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On Efficiently Financing Retirement*

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ABSTRACT

Policymakers face an increasing challenge of efficiently financing retirement consumption in the face of demographic changes and limits on government taxation and borrowing. There have been numerous proposals in which the government relies less on tax and transfer schemes and more on private savings of households. Previous analyses of such reforms underestimate the gains from eliminating tax and transfer schemes because they calibrate to a capital stock that is far smaller than the actual one. We find that the steady state welfare gains are underestimated by a factor of two. Gain differentials are even larger if we impose nonnegativity constraints on government capital, which bind in the model calibrated to a small capital stock.

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*The views expressed herein are those of the authors and not necessarily those of the Federal Reserve Bank of Minneapolis or the Federal Reserve System.

1. Introduction

U.S. policymakers face an increasing challenge of efficiently financing retirement consumption in the face of demographic changes and limits on government taxation and borrowing.[1] There have been numerous proposals for the government to rely less on tax and transfer schemes and more on private savings of households. Previous analyses of such reforms understate the gains of eliminating tax and transfer schemes because they assume a capital stock to GNP ratio around 3 when in fact this ratio is approximately twice as large.

We extend a standard overlapping generations model to include both tangible and intangible capital in production and parameterize the model using U.S. national accounts and estimates of tangible and intangible capital stocks. With larger capital shares in a model consistent with the U.S. national accounts, we find that the steady state welfare gains are more than double that of the same model parameterized with capital shares in the range used in previous studies.[2] This result assumes that the government can sell capital short, which would effectively undo any constraint on borrowing. If the government is restricted from increasing current levels of debt and going short on capital, then eliminating the current tax and transfer schemes is not feasible if the capital share is low. In fact, the government would have to rely more heavily on taxes to finance retirement as the fraction of retirees increases.

Most of the macroeconomic and public finance literature interested in issues related to financing retirement use estimates of capital shares in the range of one-quarter to one-third. For example, Auerbach and Kotlikoff (1987), in one of the first quantitative analyses of U.S. fiscal policy based on a dynamic OLG model, use a capital share of 25 percent.

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[1] See Feldstein for a nice survey of U.S. social insurance programs.

[2] Based on the findings of Abel et al. (1989), we restrict attention to equilibria that are dynamically efficient in the sense of Diamond (1965). Thus, the gains do not arise from fixing a problem of overaccumulation of capital.

This low share is consistent with the stock of U.S. fixed assets which is about 2.8 times GNP, but the relevant stock of capital for retirement saving includes consumer durables, inventories, land, and intangible capital. The latter is about 5.8 times GNP.

Our paper is most closely related to Birkeland and Prescott (2007) who compare tax and transfer schemes to saving-for-retirement schemes for several countries including the United States. In the savings schemes, people buy government bonds when young and sell them when retired. The model Birkeland and Prescott use has an implied capital stock that is 3.5 times GNP. They show that a large government debt to GNP ratio is needed to avoid deadweight losses incurred with tax and transfer schemes given demographic forecasts. Here, we assume that there are limits to government debt but more available productive capital that can be used for saving for retirement. We view the latter as more like the current United States.

2. U.S. Data

The starting point for our study is the U.S. national accounts and fixed assets. In this section, we describe how we organize these accounts in order to facilitate a meaningful comparison of theory and data.

In Table 1, we report national incomes and products, averaged over the last decade. All numbers are reported relative to GNP after making several adjustments. Alongside the main categories of incomes—namely labor income, capital income, and tangible depreciation that appear in rows 2, 5, and 16, respectively—we have notation for the model analogues. For example, labor income in row 2 is intended to be compared to wL in the model. We do a similar thing for the main categories of products in rows 20, 27, and 29.

Three main adjustments are made to the standard definition of GNP. We subtract sales tax from taxes on production and imports that appears under capital income on the income side and consumption and investment on the product side. We include consumer durables with investment and therefore add its depreciation to tangible depreciation and durable services to capital income on the income side. On the product side, we add both depreciation and capital services to consumption. Finally, we impute capital services to government capital which means an addition of capital income on the income side and consumption on the product side. We included it with consumption rather than government spending since all non-defense government spending is included with consumption.

In Table 2, we show how categories were combined in the national accounts to get measures of government expenditures and revenues. Here again, we made note of the model analogues for the main categories in rows 2, 3, 6, 9, 13, and 21. Notice that government spending includes only defense spending. These is the part of spending that is not substitutable with private consumption and is treated as such in the model.

Table 3 is the revised fixed asset table which combines data from the original BEA fixed assets tables (FA), the national account inventories, and estimates of land from the U.S. Flow of Funds. We also include estimates from McGrattan and Prescott (2010) on the magnitudes of intangible capital, which includes both plant-specific capital and technology capital that is not specific to any one plant or location. When comparing the model capital stocks and the data capital stocks, we will consider two levels for total capital: 2.8 GNP which is roughly the size of the fixed assets and 5.8 GNP which is all tangible and intangible capital.[3]

[3] Here, we do not include human capital since it is not a form of saving for retirement.

3. Model

In this section, we describe the overlapping generations model that we use for our policy analysis.

Each period, a new cohort is born and the size of the cohorts grows at rate η. People between ages 1 and 20 do not work and their consumption is implicitly included with their parents. People start working at lifetime age 21, which we record as $j = 1$. They start retirement at $j = J_r$.

The lifetime utility of someone entering the workforce is

$$\sum_{j=1}^{J_r-1} \beta^{j-1} \left[\log c_j + \alpha \log (1 - l_j)\right] + \sum_{j=J_r}^{J} \beta^{j-1} \left[\log c_j + \alpha \log (1)\right]$$

where $20 + J$ is the maximum lifetime. Individuals choose sequences of consumption $\{c_j\}$, labor $\{l_j\}$, and asset holdings $\{a_j\}$ that maximize utility subject to a sequence of budget constraints,

$$(1 + \tau_c)\, c_j + a_j' = (1 + i)\, a_j + (1 - \tau_l)\, w l_j \epsilon_j + \psi_j, \tag{3.1}$$

and an initial condition $a_1 = 0$. Assets earn an after-tax interest rate i and labor is paid an after-tax wage rate of $(1 - \tau_l)w$. To capture retirement, we use the term ϵ_j, which is equal to 1 for $j < J_r$ and 0 for $j \geq J_r$. Consumption is taxed at rate τ_c, and the term ψ_j in (3.1) is the transfers received in year j. We assume that ψ_j is the sum of a pre-specified transfer to people in year j and a lump-sum transfer made to all generations that ensures the government budget constraint is satisfied.[4]

Firms in this economy are long-lived and produce each period with the following

[4] In this version of the paper, we restrict attention to steady states with fixed working lives, fixed lifetimes, and no uncertainty of death. To capture bequests, we set ψ_J negative and assume individuals entering the workforce are the recipients.

production function,

$$Y = (K_T)^{\theta_T} (K_I)^{\theta_I} (ZL)^{1-\theta_T-\theta_I}$$

where K_T is tangible capital, K_I is intangible capital, L is total labor and Z is a parameter governing the level of technology. Technology Z grows at rate γ. Part of the capital is effectively owned by the household and part is effectively owned by the government:

$$K_T = K_T^H + K_T^G$$

$$K_I = K_I^H + K_I^G$$

and this capital evolves according to

$$K_T' = (1 - \delta_T) K_T + X_T$$

$$K_I' = (1 - \delta_I) K_I + X_I$$

where X_T and X_I are total investments in tangible and intangible capital, respectively. To see how the ownership of capital is determined, we first need to discuss the government's finances.

The government finances expenditures of consumption G, investments of tangible capital X_T^G, investments of intangible capital X_I^G, and transfers to households ψ by issuing debt B and taxing consumption C, labor L, dividends to households D^H, and profits of households Π^H. The budget constraint for the government is therefore,

$$G + \psi + iB = \tau_c C + \tau_l wL + \tau_d D^H + \tau_p \Pi^H + D^G + B' - B$$

where aggregates are computed by summing up across generations, e.g., $\psi = \sum_j \mu_j \psi_j$, with μ_j equal to the fraction of the population aged $20 + j$. Taxable profits of the households are given by

$$\Pi^H = r_T K_T^H + r_I K_I^H - \delta_T K_T^H - X_I^H,$$

which is the sum of rents on tangible and intangible capital, which are paid r_T and r_I, respectively, less depreciation of their tangible capital and expensed intangible investment. Both the households and the government receive dividends from the firm and these are given by

$$D^H = r_T K_T^H + r_I K_I^H - X_T^H - X_I^H - \tau_p \Pi^H$$

$$D^G = r_T K_T^G + r_I K_I^G - X_T^G - X_I^G.$$

Only the households pay taxes on profits, which are subtracted from their distributions D^H.

Fiscal policy in this economy includes the government's choice of effective ownership of capital. Two things determine this: the quantities of direct purchases X_T^G and X_I^G and the taxation of profits and dividends earned by households. We assume that the government's capital investments are such that the steady state after-tax interest rate i is 4 percent in equilibrium. We think of this as a fiscal interest rate policy. We also assume that the ratio of intangible to tangible capital owned by the government is equal to the ratio of intangible to tangible capital owned by households. These two restrictions uniquely determine the decomposition of capital stocks.

To see how, again consider the problem of the household. The maximization yields decision functions for consumption, labor, and asset holdings, which can be aggregated to get total consumption $C = \sum_j \mu_j c_j$, total labor supply $L = \sum_j \mu_j l_j \epsilon_j$, and total private asset holdings $A = \sum_j \mu_j a_j$. Total private asset holdings must be equal to government debt held by households plus the market values of their tangible and intangible capital:

$$A = B + V_T + V_I \tag{3.2}$$

where $V_T = (1 - \tau_d) K_T^H$ and $V_I = (1 - \tau_d)(1 - \tau_p) K_I^H$. The prices of the tangible and intangible capital are not one because the government taxes household distributions and household profits. (See McGrattan and Prescott (2005) for a derivation of these prices.)

Next, we can use information about the production technologies to relate K_T^H and K_I^H. Given i, we can compute the rental rates on tangible and intangible capital,

$$r_T = i / (1 - \tau_p) + \delta_T \tag{3.3}$$

$$r_I = i + \delta_I \tag{3.4}$$

because after-tax rates of return on household assets and productive capital must be equated. Notice that the rental rates differ across the two types of productive capital. This occurs because intangible capital is expensed and therefore the net investment is not subject to the corporate income tax. Since rental rates are also equated to marginal products, we can use (3.3) and (3.4) to construct the ratio of stocks,

$$K_I / K_T = \theta_I r_T / (\theta_T r_I) .$$

which follows from $r_T = \theta_T Y / K_T$ and $r_I = \theta_I Y / K_I$.

Using the restriction that the ratio of private and public holdings of intangible and intangible are equal, that is, $K_I^H / K_T^H = K_I / K_T$, we have

$$K_T^H = (A - B) / ((1 - \tau_d)(1 + \tau_p \theta_I r_T / (\theta_T r_I)))$$
$$K_T^G = K_T - K_T^H$$

where the total capital stock satisfies $r_T = \theta_T Y / K_T$ and, therefore, K_T solves

$$r_T = \theta_T K_T^{\theta_T - 1} [\theta_I r_T / (\theta_T r_I) K_T]^{\theta_I} (ZL)^{1 - \theta_T - \theta_I}$$

given L from the household maximization problem and rental rates r_T and r_I in (3.3) and (3.4).

Computing a steady state in this economy involves guessing the wage rate and the lump-sum transfer to all generations that ensures that the labor market clears and the government budget constraint is satisfied.

4. Specifying the Environments

For our policy experiments, we will consider four different starting points that differ in the specification of demographics and choices of capital shares. In the "current world," the economy has demographics that mimic the recent United States. The "new world" has demographics of the projected future United States. The "high share" case has capital shares consistent with capital stocks around 5.8 GNP (i.e., all tangible and intangible capital) and the "low share" case has capital shares consistent with capital stocks around 2.8 GNP (i.e., only fixed assets).

4.1. Parameters

There are also some common settings for some of the parameters. In all, the growth rate of technology is set at γ =2 percent. The implied interest rate generated from the government's fiscal policy is $i = 4$ percent. These two choices imply $\beta = 1.02/1.04$. The debt to GNP ratio in all simulations is 0.725 implying interest payments equal to 0.029 GNP (as in Table 2). The government spending to GNP ratio is 0.042, which is equal to defense spending in the United States and is treated as resources that are not substitutable with private consumption. (See Tables 1 and 2.)

Tax rates on consumption, labor, and distributions are set equal to 0.1, 0.2, and 0.1, respectively, and held fixed in all scenarios. These rates imply model tax revenues (for the current world) in line with the tax revenues in Table 2. The rate on τ_c is higher than the rate implied by sales tax in the United States and the rate τ_l is lower than typical estimates of the rate on labor income. We made these choices because part of what gets counted with labor taxes is a tax on deferred compensation for retirement savings accounts and should really be counted with taxes on consumption.[5] The tax on distributions is lower than typical estimates because the capital stock is the consolidated stock for businesses and households.

The tax rate on profits—which is the tax rate to be changed in our policy experiments—is set to 0.35 in all four economies. This choice, along with the others that impact capital income of the government, implies "other" revenues in the current-world, high-capital-share version of the model that are in line with Table 2 other revenues.

The choices of the growth rate of the economy η, the first year of retirement J_r and the length of life J determine the demographics of the economy. In the current world, we assume that $\eta = 1$ percent, $J_r = 42$ and $J = 61$. This choice implies that 75 percent of the population is working and 25 percent is retired. In the new world, we assume that $\eta = 0$ percent, $J_r = 42$ and $J = 64$. This choice implies that 66 percent of the population is working and 34 percent is retired.

The remaining parameters are different in the four scenarios. These are the capital shares θ_T, θ_I, the depreciation rates δ_T, δ_I, the coefficient on the logarithm of leisure in utility α, the level of Z once detrended by its growth rate, and the pre-specified transfers and bequests. For simplicity, we assume that $\delta_T = \delta_I = \delta$ throughout.[6]

The capital shares for the "high share" case are $\theta_T = .75\theta$ and $\theta_I = .25\theta$ with $\theta = .46$.

[5] Taxes on consumption and labor have the same impact in models with infinitely-lived agents but not in OLG models. In the latter, the timing and incidence of the two taxes matters.

[6] We show in McGrattan and Prescott (2010) that capital shares and depreciation rates for intangible capital are not separately identifiable using only the facts in Tables 1–3.

In this case, we set $\delta = .035$, which is in the range of estimates consistent with data in Table 1 and 3.[7] The utility parameter α is set at 2.5 and implies that 25 percent of available (pre-retirement) time is devoted to work. The level of Z is set at 2.4 so that GNP is normalized to 1. Both α and Z are held fixed across the current and new worlds.

The capital shares for the "low share" case are $\theta = \theta_T = .3$ and $\theta_I = 0$. In this case, we set $\delta = .05$ which is higher than for the high share case in order to generate magnitudes for depreciation consistent with the U.S. data. The utility parameter α is set at 2.75 adn the level of Z is set at 3.5. As before, we want to assume that 25 percent of available (pre-retirement) time is devoted to work and have GNP normalized to 1.

In all scenarios, we chose pre-set transfers and bequests so that the model generated the same values for (*i*) the ratio of year-J bequests year-1 consumption levels (3.57) and (*ii*) the ratio of per capita transfers to consumption for retirees (0.54).

4.2. Implied Accounts

In Tables 4–6, we compare the income and product accounts, fixed asset tables, and balance sheets for the four environments described above.

Table 4 shows the model national accounts. The first two columns are versions of the model parameterized with current demographics and the two different parameterizations based on large capital output ratios (5.8 GNP) and small capital output ratios (2.8 GNP). With the exception of G relative to GNP, none of the values were set to imply an exact match between the model and data. Therefore, we can use these results to assess how well the model does on mimicking the aggregates in the national income and product accounts.

[7] We use investment to capital ratios or depreciation to capital ratios to find the plausible range.

Obviously one dimension on which the current world results will likely differ is with regard to the labor income estimate. If there is no intangible capital, wL/Y is equal to the labor share $1-\theta$. This is true in the low θ case where labor income is equal to 70 percent of GNP. In the high θ case, we need to correct for the fact that Y is not equal to GNP. In other words, the model's empirical labor income share is $wL/(Y-X_I)$ which is 60 percent. In Table 1, we see that the revised accounts—with compensation and part of proprietors' income included—have a labor income share of roughly 60 percent.

Depreciation in the both current worlds is slightly below U.S. depreciation (which is estimated to be 0.168) and tangible investment in the high share case is slightly higher than U.S. tangible investment (which is estimated to be 0.222). However, overall the model and U.S. economies are reasonably close in terms of national accounts.

Table 5 shows the fixed asset tables. The current world totals were intended to match 5.8 GNP and 2.8 GNP, respectively. What is different is the split between household and government ownership. In the high θ case, it is split roughly in half, while in the low θ case, households own more than the total since the government share is actually negative.

Table 6 shows the balance sheet items which are the market values (and correct for the fact that the prices of the capitals are not equal to one). Consider the first column for the current world with high capital share. The government net worth is high because they own capital directly and they effectively own private capital that is taxed. Next, consider the second column which shows that the government net worth is -1.0 times GNP. This means that the government has an *effective* debt of -1.0 times GNP rather than -0.7 because they are selling capital short. In other words, the allocation for the current world, low θ is the same as another with B set equal to -1.0 and no government ownership of capital.

Comparing the first two columns of Tables 4 and 6 with the last two, we see that the projected demographic changes will have a small impact on the national income and product accounts but a large impact on net worth statements of the household and government.

5. Policy Experiment

We now use the model OLG model, with the four parameterizations described above, to evaluate the consequences and welfare gains of eliminating tax rates on capital income $\tau_p = 0$ and eliminating transfers to targeted to retirees (equal to 0.54 times consumption prior to the policy change). This is done while holding fixed the debt to GDP ratio, the government spending to GDP ratio, tax rates on consumption, labor, and dividends, and the fiscal interest rate policy.

Table 7 summarizes the main results from this experiment assuming no restrictions on government investment. As before, there are four columns corresponding to the four parameterizations of the model. The first set of numbers are the total capital stocks under the alternative policies, the second and third set of numbers are the net worths of the households and government. The elimination of capital income taxes generates increases in the capital stocks on the order of 20 percent across the experiments. Decomposing the ownership, we see a shift from public to private ownership. But, in the case of the low-θ economies, all that is happening is the government is effectively increasing its borrowing. In the new world case, effective debt rises from 2.8 GNP to 4.7 GNP. This is like the Birkeland and Prescott (2007) result. Large amounts of government debt are needed for the saving schemes. Otherwise the government has to rely on taxes.

In the new world economy with a high-θ, the net worth of the government is 1 GNP under the tax and transfer scheme and $-.3$. The latter is equivalent to having no government capital and a level of debt outstanding of 0.3 GNP, well within the 0.7 GNP limit we are assuming here.

If we redo the calculations for the low θ environments assuming that the government capital cannot be negative (that is, they cannot sell it short), then the private savings scheme would not be feasible. In fact, the government would have to rely even more on tax transfer schemes if it wants to hold its debt outstanding at 0.7 times GNP.

If we include transitional dynamics, we find that equilibrium government capital stock falls below zero even in the high θ case. If governments are restricted from effectively borrowing in this way, the gains will not be as high as the estimates in Table 7. However, what the results do show is that the government does not have to rely so heavily on distortionary tax and transfer schemes and can instead rely more on private savings schemes than previously thought.

6. Summary

In this paper, we take a first step towards critically assessing the merits of private savings plans versus tax and transfer schemes for financing consumption of retirees. Our aim was modest: we demonstrated that understating the current U.S. capital stock *can* make a large difference when evaluating alternative policies for financing retirement.

Our ultimate goal is to lift the bar by adding plausible life expectancies, annuity and insurance markets, intermediaries, and restrictions on government investment. Then we can ask if understating the current U.S. capital stock *does* make a large difference when evaluating alternative policies for financing retirement.

References

Abel, Andrew B., N. Gregory Mankiw, Lawrence H. Summers, and Richard J. Zeckhauser. 1989. Assessing Dynamic Efficiency: Theory and Evidence. *Review of Economic Studies* 56: 1-19.

Auerbach Alan J. and Kotlikoff Laurence J. 1987 *Dynamic Fiscal Policy*, (Cambridge, Cambridge University Press).

Board of Governors of the Federal Reserve System (1945–2005), *Flow of Funds Accounts of the United States*, Statistical Release Z.1 (Washington, DC: Federal Reserve System).

Birkeland, Kathryn and Edward C. Prescott. 2007. On the Needed Quantity of Government Debt. *Federal Reserve Bank of Minneapolis Quarterly Review.* 31(1): 2-15.

Diamond, Peter A. 1965. Technical Change and the Measurement of Capital and Output. *Review of Economic Studies* 32: 289–298.

Feldstein, Martin. 2005. Rethinking Social Insurance. *American Economic Review*, 95(1): 1–24.

McGrattan, Ellen R. and Edward C. Prescott. 2010. Technology Capital and the U.S. Current Account. *American Economic Review*, forthcoming.

McGrattan, Ellen R. and Edward C. Prescott. 2010. Taxes, Regulations, and the Value of U.S. and U.K. Corporations. *Review of Economic Studies*, 72(3): 767–796.

U.S. Department of Commerce, Bureau of Economic Analysis (1929–2005), National Income and Product Accounts, *Survey of Current Business* (Washington, DC: U.S. Government Printing Office).

Table 1. Revised National Income and Product, Averages Relative to GNP, 1999–2008[a]

1	Total Adjusted Income ($Y - X_I$)	1.000
2	Labor Income (wL)	.594
3	Compensation of employees, NIPA 1.10	.539
4	70% of proprietors' income, NIPA 1.10	.055
5	Capital Income ($Y - wL - \delta_T K_T - X_I$)	.238
6	Corporate profits with IVA and CCadj, NIPA 1.10	.074
7	30% of proprietors' income, NIPA 1.10	.023
8	Government enterprises, NIPA 1.10	.000
9	Rental income of persons with CCadj, NIPA 1.10	.016
10	Net interest and miscellaneous payments, NIPA 1.10	.057
11	Statistical discrepancy, NIPA 1.10	−.005
12	Taxes on production and imports[b], NIPA 1.10	.029
13	*Less:* Sales tax, NIPA 3.5	.043
14	Imputed capital services[c] (FA 1.1)	.036
15	Net income, rest of world, NIPA 1.13	.006
16	Tangible Depreciation ($\delta_T K_T$)	.168
17	Consumption of fixed capital, NIPA 1.10	.116
18	Consumer durable depreciation (FOF F.10)	.053
19	Total Adjusted Product ($Y - X_I$)	1.000
20	Consumption (C)	.738
21	Personal consumption expenditures, NIPA 1.1.5	.659
22	*Less:* Consumer durables, NIPA 1.1.5	.083
23	*Less:* Sales tax, nondurables and services	.036
24	Consumer durable depreciation (FOF F10)	.053
25	Government consumption, nondefense, NIPA 3.9.5	.110
26	Imputed capital services[c]	.036

See footnotes at the end of the table.

Table 1. Revised National Income and Product, Averages Relative to GNP, 1999–2008[a]

27	Government spending (G)	.042
28	Government expenditures, national defense, NIPA 1.1.5	.042
29	Tangible investment (X_T)	.222
30	Gross private domestic investment, NIPA 1.1.5	.156
31	Consumer durables, NIPA 1.1.5	.083
32	*Less:* Sales tax, durables	.005
33	Government investment, nondefense, NIPA 3.9.5	.025
34	Net exports of goods and services, NIPA 1.1.5	−.043
35	Net income, rest of world, NIPA 1.13	.006

Note: IVA, inventory valuation adjustment; CCadj, capital consumption adjustment; NIPA, national income and product accounts; FA, fixed assets; FOF, flow of funds.

[a] Expressions in parentheses are the model analogues of these categories.

[b] This category includes business transfers and excludes subsidies.

[c] Imputed capital services are equal to 4 percent times the current-cost net stock of government fixed assets and consumer durables goods.

Table 2. Revised Government Expenditures and Revenues, Averages Relative to GNP, 1999–2008[a]

1	Government Expenditures $(G + \psi + iB)$	.324
2	Government spending (G)	.042
3	Transfers (ψ)	.254
4	Transfer payments and subsidies, NIPA 3.1	.119
5	Government expenditures, nondefense, NIPA 1.1.5	.135
6	Interest on debt (iB)	.254
7	Interest payments, NIPA 3.1	.119
8	Government Revenues $(\tau_c C + \tau_l wL + \tau_d D^H + \tau_p \Pi^H + D^G)$	.299
9	Taxes on C, L, D^H $(\tau_c C + \tau_l wL + \tau_d D^H)$	.208
10	Personal current taxes, NIPA 3.1	.099
11	Contributions for social insurance, NIPA 3.1	.066
12	Sales tax, NIPA 3.5	.043
13	Other $(\tau_p \Pi^H + D^G)$	.091
14	Taxes on corporate income, NIPA 3.1	.023
15	Taxes from rest of world, NIPA 3.1	.001
16	Taxes on production and imports, NIPA 3.1	.069
17	*Less:* Sales tax, NIPA 3.5	.043
18	Transfer receipts, NIPA 3.1	.012
19	Income on assets and government enterprises, NIPA 3.1	.010
20	Consumption of fixed capital, NIPA 3.1	.019
21	Deficit $(B' - B)$	.025

See footnotes at the end of Table 1.

Table 3. Revised Fixed Asset Tables,
Averages Relative to GNP, 1999–2008[a]

1	Tangible capital, end of period (K'_T)	4.053
2	Fixed assets, private, FA 1.1	2.175
3	Fixed assets, public, FA 1.1	.580
4	Consumer durables, FA 1.1	.306
5	Inventories, NIPA 5.7.5	.137
6	Land, FOF B.100-B.103	.856
7	Intangible capital, end of period (K'_I)	1.718
8	Plant-specific, McGrattan-Prescott (2010)	1.198
9	Technology capital, McGrattan-Prescott (2010)	.519
10	Total ($K'_T + K'_I$)	5.771

See footnotes at the end of Table 1.

Table 4. Model National Income and Product

	Current world		New world	
	High θ	Low θ	High θ	Low θ
Income $(Y - X_I)$				
Labor income (wL)	.60	.70	.59	.70
Capital income $(Y - wL - \delta_T K_T - X_I)$	.26	.17	.27	.17
Tangible depreciation $(\delta_T K_T)$	.14	.13	.14	.13
Product $(Y - X_I)$				
Consumption (C)	.70	.74	.74	.77
Tangible investment (X_T)	.26	.22	.22	.19
Government spending (G)	.04	.04	.04	.04
Addenda: Intangible investment (X_I)	.11	.00	.09	.00

Note: θ denotes capital share

Table 5. Model Fixed Assets

	Current world		New world	
	High θ	Low θ	High θ	Low θ
Tangible capital (K'_T)	4.1	2.8	4.0	2.7
Household	2.1	3.3	3.4	5.3
Government	2.0	−.6	.6	−2.6
Intangible capital (K'_I)	1.8	.0	1.7	.0
Household	.9	.0	1.5	.0
Government	.8	.0	.2	.0

Table 6. Model Balance Sheets

	Current world		New world	
	High θ	Low θ	High θ	Low θ
Household Net Worth	3.2	3.8	4.7	5.5
Tangible capital (V_T)	1.9	3.0	3.1	4.8
Intangible capital (V_I)	.5	.0	.9	.0
Government debt (B')	.7	.7	.7	.7
Government Net Worth	2.7	−1.0	1.0	−2.8
Tangible capital ($K'_T - V_T$)	2.2	−.2	.9	−2.1
Intangible capital ($K'_I - V_I$)	1.2	.0	.9	.0
Government debt ($-B'$)	−.7	−.7	−.7	−.7

Table 7. Results and Steady-State Welfare Gains

	Current world		New world	
	High θ	Low θ	High θ	Low θ
Total capital ($K'_T + K'_I$)				
Tax and transfer	5.8	2.8	5.7	2.7
Private saving	7.0	3.4	6.8	3.4
Household Net Worth ($V + B'$)				
Tax and transfer	3.2	3.8	4.7	5.5
Private saving	5.1	5.8	7.0	8.1
Government Net Worth ($K' - V - B'$)				
Tax and transfer	2.7	−1.0	1.0	−2.8
Private saving	1.7	−2.5	−.3	−4.7
Welfare gains (%)	7.7	3.3	9.7	4.2

Note: No negativity constraints on government investment have been imposed.