

HEALTH CARE SPENDING GROWTH AND THE FUTURE OF U.S. TAX RATES

Katherine Baicker

Harvard and NBER
kbaicker@hsph.harvard.edu

Jonathan Skinner

Dartmouth and NBER
jon.skinner@dartmouth.edu

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ABSTRACT

The fraction of GDP devoted to health care in the United States is the highest in the world and growing rapidly, with health care reform unlikely to slow that growth substantially in the intermediate term. While a recent set of economic studies suggests that such growth is not inefficient given the value of health spending, the fact that almost half of health care spending is publicly financed suggests that such increases could lead to a potentially very costly rise in tax rates. This paper uses a life cycle model of labor supply and saving to trace out the impact of rising health care spending on sustainable tax policy and on the distribution of the burden of paying for health care. The sharp increase in tax rates required to finance public spending, particularly in high income tax brackets, generate efficiency costs that could reduce GDP in 2060 by 12 percent, and may create a powerful brake on future health care spending growth. Consistent with these simulations, empirical evidence based on OECD data suggests that countries facing higher tax burdens in 1980 experienced slower health care spending growth in subsequent decades.

I. INTRODUCTION

Health care spending in the United States is now 17 percent of GDP, and if unchecked it is expected to account for 37 percent of GDP by 2050 (Congressional Budget Office 2007).

Public expenditures account for almost half of health care spending (Centers for Medicare and Medicaid Services 2008). Beyond the aging of the population, rising health care costs per person account for the majority of the projected increase in government spending on Medicare and Medicaid, anticipated to grow from 4 percent of GDP now to 12 percent in 2050 (Congressional Budget Office 2007; Orszag 2008). Unchecked, these increases in entitlement spending would double the federal budget (as a share of GDP), necessitating some combination of the unpleasant options of enormous tax increases, the elimination of all other public spending, or public debt levels that far exceed those currently observed in Greece (Chernew, Baicker et al. 2010). Policy analysts from both sides of the aisle have acknowledged that rising health care spending will almost certainly lead to higher taxes. One prominent New York Times columnist helpfully translated the circumspect language of U.S. senators voicing concerns about future fiscal imbalances: “Like having Medicare? Then taxes must rise.” (Leonhardt 2009).

While this prospect has made rising health care spending a topic of considerable debate and concern, a recent literature is more sanguine, suggesting that the share of GDP devoted to health care in the U.S. is not inefficiently high, and might optimally rise to one-third of GDP in the future (Hall and Jones, 2007; Fogel, 2008). This alternative view is based on the argument that the benefits of additional years of good health arising from technological improvements in health care are large and increase sharply as income rises. However, these studies pay little attention to how society might pay for this additional health care, such as the larger role for transfers from rich to poor, and from healthy to sick. Aside from the broad recognition that taxes

are sure to rise in the future (Leonhardt 2009) there has been little discussion of how such sharply rising tax rates might affect the social value of health care spending or the non-health sectors of the economy. This paper takes a first look at this larger question by focusing on the economic and distributional implications of the projected increases in tax revenue necessary to pay for rising health care costs. We develop a sequenced life cycle model that incorporates leisure, consumption, taxation, and saving, but where the tax revenue is used to provide health care that in turn improves longevity.

We first consider the change in marginal tax rates for different income groups that would be consistent with an increase in health spending by 2060 of roughly 8 percentage points of GDP. We examine several different ways in which this tax burden could be distributed, including setting marginal rates such the share of taxes paid by different income groups remains the same, keeping the after-tax income distribution constant, or financing via payroll taxes instead of income taxes. Consistent with an important Congressional Budget Office study (Orszag, 2007), we find that rising health spending results in sharp increases in marginal tax rates, with marginal rates exceeding 65 percent in the very highest income group. These in turn imply a nearly 12 percent relative decline in estimated GDP by 2060, suggesting that estimated future marginal benefits of health care spending could be attenuated by the large efficiency costs of redistribution.

The view that financing limitations may in turn constrain national health care spending is supported by earlier empirical work by Getzen (1992). We also consider a simple test of our hypothesis that countries respond to rising marginal efficiency (or political) costs of raising taxes by considering a simple test: do countries with higher marginal costs of raising revenue – as proxied by their average tax-to-GDP ratio – experience slower subsequent growth rates in health

care spending. Using the OECD country database for higher-income countries, we find that countries with a 10 percentage point higher tax-to-GDP ratio in 1979 experienced significantly slower growth in health care spending – with an increase that was 0.7 percentage points of GDP less – between 1980 and 2008.

II. BACKGROUND

There is a vast literature exploring the internal organization and efficiency of health care, but there is limited evidence on how rising growth rates and the public financing of health care might affect the non-health-care sector of the economy and overall economic growth, or how different tax policies to pay for more expensive health care might affect the distribution of the burden of financing health care and consequent deadweight loss imposed on the economy.

Health Spending in the Economy

Stories of the toll of rising health care costs on wages and employment abound in the popular press. While these pressures have been present for many years – resulting in stagnant net wage growth (after health insurance payments) over the last decade as an increasing share of compensation is devoted to health insurance benefits – the current recession and debate over health care reform have cast the rising burden of health care costs in a much starker outline (Fletcher 2008). These consequences are particularly dire for low-income populations, who may be at greatest risk of losing jobs when the costs of benefits rise (Baicker and Levy 2008).

Rising health care costs also threaten to erode the risk pooling that occurs in private insurance markets. The majority of private health insurance in the U.S. today is obtained through employer-sponsored plans, which cover more than 170 million lives (compared with under 20 million covered through private non-group insurance plans) (America's Health

Insurance Plans 2007). Economic theory suggests that in the long run the cost of these benefits is borne entirely by workers (as long as they value the benefits) (Summers 1989), but in the short run there are constraints that affect the ability of firms to shift costs to workers, and thus rising costs can result in fewer people covered by group policies (Cutler and Madrian 1998; Currie and Madrian 2000; Carrington, McCue K. et al. 2002; Baicker and Chandra 2006). While the vast majority of large employers offer health benefits, over the last 10 years the share of small firms offering health benefits has dropped from 69 percent to 61 percent and rising costs are cited as one of the main factors influencing firms' decisions to discontinue offering benefits (Kaiser Family Foundation and Health Research and Education Trust 2008). Health care spending growth has also been shown to reduce private health insurance coverage and exacerbate adverse selection (Currie and Madrian 2000; Baicker and Chandra 2006).

Rising health care costs thus seem to present obvious challenges to the U.S. economy, but a more recent set of economic studies provides a far more sanguine perspective, suggesting that the share of GDP devoted to health care in the U.S. is not inefficiently high and, indeed, might optimally be substantially higher still in the future. One study by Robert Hall and Charles Jones suggests that given the productivity of health spending relative to other forms of consumption, we might optimally spend as much as a third of GDP on health by mid-century (Hall and Jones 2007; Fogel 2008). Kevin Murphy and Robert Topel find that health care spending in the last century has generated massive improvements in health and longevity, worth more than \$3.2 trillion annually – well in excess of the cost of care (Murphy and Topel 2006). Fundamentally, this research argues that health care is a valuable good, and that we should not be surprised that we are devoting a large and growing share of our national resources to living longer and healthier lives.

There are two approaches to reconciling these two views of whether health care costs are a cause for concern or celebration. First, the productivity of health care spending may be overstated because of a failure to distinguish between average and marginal returns to health spending (Garber and Skinner, 2008). Second, and the focus of this paper, there is little understanding of how the financing of health spending through taxes would be expected to affect GDP growth.

The Productivity of Health Spending

The literature above finds large gains to health care spending, but the distinction between average returns to health care spending and marginal returns to the last dollar spent is important but often lost (Weinstein, 2005). It may be difficult to identify the last marginal dollar, or to develop health care reforms that would leave the valuable health care services but get rid of the waste.

Garber and Skinner document differences in spending and outcomes between the U.S. and other developed countries (Garber and Skinner 2008), and suggest that much of the high apparent average benefits of health care spending were generated not by the expenditures at the margin, but instead by the very low-cost innovations such as the use of aspirin and beta blockers for cardiovascular disease, and by important behavioral changes having little to do with health care intensity per se such as better diet and lower smoking rates (Cutler and Lleras-Muney 2006; Cutler, Rosen et al. 2006). Other studies of productivity come from a group of Dartmouth researchers focused on geographic variation in the delivery of health care. These studies have in some cases found evidence of high productivity (e.g., surgery for spinal stenosis) (Tosteson, Skinner et al. 2008) or low productivity (e.g. treatment of acute myocardial infarction) (Skinner, Staiger et al. 2006). In the case of cesarean sections, increases in the use of the procedure were

likely to result in utilization of dwindling value (Baicker, Buckles et al. 2006). This suggests a more nuanced view of health care productivity, with some treatments having very large benefits but others exhibiting near-zero benefits but very large costs (Chandra and Skinner, 2010). It is thus important in modeling the U.S. health care sector to capture the effect of changes in health care productivity along the margin that is actually affected by changes in policy.

The Financing of U.S. Health Care Expenditures

A second source of worry about rising health spending comes from the fact that a substantial share of health spending is financed by public dollars. These public programs are fundamentally about redistribution: from rich to poor, and from healthy to sick. Figure 1 shows the growing share of U.S. health care financed by public dollars. (These figures are in real 2007 millions of dollars, calculated from national health expenditures from CMS deflated by CPI (Centers for Medicare and Medicaid Services and Office of the Assistant Secretary for Planning and Evaluation 2008)). All told, public dollars account for half of national health expenditures. This share is even higher when one includes not only Medicare and the federal and state shares of Medicaid and a host of other government insurance and direct care programs (such as care for veterans and care provided through community health centers), but the tax subsidization of private health insurance through the exclusion of employment-based insurance policy premiums from payroll and income tax bases. This tax expenditure is as large as Federal spending on Medicaid (Kleinbard 2008).

The deadweight loss generated by the behavior changes induced by the taxes necessary to finance these programs must be added to their direct costs when evaluating their cost-effectiveness. At first blush, these tax distortions may appear to be static in nature (they result in lower economic activity at a point in time), but as Engen and Skinner have demonstrated, tax rate

distortions can also have implications for economic growth rates by distorting investment decisions (Engen and Skinner 1996). More importantly, in a dynamic framework there are strong implications for economic growth when tax rates rise.

There is a substantial body of research exploring the size of the incremental deadweight burden in the U.S., based on the existing tax structure. Many estimates cluster around 0.3 – meaning that every dollar of public spending comes with an additional cost of 30 cents in the form of reduced economic activity (Feldstein 1973; Fullerton and Henderson 1989; Poterba 1996; Feldstein 1999; Feldstein 2006; Gahvari 2006). Saez, Slemrod, and Giertz (2009) provide a comprehensive framework and review of the substantial empirical literature on the elasticity of taxable income with respect to tax rates, including evidence from both the U.S. and abroad (Saez, Slemrod et al. 2009). They note that it is not clear whether changes in taxable income are a sufficient statistic to gauge the inefficiency introduced by taxes, but that there are advantages to collapsing the many dimensions of potential response (from hours worked to form of compensation to use of tax shelters) into this summary measure. Liebman, Luttmer, and Seif (2009) similarly find that both hours worked and retirement decisions are sensitive to changes in the social security tax rate (Liebman, Luttmer et al. 2009).

The Congressional Budget Office has produced estimates of the effect of rising health care spending on marginal tax rates and the distribution of taxes paid if increases in revenues come from income taxes (Orszag 2007). They show that, assuming public spending is valued by workers and health spending grows 1 percent faster than GDP, the increase in income taxes necessary to finance public health spending would reduce GDP by 1-6 percent if revenues were raised by maintaining the current tax structure without indexing or by 3-16 percent if revenues were raised by increasing marginal income tax rates across the board. They show the effects of

such increases on the taxes paid by taxpayers at 4 different points in the income distribution, focusing on steady-state (rather than transition paths) and on the distribution of the tax burden (rather than changes in income distribution). While this study provides a key contribution in projecting future marginal tax rates under a scenario of increasing health care spending, they did not consider the longer-term impact of such taxes on GDP growth and the welfare of individual taxpayers.

III. SIMULATION METHODS

The distributional implications of the tax-finance of almost half of health care spending depend crucially on both how quickly spending grows and the progressivity of the tax system. In this section, we sketch out the model used to characterize the impact of projected tax growth on overall economic activity and the distribution of the burden of paying for health spending under different stylized revenue systems and different scenarios about the growth in health care spending. We describe the model in more technical detail in the Appendix.

We use a life cycle model where individuals get utility from consumption and leisure in each period they are alive. They live up to age 95, with survival depending on aggregate investment in health care. They work during the first part of their lives, generating income that they can consume but taking away from their leisure. Their wages grow at a steady rate each year. They retire exogenously in the last part of their lives, during which they live off of savings from their working years and Social Security benefits. They can borrow, but must repay the loans during their lifetimes. For the sake of simplicity, there is no bequest motive.

Their wage income is subject to payroll taxes and the interest on their savings is subject to interest income taxation. The tax schedule is progressive, with an exemption and higher income groups paying higher marginal tax rates. Public health care financing can involve both

transfers from the healthy to the sick and from high income households to low income households; indeed, the growth in per capita health care expenditures may within the decade make it impossible for lower income households to bear the full cost of their health care (Baicker and Levy, 2009).

Using data from 2007 taxpayers from the IRS, we categorize individuals on the basis of the marginal tax rate that they face under federal tax rules to create a stylized, simplified tax schedule. We create four separate groups, with the share of the population in each group determined by the fraction of taxpayers facing marginal tax rates of 10 percent, 15 percent, 25-28 percent, and the highest group facing 33-35 percent marginal federal tax rates. We also assume that each income group faces an additional constant 8 percent marginal tax rate. For the lowest income group, this additional tax reflects Social Security and Medicare taxes (plus residual incremental tax rates arising from clawed-back Earned Income Tax Credits), while for higher income groups, the taxes reflect state- or city-level income taxes or corporate taxes on interest income. Thus the marginal tax rates at the baseline (2010) are thus assumed to be 18, 23, 33, and 42 percent. The annual interest-income tax is assumed to be half of the marginal tax rate, reflecting the often preferential treatment of investments through capital gains, tax-preferred accounts, and a stepped-up basis at death. (The results are not sensitive to assuming a higher marginal tax on such investments, such as in a scenario with higher long-term inflation rates.)

We assume a separable utility function with respect to leisure and consumption, with an elasticity of substitution of 1.0 (equivalent to a Cobb-Douglas labor supply curve). This means that labor supply and taxable income is relatively insensitive to a proportional tax that is used to finance health care improvements, but labor supply does respond to changes in taxes in a

progressive tax system. We further assume that each income group is subject to a single marginal tax rate (that is, they do not jump from one marginal tax bracket to another).

With four different income groups (low, medium, high, very high income) there are clearly a variety of ways to simulate increases in health care financing. We consider three possibilities. The first is to set growth in marginal tax rates such that each income group pays the same share of total revenues. An alternative approach is to raise taxes in a roughly monotonic fashion but where the after-tax Gini coefficient – a commonly used measure of income inequality – is held constant over time. Finally, we also consider the case where taxes are raised in an equal non-distortionary lump-sum fashion, similar to a private insurance premium that is not based on income.

Government programs that are financed by these taxes include both health spending and other programs including Social Security. We hold constant these other programs, relative to underlying growth in the macroeconomy. We further assume productivity growth of 1.3 percent annually, estimated per capita income growth since 1993 for the bottom 99 percent of the economy (Saez, 2009).

We first consider a benchmark case in which taxes do *not* rise over the next 50 years, but there is a continued gain in technological progress that increases life expectancy by 1.8 years. Implicitly, we are assuming that all future medical expenditures are being funded by deficit spending (and where this spending does not have an adverse impact on U.S. bond credit ratings or other economic conditions), or that other government spending is reduced by 8 percent, or that all future health gains are financed by reducing waste in U.S. health care. An alternative benchmark case is one in which health care spending does rise, but it is funded

entirely by optimal private insurance payments. We consider both scenarios as well as intermediate cases below.

A fully-dynamic model would incorporate overlapping generations, each of which has been affected by its past economic conditions and each of which will ultimately be affected by future fiscal and tax policies. One disadvantage of these models is that individuals' labor market choices are very sensitive to differences between current and future tax rates, making them very unstable when there is the prospect of dramatic increases in tax rates. Here however we adopt a simpler model to explore different tax structures (with potentially very high future tax rates) when public spending on health care spending rises. In this model people assume, myopically, that current tax rates are likely to persist. We also do not model here the complex interaction between private insurance coverage and public programs.

We calibrate this model using existing data on interest rates, wages and wage growth, and mortality at different ages; and estimates of discount rates, elasticities and health care productivity, described more fully in the Appendix.

IV. SIMULATION RESULTS

In this section, we present results from the model that can help shed light on the role that different aspects of financing health growth and the productivity of health spending play in driving macroeconomic effects of rising health spending.

Lifecycle Consumption

We begin by showing the spending and savings patterns over a lifetime that our baseline model implies. Figure 2 shows average income (including non-wage income), consumption, and

assets by age for the middle-income group. Income rises over time before a sharp reduction at retirement; income further declines as the household spends down their retirement wealth. Similarly, assets exhibit an increase until peaking at retirement, at which point they are depleted by age 95. Consumption exhibits a “hump” shape, with an increase early on because the after-tax rate of return exceeds the discount rate (plus the risk of dying early), but declines at later years as individuals account for the smaller probability of actually reaching age 90. While a more complex model accounts for additional effects of children and spouses on household spending patterns, these patterns of simulated consumption and wealth accumulation are broadly consistent with the empirical evidence.

Health

We assume a very simple health sector that absorbs all of the new revenue generated by these taxes and in turn “produces” additional health outcomes, measured here as rising survival rates. For the purposes of this exercise, we assume a robust health care production function that yields estimates of health care productivity consistent with (e.g.) Cutler et al. (2006). We begin with a survival curve in 2010 (based on U.S. vital statistics), with slightly less than 100% of the population surviving to age 20 and successively less from that age forward. Survival at every age is assumed to improve by 2060, as shown in Figure 3, with a resulting increase in life expectancy from 79.0 to 80.8 years, or an increase of 1.8 years.

Marginal Tax Rates

Figure 4 presents estimates of marginal tax rates for each of the four income groups, based on the simulation in which taxes rise by enough to increase government spending as a share of GDP by 8 percentage points by 2060, but where the tax shares of each group are held

constant over time. (We refer to this below as Scenario 1.) Marginal tax rates are predicted to increase from 18 to 26 percent for the lowest income group, and from 42 to 66 percent for the highest income group. As noted above, the implicit interest income taxes for the highest income group are equal to half of the wage tax, for a maximum of 33 percent.

GDP Growth under Different Tax and Insurance Policies

We begin by showing the baseline projected growth in the absence of any increase in marginal tax rates in Figure 5 and Table 1. Assuming a 1.3 percent annual increase in wage rates, projected GDP per taxpayer household rises from \$60.8 thousand in 2010 to \$117.5 thousand in 2060. We also consider simulated effects of a revenue increase of 8 percent of GDP financed by increases in income taxes, and an 8 percent of GDP increase financed by increases in payroll taxes, also shown in Figure 3 and Table 1. The impact of an increase in the income tax (Scenario 1) is predicted to attenuate GDP growth such that by 2060, per household GDP is \$104 thousand, or 12 percent below the baseline scenario of \$117.5 thousand.

The payroll tax (Scenario 2) is shown to have an even larger negative impact on GDP (20 percent below the baseline case) as the very high marginal tax rates necessary. In fact, the revenue generated from the highest earning bracket actually flattens out into “Laffer Curve” territory in this scenario. Recall that with payroll tax financing (Scenario 2), the tax on wages must rise by more than with income tax financing (Scenario 1), because the interest income tax is being held constant. Here, the higher marginal rates required to maintain constant tax shares exceeds 70 percent for the highest income group, at which point raising tax rates further does not generate additional revenue. Thus the efficiency costs are substantially greater given the distortionary effects of the higher marginal tax rates, with 2060 GDP rising to only \$95.6 thousand, or 20 percent below that achieved in the baseline. This simulation also illustrates the

large tradeoffs between equity and efficiency when marginal tax rate on the highest income group is so high – clearly, the efficiency costs of raising revenue in the lowest income group are much less, but would then generate potential distributional concerns.

Scenario 3, in which the same health gains are realized but with only half the increase in taxes, illustrates the large potential gains – beyond simply the money saved – in effecting cost savings that do not adversely affect health outcomes. Under this scenario, taxes rise by only 4 percent of GDP, with a resulting loss of only 5.6 percent of GDP relative to baseline (Table 1).

A different measure of inequality is the Gini coefficient for after-tax income. While there are multiple ways in which one can raise the 4 different tax rates that hold the Gini constant, we chose increased tax rates that exhibited tax increase percentages that were monotonic across income groups. When the Gini coefficient for after-tax income was held constant over time, the increase in the marginal tax rates for the highest income group were not as dramatic as in Scenario 1 where tax shares were held constant, but GDP growth was only slightly higher (\$105.3 thousand versus \$104 thousand, an 11 percent gap).

Finally, we consider the scenario in which all the increase in health care spending is financed by a non-distortionary fixed insurance premium or tax unrelated to income. Given that all individuals both pay the premium, and enjoy the additional longevity, GDP would actually increase relative to the baseline scenario, from \$117.5 to \$127.1 thousand, as workers increase hours to earn enough to cover the cost of the flat revenues that finance health spending (Scenario 5 in Table 1). Utility comparisons between this “first-best” Scenario 5 and the tax-financed increases in Scenario 2 suggest on net a substantial welfare loss arising from the distortionary taxes, but the distributional impact implies that the lowest two income groups are actually better off under the distortionary taxes even though GDP overall is lower, given its much greater

redistributive component.

The estimated distortionary effects of taxes on GDP – a roughly one-for-one reduction in GDP relative to tax revenue collection – are somewhat larger than has been estimated using traditional measures, e.g. (Gahvari 2006), but reflect the impact of raising already high marginal tax rates. Estimates of the deadweight loss imposed in systems with much higher tax rates (such as Sweden) are substantially higher, ranging from 50 cents to more than \$2 (Blomquist 1983; Rosen 1997; Hansson 2007). Saez, Slemrod, and Giertz review estimates of the elasticity of taxable income across several different countries, finding that those in higher tax brackets seem to be more sensitive generally to tax policy changes (Saez, Slemrod et al. 2009).

V. EMPIRICAL EVIDENCE ON THE LINK BETWEEN TAXES AND HEALTH EXPENDITURES

Finally, we consider a simple empirical comparison of tax-to-GDP ratios and the subsequent rise in health care spending as a percentage of GDP. Using data from the OECD, we evaluate the association between government revenues as a share of GDP in 1979 and the increase in health care spending as a share of GDP from 1980 to 2008 (or the most recent year available). As shown in Figure 5, there is a wide range in the extent to which health care spending as a percentage of GDP has increased since 1980 (measured on the vertical axis; this growth metric differs from a percentage growth – see Chandra and Skinner (2010) for additional discussion). The U.S. leads the way, with a growth of 7 percentage points, while in Sweden, Denmark, and Ireland the share grew by less than one percentage point. Tax revenues as a share of GDP in 1979 are shown on the horizontal axis. Here, too, there is substantial variation, with Sweden, Belgium, Denmark, Norway, the Netherlands, and Luxembourg above 50 percent, while Australia, Turkey, Japan, and Spain were under 30 percent.

The growth of health spending as a share of GDP over the next decades is negatively and

significantly associated with this initial level of tax effort. The correlation coefficient is -0.44 (p-value = 0.04). The regression coefficient of -0.07 suggests that in countries where revenues as a share of GDP were 10 percentage points lower in 1979, health care spending increased as a share of GDP by 0.7 less in the next 30 years. This association is consistent with the hypothesis that tax rates may serve as a limiting factor in public contributions to health spending. This was first argued by Thomas Getzen, who showed that health care expenditure growth was not determined by demand (e.g., population aging) but by the supply of financing for expanded services (Getzen 1992).

VI. CONCLUSIONS

With almost half of health expenditures publicly financed and the potential for further government subsidization of health insurance under health care reform, the rising burden of health care spending will necessitate large increases in tax rates. If the distribution of the tax burden is to remain roughly the same, this will result in rapid increases in the efficiency cost generated by financing that spending as the top tax brackets rise. In this paper, we have estimated the impact of such tax increases on economic activity, particularly in the non-health sectors of the U.S. economy. Our results suggest a large attenuation in economic growth, with estimated GDP in 2060 more than 10 percent below the baseline estimates in the absence of the distortionary impact of the tax-financing of rising health care costs.

Most models of health care spending growth (such as those of CBO and the CMS Office of the Actuary) assume that there must be a break in current trends, as the current growth of health care spending in excess of GDP cannot continue unabated, but it is unclear what policy or condition would change to effect that slow-down. Our empirical analysis across countries suggests that strains on the revenue-raising system may exert a natural brake on health care

spending, and may thus be a key (albeit inefficient) mechanism for constraining overall health care spending growth.

There are several limitations to this analysis. First, a stylized model of labor supply and a simple linear approximation to a progressive tax may not do justice to the very complex U.S. tax code. Second, the model considers sequenced equilibrium, and thus will not capture the potentially dynamic reactions of individuals who may choose to work more today if they foresee future tax hikes. And finally, the model does not simultaneously determine the optimal level and growth rate of health care spending, as do Hall and Jones (2007). In complementary work we are working to develop such a model with dynamic feedback between GDP growth and publicly financed health care spending, and with endogenous choice of government and privately provided health insurance (Baicker and Skinner 2010). Still, this paper shows that absent the success of health reform in slowing spending growth, the rising efficiency cost of tax distortions (and political opposition to further tax hikes) may ultimately temper health care spending growth in the next several decades.

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Figure 1: Health spending by source in the U.S.

Source: National Health Expenditures, CMS

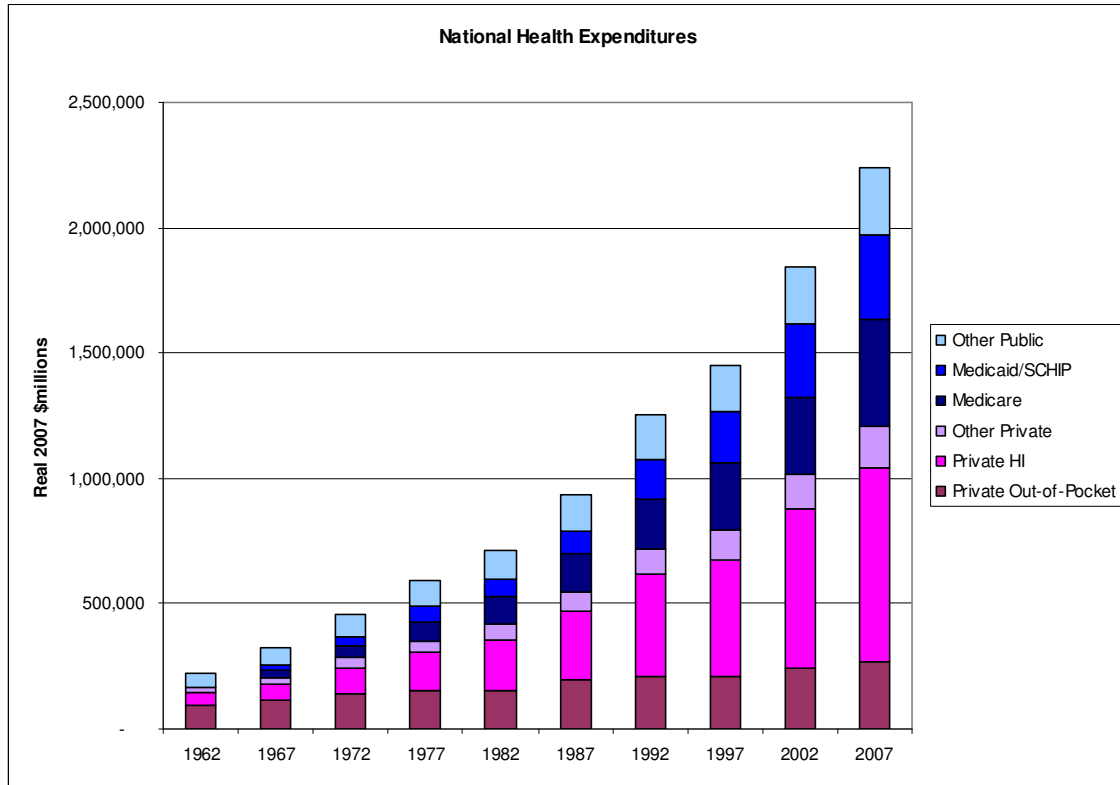


Figure 2: Baseline Earnings, Consumption, and Wealth Accumulation (in \$1,000)

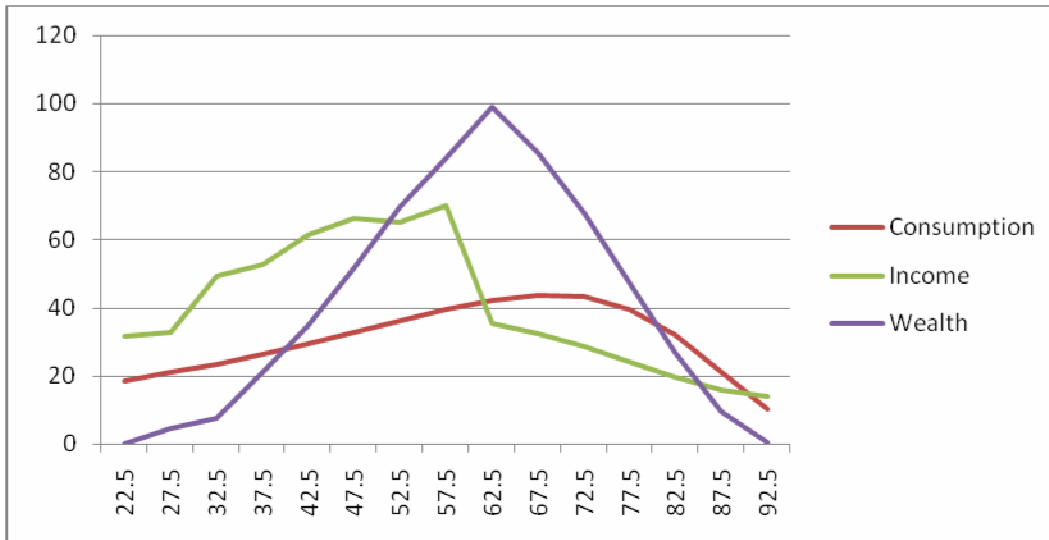
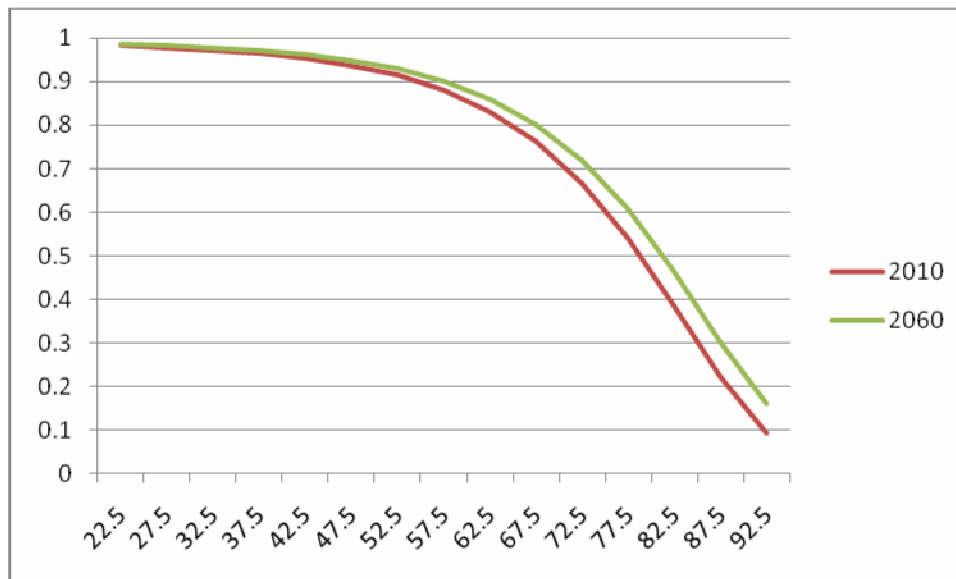


Figure 3: Survival Curves for Age 20+; Assumed for 2010 and 2060



Note: Assumed 2010 survival curve is equal to the 2004 Vital Statistics survival curve; thus both may be understated. Life expectancy is simulated to rise from 79 years to 80.8 years.

Figure 4: Predicted Marginal Tax Rates by Income Group and Federal Tax-to-GDP Ratio, 2010-2060

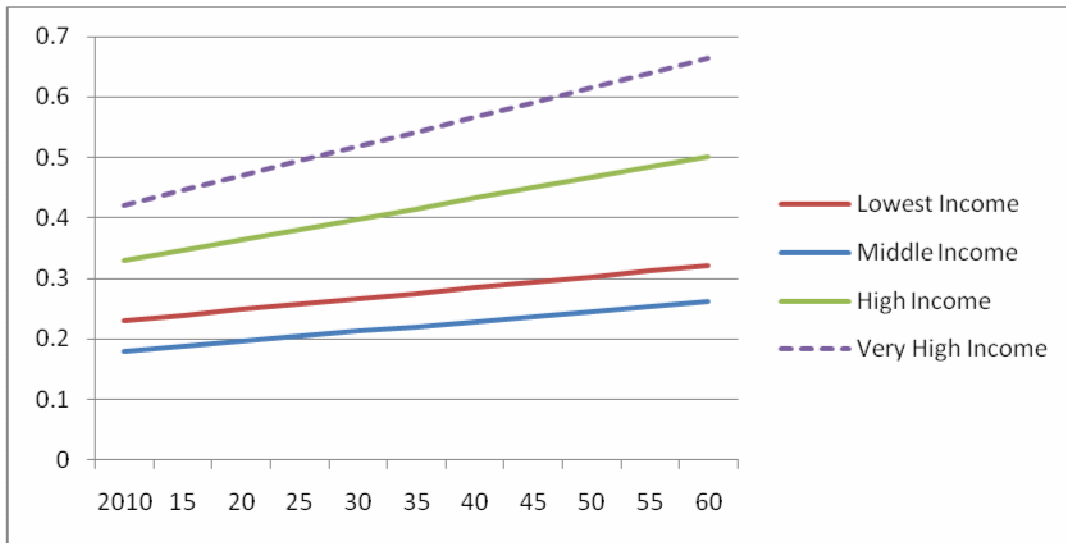


Figure 5: GDP Per Household (in thousands) Under Different Scenarios

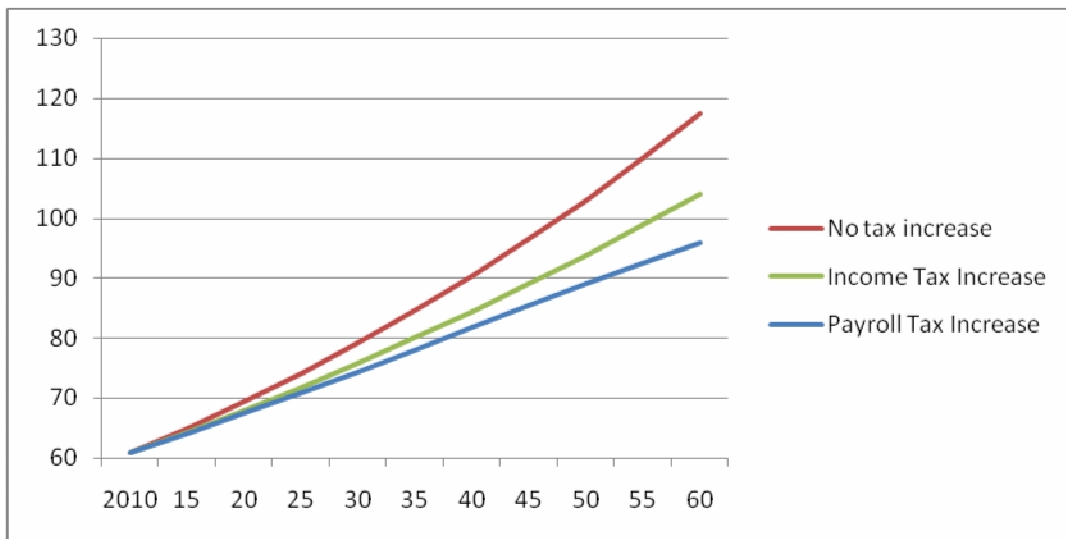
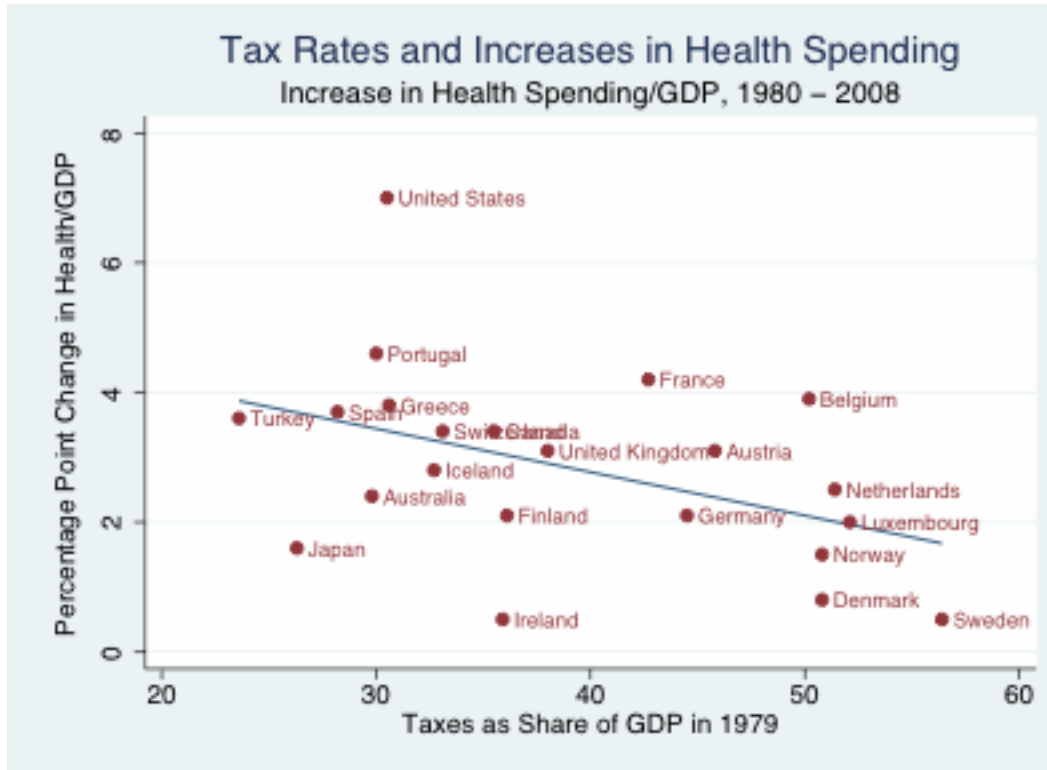


Figure 6



Notes:

Correlation coefficient = -0.44, regression coefficient = -0.067, p-value = .039. Health growth rates shown for 1980-2007 for Australia, Denmark, Greece, Japan, and Turkey; and for 1980-2006 for Luxembourg and Portugal.

Sources:

Health as a share of GDP from *OECD Health Data*, June 2010 (OECD 2010); Revenues as a share of GDP from OECD Report (Oxley and Martin 1991)

Table 1: Projected GDP per Household (in 2010 Dollars) Under Different Simulation Scenarios

YEAR	SCENARIO					
	Baseline	1	2	3	4	5
2010	60.8	60.8	60.8	60.8	60.8	60.8
2015	64.9	64.3	64.0	64.6	64.3	65.4
2020	69.4	67.9	67.4	68.6	68.0	70.3
2025	74.1	71.8	70.9	72.9	71.9	75.7
2030	79.1	75.8	74.4	77.5	76.0	81.4
2035	84.5	80.0	78.0	82.3	80.3	87.6
2040	90.3	84.4	81.7	87.4	84.9	94.3
2045	96.4	89.0	85.4	92.8	89.6	101.6
2050	103.0	93.8	89.0	98.6	94.6	109.4
2055	110.0	98.8	92.5	104.6	99.8	117.9
2060	117.5	104.0	95.8	111.1	105.3	127.1

Notes: Assumed wage growth is 1.3 percent annually. The Scenarios are:

0. Baseline. Tax rates are fixed but survival rises by 1.8 years (as it does in all simulations below).
1. Income tax rates rise by enough to generate additional revenue of 8 percent of baseline GDP, maintaining share of taxes paid by each income group
2. A payroll tax (excluding interest income taxation) is used to generate additional revenue of 8 percent of GDP, maintaining share of taxes paid by each income group
3. Income tax rates rise by enough to raise additional revenue of 4 percent of baseline GDP, maintaining share of taxes paid by each income group
4. Income tax rates rise by enough to generate additional revenue of 8 percent of baseline GDP, holding Gini coefficient (capturing after-tax income distribution) constant
5. Additional revenue of 8 percent of baseline GDP is raised using lump-sum insurance assessments

TECHNICAL APPENDIX: THE SIMULATION MODEL

We use a life cycle model with leisure, consumption, and saving, as well as uncertain lifetimes. The tax distortions arise from income taxation in the form of a payroll tax on wages and an interest income tax. We include five-year time periods, so that people live from age 20-24 ($i = 1$) to at most age 90-94 ($i = 15$). Lifetime utility is:

$$U_k = \sum_{i=1}^D \left[\frac{S_{it}}{(1+\delta)^{i-1}} \right] U(C_{it}, \ell_{it}) \quad (1)$$

Utility in each period is a function of leisure ℓ and consumption C , discounted at the rate δ , and weighted by the expected value of survival S_{it} . To ensure stability in the model we specify a separable utility function for consumption and leisure with a intertemporal and intratemporal elasticity of substitution parameter $1/\gamma$.

$$\begin{aligned} U(C_{it}, \ell_{it}) &= B + \left[\frac{C_{it}^{1-\gamma} + \alpha \ell_{it}^{1-\gamma}}{1-\gamma} \right] \text{ if } i < R \\ &= B + \left[\frac{C_{it}^{1-\gamma} + \alpha 1^{1-\gamma}}{1-\gamma} \right] \text{ otherwise} \end{aligned} \quad (2)$$

(The model reverts to a log-linear structure when $\gamma = 1$.) We have assumed away retirement decisions, but instead assume exogenous retirement at age R , which corresponds to leisure comprising all of the time endowment (that is, $\ell = 1$). The presence of the term $B > 0$ ensures that utility is everywhere positive even when $\gamma > 1$, with the second term on the right-hand side of Equation (2) everywhere negative.¹ We set B to ensure that for the 2nd (median) group, the discounted value of a life is equal to roughly 4 million dollars; somewhat lower than estimates by Murphy and Topel (2006) because median income is less than average income. Except for measuring the dollar benefit of additional lifespan, the value of B does not affect labor supply or saving behavior.

Structure of the dynamic model

The standard approach for using life cycle models with dynamic transition paths is to construct an overlapping-generations model, so that different cohorts are alive at a point in time, each of which has been affected by its past economic shocks (think of the depression generation) and each of which will ultimately be affected by future fiscal and tax policies. One disadvantage of these models is that they are forward-looking with regard to policy variables, so that people who are today age 20 should – in theory – anticipate the very high tax rates necessary to pay for health care in 2040. This in turn should – also in theory – cause younger workers to step up labor supply today to avoid the onerous future taxes, assuming that taxes on saving don't rise so much that individuals go on a spending spree today.

¹ Utility arising from being retired simplifies to $\alpha/(1-\gamma)$, but we write it in its expanded version to show that the utility function is common across the life-cycle.

While we have explored this approach, here we adopt a simpler model of “sequenced” steady state equilibria, where in the initial benchmark year (2010), individuals make plans as if those 2010 tax rates were going to persist into the future. Similarly, as tax rates rise, we reevaluate steady-state consumption, work effort, savings, and tax revenue under the assumption that the (say) 2020 tax regime will persist not just in 2020, but also going forward. This assumption is similar to a “myopic” view that current policies will exist in the future.²

When simulating the gradual rise in tax rates forecast for the next half-century (with similar five-year periods for $t = 1, 2, \dots, 10$), we allow for growth in wage rates (at a rate g_w), changes in survival S_{it} , and changes in marginal tax rates.

The individual's budget constraint

The present value of earnings and transfers constrain total the present value of consumption:

$$\sum_{i=1}^D [\Gamma_{it} + \mu_{it} \tau_{it} + w_{it} (1 - \tau_{wt}) (1 - \ell_{it})] R_{it} \geq \sum_{i=1}^D C_{it} R_{it} \quad (3)$$

where the discount rate $R_{it} = [1 + r(1 - \tau_{rt})]^{1-i}$ and w_{it} is the full hourly compensation while $(1 - \ell_{it})$ is the fraction of time spent working. We allow for a positive marginal tax rate on labor income, τ_{wt} , an interest income tax rate τ_{rt} and a credit (or exemption) $\mu_{it} \tau_{wt}$ to reflect the progressivity of the tax system that collects revenue for non-health care services such as Social Security, national defense, education, and other government functions. There are no explicit borrowing constraints in the model. Social Security income, equal to Γ_{it} , is zero for ages less than 65 but equal to empirical measures of Social Security payments for ages 65 and up. The interest rate is assumed to be constant, as would be the case in an open-economy model. It is also useful to define assets:

$$A_{i+1,t+1} = A_{it} (1 + r(1 - \tau_{rt})) + [Y_{it} - T_{it} - C_{it}] \quad (4)$$

where T is the total taxes paid in that year (defined below), and we impose a lifecycle model by setting initial assets equal to zero. Hence there are no transfers to subsequent generations when people die with existing balances in their savings accounts.

The government budget constraint

Taxes paid at each age and for each year are written

$$T_{it} = (w_{it} (1 - \ell_{it}) - \mu_{it}) \tau_{wt} + \tau_{rt} r A_{it} \quad (5)$$

²One could also model this as reflecting uncertainty about future tax and fiscal policies, but modeling such uncertainty properly would be far more complex. In some cases, uncertain tax policies could cause people to save more, in other cases to save less, depending on the nature of the utility function. See the older literature by Shoven, Fullerton, and Whalley for models with similar myopic expectations.

The present value of taxes on a lifetime basis is written $\Phi = \sum_i S_{it} T_{it}$. We use Φ when measuring the efficiency cost of taxation by comparing it to the dollar value of the resulting change in utility. We convert utility change to a “money metric” change by dividing ΔU , the change in utility, by the marginal utility of first-period consumption. In other words, if at the margin we increased first-period consumption by say X dollars (holding the marginal utility of consumption constant), the change in utility ΔU would equal the marginal utility of consumption times X. Working in reverse, ΔU divided by the marginal utility of first-period consumption yields the dollar value X necessary to decrease utility (or increase utility) by the observed change ΔU . In practice, we measure the marginal efficiency cost by changing tax rates at the initial equilibrium, measuring the resulting change in revenue and the dollar value of the change in utility, and taking the negative value of that ratio.

Health care and health

Rather than developing an explicit health care sector, we instead consider several simulations with gradually rising survival rates over time. When we include the “output” from increasing health care spending, we focus primarily on lifespan extension by decreasing the period-specific mortality rate by a constant proportion. We define the conditional probability of dying at age i in year t as:

$$m_{it} = \frac{S_{it-1} - S_{it}}{S_{it-1}}$$

We model technological improvement in health care as $m_{it} = m_{i1}/(1+g_s)^{t-1}$. Based on the estimate in Cutler et al. (2006) we chose g_s , the economy-wide growth in health improvements, to yield empirically consistent (if optimistic) estimates of the resulting survival gains under the assumption that all of the new tax revenue is devoted entirely to health care spending.

Different income groups

Public health care financing can involve both transfers from the healthy to the sick and from high income households to low income households. We will therefore introduce 4 different income groups into the model to allow transfers from high to low income groups to be an integral part of the future financing of health care costs. Indeed, the growth in per capita health care expenditures may within the decade make it impossible for lower income households to bear the full cost of their health care. Thus, over time we can expect an ever-larger distortionary *transfer* component of health care financing (Kaplow 2008). To capture progressivity in the tax code, we allow for initial marginal tax rates and intercept points that differ across income groups. The marginal tax rates were determined from data in the Statistics of Income, and the intercept points then determined to ensure that the shares of tax payments in each simulated group were roughly equal to the actual shares of tax payments as reported in *Statistics of Income*.

The very highest income group as shown in the *Statistics of Income* showed adjusted gross income levels roughly 14 times the middle-income group, but they comprised only 2.5% of the taxpayer population. To avoid trying to fit labor supply measures to such wide differences in income, we instead made a simplifying assumption – that there were two high-income earners in each tax entity, thus leading to roughly 5 percent of the population earning 7 times the middle income group. Thus the tax and income shares are unaffected by this change.

What the model is missing

As noted above, we do not implement a full-blown overlapping-generations model, nor do we allow for changes in asset accumulation to affect interest rates or gross wages. (We thereby assume an open economy model.) The U.S. is a combination of both private and public health insurance, and that mix might be expected to evolve over time. However, we do not model the more complex interaction between private insurance coverage and potential crowding out effects of public programs as private premiums continue to rise. Finally, we do not include uncertainty in the model, either about income, uninsured medical expenses, or even the direction of future tax policy in the U.S.

Calibrating the model

As mentioned above, the model is calibrated using 15 five-year age groups from age 20-25 to age 90-95. We set the real (after-inflation) annualized gross interest rate r equal to .04, (Council of Economic Advisers 2008) and convert all annualized growth rates and parameters into their equivalent 5-year counterparts. Although it is difficult to observe, we choose a value of $\delta = .01$, which, coupled with the influence of uncertain lifespan, ensures an empirically plausible time-path of consumption. Consistent with other simulation studies, we assume $\gamma = 1$ (or intertemporal elasticity of substitution of 1), primarily because we want to get the labor supply elasticity right. Because the intratemporal and intertemporal elasticities of substitution are assumed equal in this model, we are also assuming an intertemporal elasticity equal to 1, which is at the low end of the values of gamma (De Nardi, French et al. 2006). Using larger labor supply elasticities would lead to even larger incentive effects in this model.

Age-specific earnings data are drawn from Census data on earnings and Bureau of Labor Statistics data on hours – with the “full wage” calculated as the hourly rate of compensation times the number of full hours available for work (Bureau of Labor Statistics 2008; Bureau of the Census 2008). Benchmark survival data S_{a1} at five year intervals comes from Vital Statistics data (National Center for Health Statistics 2008; U.S. Census Bureau 2008). Tax rates for each income group are described in the text. The virtual “intercept” of their linear tax rate is determined by matching the actual tax share that each income group pays (from *Statistics of Income*) to their benchmark simulated tax share.

For retirees in different income groups, their base income is equal to their social security payments (by income group, equal to 75%, 100%, 150% 150% of the average \$14,000 annual payment) plus any interest income, albeit taxed at the (modest) interest income tax. However, given their receipt of social security, retirees do not receive their exemption amounts.³

The interest income tax is assumed to be half of the wage tax, reflecting the variety of tax benefits available from 401k and IRA accounts, capital gains taxes, and the stepped-up basis at death for the revaluation of assets. Finally, we assume a productivity growth rate in wages of 1.3

³ Given that the lowest income group’s Social Security benefits are just over \$10,000, their tax schedule is largely unchanged after age 65.

percent. This more conservative estimate (relative to the 2.3 percent rate assumed in Hall and Jones, 2007) reflects average growth rates among the bottom 99th percentile of the income distribution between 1993-2008 (Saez, 2009).