low national savings. Section IV reports the simulated economy-wide effects of the Lifetime Pay Bill using the SB Model.[6] The quantitative effects of this Bill provide an example of how public policy can be used to increase annuitization and retirement saving and provides evidence on how increased annuitization can affect economic growth, consumption, investment, jobs and unemployment, household saving and the aggregate financial position of households. Increased annuitization is shown to have positive impacts on the economy as a whole, not just for retirees. Concluding perspectives are provided in Section V.

## II. The U.S. Savings and Retirement Savings Problems—The Facts of Life

By virtually all measures, the U.S. savings rate is far short of what is needed to fund the consumption and investment expenditures of a growing economy and to adequately meet the financial needs of a growing number of retirees. Table 1 shows that U.S. gross national domestic saving as a percentage of national income has been declining continuously for many years. Although the first column of Table 1 indicates positive household saving, this is largely due to including the consumption of fixed capital (depreciation) in the calculation. Tables 2 and 3 illustrate the steady declines in U.S. savings rates using data from the Bureau of Economic Analysis (BEA) and the Federal Reserve Flow-of-Funds. According to the Federal Reserve

[5] Very likely, given slower growth in the labor force and a looming gap, fed by higher inflation, between the financial requirements of retirement and the means of funding, increased employment of age 65-and-over individuals probably will occur under what could be less than trend economic growth but still a tight labor market.

[6] Appendix A discusses how the Lifetime Pay Bill was integrated into the SB Model, the underlying assumptions used, and how the model simulations were performed. Appendix B presents a brief description of the SB Model.

System definition, saving is the net addition to wealth. In otherwords, it is the difference between the household sector's net acquisition of assets (financial assets including cash, bank deposits, stocks, bonds, life insurance, pensions, and net investment in tangible assets such as residential structures, fixed assets, and consumer durables) and its net accumulation of liabilities. This definition provides a better measure of the household sector's saving than does the NIPA personal savings rate, calculated as the difference between disposable income and consumption.

**Table 1**
**U.S. Gross National Domestic Saving (1991-2005)**
**(Billions of Dollars)**

| | Households | Business | Government | | Total | Total as Percentage of Gross National Income |
|---|---|---|---|---|---|---|
| | | | Federal | State & Local | | |
| **1991** | 413.7 | 629.3 | -141.5 | 62.7 | 964.1 | 16.2 |
| **1992** | 462.8 | 637.4 | -222.7 | 70.6 | 948.2 | 15.1 |
| **1993** | 384.1 | 699.1 | -195.5 | 74.7 | 962.4 | 14.7 |
| **1994** | 356.6 | 757.4 | -132.2 | 88.9 | 1070.7 | 15.4 |
| **1995** | 364.1 | 840.4 | -115.1 | 95.2 | 1184.5 | 16.2 |
| **1996** | 346.6 | 891.2 | -59.7 | 113.0 | 1291.1 | 16.6 |
| **1997** | 343.4 | 963.1 | 26.7 | 130.7 | 1461.1 | 17.7 |
| **1998** | 409.7 | 919.3 | 121.6 | 148.2 | 1598.7 | 18.2 |
| **1999** | 303.1 | 1030.3 | 188.5 | 152.5 | 1674.3 | 17.9 |
| **2000** | 323.3 | 1010.9 | 276.6 | 159.8 | 1770.5 | 17.7 |
| **2001** | 304.0 | 1096.0 | 134.9 | 122.6 | 1657.6 | 16.2 |
| **2002** | 371.5 | 1188.1 | -159.1 | 88.6 | 1489.1 | 14.2 |
| **2003** | 376.6 | 1256.7 | -281.7 | 107.4 | 1459.0 | 13.3 |
| **2004** | 410.2 | 1297.5 | -287.9 | 123.8 | 1543.7 | 13.2 |
| **2005** | 258.7 | 1413.6 | -210.1 | 149.9 | 1612.0 | 13.0 |

Sources: DE calculations using data from the *Bureau of Economic Analysis* (BEA), National Income and Product Accounts, Table 5.1 and *Survey of Current Business*, September, 2006, Table 5.1.

Gross Saving for households is calculated by adding household consumption of fixed capital to household net saving. Gross Saving for business is calculated by adding consumption of fixed capital for domestic business and wage accruals less disbursements to undistributed corporate profits with inventory valuation adjustment and capital consumption adjustments. The federal government and state and local government saving is calculated as current receipts minus current expenditures (net government saving) plus consumption of fixed capital.

**Table 2**
**"Personal" Saving by Households in the U.S.: By Decade and Recently**
**(Personal Savings Rate, Percent)**

| | |
|---|---|
| 1961-1970 | 8.5 |
| 1971-1980 | 9.6 |
| 1981-1990 | 8.7 |
| 1991-2000 | 4.7 |
| 2001 | 1.8 |
| 2002 | 2.4 |
| 2003 | 2.1 |
| 2004 | 2.0 |
| 2005 | -0.4 |
| 2001-05 | 1.6 |
| Latest—2006:3 | -0.5 |

Source: DE calculations using data from the *Bureau of Economic Analysis* (BEA).

The data in these Tables reflect, in part, the strong spending and heavy borrowing that have occurred in recent years. In particular, much of the greater-than-average economic growth

and consumer spending of recent years has been financed through increased household sector borrowing using real estate as asset collateral. New financial instruments and mortgage products have permitted the extraction of previously untapped equity from a buildup in real estate values. Low interest rates, the proliferation of new mortgage instruments, and new ways of using the equity heretofore residing in residential real estate have helped boost private sector spending to well above previous levels and have led to real estate price increases that have gone far beyond those of history. This has raised aggregate consumption spending in excess of disposable income, producing a negative personal savings rate. Negative personal savings is not sustainable over the long run and further indicates that household funding for retirement has been diminishing.

**Table 3**
**Savings Rate on the Household Balance Sheet: Recent History**
**(Percent)**

| | |
|---|---|
| 1991 | 9.5 |
| 1992 | 10.0 |
| 1993 | 9.1 |
| 1994 | 8.8 |
| 1995 | 8.0 |
| 1996 | 8.5 |
| 1997 | 6.8 |
| 1998 | 7.4 |
| 1999 | 3.9 |
| 2000 | 0.1 |
| 2001 | 4.8 |
| 2002 | 3.3 |
| 2003 | 6.2 |
| 2004 | 4.0 |
| 2005 | 0.8 |
| Latest 2006:2 | 0.1 |

Source: DE calculations using data from the Federal Reserve, *Flow-of-Funds Accounts of the United States, Flows and Outstandings,* Second Quarter, 2006.

Personal savings (balance sheet measure) as a percentage of disposable personal income. Savings include equity in consumer durables.

The ratio of debt-to-income for households has been on the rise and is near historical highs. However, debt-to-asset ratios remain adequate, principally because of rising asset values of collateral in residential real estate and in the stock market. Should erosion occur, as is likely to happen during a recession or near-recession, then debt-to-asset ratios and corresponding repayment burdens could become excessive, forcing the personal savings rate to rise back into

positive territory and consumption to weaken. However, in such a situation there would still be insufficient funds out of current income for the funding of retirement since debt and debt loads would have to be repaid.

Indeed, the lack of saving in the United States is mirrored by the increased current account deficit. Spending on goods and services purchased from abroad has increased relative to exports, and earnings on U.S. investments elsewhere have fallen short of those by foreign investors in the United States. Borrowing from outside the U.S. has grown along with the current account deficit and now stands at a record-high, relative to U.S. GDP, indicating potential vulnerability in U.S. financial markets and for the economy to shifts in lender and investor preferences away from the U.S.. Increases of the current account deficit and corresponding increases in international indebtedness leave the economy vulnerable to major shifts of funds away from the dollar. Such activity would likely be accompanied by a weaker dollar, lower stock prices, and higher interest rates than would otherwise occur, eventually restraining U.S. economic growth and resulting in a lower standard-of-living.

These trends have had a profoundly negative effect on saving for retirement. Table 4 shows how little most American families have put away for retirement.

**Table 4**
**Reported Total Savings and Investments, by Age***

| Income Range | All Workers | Ages 25-34 | Ages 35-44 | Ages 45-54 | Ages 55+ |
|---|---|---|---|---|---|
| Less than $25,000 | 52% | 70% | 50% | 41% | 39% |
| $25,000-$49,999 | 13% | 12% | 15% | 14% | 12% |
| $50,000-$99,999 | 11% | 9% | 14% | 13% | 7% |
| $100,000-$249,000 | 12% | 5% | 10% | 17% | 23% |
| $250,000 or more | 11% | 4% | 10% | 16% | 19% |

*Not including value of primary residence.
Source: Employment Benefit Research Institute and Mathew Greenwald & Associates, Inc., 2005 *Retirement Confidence Survey,* reprinted in Cebi (2006).

Other than the values of a primary residence or other residences, which in recent years have risen to levels that could provide a potential source of retirement funds, saving and investment appear inadequate for any reasonable lifetime retirement needs. In the survey reported in Table 4, a total of 51% of the population aged 55-or-older had less than $49,999 in

potential retirement assets. Over 80% of families with a head-of-household aged 55 or older had under $250,000 in potential retirement assets. If representative, these figures highlight the potential shortfall in retirement funds. Gains of housing values in recent years have increased the potential funding of retirement, but much has been offset by increased debt as households used the proceeds for spending on new homes, additions and alterations, and the consumption of goods and services.

What are the main sources of retirement funding? Table 5 shows the distribution of retirement funds as of yearend 2005. Annuities are a small portion of retirement funding (Table 5) but are increasing in absolute amount (Table 6).

**Table 5**
**Sources of Retirement Finance**
**($ Trillions, Yearend, and Percent of Total, 2005)**

| Type | Amount | Percent of Total |
|---|---|---|
| Annuities (1) | 1.4 | 9.7 |
| Government Pension Plans | 3.8 | 26.2 |
| Private Defined Benefit Plans | 1.9 | 13.1 |
| Defined Contribution Plans | 3.7 | 25.5 |
| Individual Retirement Accounts | 3.7 | 25.5 |
| Total | 14.5 | 100.0 |

Source: Investment Company Institute, "The U.S. Retirement Market, 2005," p. 2.
(1) Includes all fixed and variable annuity reserves at life insurance companies less annuities held by IRAs, 403b plans, 457 plans, and private pension funds.

**Table 6**
**Annuities Outstanding: 1994-2005**
**($ Trillions)**

| Year | |
|---|---|
| 1994 | 0.5 |
| 1995 | 0.6 |
| 1996 | 0.6 |
| 1997 | 0.7 |
| 1998 | 0.8 |
| 1999 | 0.9 |
| 2000 | 1.0 |
| 2001 | 1.0 |
| 2002 | 1.0 |
| 2003 | 1.1 |
| 2004 | 1.3 |
| 2005 | 1.4 |

Source: Investment Company Institute, "The U.S. Retirement Market, 2005," p. 2.
(1) Includes all fixed and variable annuity reserves at life insurance companies less annuities held by IRAs, 403b plans, 457 plans, and private pension funds.

## III. The Potential Role of Annuities in Retirement Saving

The long-time decline in household savings as a percent of income, increased use of debt collateralized by real estate to finance current consumption in excess of current disposable income, increasing consumer debt loads, large and prospective federal budget deficits, large and

rising trade and current account deficits and growing international indebtedness indicate a looming shortage of funds for the growing retirement needs of an aging population.

To fund that shortage, there are the following possibilities—1) consumption cutbacks, with higher savings, job losses and slower growth in economic activity that would penalize *all* households; 2) the federal government stepping up financial support, increasing an already very large and daunting stream of expected future outyear budget deficits; 3) higher taxes; 4) non-U.S. countries increasing further the funding of U.S. financial needs; or 5) the political and social system responding with new innovations and changes in the ways that retirement is financed, some of them possibly radical.

Currently, the major sources for financing retirement are public (Social Security, Medicare and Medicaid), corporate (pensions and 401ks), and individuals (IRAs, Roth IRAs). Among the affluent and some middle-class families, current saving and the drawing down of balance sheet assets also are sources of retirement funds. *In the past, while growing in popularity, annuities have not been utilized very heavily. In fact, most research indicates that annuities are underutilized.*[7] *Thus, there is considerable potential for increased annuitization.*

Though a long way from the answer to America's looming retirement funding crisis, increased use of annuities can provide a way to increase retirement support from the private sector and the wealth accumulation of individual households rather than calling upon federal, or state and local, government to provide significant increases in outlays or entitlements.

## IV. Increased Annuitization—A Macroeconometric Assessment

What might be the macroeconomic impacts of increased annuitization? Would a switch by households from the current means of financing retirement to increased use of annuities have any noticeable effects on the economy, the pattern of consumption, savings, household financial

[7] See Brown, Mitchell, Poterba and Warshawsky (2001); Brown and Poterba (2004); Gale, Gruber, Orszag (2006); the CBO (1998) and the references contained therein. The cost of annuities most often is cited as the biggest impediment to increased annuitization. The research cited indicates about a 15% to 20% markup of annuity costs relative to fair value. Adverse selection represents about half the markup and the rest is other factors such as marketing costs and insurance company profit.

well-being, jobs and the standard-of-living of retired Americans—for that matter all Americans? Heretofore, the main provider of annuities has been life insurance companies and the amounts of annuities outstanding, while growing, still minimal.

There are currently several proposals in the U.S. Congress to encourage increased use of annuities by households. The Lifetime Pension Annuity for You Act (Lifetime PAY) (H.R.2951), sponsored by Representative Earl Pomeroy, introduces tax incentives for this specific purpose. Table 7 summarizes its key dimensions and characteristics. Another similar bill, the Flexible Retirement for Life Act, is summarized in Table 8.

**Table 7**
**Lifetime PAY Bill—Dimensions and Characteristics**

| | |
|---|---|
| **Title:** | Lifetime Pension Annuity for You Act (Lifetime PAY) HR 2951 |
| **Sponsor:** | Rep. Earl Pomeroy (D-ND) |
| **Introduced:** | June 16, 2005 (updated from earlier 2003 bill(s)) |
| **Description:** | Allow taxpayers to exclude up to 25% of qualified (401K/IRAs, etc.) annuity income and up to 50% for non-qualified (non-tax deferred assets like a savings account). |
| **Exclusions/Caps:** | Tax saving/exclusion capped at $5,000 of annuity income ($10,000 for joint returns). Cap is indexed for inflation. |
| **Economic Impact:** | Gentry/Rothschild (2006) estimate that households aged 65 would annuitize $50,000 of net worth, on average.<br>With roughly 1.25 million 65-aged households, aggregate assets annuitized are roughly $65 billion.<br>At current interest rates, the implied annual income flow would be $5 billion to $6 billion ex-inflation adjustment. |
| **Revenue Loss:** | Gentry/Rothschild (2006) assume a 12.5% average effective tax rate, estimating an implied $0.5 billion to $0.75 billion annual tax loss to the federal government.<br>Assuming a top marginal tax rate of 35%, the implied losses would top $2 billion. |

Sources: DE and Gentry/Rothschild, September 2006.

**Table 8**
**Flexible Retirement for Life Act—Dimensions and Characteristics**

| | |
|---|---|
| **Title:** | Flexible Retirement for Life Act S. 381; HR 3912; HR 819 |
| **Sponsor:** | Sen. Smith (R-OR); Conrad (D-ND); Rep. Nancy Johnson (R-CT); Rep. Tanner (D-TN) |
| **Introduced:** | Sept. 27, 2005 (updated from earlier bill(s)). |
| **Description:** | Allow taxpayers to exclude up to 50% of the annuity income from an asset. |
| **Exclusions/Caps:** | Tax saving/exclusion capped to $20,000 in annuity income. |
| **Economic Impact:** | None estimated |
| **Revenue Loss:** | None estimated |

Sources: DE and Gentry/Rothschild, September 2006.

To assess the macroeconomic effects of the Lifetime PAY Bill, the Sinai-Boston (SB) large-scale macroeconometric model of the U.S. was utilized.[8] For questions on the

[8] See Appendix B for a brief description of the SB Model. Over a number of years, the SB Model has been used many times for quantitative analyses of changes in various policies or proposed new programs.

macroeconomic impacts of such a bill, the SB Model is quite suitable, with the SB framework allowing for effects on consumption, personal savings, its distribution across the household balance sheet and the potential cost-effectiveness, or lack thereof, of the tax policy. In particular, the effects of the Lifetime PAY Bill on household flows-of-funds saving and on household sector balance sheets are highlighted.

The method of analysis used was "counterfactual simulation."[9] Counterfactual simulation refers to analysis where a particular policy, program or bill, not present in history is assumed to have been enacted at some point, with the "what if" question "had the program been in effect, what would have happened?" Since the data of history and the sample period do *not* reflect the policy, asking of the Model in historical simulation what would be the effects had the policy been in place, when indeed it was not, involves examining the simulated paths of behavior for the variables of interest on implementation of the policy compared to what actually happened.[10]

Tables 9 to 16 summarize the macroeconomic effects of the Lifetime PAY Bill using the SB Model as the framework for analysis as if the Lifetime PAY Bill had been in effect over 1995-2005. An 11-year timespan was used to allow the effects of the program to evolve given the many adjustment and expectations lags in the Model and to provide enough time for the buildup of funds in the household sector that is implied by the Bill.

Two sets of results are provided, differing only in how the tax costs of the Lifetime PAY Bill were calculated. The simulations reported in Tables 9 to 12 use the tax costs for the

[9] See Appendix A, which discusses how the Lifetime PAY Bill was implemented in the SB Model, with some performance results.

[10] It should be noted that the Baseline (History) assumes that the income implicitly or explicitly generated by the asset to be annuitized is income that is not consumed. But, in the simulation, when the asset is annuitized by shifting it to an insurance company, the assumption made is that the annuity income generated is consumed or saved according to the consumption and savings behavior embedded in the model. Given that a new policy might be specific to a particular segment of the population, or age cohort, and not been present before, the response coefficients in the model, which are fixed and estimated based on history, may have some bias. This point essentially reflects the so-called "Lucas Critique" which argues that econometric model simulations based on history and sample period estimates of fixed coefficients are likely to give invalid results to the extent the structure of the model, i.e., its coefficients, do not reflect the policy or, in this case, much annuitization, and might change in reaction to the policy. However, depending on how unlike other measures in history is the policy or its potential magnitudes of impact, an econometric model can be argued to give "roughly" valid, i.e., accurate, results in simulation especially for the range of stochastic variation provided by the model.

Lifetime PAY Bill based on the method of calculation by Gentry-Rothschild (GR, 2006).[11] In Tables 13 to 16, the ex-ante cost estimates by DE use average effective marginal tax rates for the population-at-large.

Table 13 reports the estimated effects of the Lifetime PAY Bill on the economy. Table 14 has the breakdown for the "costs" of the bill in terms of revenue loss, static vs. dynamic, or ex-ante vs. ex-post, using DE estimates. Table 15 shows the effects on saving for measures defined on household flow-of-funds data; also some summary measures of the aggregate household balance sheet, or financial position of households, as a consequence of enactment. The more conventional result on personal savings, using the National Income and Product Account (NIPA) approach, is provided in Table 13. It shows declines. Table 16 presents the DE preferred way of looking at household "savings."

Only the results shown in Tables 13 to 16, using DE estimates of static, or ex-ante, tax costs are discussed.[12]

[11] Most likely, the GR estimates take as the tax rates for calculating the ex-ante costs to the federal government those of lower income families. This seems plausible since the 65-and-over population, as beneficiaries of the Lifetime PAY Bill, are thought to have lower income tax rates than the population-at-large. However, in the simulation the feedback effects of the Lifetime PAY Bill on the economy and then on tax receipts, ex-post, produced an accumulation of tax receipts from all sources—personal, excise, Social Security, corporate, capital gains and estate—that exceeded the ex-ante, or static, costs of the program. While the tax feedback is correct directionally, we find this result to be implausible. Only one tax studied of all the tax policy changes analyzed by DE over many years has had the property of more than paying for itself—that was capital gains tax reduction where unlocked capital gains realizations at new lower capital gains tax rates could release enough capital gains tax receipts, ex-post, so as to bring the tax receipts after implementation to greater levels than the original estimated costs. No such ex-post property can be found for the increased annuitization Lifetime PAY Bill nor could behavior in the economy be expected to change as might be the case when capital gains taxes are reduced. Changes in the structure of the economy from reductions in capital gains taxes, also when taxes on dividends were reduced, can plausibly be expected to bring some surprising ex-post results. Given that the SB Model parameter responses for tax receipts have been thoroughly tested and validated and appear quite reasonable, we concluded that the ex-ante tax calculations of GR were too low. We do report the results of the Model simulations using GR estimates of the tax costs per family from annuitization, and the calculated tax losses. But the results with the DE estimated tax losses are much more in-line, ex-post, with expectations and empirical evidence from other tax reductions. A positive tax feedback effect, on average, of $0.51 per dollar of initial revenue loss was simulated. It should be remembered that in a full economy-wide simulation, the increased tax receipts from the stimulus of the Lifetime PAY Bill will not only show up in personal income tax receipts but also in corporate, excise, Social Security, capital gains, and potentially even estate tax receipts because of higher household net worth.

[12] The results presented in Tables 9 to 12 (with the GR calculations of static tax losses) and in Tables 13 to 16 are quite close, differing most in the estimated ex-ante costs of the Lifetime PAY Bill: DE ($144.5 billion cumulated over 11 years) versus GR ($45.8 billion over 11 years). While not much difference can be seen between the results on overall macroeconomic activity (Tables 9 and 13), the savings and distribution of them as a consequence of the increased annuitization (Tables 11-12 vs. Tables 15-16) show noticeable differences.

**Table 9**
**Increased Annuitization and the Macro Economy:**
**A Quantitative Assessment—Lifetime PAY Bill* ****
**(Changes Relative to Baseline)**

| Macroeconomic Dimension | 1995-99 Avg. | 2000-05 Avg. | 1995-2005 Avg. |
|---|---|---|---|
| Economy | | | |
| Real GDP (Bils. '00 $s.) | 9.0 | 45.3 | 28.8 |
| Consumption (Bils. '00 $s.) | 8.6 | 44.2 | 28.0 |
| Business Capital Spending (Bils. '00 $s.) | 3.6 | 0.9 | 5.9 |
| Inflation | | | |
| CPI-U (%) | 0.0 | 0.0 | 0.0 |
| Consumption Deflator Ex-Food & Energy (%) | 0.0 | 0.0 | 0.0 |
| Employment & Unemployment | | | |
| Nonfarm Payroll (Thous.) | 65 | 319 | 204 |
| Unemployment Rate (%) | -0.1 | -0.2 | -0.2 |
| Business Profits | | | |
| S&P500 EPS ($s/Share) | 0.12 | 0.54 | 0.35 |
| Aftertax Corp. Profit ($ Bils.) | 1.4 | 4.8 | 3.3 |
| Stock Market | | | |
| S&P500 (Index) | 0.13 | 0.33 | 0.24 |
| Personal Savings ($ Bils.) (1) | -5.0 | -36.3 | -22.1 |
| Budget Deficit ($ Bils.) | -0.1 | 6.1 | 3.3 |

* Counterfactual simulations (11 years, 1995-2005) with the SB Model of the U.S. Economy; Full Feedback; Federal Reserve Monetary Accommodation, No Change in the Federal Funds Rate from Historical Levels.

** Tax costs estimated by Gentry-Rothschild (2006) and 65-aged households annuitizing $50,000 of net worth.

(1) National Income and Product Accounts (NIPA) definition—Disposable Income less Consumption less Non-Mortgage Interest less Transfer Payments to Government and Rest-of-the World.

**Table 10**
**Increased Annuitization in the Macro Economy:**
**A Quantitative Assessment—Lifetime PAY Bill* ****
**"Static," Ex-Ante and "Dynamic," or Ex-Post, Costs**
**(Changes Relative to Baseline)**

| Taxes and Federal Budget | 1995-99 Cum. | 2000-05 Cum. | 1995-2005 Cum. |
|---|---|---|---|
| Tax Receipts ($ Bils., Unified) | | | |
| Ex-Ante (Gentry-Rothschild) (1) | -10.5 | -35.4 | -45.8 |
| Ex-Post (2): | -3.3 | 17.5 | 14.1 |
| Individual-Excl. Capital Gains | -8.2 | -18.1 | -26.3 |
| Individual Capital Gains | 0.4 | 5.9 | 6.3 |
| Corporate | 2.2 | 7.8 | 10.0 |
| Excise | 0.4 | 2.8 | 3.3 |
| Social Security | 2.3 | 19.3 | 21.5 |
| Net Costs ($ Bils., Unified) – Ex-Post | -3.3 | 17.5 | 14.1 |
| Budget Surplus/Deficit (Unified) | -1.0 | 34.0 | 33.0 |
| Govt. Debt/GDP (Pctg. Pts.) | 0.0 | -0.3 | -0.2 |
| Percent of Tax Cut Recovered Ex-Post (Ratio x 100) | 31.4 | 149.4 | 130.8 |

* Counterfactual simulations (11 years, 1995-2005) with the SB Model of the U.S. Economy; Full Feedback; Federal Reserve Monetary Accommodation, No Change in the Federal Funds Rate from Historical Levels.

** Tax costs estimated by Gentry-Rothschild (2006) and 65-aged households annuitizing $50,000 of net worth.

(1) See Gentry-Rothschild (2006).

(2) Individual, Corporate, Excise and Social Security from NIPA definitions and do not exactly equal the unified total. Division of "Individual" into "Capital Gains" and "Individual-Excluding Capital Gains" by the SB Model.

**Table 11**
**Increased Annuitization in the Macro Economy:**
**A Quantitative Assessment—Household Sector "Savings" and Financial Position—**
**Lifetime PAY Bill* ****
**(Changes Relative to Baseline)**

| Assets/Liabilities/Net Worth | 1995-99 Avg. | 2000-05 Avg. | 1995-2005 Avg. |
|---|---|---|---|
| Financial Assets Ex-Stocks ($ Bils.) | 7.9 | 26.1 | 17.8 |
| Cash & Equivalent | 2.4 | 4.3 | 3.4 |
| Bonds | 5.5 | 21.8 | 14.4 |
| Household Equity (Stocks) | 9.7 | 44.3 | 28.6 |
| Liability/Debt ($ Bils.) | -3.7 | -15.8 | -10.3 |
| Consumer Credit | -4.3 | -22.4 | -14.2 |
| Mortgage Debt | 0.7 | 6.5 | 3.9 |
| Flow-of-Funds Saving ($ Bils.) | 6.5 | 31.2 | 20.2 |
| Flow-of-Funds Saving Rate (Pctg. Pts.) | 0.1 | 0.3 | 0.2 |
| Household Debt Service ($ Bils.) | -0.01 | -0.08 | -0.05 |
| Other Financial Risk Variables: | | | |
| Financial Assets/Liabilities (Pctg. Pts.) | 0.8 | 4.6 | 2.9 |
| Debt/Income (%) | -0.2 | -1.1 | -0.7 |
| Debt/Wealth (%) | -0.05 | -0.40 | -0.24 |
| DE Household Financial Position Index | 0.1 | -7.5 | -4.1 |

* Counterfactual simulations (11 years, 1995-2005) with the SB Model of the U.S. Economy; Full Feedback; Federal Reserve Monetary Accommodation, No Change in the Federal Funds Rate from Historical Levels.

** Tax costs estimated by Gentry-Rothschild (2006) and 65-aged households annuitizing $50,000 of net worth.

**Table 12**
**Increased Annuitization in the Macro Economy:**
**A Quantitative Assessment—Balance Sheet "Savings"—Lifetime PAY Bill* ****
**(Changes Relative to Baseline)**

| "Savings" Flows ($ Bils.) | 1995-99 Avg. | 2000-05 Avg. | 1995-2005 Avg. |
|---|---|---|---|
| Financial Assets | 18.1 | 86.8 | -55.6 |
| Money & Deposits | 2.4 | 4.2 | 3.4 |
| Misc. Assets | 0.2 | 0.6 | 0.4 |
| Bonds | 5.5 | 26.8 | 14.4 |
| Stocks (1) | 9.7 | 44.3 | 28.6 |
| Life Insurance | 1.7 | 10.8 | 6.7 |
| Pensions (Including Annuitized Assets) | -1.3 | 5.1 | 2.2 |
| Financial Liabilities (Debt) | -3.7 | -15.8 | -10.3 |
| Physical Assets (2) | 4.5 | 14.3 | 9.9 |
| Consumer Durables | 2.5 | -0.2 | 1.0 |
| Real Estate | 1.9 | 14.6 | 8.8 |
| Net "Earnings" ($ Bils.) (3) | 1.0 | 9.3 | 5.5 |
| Interest and Dividends | 0.7 | 5.1 | 3.1 |
| Borrowing Costs | -0.3 | -4.2 | -2.4 |
| "Savings—Total" (Finan. Assets less Liabs. plus Phys. Assets plus Net "Earnings") | 27.3 | 126.2 | 81.2 |
| "Savings" Rate (Pctg. Pts.) (4) | 0.5 | 1.6 | 1.1 |

* Counterfactual simulations (11 years, 1995-2005) with the SB Model of the U.S. Economy; Full Feedback; Federal Reserve Monetary Accommodation, No Change in the Federal Funds Rate from Historical Levels.

** Tax costs estimated by Gentry-Rothschild (2006) and 65-aged households annuitizing $50,000 of net worth.

(1) Market value-based.

(2) Principally residential real estate and automobiles, light trucks—all at market value.

(3) Interest and dividends earned on the additional financial assets and stock plus reductions in borrowing costs.

(4) Defined as "Savings—Total" divided by disposable income.

Some results from GR became key inputs into the SB Model simulations of the Lifetime PAY Bill. Certain other assumptions were made relating to the sources of the increased annuitization, the providers of the annuities, and how the "income" from increased annuitization was treated in the behavior of households.

First, the GR estimate of an increase in annuitization of $50,000 per retiree household was adopted. This estimate of increased annuitization under the Lifetime PAY Bill, along with Census figures on the number of retired households at age 65, permitted a calculation of the aggregate annuitized assets under the Lifetime PAY Bill for each of the years 1995 to 2005.

Second, the increased annuity "income" to retiree households was estimated at the GR 8.9% of total assets annuitized, with each subsequent year adding another age 65 retiree cohort on the same basis.

Third, in one of the two model simulations of the Lifetime PAY Bill, the GR estimates of static tax costs, i.e., before economy-wide feedback, were used to cost the Lifetime PAY Bill in terms of ex-ante reductions in tax receipts to the federal government. The GR calculations were based on microeconomic estimates that indicated approximately $0.10 to $0.15 lost tax revenues per dollar of additional annuitization. The approach used by GR differed from the standard approach used by DE in its estimation of the ex-ante, or static, tax losses associated with the Lifetime PAY Bill.

There were several other key assumptions and inputs made for the retrospective model simulations.

The increase in annuity assets was assumed to be sourced from other "qualified" assets such as 401ks or IRAs. That is, the $50,000 per household increase in annuitization was accomplished by switching funds out of other pension assets and remitting them to the provider, life insurance companies. In turn, the aggregate of the providers remitted income to the aggregate of retiree families at an 8.9% return per annum on the assets annuitized. In this circumstance, where the switch was from qualified assets into annuities, the annuity income permitted to be excluded from taxation was up to $5,000 for individuals and $10,000 for joint returns. Funds withdrawn from other qualified pension assets, if used as income, are taxed at the full marginal income tax rate.

The spending and saving propensities estimated in the SB Model were taken as those of the retiree households who received the tax-free annuity income. Thus, households were assumed to treat the annuity income much as other ordinary income might be treated in terms of the propensities to consume and the propensities to save. In the SB Model, the long-run propensity to consume (after two years) disposable income runs close to 65 cents and the long-run propensity to save approximately 35 cents.

Finally, the income generated from increased annuitization was not counted in disposable income by the Bureau of Economic Analysis (BEA), nor does it appear as dividends or interest. Under the Lifetime PAY Bill the aggregate annuity income remitted to 65-age retiree households is either spent or saved. But, since there is no corresponding increase in disposable income, personal savings and the personal savings rate fall. Savings is calculated as a residual, essentially the difference between disposable income and consumption outlays (Table 13). Measured another way, by the distribution of the additional funds obtained from increased annuitization across household flows-of-funds and the household sector balance sheet, additional savings did occur (Tables 15, 16). In the results presented, considerable attention is paid to household "savings" but not the traditional NIPA notion of saving; instead, savings as defined on the household balance sheet.[13] Also, Federal Reserve monetary policy was held constant, with the U.S. central bank "accommodating" the stimulus from the Lifetime PAY Bill by maintaining its key short-term interest rate, the federal funds rate, at Baseline levels.

The results from Tables 13 to 16 indicate the following—

- *Economy*—increased economic activity from increased consumption of retired families and the multiplier effects of the higher spending on other outlays by other households and businesses. Jobs creation and the derived increases of income lead to additional consumer spending as well. Table 13 shows a $34.3 billion per annum rise in real GDP compared to the Baseline, with the bulk of the gains

[13] The NIPA definition of personal saving, while appropriate for the definitional accounting of the macroeconomy, does not represent fully nor spell out the true "saving" of households. The personal savings residual is defined by disposable income, except for some minor details, less consumption. But, savings is more properly analyzed in terms of household sector flows-of-funds and the aggregate household sector balance sheet, where the disposition of savings into financial assets, financial liabilities, the purchase of equities, and use in financing expenditures on consumer durables or real estate all can be seen. Savings thought of in this way more properly is represented by changes in assets, liabilities, household holdings of stock, or changes in physical assets, valued at market prices, along with whatever interest earnings or costs are generated for the incremental changes in assets and liabilities on the balance sheet. The negative personal savings of the NIPA accounting recently, while of interest, does not really represent the "savings" or "financial position" of households where the distributions of savings over time show up in various stocks of assets or liabilities which define, and determine, household net worth and the ability of households to spend and finance.

coming from higher consumption. The higher consumption for retired and other households suggests an improvement in the standard-of-living of most Americans, at least on a consumption per capita basis.

- *Inflation*—no change in the rate of inflation from the Baseline given the modest nature of the increase of aggregate spending and a slight increase in productivity and the potential supply of the economy. The fiscal stimulus of the Lifetime PAY Bill is modest as tax policy changes go, $144.5 billion of cumulated tax reductions over 11 years or about 2% of the average for disposable income over that period.

- *Jobs and unemployment*—small increases for jobs, with an average 239,000 jobs added per year as a consequence of the Lifetime PAY Bill. The unemployment rate averaged 0.1 percentage point per year lower over the 11-year period of the simulation.[14]

- *Profits*—higher from increased economic activity and increased business sales. No obvious cost-inflationary pressure is evidenced, permitting modest increases in sales revenues to flow into profits. The S&P500 EPS (Operating) was up $0.42 per year, a relatively small amount, but nevertheless significantly positive.

- *Savings*—lower on the NIPA basis from increased consumption out of the annuity "income," the latter not counted in disposable income, but also because increased wealth raises consumption to take down savings and thus the personal savings rate.

- *Household financial positions*—improved, as additional funds in the form of annuity income generated and the tax savings from the exclusion of some annuity income from taxation provide funds to be deposited into assets, invested in stocks or real estate, or used to reduce outstanding liabilities. A summary measure of household financial positions—the DE Household Financial Position Index—was lower by 3.8 points per annum over 1995 to 2005. Lower values reflect improved household financial well-being, higher values a worsening.

[14] Most likely, the creation of jobs going forward would be less than those in the retrospective, or counterfactual, simulation. During the mid- to late-1990s, jobs were very responsive to changes in economic activity. The labor force was growing rapidly, the labor force participation rate was high, and the boom in technology and in the economy was increasing the demands for workers. But, now with slowing labor force growth and a low labor force participation rate any policy stimulus to the economy could well produce many fewer jobs in response than was the case in the 1990s. Given that the SB Model is estimated with 1970s, 1980s, 1990s and 2000-05 data, the responses of jobs creation to the Lifetime PAY Bill may be biased upward.

**Table 13**
**Increased Annuitization in the Macro Economy:**
**A Macroeconomic Assessment—Lifetime PAY Bill* ****
**(Changes Relative to Baseline)**

| Macroeconomic Dimension | 1995-99 Avg. | 2000-05 Avg. | 1995-2005 Avg. |
|---|---|---|---|
| Economy | | | |
| Real GDP (Bils. '00 $s.) | 12.2 | 52.7 | 34.3 |
| Consumption (Bils. '00 $s.) | 12.3 | 55.6 | 36.0 |
| Business Capital Spending (Bils. '00 $s.) | 1.2 | 6.2 | 3.9 |
| Inflation | | | |
| CPI-U (%) | 0.0 | 0.0 | 0.0 |
| Consumption Deflator Ex-Food & Energy (%) | 0.0 | 0.0 | 0.0 |
| Employment & Unemployment | | | |
| Nonfarm Payroll (Thous.) | 92 | 361 | 239 |
| Unemployment Rate (%) | -0.1 | -0.2 | -0.1 |
| Business Profits | | | |
| S&P500 EPS ($s/Share) | 0.17 | 0.63 | 0.42 |
| Aftertax Corp. Profit ($ Bils.) | 1.9 | 5.3 | 3.7 |
| Stock Market | | | |
| S&P500 (Index) | 0.2 | 0.5 | 0.4 |
| Personal Savings ($ Bils.) (1) | -3.3 | -33.6 | -19.8 |
| Budget Deficit ($ Bils.) | -3.9 | -7.6 | -5.9 |

* Counterfactual simulations (11 years, 1995-2005) with the SB Model of the U.S. Economy; Full Feedback; Federal Reserve Monetary Accommodation, No Change in the Federal Funds Rate from Historical Levels.

** Ex-ante tax costs estimated by Decision Economics, Inc. (DE).

(1) National Income and Product Accounts (NIPA) definition—Disposable Income less Consumption less Non-Mortgage Interest less Transfer Payments to Government and Rest-of-the World.

**Table 14**
**Increased Annuitization in the Macro Economy:**
**A Quantitative Assessment—Lifetime PAY Bill* ****
**"Static," Ex-Ante and "Dynamic," or Ex-Post, Costs**
**(Changes Relative to Baseline)**

| Taxes and Federal Budget | 1995-99 Cum. | 2000-05 Cum. | 1995-2005 Cum. |
|---|---|---|---|
| Tax Receipts ($ Bils., Unified) | | | |
| Ex-Ante | -33.1 | -111.4 | -144.5 |
| Ex-Post (1): | -22.9 | -49.6 | -72.4 |
| Individual-Excl. Capital Gains | -30.0 | -91.2 | -121.2 |
| Individual Capital Gains | 0.7 | 7.0 | 7.8 |
| Corporate | 3.1 | 8.7 | 11.8 |
| Excise | 0.6 | 3.3 | 3.9 |
| Social Security | 3.2 | 22.6 | 25.7 |
| Net Costs ($ Bils., Unified) | -22.9 | -49.6 | -72.4 |
| Budget Surplus/Deficit (Unified) | -19.6 | -45.3 | -65.0 |
| Govt. Debt/GDP (Pctg. Pts.) | 0.0 | 0.3 | 0.2 |
| Percent of Tax Cut Recovered Ex-Post (Ratio x 100) | 69.2 | 44.5 | 50.1 |

* Counterfactual simulations (11 years, 1995-2005) with the SB Model of the U.S. Economy; Full Feedback; Federal Reserve Monetary Accommodation, No Change in the Federal Funds Rate from Historical Levels.

** Ex-ante tax costs estimated by Decision Economics, Inc. (DE).

(1) Individual, Corporate, Excise and Social Security from NIPA definitions and do not exactly equal the unified total. Division of "Individual" into "Capital Gains" and "Individual-Excluding Capital Gains" by the SB Model.

**Table 15**
**Increased Annuitization in the Macro Economy:**
**A Quantitative Assessment—Household Sector "Savings" and Financial Position—**
**Lifetime PAY Bill* ****
**(Changes Relative to Baseline)**

| Assets/Liabilities/Net Worth | 1995-99 Avg. | 2000-05 Avg. | 1995-2005 Avg. |
|---|---|---|---|
| Financial Assets Ex-Stocks ($ Bils.) | 8.3 | 27.3 | 18.9 |
| Cash & Equivalent | 2.5 | 4.6 | 3.7 |
| Bonds | 5.7 | 22.6 | 15.0 |
| Household Equity (Stocks) | 14.2 | 44.5 | 30.8 |
| Liability/Debt ($ Bils.) | -3.5 | -15.7 | -10.2 |
| Consumer Credit | -3.8 | -21.0 | -13.2 |
| Mortgage Debt | 0.3 | 5.0 | 2.9 |
| Flow-of-Funds Saving ($ Bils.) | 8.1 | 29.8 | 20.0 |
| Flow-of-Funds Saving Rate (Pctg. Pts.) | 0.1 | 0.8 | 0.2 |
| Household Debt Service ($ Bils.) | -0.01 | -0.07 | -0.04 |
| Other Financial Risk Variables: | | | |
| Financial Assets/Liabilities (Pctg. Pts.) | 1.2 | 5.2 | 3.3 |
| Debt/Income (%) | -0.2 | -1.3 | -0.8 |
| Debt/Wealth (%) | 0.0 | -0.2 | -0.1 |
| DE Household Financial Position Index | 0.1 | -7.0 | -3.8 |

* Counterfactual simulations (11 years, 1995-2005) with the SB Model of the U.S. Economy; Full Feedback; Federal Reserve Monetary Accommodation, No Change in the Federal Funds Rate from Historical Levels.

** Ex-ante tax costs estimated by Decision Economics, Inc. (DE).

**Table 16**
**Increased Annuitization in the Macro Economy:**
**A Quantitative Assessment—Balance Sheet "Savings"—Lifetime PAY Bill* ****
**(Changes Relative to Baseline)**

| "Savings" Flows ($ Bils.) | 1995-99 Avg. | 2000-05 Avg. | 1995-2005 Avg. |
|---|---|---|---|
| Financial Assets | 23.9 | 88.2 | 59.0 |
| Money & Deposits | 2.5 | 4.6 | 3.7 |
| Misc. Assets | 0.2 | 0.7 | 0.5 |
| Bonds | 5.8 | 22.6 | 15.0 |
| Stocks (1) | 14.2 | 44.5 | 30.8 |
| Life Insurance | 1.7 | 10.8 | 6.7 |
| Pensions (Including Annuitized Assets) | -0.6 | 4.9 | 2.4 |
| Financial Liabilities (Debt) | -3.5 | -15.8 | -10.2 |
| Physical Assets (2) | 5.2 | 15.4 | 10.7 |
| Consumer Durables | 2.9 | 0.4 | 1.5 |
| Real Estate | 2.3 | 15.0 | 9.2 |
| Net "Earnings" ($ Bils.) (3) | 0.8 | 7.9 | 4.7 |
| Interest and Dividends | 1.0 | 5.8 | 3.6 |
| Borrowing Costs | 0.2 | -2.1 | -1.1 |
| "Savings—Total" (Finan. Assets less Liabs. plus Phys. Assets plus Net "Earnings") | 33.3 | 127.3 | 84.7 |
| "Savings" Rate (Pctg. Pts.) (4) | 0.6 | 1.6 | 1.2 |

* Counterfactual simulations (11 years, 1995-2005) with the SB Model of the U.S. Economy; Full Feedback; Federal Reserve Monetary Accommodation, No Change in the Federal Funds Rate from Historical Levels.

** Ex-ante tax costs estimated by Decision Economics, Inc. (DE).

(1) Market value-based.

(2) Principally residential real estate and automobiles, light trucks—all at market value.

(3) Interest and dividends earned on the additional financial assets and stock plus reductions in borrowing costs.

(4) Defined as "Savings—Total" divided by disposable income.

- *Savings on the household balance sheet*—definitely increased, as shown in Tables 15 and 16. The additional savings is out of the increased annuity income that is not spent, flows into financial assets, reduces financial liabilities, and helps finance additions to household physical assets. Financial measures of household financial risk, ranging from household debt service to debt/income and debt/wealth ratios, all improve. Household financial positions are better as a result.

- *Lifetime PAY Bill costs*—by DE calculations a cumulated $144.5 billion reduction in tax receipts, ex-ante, to the federal government. But, because of the stimulus to the economy and positive feedback effects on tax receipts of an improved economy—individual, corporate, excise, capital gains and estate—the original ex-ante, or static, costs of the program are defrayed. Table 14 shows that after 11 years some $72.4 billion of additional tax receipts are realized, a recovery rate of 50.1% of the ex-ante, or static, revenue costs.

What the collective results of the SB macroeconometric model simulation of the Lifetime PAY Bill show is a modest amount of economy-wide stimulus, mainly in consumption spending, with no change in inflation, some increases in jobs, and a slight decline in the unemployment rate. The increased annuitization of the Lifetime PAY Bill is stimulative to the U.S. economy.

The mechanism of the stimulus is essentially the federal government tax subsidy to increased annuitization by 65-aged retiree households. The federal government provides an incentive to retirees to save and generates a steady and predictable stream of income for as long as the retiree head-of-household lives, single- or joint-return based.

The assured and steady income stream generated through the increased annuitization raises consumption. Use of the alternatives, in this case by assumption 401ks and IRAs, would not have provided a similar result because of the tax benefit, but the regularity of the additional income stream in terms of “permanent income” helps provide stimulus, transmitted through the economy by traditional multiplier effects.

The increased private sector consumption generates multiplier-accelerator interactions throughout the economy, raising real GDP by more than the original amounts of the stimulus and induces spending by business on capital goods, by households on housing and residential construction, and increases corporate profits from increased sales and greater revenues. The stock market is somewhat higher and household wealth increases—both from higher market values of household equity (stock) and residential real estate. The increased wealth, with lags, increases consumption spending.

As measured on the NIPA basis, personal savings decline by an average $19.8 billion per year, shown in Table 13, over 11 years. However, it must be remembered that the NIPA savings are a residual—the difference between disposable income and consumer spending. Since the increase in annuity income is not counted in personal disposable income, in the aggregate disposable income does not change but consumption increases, and saving, by definition, must fall despite the rise in household receipts of annuity income in excess of the additional consumption.

Such a result on savings is counterintuitive and makes little sense. If an asset previously on the balance sheet is turned into an asset on deposit at life insurance companies and the payments made to households are essentially income, the extra dollars provided must be either spent or saved. In the SB Model of the U.S. economy, after about two years, extra spending out of a dollar of extra receipts generated as "disposable income" is approximately $0.65. The extra "saving" out of a dollar of these extra receipts is about $0.35. Savings rise and do not decline. Indeed, this additional savings must be used somewhere by households, either in the accumulation of financial assets, the decumulation of financial liabilities, paid out as taxes, or used to help increase holdings of stocks, or houses, or cars.

In Table 15 is shown how the household balance sheet and flow-of-funds measure of saving, and the saving rate, would have responded to the Lifetime PAY Bill. Here, the

distribution of the savings across most of the sources and uses of funds of the household sector and the household sector balance sheet is shown. *Savings is positive and household financial positions are enhanced.*

This conclusion shows up in the increase of financial assets, some $59 billion per annum over the 11-year period, in the reduction of liabilities by $10.2 billion per year over the same timespan, in the increase in physical assets, i.e., consumer durables and real estate, and in improvements for various measures of household financial risk shown in Table 15. These measures range from the ratio of financial assets-to-liabilities, to household debt service, to debt/income and debt/wealth ratios, and finally, the DE proprietary measure of household financial position, an Index, which shows considerable improvement. *Household savings rise as a result of the Lifetime PAY Bill and household sector financial positions improve.*

Finally, and perhaps more relevant to savings, Table 16 shows a definite increase of true saving in a balance sheet sense, defined as the change in financial assets plus the reduction of liabilities and increase of equity in physical assets, along with the interest earnings on the rise of financial assets, dividend increases on higher household equity, and cost savings as households use some of the annuity income to reduce outstanding liabilities.

Several caveats to these results must be indicated, however.

First, the propensities to spend and save for 65-aged retired households are assumed to be the same as the average marginal propensities to consume and save of the population-at-large. This may not be true. Data on income distribution suggest that income, and thus marginal tax rates, on retired families are less than for other age cohorts. However, much income may not be ordinary income or the wealth of retired households may be greater than those in lower age cohorts. The differences in these propensities, in actuality, may not be that great, but should be noted.

Second, the behavior and statistics that define and describe the retirement household population could be very specialized. Not much research has been done on the characteristics of retired families, e.g., spending and saving patterns.

Third, it is not clear that retirement patterns in the future will be like those in the past. More-and-more 65-aged retiree households may choose to work in one way or another.

Finally, the responses to annuity income could be different than to ordinary income as a source, perhaps treated more as dividends or interest, or some other form of remuneration and, therefore, with different, and lower, propensities to consume, and higher propensities to save. If so, then the macroeconomic impacts of the Lifetime PAY Bill would be less.

There are other qualifications to the results, some technical in nature having to do with the macroeconometric model processes of implementation, methodology, and adjustments of response for several categories of consumption on the increased annuitization income.

But, both analytically and intuitively, the tax subsidy provided through the exclusion of income from taxation on increased annuitization should bring about increased consumption and increased saving which, in turn, would be deployed into household flows-of-funds and the household sector balance sheet.

## V. Other Increased Annuitization Possibilities

For consumption behavior and savings for retirement, in the aggregate, the results from the SB macroeconometric model simulation of the Lifetime PAY Bill suggest that increased annuitization would have beneficial effects on aggregate economic activity, capital formation, jobs, profits, savings and the financial position of households.

Could a more general program of increased annuitization that spans more than just households who reach the age of 65, as in the Lifetime PAY Bill, be worthwhile?

Analytically, and very likely empirically, the answer probably is yes. One approach of increasing interest is the automatic checkoff plan for saving and annuitizing. As outlined in Gale

and Orszag (2006), individuals in their first job would automatically opt-in to a 401k or IRA plan. Contributions would rise with income and could include some government-financed match. The contributions would automatically rollover to the next employer's 401k plan or to a self-directed IRA. So at retirement, each individual would have at most two accounts in addition to those with a traditional pension—a 401k and an IRA. Both accounts would then be automatically annuitized. Workers could choose not to save or annuitize but the default option would be to save and to annuitize. The self-annuitization feature is particularly important, as it would reduce some of the adverse selection in the market. In particular, if a government match had to be annuitized, then the market for annuities could gain critical mass.

Yet other possibilities can be imagined.

Tax-advantaged switches of portions of net worth to annuities of various types could be offered to households long before retirement, with accounts set up at providers allowing inside buildup of earnings and choices by households on how the monies would be invested. The wide variety of choices in the provision of annuities and the shaping of them to fit the demands of holders make the annuity instrument quite attractive for such a situation.

Should legislation occur to permit more providers of annuities, then the costs of annuitization likely would come down and volume of sales be much higher, benefiting all annuity providers, depending on the elasticity of demand for the annuity instruments.

With so little penetration of annuities in the retirement market, a tax-subsidized reduction in the cost of annuitization relative to other choices for retirement could incur quite a bit of switching into annuities. This would be particularly true if there were more sellers of them.

## VI. Concluding Comments

The results of the research reported here are macroeconomic in nature, an assessment of the quantitative effects of increased annuitization at the aggregate level. The magnitudes found in this study are not necessarily large in the context of an $11 trillion economy, but are

significant in direction and absolute amounts. The approach used allowed for the full-system economy-wide dynamics of increased annuitization, including multiplier, accelerator and dynamic feedback effects into and through the economy, and indicates directionally, and within bounds quantitatively, the potential effects on various aggregate measures of economic performance such as real GDP, consumption, jobs and unemployment, saving, capital formation, household financial positions, and the "net" cost to the federal government of the policy measure used to increase annuitization.

The macro economy improves, consumers are better off, and savings, measured on household balance sheets, go up, helping to mitigate the U.S. national saving problem and to provide a better life for retirees in retirement as against a looming potential national crisis in funding retirement as sources fall short of the financial requirements of retired Americans.

The quantitative effects on the macro economy from the Lifetime PAY Bill provide one example of what the effects of increased annuitization could mean for economic growth, consumption, jobs and unemployment, household saving and household financial positions in the aggregate, and not just for retirees. This study finds them generally to be positive.

## Bibliography

ACLI Factbook, 2004, Ch. 8.

Bernanke, Ben S. "The Coming Demographic Transition: Will We Treat Future Generations Fairly?" Remarks presented to the Washington Economic Club, Washington, D.C., October 4, 2006.

Brown, Jeffrey R. "Life Annuities and Uncertain Lifetimes." *NBER Reporter*, Spring 2004.

Brown, Jeffrey R. and James M. Poterba. "Household Demand for Variable Annuities." Center for Retirement Research, Boston College, March 2004.

Brown, Jeffrey R., Olivia S. Mitchell, James M. Poterba, and Mark Warshawsky, "New Evidence on the Money's Worth of Individual Annuities" in Brown, Mitchell, Poterba and Warshawsky, *The Role of Annuity Markets in Retirement Planning*, MIT Press, Cambridge, 2001.

Çebi, Pinar. "Can Annuities Enhance Retirement Lifestyles?" *ACCF Special Report*, April 2006.

Congressional Budget Office. "Social Security Privatization and the Annuities Market." February 1998.

Davidson, Thomas, Jeffrey Brown, and Peter Diamond. "Annuities and Individual Welfare," *American Economic Review*, December 2005, pp. 1573-90.

Elmendorf, Douglas W. and Louise M. Scheiner. "Should America Save for Its Old Age? Fiscal Policy, Population Aging, and National Saving," *Journal of Economic Perspectives,* Summer 2000, pp. 57-74.

Gale, William G., Jonathan Gruber and Peter R. Orszag. "Improving Opportunities and Incentives for Saving by Middle and Low-Income Households." Hamilton Project White Paper 2006-02, April 2006.

Gentry, William M. and Casey G. Rothschild. "Lifetime Annuities for U.S.: Evaluating the Efficacy of Policy Interventions in the Life Annuity Markets." September 21, 2006.

Hansen, Gary D. and Selahatiin İmrohoroğlu. "Consumption Over the Life Cycle: The Role of Annuities." *NBER Working Paper Series*, #12341, June 2006.

Investment Company Institute, "The U.S. Retirement Market, 2005," July 2006.

Mitchell, Olivia S. and David McCarthy. "Annuities for an Aging World." *NBER Working Paper Series*, #9092, August 2002.

Orszag, J. Michael. "Annuities: The Problems." Presented at NAPF Annual Conference, May 11-12, 2000.

Poterba, James M. "Annuity Markets and Retirement Security." Center for Retirement Research Working Papers 2001-10, June 2001.

Turner, John. "Social Security Privatization Around the World." AARP Public Policy Institute, October 2005.

Wilber, Steven C. "The Effectiveness of Tax-Preferred Savings Vehicles in Promoting Saving and Retirement Security." ACCF Special Report, February 2003.

Yaari, Menaham. "Uncertain Lifetime, Life Insurance, and the Theory of the Consumer." *Review of Economic Studies,* 32(2) 1965, pp. 137-150.

## Appendix A
## Implementation of the Lifetime Pension Annuity for You Act (Lifetime PAY) Bill in the SB Model of the U.S. Economy

This Appendix briefly describes how the Retrospective (Historical and Counterfactual) simulations were performed.

### The Model

The Sinai-Boston (SB) Quarterly Large-Scale Macroeconometric Model of the U.S. is designed to be used for economic analysis, forecasting, policy simulations and "what-if" quantitative macroeconomic analyses. As such, it has been constructed to embody complex realistic economic relationships in a set of dynamic, simultaneous, nonlinear difference equations with parameters econometrically estimated based on historical data. The Model is subjected to a wide variety of validation tests—historical, future, policy and destructive shocks—to ensure its reliability in forecasting and simulation.

The SB Model consists of equations designed to capture the macro behavioral interactions in the U.S. economy—aggregate demand and its various components; aggregate supply including production and productivity; jobs and incomes; profits; interest rates, the stock market, exchange rates; expectations, backward- and forward-looking; and foreign trade and its interactions in the U.S. economy. The Model is open economy in its orientation—U.S. economic activity to the rest-of-the-world (global economy) and the rest-of-the-world back to the United States.

The Model contains over 900 equations, including behavioral, identities, legal and institutional, and exogenous. The processes and the interactions of the U.S. business cycle are modeled on the dynamic, time-series nature of macroeconomic behavior and transmission effects to the real economy from financial markets, as well as from exogenous monetary, fiscal, and other policies. Feedback effects, positive and negative, such as is found in engineering systems, permeate the Model's structure, as do expectations, some "extrapolative" and some "model-consistent," the latter model-driven future results for variables that are treated as expectations in the present.

The structure of the Model has as its main focus the behavioral equations, regressions that relate a dependent variable, or activity, to various independent, or simultaneous, sometimes with lags, causal influences. The parameters of the regression equations are estimated principally with Two-Stage Least Squares, by Instrumental Variable techniques or by Ordinary Least Squares, as the equation specifications and econometrics dictate.

The behavioral equations structure the interrelationships—static and dynamic—of the model variables over the time periods covered by the sample period. As a consequence, the responses embodied in the equations' estimated coefficients can only reflect historical behavior and the cyclical processes of the history of the model estimation. Generally, some 30-to-35 years of sample period data are included, although where changes in the structure of the economy and/or new innovations have occurred, the sample period can be as short as just a few years.

### Quantitative Assessment with the SB Model—The Counterfactual (Retrospective) Simulations

The methodology used to examine the macroeconomic effects of enactment for the Lifetime PAY Bill was a Counterfactual (Retrospective) simulation of the SB Model over the period 1995-2005, some 11 years.

Counterfactual simulations replace the data of an historical stochastic Baseline solution with alternative data generated by the model in response to a "what if" question made of history on a change in policy from what actually took place that produces a different set of numerical values of interest (time path) for the variables that the model determines—a time path of values other than what occurred in history. The purpose of Counterfactual simulation is to determine how different the alternative time paths for the variables of interest would be from history under a "what if" situation.

Two retrospective simulations were performed to address the question of the effects on the economy if the Lifetime PAY Bill had been enacted. One uses the ex-ante tax reduction estimates of GR (2006) for the Lifetime PAY Bill; the other the DE estimated costs for the Bill in terms of revenues lost, ex-ante.

The Counterfactual simulation examined the effects of the increased annuitization on a number of economic variables—growth in real GDP, personal and disposable income, consumption and its components, saving, household wealth, inflation in the CPI and in compensation, employment and the unemployment rate, and the federal budget deficit. As such, the paths of the variables simulated represented "results" that did not happen in history where there was no increased annuitization. A comparison of the simulated values under increased annuitization against the Baseline provided the information on the potential effects.

**Mechanics of the Model Simulations**

To implement the Lifetime PAY Act through simulation with the SB Model, the following steps were taken.

First, a stochastic Historical Baseline solution of the model had to be created that nearly exactly tracked actual history for all variables.

To obtain the stochastic representation of history, such a track is replicated through adjustments with "plus adds" and "minus adds" in the behavioral equations to force a match with the actual historical data. These "adds," or "add factors," are adjustments to the constant intercepts of the behavioral equations, either plus or minus, that line up the value of the dependent variable with its historical value at time equal zero. In doing this for all of the stochastic equations of the model, and repeating period-by-period, a stochastic version of history is obtained. With modern computer technology and search software, the determination of the add factor values that line up the model variable results with history is generally straightforward.

The resulting stochastic historical simulation is used as the Baseline for the "what-if" analyses. The Baseline can be shocked with changes in exogenous variables or parameters such as tax rates or federal government spending, or by shifting certain behavioral equations through add factors on the equation intercepts to depict, and describe the "what if" questions being asked of the model. Technical adjustments to certain equations, where model accommodation of the scenarios being analyzed is difficult, also are made. For example, in the increased annuitization of the Lifetime PAY Bill, shifts in the intercepts of certain consumption equations were made according to assumed parameter responses of consumption to increased income. The shifts were based on estimates of the propensities-to-consume in the model. The additional "income" from increased annuitization was not counted in personal or disposable income as is the case in NIPA accounting.

The counterfactual simulation placed key variables at different values than in history. To perform the simulations for any "what-if" question, numerical values of some variable inputs are changed to generate the economic responses.

In the simulations for the Lifetime PAY Bill, the aim was to determine the impact of the tax break that the Lifetime PAY Bill would generate from the switching of tax deferred savings assets, such as 401(k) plans, to annuities. According to the Bill, the resulting income from the annuities would be tax-free up to $5,000 for an individual tax return and $10,000 on a joint tax return.

**Some Issues in Simulating Increased Annuitization**

The simulations of increased annuitization presented an unusual situation because annuity income is not included in the disposable income of the National Income and Product Accounts (NIPA). Annuity income is not part of personal income (and therefore not part of gross domestic income and gross domestic product) because it does not arise from current production. Nevertheless, consumers spend out of annuity income even though it is not counted as income in GDP. Moreover, the Lifetime PAY Bill could create an incentive through tax saving that would prompt consumers to purchase more annuities.

To circumvent double-counting annuity income, consumption equations containing disposable income were adjusted upward by how much each reacts to increased disposable income. These responses were part of each equation and are one part of consumer behavior captured in the behavioral equations in the SB Model. These equations included real personal consumption equations, household wealth equations, some vehicle sales and real estate-related equations—a total of about 45.

Although the annuity income was not counted directly, the personal tax payments that the government foregoes are counted since the "disposable" part of disposable income refers to what consumers' control. The tax reductions in switching to an annuity reduced personal federal income tax payments, but did not change the effective personal federal tax rate on ordinary

income. The tax payments foregone are part of incomes and spending, however, and do serve to boost consumer spending.

From a behavioral standpoint, purchasing an annuity represents a tradeoff of wealth (assets) in exchange for income and a guarantee of future income. To capture this behavior in the model simulations, the historical add factor on the component of the household balance sheet that included pensions and annuities was decreased by the amount of the assets transferred to insurance companies, amounts averaging about $63 billion per year, in total, over 1995-2005. This reduction was designed to capture the wealth-income tradeoff for consumers who purchase annuities.

**Role of the Monetary Authority (Federal Reserve)**

The Federal Reserve was assumed to accommodate the increased annuitization. This means that bank reserves had to be adjusted to approximately maintain the historical path of monetary policy described by the federal funds rate.

**"Add Factors" and "Endogenous Variables"**

Variables determined by the model, or "endogenous" variables, move off their historical time path if other variables in the model change from history and cause the endogenous variables to reach other values. In historical simulation, before any adjustment to an add factor is made, the add factors changed value is determined by the equation of the Model.

To move an endogenous variable deliberately, the "add factor" for that variable is moved in the direction and amount determined before the simulation. To produce the effect of additional disposable income, add factors for consumption and household wealth were increased to capture the impact that the additional annuity income would have had.

The personal tax rate was not changed in the simulations. Rather, a level adjustment downward (lower tax revenue for the government) was made so that the federal budget deficit reflected the costs of the tax reduction.

## Appendix B

## The Sinai-Boston (SB) Model of The U.S. Economy (2005-06 Version)—A Brief Summary

The Sinai-Boston (SB) Model of the United States Economy (2005-2006 Version) is a large-scale quarterly macroeconometric model that includes considerable detail on:

- *aggregate demands*—consumption, residential construction, business fixed investment, government, net exports and the balance of payments and aggregate capital account.
- *financial markets and asset prices*
  - interest rates, stock prices, and currency exchange rates;
  - sector flows-of-funds for households, nonfinancial corporations, bank and nonbank financial intermediaries, government, and the rest-of-the-world;
  - balance sheet stocks of assets, liabilities and net worth, and the financial risk of various sectors;
  - real estate prices of new and existing homes;
- *transmission channels—monetary policy and financial markets to the economy*
  - interest rates and exchange rates;
  - household balance sheet and financial risk effects on consumption;
  - stock market, housing prices and residential real estate, wealth effects on consumption;
  - housing prices and the value of real estate, wealth effects on consumption and housing;
  - housing prices, cashout mortgage financing, capital gains/losses, and real estate wealth effects on consumption and residential construction;
  - rental price of capital and business "financial risk" effects on capital spending;
  - capital gains realizations for stock and real estate, effects on consumption spending, savings and balance sheets;
  - aftertax real interest rates, saving and spending;
  - aftertax expected rates of interest, affordability and housing.
- *interactions of the financial system with the real economy* through the transmission channels of "price effects"—interest rates, stock prices and currency exchange rates; cash flow and sectoral uses and sources of funds; balance sheet and wealth effects; financial risk; capital gains and capital gains realizations.
- *price and wage inflation* modeled through a stages-of-processing approach—producer prices, consumer prices, price deflators and expected inflation effects on prices and wages.
- *expectations—forward-looking model-consistent*, particularly for financial markets.
- *expectations— extrapolative, backward-looking*, particularly for the real economy, reflecting expectation and adjustment lags.
- *consumer and business sentiment*, directly on consumption and some categories of business fixed investment; also on financial markets.
- *trade, international activity and international financial flows,* including the current account.
- *potential output from productivity*, labor force participation rates, employment and unemployment.
- *trade and current account endogeneity* to economic growth and interest rates; exchange rates, exports and imports.

The SB Model (2005-06 Version) has approximately 950 equations continuing nearly 1500 variables, 950 endogenous (including identities) and over 500 exogenous. The "financial system" and its channels to the real economy are extensively covered, with about one-third of the behavioral equations, including sector sources and uses of funds, balance sheets, equity market wealth, real estate wealth, mortgage and housing finance, and measures of financial risk comprising the "financial system."

### Aggregate Demands

The aggregate demands of the model include 31 categories of behavioral equations for real final demands—16 for consumption; 8 for business capital spending and inventories; 11 for exports and imports; and 2 for federal and state and local government purchases.

Computer spending is separately identified in all relevant final demands, minimizing distortions caused by the rapid decline in computer prices.

For simulation purposes, this richness of detail allows the model to yield differentiated impacts among the various demand categories, improving the linkages to downstream systems used in disaggregated industry models. The latter provide a "bottom-up" check on aggregate profits in the model, such as the S&P500 Operating EPS, a principal measure for profits.

**Markets**

There is a "goods" market, "money" market, "loans" market, "financial intermediaries" markets, numerous "fixed income" securities markets, the "equity" market, and "currency exchange" market. There is a "labor" market, which helps determine aggregate supply and the potential output of the economy. There is an "international" market where trade, capital flows and the current account are modeled. The "financial intermediaries" sector is comprised of commercial banks, thrift institutions, and nonbank financial intermediaries. There is a government sector—federal and state and local and their financing.

**Financial System**

The "financial system" is an elaborate and detailed part of the SB Model, consisting of 479 equations, 317 behavioral and 162 exogenous. The richness of detail extends to 59 fixed income markets, where a wide array of interest rates in nominal and real aftertax terms have significant effects on portfolio adjustments, flows-of-funds, balance sheet states, financial risks, and as a transmission channel from the financial system to the real economy.

Flows-of-funds (uses and sources) by sector and sectoral balance sheet stocks of assets and liabilities are represented for households, nonfinancial corporations, the federal government, state and local government, commercial banks, thrift institutions, nonbank financial intermediaries and the rest-of-the-world, another feature of the Model that distinguishes it from most others. Spending and financing are jointly determined, with financial flows, liquidity and financial risk feeding into numerous real sector expenditures. The real spending side of the model explicitly recognizes "wealth" effects from equities and real estate valuations and the effects of realized capital gains, or losses, in equities and in the real asset, housing, for balance sheets, consumption, and tax receipts.

The formation of expectations in financial and real markets distinguishes the SB Model from many others, with forward-looking and model-consistent, "permanent," and extrapolative expectations of different lagged structures empirically estimated and appearing in different real economy or financial processes.

A "quick" effect of future expectations into current financial asset prices and returns characterizes key financial markets through the generation and discounting to the present of model-consistent expectations for some fundamental factors that affect long-term interest rates, the U.S. equity market and exchange rates. In turn, real final demands or aggregate demands are impacted sooner through the financial-real interactions of the Model than might otherwise occur if expectations were not so modeled.

**Interest Rates**

Interest rates are modeled with a segmented market approach, where fixed income markets reflect the demands and supplies for various assets across sectors and interrelated behavior between different markets. Real after-tax interest rates provide a major input into spending and borrowing, rather than nominal interest rates. And, tax considerations enter extensively throughout the Model affecting asset prices and incentives such as in the aftertax weighted average cost-of-capital and rental cost of housing. Monetary policy, credit demands, fiscal policy and budget deficits, expected and current, financial intermediaries activity, inflation and expected inflation, and the exchange rate are key determinants of interest rates.

**Equity Markets**

The stock market reflects the demands and supplies for equities in a fundamental valuation approach, based on the present value of expected earnings, expected after-tax returns on equity, volatility of earnings, and interest rates. The expectations are forward-looking, reflecting market behavior that incorporates future expectations into current asset prices. Multiple interest rates play a role in determining stock market prices.

**Exchange Rates**

The dollar exchange rate is modeled against key bilateral exchange rates such as the yen, euro, and pound-sterling, in addition to a trade-weighted average of sixteen countries, the Federal Reserve Major Currency Exchange Rate. The dollar is modeled as a function of expected inflation in the United States vis-à-vis several key OECD countries, relative short- and long-term interest rates in the United States and abroad, trade flows and the current account, expectations of future relative economic growth across countries, and some elements of overseas demand for U.S. assets.

**Financial-Real and Real-Financial Interactions**

A considerable number of channels for financial-real interactions are modeled, including multiple effects of interest rates on aggregate demands through direct impacts on spending and borrowing and indirectly through balance sheet states, and various measures of financial risk defined on the balance sheet that affect spending from borrower and lender risks.

The channels for the effects of the stock market are numerous—household wealth, capital gains realizations, the weighted average cost-of-capital, and also the external financing of business. Tax receipts at the federal and state level also are affected by the stock market, through realized capital gains, as is the federal budget position. The impacts are on consumption, business fixed investment, residential construction, exports and imports.

Exchange rates, set by the demand and supply for the U.S. currency vis-à-vis other major currencies, impact interest rates, inflation, profits, trade flows and the current account, budget deficits, and thus spending aggregates, directly and indirectly.

Quick discounting of future expected values on profits, the economy, deficits, and relative economic growth across countries impact current financial asset prices, including interest rates, thus spending through the channels for financial and real asset prices.

**Transmission Channels—Mortgage and Housing Finance**

Financial conditions and mortgage-housing finance affect housing, residential construction, and consumption. The housing market affects consumption through several channels—a real estate wealth effect and the equity in residential real estate liquefied by home-equity borrowing and cashout financing. Interest rates, the cost-of-borrowing and cost-of-capital, traditional channels for monetary policy to the real economy, help determine consumption, housing activity and residential construction, and business capital spending in numerous ways. One is directly as a choice for households between saving and spending. A second operates through debt service-to-income and debt service-to-cash flow, or "financial risk" variables, into consumer spending and business capital spending. A third operates through interest rates, the present value of expected future profits, the stock market, equity wealth, and household spending. A fourth occurs through the effects of interest rates and mortgage financing on affordability as it relates to home sales; in turn, affecting home prices, real estate wealth, and consumer spending.

Other linkages also exist that impact private and public sector spending—federal, state and local.

Expected future budget deficits affect current interest rates, particularly longer duration, and then through financial-real linkages relating to interest rates, debt service and the cost-of-capital and then private sector expenditures.

The wealth effect induces consumers to spend out of both real estate wealth and non-real estate wealth (consisting of financial assets, including equities, less liabilities). Capital gains realizations from gains (or losses) realized on sales of stocks or realized gains of sales of residential real estate impact on spending and saving, with the funds flows spent, saved, or used to pay taxes at the federal and state and local levels.

Consumers also have a channel of spending out of the liquefied home equity resulting from cash-out financing as affected by home prices and interest rates. By refinancing a home mortgage, homeowners can convert the appreciated value of real estate into spending on consumer goods and services. This is a relatively recent channel in the U.S. economy which developed during the late 1990s and through this decade.

**Price and Wage Inflation**

Prices and inflation rates are determined by a stages-of-processing approach that flows from producer price indexes through consumer price indexes to chain price indexes for GDP deflator components. Prices also reflect the production and supply side of the economy through the "gap" and capacity. Wages and benefits are determined by labor market conditions and are influenced by price inflation and inflation expectations.

There is no explicit NAIRU in the Model, with a highly disaggregated and structural setting-out of inflation at all stages-of-processing. A NAIRU-like result can be produced by the Model and results from factors that raise inflation and lower unemployment until the demand for labor, relative to the supply, along with expected inflation, gets to the point where at a low unemployment rate, inflation begins to accelerate. In the SB Model, this result does not occur from a "natural rate" calculation feeding directly into price and/or wage inflation, but instead from behind-the-scene structural inflation and wage-setting behavior that generate the relationship between inflation and unemployment which superficially looks like the presence of a Phillips Curve and a "NAIRU."

**Rest-of-the-World and Linkages**

The Model is "open economy" in its orientation and considers extensively the interactions of money, finance, credit and sectoral balance sheet states in the real economy. Trade and international capital flows are integral to the dollar exchange rate, which has considerable effect on inflation, interest rates, and the economy.

The Model uses foreign demand variable prices and interest rates to link the rest-of-the-world to the U.S. economy. Export equations are driven by foreign demands, exchange rates and prices. Price variables from key foreign countries help determine prices in the U.S. through costs-of-production and prices at retail, capturing the increased openness of the U.S. economy and trade that emerged in the 1990s. Foreign exchange rates play a part in interest rate determination, trade flows, and indirectly the stock market and cost-of-capital.

The components of the current account, goods, services, income receipts and payments and transfers are modeled in detail. Financing of the current account, the purchase and sale of financial assets, is also included in the Model.

**Expectations**

Expectations of future economic and financial variables play an important role in the SB Model.

Expectations enter the Model in many forms—from surveys of consumer and business sentiment conducted by widely-followed organizations (such as the U. of M. Survey Research Center and the Conference Board) to calculations of expectations for GDP and prices by mathematical formulas.

Survey expectations appear in numerous consumer and business spending equations. Expectations constructed by formula can be backward-looking, using past values of economic variables, or forward-looking, using future values of variables based on calculations by the Model.

In the SB Model Version 2005-06, greater use is made of various surveys for the expectations of households and businesses, including the Gallop Poll Presidential Approval Rating. A number have been found to directly affect some categories of private sector expenditures.

Expectations differ across agents in the economy, formed as extrapolative or backward-looking on income and the expected inflation of consumers. Inflation expectations affect wage inflation and price inflation. Expected future profits affect equity prices, wealth and consumption. The long-term interest rate is affected by bond market inflation expectations that are formed in a second order Pascal probability distribution weighting time model.

**Policy and Exogenous Variables**

The Model contains a large number of the exogenous variables, 537. This is not unusual in a large-scale macroeconometric model, with many of the exogenous variables simply identities, or definitions, that are used or to complete the coverage of the model.

Main policy levers include tax rates at all levels, personal, business, social security, and for capital gains; federal government expenditures, military defense and nondefense; population and age groups; nonborrowed reserves and Federal Reserve credit; numerous fixed parameters representing institutional or legislated rules or laws; and definitional derivations of capital stocks for equipment, plant, residential housing, and other such items. Balance sheet stocks also are definitionally determined.

**Table B.1**
**The Sinai-Boston (SB) Model of the U.S. Economy (2005-06 Version)**

| | Behavioral | Identities | Behavioral | Total Exogenous | Total Variables |
|---|---|---|---|---|---|
| GDP and Final Demands | 45 | 121 | 166 | 147 | 313 |
| GDP | 3 | 2 | 5 | 1 | 6 |
| Consumption | 16 | 35 | 51 | 37 | 88 |
| Business Fixed Investment | 6 | 23 | 29 | 37 | 66 |
| Residential Investment | 5 | 3 | 8 | 6 | 14 |
| Inventory Investment | 2 | 6 | 8 | 9 | 17 |
| Exports | 5 | 11 | 16 | 12 | 28 |
| Imports | 6 | 10 | 16 | 15 | 31 |
| Government | 2 | 17 | 19 | 21 | 40 |
| Federal | | | | | |
| State and Local | | | | | |
| Final Sales, etc. | 0 | 14 | 14 | 9 | 23 |
| Supply, Potential Output, and Capacity | 20 | 6 | 26 | 20 | 46 |
| Capital Stock | 1 | 23 | 24 | 21 | 45 |
| Prices, Wages and Productivity | 112 | 59 | 171 | 90 | 261 |
| Producer Prices | 29 | 0 | 29 | 22 | 51 |
| Consumer Prices | 6 | 1 | 7 | 0 | 7 |
| Chain GDP Price Deflators | 47 | 35 | 82 | 50 | 132 |
| Wages | 13 | 5 | 18 | 4 | 22 |
| Productivity | 3 | 12 | 15 | 5 | 20 |
| Prices—Other | 14 | 1 | 15 | 9 | 24 |
| Deflator Inflation Rates | 0 | 5 | 5 | 0 | 5 |
| Expected Inflation | 1 | 0 | 1 | 0 | 1 |
| Incomes | 22 | 21 | 43 | 18 | 61 |
| Wages, Salaries and Supplements | 4 | 3 | 7 | 1 | 8 |
| Personal Income—Other | 12 | 12 | 24 | 13 | 37 |
| Corporate Profits | 6 | 6 | 12 | 4 | 16 |
| Dividends | 1 | 0 | 1 | 0 | 1 |
| Interest | 3 | 2 | 5 | 3 | 13 |
| Consumption-Related | 11 | 1 | 12 | 3 | 15 |
| Investment-related | 24 | 27 | 51 | 13 | 64 |
| Business Investment | 1 | 7 | 8 | 3 | 11 |
| Residential Investment | 23 | 20 | 43 | 10 | 53 |
| Financial System | 142 | 175 | 317 | 162 | 479 |
| Monetary and Reserve Aggregates | 10 | 15 | 25 | 13 | 38 |
| Financial Markets | | | | | |
| Interest Rates | 59 | 19 | 78 | 54 | 132 |
| Stock Market | 7 | 8 | 15 | 11 | 26 |
| Exchange Rates | 10 | 4 | 14 | 26 | 40 |
| Flows-of-Funds or Uses and Sources of Funds | 71 | 89 | 160 | 95 | 255 |
| Household | 26 | 23 | 49 | 18 | 67 |
| Nonfinancial Corporations | 36 | 30 | 66 | 24 | 90 |
| Depository Institutions | 3 | 0 | 3 | 0 | 3 |
| Nonbank Financial Intermediaries | 2 | 2 | 4 | 4 | 8 |
| Government—Federal, State and Local | 6 | 36 | 42 | 52 | 94 |
| Sectoral Balance Sheets | 2 | 52 | 54 | 0 | 54 |
| Household | 0 | 22 | 22 | 0 | 22 |
| Nonfinancial Corporations | 0 | 26 | 26 | 0 | 26 |
| Depository Institutions | 2 | 1 | 3 | 0 | 3 |
| Nonbank Financial Intermediaries | 2 | 2 | 4 | 4 | 8 |
| Government—Federal, State and Local | 0 | 3 | 3 | 0 | 3 |

**Table B.1 (continued)**
**The Sinai-Boston (SB) Model of the U.S. Economy (2005-06 Version)**

| | Behavioral | Identities | Behavioral | Total Exogenous | Total Variables |
|---|---|---|---|---|---|
| Rest-of-the-World | 21 | 22 | 43 | 23 | 66 |
| Demographics | 1 | 2 | 3 | 8 | 11 |
| Miscellaneous | 8 | 68 | 76 | 24 | 100 |
| Expectations | 7 | 21 | 28 | 8 | 36 |
| Forward-Looking (Model Consistent) | 0 | 17 | 17 | 2 | 19 |
| Backward-Looking | | | | | |
| "Bond Market" | 0 | 2 | 2 | 0 | 2 |
| Expectational Lags | 1 | 1 | 2 | 1 | 3 |
| Adjustment Lags | 0 | 0 | 0 | 0 | 0 |
| Market-Formed | 2 | 1 | 3 | 1 | 4 |
| Surveys | 4 | 0 | 4 | 2 | 6 |
| Rates of Return | 0 | 31 | 31 | 9 | 40 |
| Saving | 1 | 16 | 17 | 7 | 24 |
| **Total** | **416** | **529** | **947** | **537** | **1491** |
| **Addendum:** | | | | | |
| Financial Transmission Channels | | | | | |
| Consumption | 23 | 0 | 23 | 0 | 23 |
| Via Interest Rates | 2 | 0 | 2 | 0 | 2 |
| Via Wealth (Asset Markets, Real Estate, Equity) | 11 | 0 | 11 | 0 | 11 |
| Via Debt Service | 3 | 0 | 3 | 0 | 3 |
| Via Mortgage Finance | 7 | 0 | 7 | 0 | 7 |
| Via Cash Out Financing | 6 | 0 | 6 | 0 | 6 |
| Via Capital Gains | 5 | 0 | 5 | 0 | 5 |
| Nonresidential Business Fixed Investment | 6 | 0 | 6 | 0 | 6 |
| Via Interest Rates | 1 | 0 | 1 | 0 | 1 |
| Via Debt Service | 5 | 0 | 5 | 0 | 5 |
| Via Rental Price of Capital | 0 | 2 | 0 | 0 | 2 |
| Via Aftertax Cost-of-Capital | | | | | |
| Residential Investment | 6 | 0 | 6 | 0 | 6 |
| Via Interest Rates | 4 | 0 | 4 | 0 | 4 |
| Via Mortgage-Housing | 2 | 0 | 2 | 0 | 2 |
| Via Rental Cost | 0 | 1 | 0 | 0 | 1 |
| Inventories | 1 | 0 | 1 | 0 | 1 |
| Net Exports | 6 | 2 | 8 | 2 | 10 |

**Table B.2**
**The Sinai-Boston (SB) Model of the U.S. Economy (2005-06 Version)**
**Historical Performance—Full Model Simulation, 1990:1-2004:4***

| Variable | RMSE | % RMSE |
|---|---|---|
| Real GDP (Bils. 2000 $s) | 111.7 | 1.25 |
| Consumption ( " ) | 98.7 | 1.60 |
| Resid. Inv. ( " ) | 35.6 | 8.78 |
| Bus. Fixed Inv. ( " ) | | |
| Equip. | 77.8 | 10.84 |
| Plt. | 27.3 | 10.47 |
| S&L Govt. ( " ) | 27.6 | 2.67 |
| Fed. Govt. ( " ) | 0.4 | 0.37 |
| Exports ( " ) | 49.1 | 5.65 |
| Imports ( " ) | 51.0 | 4.43 |
| Unemployment Rate (%) | 0.4 | 7.54 |
| Prices & Wages (Level) | | |
| GDP Deflator | 0.01 | 1.10 |
| GDP Deflator (% chg.) | 0.76 | 36.86 |
| PPI | 0.04 | 3.82 |
| Nonfarm Bus. Comp. | 0.02 | 1.74 |
| Profits | | |
| S&P500 EPS ($/share) | 1.41 | 13.36 |
| Interest Rates (%) | | |
| 3-Mos. T-bill | 1.04 | 26.74 |
| 10-Yr. Treas. | 0.45 | 7.72 |
| Exch. Rate (Level) | | |
| FRB Major Cur. Exch. Rate | 0.10 | 10.56 |

*See Table B.1 for Model breakdown and numbers and types of equations.