A DEFENSE OF THE CURRENT US TAX TREATMENT OF EMPLOYER-PROVIDED MEDICAL INSURANCE

by

Kevin X. D. Huang and Gregory W. Huffman

Working Paper No. 10-W01R

February 2010
Revised October 2011

DEPARTMENT OF ECONOMICS
VANDERBILT UNIVERSITY
NASHVILLE, TN 37235

www.vanderbilt.edu/econ

A Defense of the Current US Tax Treatment of Employer-Provided Medical Insurance

Kevin X. D. Huang and Gregory W. Huffman*

October 2011

Abstract

We develop a general equilibrium search model with endogenous health accumulation and a unique feature of the US tax code, that exempts employer-provided medical benefits from taxation, to jointly account for US long term unemployment rate and medical expenditure to aggregate consumption ratio. Through various counterfactual experiments, we find (1) eliminating the employment-based tax subsidy lowers medical expenditure but, via a general equilibrium labor market effect, increases unemployment and lowers output, and contrary to conventional wisdom, lowers welfare; (2) having government raise taxes to finance the provision of medical care substantially increases unemployment rate, while reducing income and welfare.

JEL codes: E22, E13, H21, I12

Keywords: Employer-provided medical insurance; Taxation; Unemployment rate; Medical expenditure; Government provision of medical care

*Department of Economics, Vanderbilt University, VU Station B 351819, 2301 Vanderbilt Place, Nashville, TN 37235, USA. Corresponding author: Kevin.Huang@Vanderbilt.edu (Kevin X.D. Huang).

1 Introduction

The current US tax code allows compensation in the form of employer-provided medical insurance to be free of taxation. This tax structure is an anomaly dating back to World War II, to be explained below, that is unique to the US economy. This distinctive tax treatment is widely excoriated as distorting consumption decisions, resulting in overconsumption of medical services relative to other commodities, and a loss in welfare. Support for this notion can be found in the observation, to be illustrated below, that the medical sector occupies a much larger share of aggregate spending in the US, compared with most OECD countries. At least since the argument made by Feldstein and Friedman [12], the conventional wisdom has been that the resulting welfare cost of such a distortion in consumption can be "very large." Based on this assessment, Feldstein and Friedman urged that "eliminating the special tax subsidies of health insurance premiums should be a high priority subject for tax reform." This consensus view seems to be shared also by policymakers who have been investigating ways for reducing medical expenditure (e.g., Congressional Budget Office [9]).

The objective of the current paper is to suggest a potentially important countervailing effect of the special tax treatment of employer-provided medical insurance on labor market decisions: Unemployed workers may search harder to find a job and employed workers may work harder to retain a job, in order to obtain and maintain the tax-exempt medical benefits.[1] This can result in a higher transition rate from unemployment to employment, a lower transition rate from employment to unemployment,[2] and thus a lower unemployment rate and

[1] In the US, most firms offer some form of health insurance – some reports are that 99% of all large firms, with 200 or more workers, offer health benefits to their employees – and most workers obtain some form of health care through their employers. According to Employee Benefit Research Institute [10], the vast majority of insured non-elderly Americans obtain their health insurance through their own or a family member's employment. Gould [14] documents that, in 2003, 60.4% of the total US population had health insurance provided through an employment relationship.

[2] An earlier strand of literature focused on whether or not tying medical insurance to employment might reduce the mobility of workers from one employer to another (without an intermittent spell of unemployment), a phenomenon termed "job-lock", as workers might be reluctant to change jobs, to the extent that this may entail a change in their medical policies. Whereas conceivably such impediments to factor mobility may result in an inefficient allocation of resources, there is no consensus that they result in any significant long run effects, especially in the presence of various existing state and federal "continuation of coverage" laws (e.g.,

a higher output level.[3] Support for this notion can be found in the observation, illustrated below, that the US has a relatively lower unemployment rate and the US workers typically work longer hours (and conceivably work harder), compared with most OECD countries. It has also been documented that gross job and worker flows are larger and unemployment durations are shorter in the US than in most European countries (e.g., Bassanini and Marianna [3]; Layard, Nickell and Jackman [22]; Pries and Rogerson [33]).[4]

In the framework of this paper, the tax exemption for employer-provided medical insurance will have several impacts: on the one hand it will lower unemployment and raise output and income, but on the other hand it will result in greater effort and total hours worked. These forces have opposite effects on households's utility, and the latter negative effect exacerbates the efficiency cost of overconsumption of medical services relative to non-medical commodities resultant from the preferential tax treatment. The net effect that this would have on welfare in general equilibrium is not only of a theoretical curiosity, but also of considerable policy interest and concern.

To aid our investigation of this issue, we construct a general equilibrium model with labor market search, and with endogenous health accumulation, coupled with the unique feature of the US tax system that allows the purchase of employer-provided medical insurance to be tax exempt. Our analytical framework generalizes Grossman's [15] classic formulation

COBRA), such as the Health Insurance Portability and Accountability Act (HIPAA) that President Clinton signed into law in 1996. Gruber and Madrian [16] state that "there is virtually no evidence in the literature on the welfare implications of these results", and Fang and Gavazza [11] find that these results "cannot explain the empirical patterns in health-care expenditures". Our focus in this paper is on health care expenditure and its relation with movements into and out of employment and unemployment, which have drawn considerable attention in the more recent literature.

[3]Rogerson [34], [35], [36] suggests that, in contrast with the Europoean Union, in the US not only is the unemployment rate much lower, but the labor force participation rate is much higher, and the latter is a factor at least as important as the former in contributing to a considerably higher employment rate (i.e., the ratio of employment to working age population). Taking into account the labor force participation margin of the employment rate is only likely to further strengthen the result of this paper.

[4]While much of the literature focuses on the relevance of preferences, technologies, labor market policies, and other cultural or institutional factors, a related recent literature emphasizes the role of cross-country differences in taxation in shaping the cross-country differences in labor market behaviors (e.g., Ohanian, Raffo, and Rogerson [29]; Olovsson [30]; Prescott [31], [32]; Rogerson [37]).

of demand for health into a variant of the neoclassical growth model with the special tax code. The model is augmented to include job market search and transitions into and out of employment and unemployment, to capture the notion that government policies or institutions can influence individual's incentives to seek and retain a job. In our model, the effort exerted by an unemployed worker to find a job, and that by an employed worker to retain a job affect the job finding and separation probabilities. But such effort bears utility costs. As is consistent with the postwar US experience, worker compensation in the model includes not only the taxable wage, but also non-taxable medical benefits provided through the employer. On the other hand, the workers derive utility from not only their consumption of non-medical commodities, but also their health capital, that is subject to a natural rate of depreciation, and which can also be accumulated through obtaining health care services. Production and physical capital accumulation are modeled in a standard way, as in the standard neoclassical framework, and the government taxes labor and capital income to finance its spending. The model that is presented here is thus intended to capture various important features of the current US system. We wish to emphasize at the outset that our paper is not about health insurance *per se*. Rather, it focuses on how the special tax treatment of employment-based health insurance affects the incentives that workers have to obtain or maintain employment, and to consume medical commodities.

As we will show below, the model can jointly account for the labor market and health care expenditure data discussed above, in particular, US long term unemployment rate and medical expenditure to aggregate consumption ratio. Health care services are a significant fraction of total consumption and output in our model as in the data, and thus the mechanism by which medical services are allocated has a significant impact on search effort and employment decisions in the model, as in the current US economy. Therefore, the model captures the fact that American workers may seek employment, in part, based on the payoff in terms of the tax exempt medical coverage provided through the employment relationship, along with many of the other salient features of the current US system. This will then permit the study of how alternative tax treatments for medical expenditures influence the transition rates of workers to and from employment and unemployment, and in turn affect the durations of unemployment and employment spells, unemployment rate, output, and welfare. In sum, the model is useful

in that it can be used to study the impact that various mechanisms for the allocation of medical services can have on aggregate economic outcomes.

We then use the model to conduct a series of counterfactual experiments based on this line of thinking. In these experiments, aggregate economic outcomes from our benchmark model, with employer-provided medical benefits being tax exempt, which is meant to proxy the current US economic system, are compared with those obtained in alternative systems. One alternative considered is a system in which individuals purchase their own health care services without a preferential tax treatment. A second alternative is a system in which the government provides health care services to the entire population. Lastly, as a useful point of comparison, a laissez faire system is also studied in which all distortional policies are removed and there is no government intervention at all.

Our main findings here are summarized as follows. First, we consider eliminating the special tax treatment of employment-based medical benefits, while maintaining all other institutional features and government policies. *This results in a net loss rather than gain in welfare.* On one hand, this partial reform leads to a more efficient substitution between the two types of commodities, with the consumption of medical services falling relative to that of non-medical good. This represents an efficiency gain in the market for goods. On the other hand, the partial reform reduces workers' incentives to seek employment due to the lost tax shelter. Both the effort by unemployed workers to search for a job and that by employed workers to maintain a job are lower. Thus the transition rate from unemployment to employment is lower and that from employment to unemployment is higher. This results in a higher rate and longer duration of unemployment, and a lower rate and shorter duration of employment. Additionally, the level of physical capital is also lower. Consequently, aggregate output and income are lower. Even after taking into account the reduced dis-utility due to the lowered employment effort, the effect from the lost capital, production, and income, due to the depressed labor market activities, more than offsets the efficiency gain from improved substitution in the goods market. The net effect is a *welfare loss.* To gain some perspective of the magnitude of this welfare loss, it is compared to the welfare gain that would result from a laissez faire system in which there is no government intervention in the economy at all.

Next, we consider having the government provide health care services to the entire pop-

ulation. Whether this policy is financed by raising the labor (or capital) income tax rates, or by cutting the existing government spending while maintaining the current tax rates, it results in substantial increases in unemployment rate and decreases in output and welfare. The results are dramatically worse if the tax rates are raised to finance the government-run health care program.

The rest of the paper is organized as follows. In Section 2, we present some observations on health care and the labor market for a group of countries to further motivate our study. We proceed to set up our model in Section 3, and to derive and explain the model's equilibrium conditions in Section 4. In Sections 5 and 6, the model is parameterized so as to conform to the observed behavior of the US under the current tax system. Here we show that the model can jointly account for the labor market and health care expenditure data of the US. In particular, the focus here is on the US long term unemployment rate and medical expenditure to aggregate consumption ratio. Section 7 is focused on analyzing the consequence of the partial reform, and Section 8 is devoted to analyzing the behavior of the government regime, both using our baseline model framework. Some final remarks can be found in Section 9.

2 Some Observations on Health Care and the Labor Market

The current US tax code enables employers to compensate their employees by providing them with medical benefits, and neither the employers nor the employees are required to pay taxes on this form of compensation. This tax structure is an artifact that dates back to World War II. During that time wage and price controls were in place and, because of this, and the fact that the war itself also contributed to a shortage of labor, employers were grappling with the issue of how to compete in attracting scarce labor. It was then ventured that employers might try to offer non-wage compensation, and in particular, medical insurance. In summary, this feature of the tax code does not appear to be the result of any well conceived or well designed process, with economic efficiency in mind. Since aggregate expenditures on health care were comparatively small at that time, the effect of this policy was thought to be inconsequential.

As the population has aged, and increased incomes have combined with important (and increasingly expensive) medical breakthroughs, this has meant that expenditures on medical services have outpaced other types of expenditures. Since the tax code then permits indi-

viduals to obtain these medical services tax free, through their employers' plans, this has only increased the amount of medical services that individuals have sought to purchase. It is now a much-publicized fact that health care expenditures have grown substantially in the recent decades. This is illustrated in Figure 1, which shows the share of private consumption expenditure that is devoted to medical services in the US.[5] As can be seen from the figure, this fraction grew from just 5% in 1959, to over 17% in 2008. Even the "dip" that is present during the 1990s is a period in which the consumption of medical services actually rose, but just not as much as other components of private consumption.

This is further illustrated by Figure 2.[6] This figure shows that growth in real wages in the US, from 1983 until 2005, was very low. In fact, the cumulative growth in real wages over this period was only 12.5%. However, the total growth in real benefits, per hour worked, over this same period was 46%. Perhaps the most important portion of these benefits is employer-financed medical care. From 1983 until 2005 the cumulative growth in the real cost of private industry health insurance, per hour worked, was 182%! It is clear that there has been a dramatic shift in labor compensation from wages, which are taxable, to other forms of compensation, such as medical insurance or care, which are tax exempt.

This special tax structure is unique to the US.[7] This may help explain, without precluding other potential explanations, why medical expenditure is much higher in the US than in most OECD countries. As is clear from Figure 3, while total health care expenditure as a fraction of GDP has generally risen in all countries (for reasons not explored in this paper), it has been persistently higher in the US than in the other countries. The difference in health care expenditure between the US and the other countries – to the extent that it is related to the special tax structure – is more striking than what Figure 3 shows, since this figure illustrates the fraction of *all* spending that is devoted to medical expenditures, including both private and government spending.[8] However, the US has a much smaller share of health care

[5] Source of data: Economic Report of the President (2008).

[6] Source of data: Bureau of Labor Statistics (2008).

[7] While some countries, such as Japan, have alternative systems that require employers to pay labor-based taxes that are then dedicated to providing medical services, many other countries fund medical insurance out of general tax revenue. Yet, the US appears to be the only country in which medical benefits provided through employment relationships are tax exempt.

[8] In contrast, Figure 1 shows the fraction of all private consumption spending that is devoted to medical

expenditure that is paid for by public funds when compared with the other countries (this can be seen from Figure 4). It is worth pointing out that, whereas the share of public expenditure on health care as a percentage of total health expenditure is smaller in the US than in the other countries, the US actually has a larger *total* amount of public health expenditure per capita than most of the other countries, as is apparent from Figure 5. Here the important and relevant point is that the US private health care expenditure is relatively even greater, and since much attention has been devoted to this fact, this is a focal point of the decision-making of US families or households.[9]

It is a message of this paper that the special tax treatment of employer-provided medical benefits may then promote the incentives that US workers have to seek and maintain employment. This may help explain, once again, without excluding other potential accounts, the observed differences in the labor market outcomes between the US and other OECD countries. For instance, Table 1 shows the average annual unemployment rates for a variety of countries from 2000 until 2008. It is clear from the table that the US has a comparatively low level of unemployment rate when compared with other countries. In fact, the average unemployment rate for the Eurozone countries over this period was 8.3%, while that of the US was 5.1%. The table further indicates that in the US workers typically work more hours than in most of the European countries. Also, as is discussed in the introduction section, gross job and worker flows are considerably smaller, unemployment durations are considerably longer, and the ratios of aggregate employment to working age population are consistently lower in most European countries than in the US. The vastly different patterns of employment and unemployment, between the US and the European countries, have been well-documented, and known for quite some time. It is our view that these cross-country differences in the

spending in the US.

[9]Source of data for Figures 3-5: OECD (2008). Most of the US public health care funds go to paying for health care for the elderly, who are usually retired, for disabled or indigent individuals, as well as for military and other government employees. All of these people are not whom we are thinking of as producing the output in the model to be presented below. The focus of the current paper is on the behaviors of typical US working families or households. The basic decision-making unit in the model is that of a family or household of potential workers who can help produce output for consumption and investment. These families or households typically do not receive medical care from the government, and our baseline model will be consistent with the fact that these families mainly finance their own medical care or insurance, through their employers.

labor market outcomes may in part have to do with the different medical insurance schemes in the various countries.

In summary, it is clear that, when compared with many European countries, the US has for some time simultaneously spent more on medical care, with a unique tax system for subsidizing this spending through an employment relationship, and had a lower unemployment rate. It is a message of this paper that these two observations may be related to each other, and the model presented below will illustrate this connection.

3 The Model

Our analytical framework integrates endogenous health accumulation into a variant of the neoclassical growth model with labor and capital income taxes, augmented to include job market search and transitions into and out of unemployment, and a unique feature of the US tax code, under which employer-provided medical benefits are tax exempt. The model presented here is intended to capture various important features of the current US economic system that are essential to address the topic at hand.

There is a measure one of households each containing a measure one of potential working families that may differ in their employment statuses. To preserve simplicity, but without loss of generality or insight, we assume that the families within each household can perfectly insure each other against variations in their labor income due to variations in job status. This feature of the model is similar to that of Merz [27], and the nature of one such insurance scheme is described in Andolfatto [2].

At each date t, each of the households derives utility from its total consumption of non-medical goods and services during the date, c_t, and its total health stock at that date, h_t, as specified by a period utility function, $U(c_t, h_t)$, which is strictly increasing, strictly concave, and twice continuously differentiable in both of its arguments. This stock of health at date t is derived from its total consumption of medical goods and services during that date, m_t, and its health stock at the previous date, h_{t-1}, subject to a natural rate of depreciation, ρ, as is governed by the following law of motion,

$$h_t = (1 - \rho)h_{t-1} + m_t. \tag{1}$$

This approach in modeling endogenous health accumulation generalizes Grossman's [15] no-

tion of consumption motive for health care.[10]

At the same time, the household also determines how much effort each of its currently employed families should expend to keep the job, and how intensely each of its currently unemployed families should search for a job. The household cares about the dis-utility of each of its employed families resulting from exerting effort, a_{1t}, in trying to maintain a job, and of its unemployed families resulting from exerting effort, a_{2t}, in trying to obtain a job. This dis-utility is then characterized by the function, $V(a_{1t}, a_{2t}; n_t)$, which is strictly decreasing, strictly concave, and twice continuously differentiable in the first two arguments, and is concave and twice continuously differentiable in the third argument, n_t, which is the fraction of the families within the household that are employed at date t, and, thus, $(1-n_t)$ is the fraction of the families within the household that are currently unemployed. Whereas the cost of such effort is measured in units of foregone utility or leisure, they could be interpreted broadly as any resources expended on retaining or obtaining employment.

The household's expected, discounted lifetime utility can then be expressed as

$$\mathrm{E}\sum_{t=0}^{\infty}\beta^t\left[U(c_t,h_t)+V(a_{1t},a_{2t};n_t)\right], \tag{2}$$

where E is the expectation operator and β is the household's subjective discount factor.

An important characteristic of the model is that the effort exerted by the working families influence the transition probabilities into and out of employment and unemployment. This is meant to capture the idea that members of the labor force can exert effort, or can otherwise make decisions, that influence their likelihood of obtaining, or of maintaining, employment. To put this into notation, an employed family expending effort a_{1t} in period t will have a probability $\theta_1(a_{1t})$ to retain the job in period $t+1$, and an unemployed family expending effort a_{2t} in period t will have a probability $\theta_2(a_{2t})$ to obtain a job in period $t+1$, where the

[10] Our model abstracts from the investment motive for health care, both in the sense, also discussed in Grossman [15], that better health status may reduce sick time and thus make more of the time endowment available for work or leisure, and in the sense that "health stock" may enter as another productive factor, additional to physical capital and labor, into the production function. Although the results to be presented below do not rely on the investment motive for medical care, incorporating such additional feature into our model would strengthen the results of this paper, and especially could make the welfare effects of our counterfactual policy experiments to be conducted below much more pronounced.

two probabilities are strictly increasing, strictly concave, and twice continuously differentiable in the corresponding effort levels. This search-matching technology implies the following law of motion for the fraction of employed families within the household,

$$n_{t+1} = \theta_1(a_{1t})n_t + \theta_2(a_{2t})(1 - n_t). \tag{3}$$

This approach in modeling how effort affects dis-utility, and the transition probabilities into and out of unemployment are similar in spirit to those specified in Wang and Williamson [40].

A defining feature of the model is that an employed family can obtain health care tax free through the employment relationship. The post-tax unit labor compensation to a working family, $\bar{w}_t$, is then split into two components: a post-tax wage, w_t, and a tax-exempt medical benefit, m_t^b, such that,

$$\bar{w}_t = w_t + m_t^b. \tag{4}$$

This employment-based tax shelter on medical care effectively ties the household's decisions on endogenous health accumulation and consumption to its decisions on labor market effort and, therefore, transitions into and out of employment and unemployment. The general equilibrium interactions between these multiple, yet inter-related dimensions in decision-making by the household are central to our analysis of the current US system and our various counterfactual experiments.

The household's budget constraint at date t is then given by

$$c_t + m_t + k_{t+1} = \bar{w}_t n_t + (1 + \bar{r}_t)k_t + g_t. \tag{5}$$

where $\bar{r}_t$ is the post-tax return on the household's holding of physical capital at date t, k_t, net of a capital depreciation rate δ, and g_t is a lump-sum transfer from the government to the household. Whereas it is up to the household to choose the level of its health care consumption, m_t, only those families with employed workers are entitled to the special tax subsidy, through their employment relationships, as is captured by the m_t^b component of $\bar{w}_t$ specified in (4). To make this latter point transparent, we recognize that the pre-tax unit labor cost to a firm, u_t, as the sum of a taxable wage and the compensation in the form of a non-taxable medical benefit, is given by

$$u_t = \frac{w_t}{1 - \tau_n} + m_t^b, \tag{6}$$

where τ_n is the labor income tax rate. We can then rewrite the post-tax unit labor compensation to a worker as the sum of total compensation taxed at a uniform rate and a rebate for the amount of compensation in the form of medical benefits,

$$\bar{w}_t = (1 - \tau_n)u_t + \tau_n m_t^b. \tag{7}$$

Using this expression, we can rewrite the household's budget constraint at date t as,

$$c_t + \left[m_t - \left(\tau_n m_t^b\right) n_t\right] + k_{t+1} = \left[(1 - \tau_n)u_t\right] n_t + (1 + \bar{r}_t)k_t + g_t. \tag{8}$$

As is clear from the second term in (8), only the employed families in the household (a fraction n_t) receive the tax rebate on medical benefits ($\tau_n m_t^b$) specified by the last term in (7). The special tax treatment gives rise to a subsidy on consumption of the medical commodity to the extent there is an employment relationship to back it up (and the benefits do not extend to outside of the family). It is in this sense that the tax shelter bundles the incentives that the workers have to seek or maintain employment with their families' needs for health insurance or care. This bundling holds the key to the paper's central mechanism for understanding the joint behaviors of unemployment rate and medical expenditure to aggregate consumption ratio in the current US economy and in our counterfactual analysis.

We shall keep our baseline model as simple as possible in order to focus on this central mechanism, and to isolate its role from other potential accounts for the current US system. As is typically assumed, there is a large number of perfectly competitive firms, which rent capital and hire labor from the households to produce output. The representative firm has access to a production function, which generates $F(K_t, N_t; z_t)$ units of output from K_t units of capital and N_t units of labor inputs, under the level of technology z_t. The production function is of constant returns to scale with respect to the capital and labor inputs, and is strictly increasing, strictly quasi-concave, and twice continuously differentiable in both of these two variables. The firm's profit in period t is

$$F(K_t, N_t; z_t) - (r_t + \delta)K_t - u_t N_t, \tag{9}$$

where r_t is the pre-tax capital rental rate net of the capital depreciation rate δ, given by

$$r_t = \frac{\bar{r}_t}{1 - \tau_k}, \tag{10}$$

where τ_k is the capital income tax rate.

One simplification of our model has to do with the question of how hours worked and compensation for labor services, as well as its taxable and non-taxable components, should be determined, upon a successful search and matching. Instead of imposing an ad hoc, perhaps also necessarily complex, multi-dimensional bargaining procedure, we deviate from much of the recent labor-market search-matching literature to adopt a more classical approach, along the line of Lucas and Prescott [24]. It is assumed that a matched worker supplies one unit of his time endowment as labor input inelastically, that he gets paid a competitive wage, in the sense that the pre-tax unit labor compensation is determined by the marginal product of labor, and that he also gets to determine the compensation structure that maximizes his household's expected lifetime utility. This feature of the model is consistent with the above specification of the search-matching technology under which the matching or separation probability is determined exclusively by the effort that a worker expends to search for a job, or to keep a job, without any explicit role by a firm posting a vacancy or engaging in the search activity at the same time. Since the model leaves no room for the firm to seek any surplus, it pays for both labor and capital inputs the competitive market values of their marginal products.[11] As such, since it has no bearing on profits, the firm only cares about the total value of compensation to labor, and does not care about the composition of the compensation into the wage and medical services component, as long as they add up to the same total value. This permits the quantity of medical services to be chosen optimally by the household.

Another simplification of our model, as already alluded to, and as also in contrast to much of the recent search-matching literature, is the absence of any externalities in the search-matching technology in the model. That is, the likelihood of an unemployed family obtaining a job, or of an employed family losing a job, is unrelated to the aggregate quantity

[11] Such a classical approach is standard in the joint-research literature that is used to avoid dealing with multi-dimensional bargaining, dating back at least to Burdett and Mortensen [6], and applied more recently by Mankart and Oikonomou [25], and Guler, Guvenen, and Violante [17]. An alternative interpretation of this structure would be that of the worker searching for the location where the employers or firms are producing. When the worker finds this location, the firms behave competitively because the gains from bargaining are quickly bid away so that the worker is just able to obtain a wage that is the marginal product of labor. The worker can keep receiving this wage until he loses his job, and he must then search again.

of employed or unemployed families in the economy.

The model also abstracts from unemployment insurance, and other government programs, which may create impediments to individuals obtaining and maintaining employment. In our benchmark model, it is assumed that the government rebates the labor and capital income tax revenues to the households in the form of a non-distortional, lump-sum transfer,

$$g_t = \tau_n \frac{w_t}{1-\tau_n} N_t + \tau_k r_t K_t. \tag{11}$$

The main focus here will be on how the distinctive tax treatment of employer-provided health benefits affects the incentives that workers have to obtain or maintain employment, and to consume medical commodities. For this purpose, the model also abstracts from transitions into and out of the labor force.[12]

While the model described above has the maximum degree of simplicity, it exhibits all the features necessary to addressing the topic at hand. The endogenous health accumulation and labor-market search-matching features of our model enable the model to jointly account for US long term unemployment rate and medical expenditure to aggregate consumption ratio. These features of the model are critical for evaluating how the various tax or spending policies, as they pertain to the treatment of the medical commodity, would influence the unemployment rate and duration, and, ultimately, the welfare of individuals. Our view is that it is important to understand the effects that the current tax policy for medical care and various contemplated reforms can have on employment incentives and the transition probabilities into and out of unemployment, and that our model presented above provides an arguably simplest possible general equilibrium framework for conducting these thought experiments.

4 Equilibrium

In this section we provide a general characterization of the model's equilibrium conditions. Letting γ denote the fraction of the medical good that a working family chooses to consume that can be qualified as tax-exempt benefits (i.e., $m_t^b = \gamma m_t$), we can rewrite the household's

[12] Although the results to be presented below do not rely on any of these additional features, it is not difficult to imagine how some of these features might be incorporated into the model, and would in turn strengthen the results of this paper.

budget constraint in period t as the following,

$$c_t + (1 - \gamma\tau_n n_t)m_t + (k_{t+1} - k_t) = (1 - \tau_n)u_t n_t + \bar{r}_t k_t + g_t. \tag{12}$$

The right side of this equation is the sum of total labor compensation taxed at a uniform rate, the post-tax return to capital net of depreciation, and any transfer from the government, while the left side is the sum of consumption of the non-medical good, consumption of the medical commodity, net of any tax rebate that accompanies it through an employment relationship, and net investment in physical capital.

At each date t, a household chooses $c_t > 0$, $m_t \in (0, u_t/\gamma]$, $a_{1t} \geq 0$, $a_{2t} \geq 0$, $k_{t+1} \geq 0$, and $n_{t+1} \geq 0$ to maximize the expected utility subject to the laws of motion for employment and health, as well as the budget constraint, taking as given the initial conditions k_0, h_{-1},and n_0, unit labor compensation, capital rental rates, and labor and capital tax rates.

The Euler equation associated with optimal intertemporal allocation of consumption of the non-medical commodity, through optimal accumulation in physical capital, gives rise to the following familiar condition,

$$U_c(t) = \beta \mathrm{E_t}\left[U_c(t+1)(1 + \bar{r}_{t+1})\right]. \tag{13}$$

The left side of this equation is the cost of giving up one unit of consumption, measured in terms of (marginal) utility, where the right side is the present value of expected future benefit from investing the foregone consumption good in physical capital.

The Euler equation associated with optimal health accumulation gives rise to the following condition,

$$U_c(t)(1 - \gamma\tau_n n_t) = U_h(t) + \beta(1 - \rho)\mathrm{E_t}\left[U_c(t+1)(1 - \gamma\tau_n n_{t+1})\right]. \tag{14}$$

This in effect is the condition for optimal intratemporal allocation of consumption of the medical commodity and of the non-medical commodity, which equates the marginal utility of consuming another unit of the medical good, with that of consuming an equal value of the non-medical good. To see this, the left side of this equation is the cost of consuming another unit of the medical good, measured in terms of the foregone (marginal) utility from consuming an equal value of the non-medical good. "Equal value"means that this cost has to

be adjusted for the fact that the medical commodity is purchased with pre-tax compensation, to the extent that there is an employment relationship to support it. The right side of this equation is the benefit from consuming another unit of the medical commodity. The benefit includes better health (h_t) at the present date, and at future dates as well, with a decay factor of $(1-\rho)$. The benefit, measured in terms of present and expected future (marginal) utilities, generalizes Grossman's notion of consumption motive for health care, and relates it to the household's incentives in the labor market through the special feature of the tax code.

The Euler equation associated with optimal intratemporal allocation of effort levels in the labor market by employed and unemployed workers is given by

$$\frac{V_{a_1}(t)}{\theta_1'(a_{1t})n_t} = \frac{V_{a_2}(t)}{\theta_2'(a_{2t})(1-n_t)}. \tag{15}$$

This condition equates the marginal dis-utility from having unemployed workers search more intensively for jobs, with the marginal dis-utility of having employed workers exert more effort to retain their jobs, adjusted for the marginal effects of these effects on the transition probabilities of the workers into and out of employment and unemployment.

Finally, the intertemporal Euler equation for optimal employment and unemployment is given by

$$\frac{-V_{a_2}(t)}{\theta_2'(a_{2t})(1-n_t)} = \beta \mathrm{E_t}\left\{U_c(t+1)\bar{w}_{t+1} + V_n(t+1) + [\theta_1(a_{1,t+1}) - \theta_2(a_{2,t+1})]\left[\frac{-V_{a_1}(t+1)}{\theta_1'(a_{1,t+1})n_{t+1}}\right]\right\}. \tag{16}$$

The left side of this equation is the cost of having unemployed workers exert more effort to search for a job, measured in terms of (marginal) dis-utility, taking into account how the extra effort increases the marginal transition probability of the currently unemployed workers into employment in the next period. The right side of this equation summarizes the present value of expected future benefits from the extra current effort. The first term shows the benefit from having higher employment next date (i.e. higher n_{t+1}) in terms of more produced output for consumption. The second term shows a net effect on marginal utility during the next period due to the tension that there will be fewer unemployed workers exerting effort to obtain a job, but more employed workers exerting effort to retain their jobs. The last term shows how the increased employment next period may increase employment in the subsequent period – note that the first component of the last term is $\partial n_{t+2} \backslash \partial n_{t+1}$ – taking into account the fact that

effort must be exerted in order for the employed workers to retain their jobs (as captured by the second component of the last term).

At each date t, the representative firm chooses K_t and N_t to maximize its current-period profit, taking r_t and u_t (as well as its composition) as given. The optimization conditions for profit maximization take the following familiar forms,

$$r_t = F_K(K_t, N_t; z_t) - \delta, \quad u_t = F_N(K_t, N_t; z_t). \tag{17}$$

The household and government budget constraints together give rise to the following resource constraint,

$$C_t + M_t + K_{t+1} - (1-\delta)K_t = F(K_t, N_t; z_t). \tag{18}$$

Finally, we note that, in equilibrium, it holds that $c_t = C_t$, $m_t = M_t$, $k_t = K_t$, and $n_t = N_t$. Equations (13)-(18), together with the laws of motion for employment and the health stock, characterize an equilibrium.

5 Accounting for the Current US System

In this section, we show that the model developed above can be made consistent with many of the salient features of the current US economic system. In particular, we show that it can provide a joint account for US long term unemployment rate and medical expenditure to aggregate consumption ratio.

To illustrate this point, we follow Yogo [41] to parameterize the period utility $U(c_t, h_t)$ as follows,

$$U(c_t, h_t) = \frac{\eta}{\eta - 1} \log \left[(1-\phi) c_t^{\frac{\eta-1}{\eta}} + \phi h_t^{\frac{\eta-1}{\eta}} \right], \tag{19}$$

where the parameter $\phi \in (0,1)$ determines the importance of health stock relative to consumption of the non-medical commodity in the households' preferences, and the parameter $\eta > 0$ measures the elasticity of substitution between the health status and the non-medical consumption good. We parameterize the production function $F(K_t, N_t; z_t)$ into the standard Cobb-Douglas form,

$$F(K_t, N_t; z_t) = z_t K_t^{\alpha} N_t^{1-\alpha}, \tag{20}$$

where $\alpha \in (0,1)$ determines the share of the cost of capital in the value-added productive inputs in the long-run stationary equilibrium.

For the purpose of this section, however, we do not need to specify any specific functional form for either the period dis-utility function, $V(a_{1t}, a_{2t}; n_t)$, or the transition probability functions, $\theta_i(a_{it})$, for $i = 1, 2$.

To proceed, we need to choose the benchmark values of the model's parameters. We set the share of payment to capital in the value-added productive factors, α, to 0.4, the subjective annual discount factor, β, to 0.9702, and the annual physical capital depreciation rate, δ, to 0.076. These are standard values used in the literature (e.g., Chen, Imrohoroglu, and Imrohoroglu).

We set $\gamma = 1$ in our baseline economy, in light of the observation that employment-based medical benefits are tax exempt in the postwar US system. The recent estimates point to an average annual depreciation rate of health stock of about 4 percent for the US working-age population (e.g., Fonseca, Michaud, Galama, and Kapteyn [13]; Scholz and Seshadri [38]; Zhao [42]), so we set $\rho = 0.04$, to be consistent with these studies. We set the parameter governing the relative importance of health in preferences $\phi = 0.3$, as common in the literature (e.g., Halliday, He, and Zhang [20]; Yogo [41]). In terms of selecting a value for ϕ, some recent studies adopt the standard Cobb-Douglas specification implying a unitary elasticity of substitution between health and non-medical good consumption (e.g., Fonseca *et al.* [13]; Jung and Tran [21]), whereby some other studies use a value much lower than unit (e.g., Halliday *et al.* [20]; Scholz and Seshadri [38]). Here, we set $\eta = 0.7$, to be consistent with the recent estimate by Yogo [41] in a macroeconomic context.[13]

Following McGratten and Prescott [26], we set the capital income tax rate $\tau_k = 0.35$. Computing the tax rate on labor income is slightly more complicated. Again, it is important to focus on the fact that the typical decision-maker in our model is a worker, or a potential

[13] This value for η seems quite reasonable from a macroeconomic perspective. If η were to be close to zero, this would imply that a change in the relative price of the two consumption goods would not change the relative makeup of the consumption bundle, which is inconsistent with the observation that all other countries seem to consume fewer medical goods and services relative to total consumption, compared to people in the US. On the other hand, if η were to be too large, then a small variation in the relative price would generate implausibly large shifts in the consumption bundle, which also seems to be inconsistent with casual observation. Therefore, it would seem that a reasonable number for this elasticity should be less than one, but not close to zero.

worker, and so we need to look at the tax rates faced by such people. In the US, almost all of the income tax is paid by individuals in the 28 percent federal bracket or higher.[14] State income tax rates vary from zero, to 11 percent. The payroll tax on earnings is 12.4 percent, and currently applies to the first $106,800 of labor income. Most states have consumption taxes of various commodities, which also raise the effective tax rate on labor.[15] It would seem that a conservative estimate of the appropriate labor income tax rate would be 35 percent. However, if one adds a 28 percent federal rate, to a modest state tax rate of 5 percent, a 12.4 percent payroll tax, and a 2.9 percent Medicare tax (with no income cap), one arrives at a 48.3 percent rate - ignoring the consumption tax.[16] Nevertheless, we choose a conservative benchmark value here by setting $\tau_n = 0.35$. Our results are robust to alternative variables of the model's parameters within their empirically plausible ranges. One parameter value that matters for the results quantitatively is the labor income tax rate. We choose a conservative value above, but at the same time acknowledge that this choice of labor income tax rate might well be an underestimate of the historical average in the data, and that the welfare effects of various counterfactual policy experiments to be conducted below can be more pronounced for higher yet still empirically reasonable values of the labor income tax rate.

We can now proceed to compute the steady-state equilibrium for our benchmark economy. We compute the steady state by setting the technology level (z) to its unconditional mean of 1 and shutting off the time dimension. In what follows, we use a variable with an asterisk to denote its steady-state value. We begin by calculating the steady-state unemployment rate. Using the steady-state version of (3), we obtain,

$$N^* = \frac{\theta_2(a_2^*)}{\theta_2(a_2^*) + 1 - \theta_1(a_1^*)}. \tag{21}$$

[14] See page 28 in McGratten and Prescott [26].

[15] According to McGratten and Prescott [26], the average consumption tax rate is 8.6 percent. Of course, this should be added on to the labor tax rate, since it is well known that a consumption tax has the same impact as a labor tax. Purchases of medical commodities are still subject to a sales or consumption tax, and so adding in this tax would not further distort the margin between medical goods and non-medical goods. However, the addition of this tax will certainly reduce the incentive to seeking employment, and will make the effect of our policy experiments to be conducted below more pronounced.

[16] Boskin [5] suggests that the marginal tax rate on labor income is already at 44.1 percent, even though he also ignores the tax on consumption goods.

It should be noted that the steady-state transition probabilities from unemployment into employment, and from employment into unemployment, are, $\pi^*_{ue} = \theta_2(a^*_2)$, and, $\pi^*_{eu} = 1-\theta_1(a^*_1)$, respectively. Empirical studies on gross worker flows in the postwar US economy conducted by Abowd and Zellner [1], Blanchard and Diamond [4], Clark [8], Hall [18], [19], Mortensen [28], and Shimer [39], among others, suggest the average rates of transition from employment to unemployment between 2.6 and 4.52 percent (this does not count transitions from employment to nonparticipation, or to a new job), and from unemployment to employment between 49.1 and 83.4 percent. Matching up π^*_{eu} and π^*_{ue} with the midpoints of these two ranges of estimates, 0.0356 and 0.6625, respectively, and using (21), we can compute the steady-state employment as, $N^* = 0.949$, which implies a steady-state unemployment rate of 5.1 percent, matching well the average unemployment rate in the postwar US economy.

We can next use the steady-state version of (14) to derive,

$$\frac{M^*}{C^*} = \rho \left\{ \frac{\phi}{(1-\phi)[1-\beta(1-\rho)](1-\gamma\tau_n N^*)} \right\}^{\eta}, \tag{22}$$

which is then equal to 0.1913, under the parameter configuration and solution for employment above, giving rise to a ratio of medical expenditure to total private consumption of 16.06 percent, matching well the figure in the current US system.

Combining the steady-state versions of (10), (13), and the first relation in (17), we obtain,

$$\frac{K^*}{N^*} = \left(\frac{1-\beta}{\alpha\beta} \frac{1}{1-\tau_k} + \frac{\delta}{\alpha} \right)^{\frac{1}{\alpha-1}}, \tag{23}$$

which, under the parameter configuration, is equal to 7.1137. This together with the production function imply a steady-state annual capital-output ratio of 3.2453, which is consistent with the US data.

We can then substitute the results derived from (21), (22), and (23) into (18) to obtain the steady-state level of medical and non-medical consumption, $M^* = 0.2517$, and $C^* = 1.3155$, respectively. The levels of output and capital, as well as the other endogenous variables, can be easily derived using the above results and the steady-state versions of the rest of the equilibrium conditions.

6 Remaining Parameters

The technology and preferences are constructed and parameterized so as to mimic many of the characteristics of the US economy. We have shown that the steady state of the model is consistent with some of the key features of the US labor market and medical expenditure data. This is done without any specification for how effort affects dis-utility and transition probabilities.

To permit the analysis of how the economy will react to various policy changes, we need to parameterize both the dis-utility function, $V(a_{1t}, a_{2t}; n_t)$, and the transition probability functions, $\theta_i(a_{it})$, for $i = 1, 2$. We postulate the following forms,

$$V(a_{1t}, a_{2t}; n_t) = -n_t a_{1t}^2 - (1 - n_t) a_{2t}^2, \tag{24}$$

for the dis-utility function, and

$$\theta_i(a_{it}) = 1 - e^{-\theta_i a_{it}}, \quad \theta_i > 0, \quad i = 1, 2, \tag{25}$$

for the transition probability functions. It should be worth noting that, this functional form of dis-utility from effort and the form of the two transition probabilities as functions of effort (and employment status) are similar to those specified in Wang and Williamson [40]. They clearly satisfy the general properties specified in Section 3 above. It is here also worth mentioning that, the optimal effort level may differ for an employed worker than for an unemployed worker if, with the same effort level, the probability for the former to retain employment differs from the probability for the latter to obtain employment, that is, if the two parameters governing the transition probabilities across different employment statuses, θ_1 and θ_2, differ from each other.

We shall let the data tell whether such difference exits. To this end, we substitute the results obtained in Section 5 above into the steady-state versions of (15) and (16) to get,

$$\theta_1 = \sqrt{\frac{\frac{\log(\pi^*_{eu})}{\pi^*_{eu}}\left[\pi^*_{eu}\log(\pi^*_{eu}) - (1-\pi^*_{ue})\log(1-\pi^*_{ue}) + 2(1-\pi^*_{eu}-\pi^*_{ue}) - \frac{2}{\beta}\right]}{\left\{\left[(1-\phi)(C^*)^{\frac{\eta-1}{\eta}} + \phi(\frac{M^*}{\rho})^{\frac{\eta-1}{\eta}}\right]^{-1}(1-\phi)(C^*)^{-\frac{1}{\eta}}\right\}\left[(1-\tau_n)(1-\alpha)\left(\frac{K^*}{N^*}\right)^{\alpha} + \gamma\tau_n M^*\right]}},$$

$$\theta_2 = \theta_1\sqrt{\frac{\pi^*_{eu}}{\log(\pi^*_{eu})}\frac{\log(1-\pi^*_{ue})}{1-\pi^*_{ue}}},$$

which are then equal to 13.9 and 2.6, respectively. This means that, for a given effort level, the probability for an employed worker to retain employment is higher than the probability for an unemployed worker to obtain employment. It is in this sense that effort exerted by an employed worker is more effective than effort exerted by an unemployed worker in securing employment.

At this point the parameters of the benchmark model have all been specified. In the subsequent sections of the paper we use the model to conduct a series of counterfactual policy experiments.

7 Partial Reform

We can now proceed to our counterfactual analysis to be organized around the following question: Is the current US practice of tax-supported medical benefits through employment relationships a sensible policy alternative to some easily contemplated alternative policies? To help answer this question, we first compute the steady-state equilibrium for an alternative economy that is identical to the benchmark economy in all aspects, except that there were no tax deductibility for employment-based medical services (i.e., $\gamma = 0$). The results from this counterfactual experiment are reported in the second column of Table 3.

The partial reform of simply eliminating the employment-based, tax-deductible medical benefits lowers the effort by employed workers to retain employment and by unemployed workers to obtain employment. As a consequence, the rate of transition from employment to unemployment would be higher, and that from unemployment to employment would be lower, than in the benchmark economy (0.0394 versus 0.0356, and 0.6424 versus 0.6625, respectively). Hence, employment would be lower, giving rise to a higher unemployment rate of 5.8 percent, compared to the 5.1 percent unemployment rate in the benchmark economy with tax-supported medical commodities provided through employers. In terms of the effects on unemployment and employment durations, this partial reform would increase the average span of unemployment by 2.5 weeks and decrease the average span of employment by 2.7 years. The level of physical capital would be lower as well. With lower levels of labor and capital inputs, output would decline, by 0.71 percent from the level in the benchmark economy. Eliminating the employment-based tax shelter on medical care would also raise the

price of medical goods relative to that of non-medical goods. As a result, consumption of medical goods would fall and that of non-medical goods would rise relative to each other, and the fraction of medical expenditure in total consumption would decline, from 16.06 percent in the benchmark economy, to 12.6 percent in the post-reform economy.

As was discussed in much detail in Sections 1 and 2, it is well-known that durations of unemployment are considerably longer, and rates of unemployment are considerably higher, in most European countries than in the US. It has also been well documented that the fraction of health care expenditure in total consumption is considerably lower in other countries than in the US. The analysis conducted here shows that one possible explanation for these differences might be the different mechanisms in these countries that are used for the provision of medical care or insurance. This simple reform does not account for all the differences in unemployment, and medical expenditures as a fraction of consumption, between the US and other industrialized countries. The current tax treatment is merely one of many factors that could contribute to the relatively low rate of unemployment or high ratio of medical to total consumption in the US, and in no means we are suggesting that this feature alone could account for all the differences between the US and other countries.

It is of critical importance to note that, in the model, removing the employment-based medical tax shelter brings with it a welfare *loss* rather than *gain*.[17] In the spirit of Lucas [23], we use a compensation-consumption-equivalence (CCE) measure to help quantify this welfare cost. More specifically, we measure the welfare cost (benefit) by the fraction that the benchmark non-medical consumption would have to be decreased (increased), in order to lower (raise) the benchmark level of utility down (up) to the new "post-reform" level, so as to make households indifferent between living in the benchmark economy, and living in the post-reform economy. We find that simply eliminating the medical tax shelter, while maintaining all of the other institutional features and government policies, would *lower* the CCE measure of welfare by 1.98 percent. In other words, households would be willing to give up 1.98 percent of the benchmark consumption in exchange for the medical tax shelter to stay.

[17] Obviously this is *not* to suggest that it is *optimal* to give a tax subsidy to the purchase of medical services. Clearly, the best policy is to reduce taxes to as low as possible, which is the policy that is to be studied below.

As was discussed in the introduction of this paper, the conventional wisdom seems to be that the unique tax feature of the US, which gives rise to apparently high level of spending on medical services, must be inferior to most policy alternatives. This result from our model should give pause to these critics of the current US system.

These results, although perhaps surprising, make intuitive sense. Eliminating the employment-based tax shelter on medical commodities reduces the incentives that individuals have in exerting effort to secure employment. Both the effort by unemployed workers to obtain employment, and that by employed workers to maintain employment, are lower. Thus, the transition rate from unemployment to employment is lower, and that from employment to unemployment is higher, resulting in a higher rate and longer duration of unemployment, and a lower rate and shorter duration of employment. Both the levels of physical capital and output are lower, and so is the level of total income. Although the partial reform reduces the distortion in the goods market, leading to a more efficient substitution between the two types of commodities, it magnifies the distortion in the labor market due to the presence of the labor income tax, which discourages individuals from exerting effort to secure and hold jobs, and the distortion in the capital market emerging from the general equilibrium connection between labor and capital, and magnified by the presence of the capital income tax. These labor and capital market distortions are of the first-order significance. Even after taking into account the reduced dis-utility due to the lowered effort, the effects from the lost output and income, due to the depressed labor and capital market activities from the partial reform, more than offset the efficiency gain from the improved substitution in the goods market. Hence, without removing these larger distortions in the factor markets in the first place, simply eliminating a counteracting factor, here the tax shelter on medical insurance or care purchased through employers, moves the economy to an inferior equilibrium. The effect is a net welfare loss.

It is worth emphasizing that, with $\tau_n = 35\%$ as a benchmark choice, the above calculation might be understating the true welfare cost of this partial reform. As mentioned before, the baseline calibration of labor income tax rate of 0.35 might well be an underestimate of the historical average of labor income tax rates in the data. In a number of additional counterfactual experiments under slightly higher, yet still empirically plausible, labor income

tax rates, we find that the effects of the partial reform are much more pronounced, and the resultant welfare costs are much greater. For example, if the benchmark model has a labor tax rate of 45%, then the reform of eliminating the medical tax shelter raises unemployment from 5.1% to 6.2%, with a resulting welfare cost of 2.38%. This should not be surprising. To the extent that a labor tax creates a first-order distortion in the labor market that discourages individuals from exerting effort to secure and hold jobs, the employment-based medical tax shelter, being itself a distortion in the goods markets, partially corrects or offsets this labor market distortion. Thus, simply eliminating the medical tax shelter, without fixing the first-order distortion in the first place, would lead to lower effort, higher unemployment rate, and lower output and welfare. The higher the labor income tax rate is initially, the greater would be the loss from such partial reform of simply removing the tax shelter for employer-provided medical care.

For comparison, we also compute the steady-state equilibrium under laissez faire by setting $\tau_n = \tau_k = 0$, which effectively eliminates the government. While this is a far-fetched experiment to conduct, it can serve as a useful point of comparison to help us get an idea on how these previous two economies compare with the true optimum, which has no government intervention at all. The results are reported in the third column of Table 3.

This drastic reform would remove all distortions, and thus would encourage individuals to exert effort in securing employment and to accumulate capital. In consequence, the rate of transition from employment to unemployment would be lower, and that from unemployment to employment would be higher, than in the benchmark economy (0.0292 versus 0.0356, and 0.7085 versus 0.6625, respectively). Unemployment rate would decline, to 3.96 percent, from 5.10 percent in the benchmark economy. The level of physical capital would be higher and, with higher levels of labor and capital inputs, output would increase by 11.4 percent from the level in the benchmark economy. The non-medical commodity would become cheaper relative to the medical commodity and, as a result, the fraction of medical expenditure in total consumption would decline, from 16.06 percent in the benchmark economy, to 12.6 percent under laissez faire. Not surprisingly, with all distortions removed all at once, welfare must be higher. Indeed, we find that the CCE measure of welfare would increase by 4.4 percent, from the level in the benchmark economy.

8 Government Provision of Medical Services

We turn now to assess the welfare consequences of government provision of medical services. Within such a government regime, at each date t, a household chooses $c_t > 0$, $a_{1t} \geq 0$, $a_{2t} \geq 0$, $k_{t+1} \geq 0$, and $n_{t+1} \geq 0$, to maximize the expected utility, subject to the law of motion for employment, and a budget constraint,

$$c_t + k_{t+1} = \bar{w}_t n_t + (1 + \bar{r}_t)k_t + g_t,$$

taking as given the initial conditions k_0 and n_0, wage and capital rental rates, and the labor and capital income tax rates. An equilibrium is characterized by Equations (13), and (15)-(18), together with the laws of motion for employment and for the health stock, and a government budget constraint,

$$M_t + g_t = \tau_n u_t N_t + \tau_k r_t K_t. \tag{26}$$

In this instance, all individuals, regardless of their employment statuses, get the same medical commodity (M_t) provided by the government, and they only need to purchase the non-medical good, and make decisions concerning labor market effort and physical capital accumulation. However, it is then important that the government chooses a value for this medical expenditure, which is received by all individuals. Of course, either too high or too low a value of M_t would result in reduced welfare. Therefore, we will consider a range of values for M_t. This will have the added benefit of shedding some insight on the optimal value of M_t in this instance, which can then be compared with the value that results from the benchmark economy.

There is also the matter of how this extra government expenditure is financed. We will consider two options: one where existing government expenditures and transfers are slashed so that tax rates can be maintained at their benchmark levels, and a second option where the tax rate on labor is increased to finance the previous level of government spending plus the new medical spending.

8.1 Holding Tax Rates Unchanged

We consider first the case in which the new government-run medical program is financed by cutting the existing government spending (g_t). It would seem unrealistic to contemplate

that the government is going to starve all of its many current programs in order to finance a new government-run medical program, but we can nevertheless study the effects of such a contemplated policy reform. Figure 6 plots the rate of unemployment, the compensation-consumption-equivalence measure of welfare loss relative to the level of welfare in the baseline economy, and the percentage cut in the existing government spending that would be required in order to finance the government medical program. The horizontal axis is the ratio of government spending on the medical commodity (M_t), relative to the level of medical expenditure in the benchmark economy. A value less (more) than one means spending less (more) on the medical good in this regime than in the benchmark economy. This figure covers a range of different levels of government medical program, from $\pm 25\%$ of the level of medical spending in the baseline economy.

As is apparent from the upper panel of the figure, all of the levels of M_t under consideration would result in higher rates of unemployment than in the baseline economy. The unemployment rate is 5.1% in the baseline economy, while this panel shows it ranging from 5.21% to 5.81% under the government regime with different levels of public medical services. Even when the level of government medical spending is maintained at the level of medical expenditure in the baseline economy, unemployment rate would still rise to 5.5%.

The lower panel of the figure shows that the required reduction in the existing government spending increases monotonically with the level of government-run medical program. As can be seen from this panel, the cut would increase from 24% to 50%, as the level of government medical spending rises from 25% below to 25% above the level of medical spending in the baseline economy. Such a spending reduction is certainly a non-trivial amount.

The middle panel of the figure shows that this government regime would always result in a reduction in welfare regardless of the level of public medical services provided. Loss in welfare would be 0.21% from the level in the baseline economy, if the government medical program is run at a level comparable to that of medical spending in the baseline economy, but would be considerably greater if decreases or moderate to large increases in the level of government medical spending are contemplated.

It is also important to note the middle panel of Figure 6 also shows something else that is important. In this case if the government is providing medical care, then the optimal

amount of the medical commodity will be approximately *10% greater* than in the benchmark economy. This would certainly conflict with the belief that having the government provide medical care must necessitate a reduction in total spending.

8.2 Holding Existing Government Spending Unchanged

Next, we examine the case in which spending on the new government-run medical program is financed by raising the labor income tax rate, while other government spending is maintained at its level in the benchmark economy. Figure 7 plots the rate of unemployment, the compensation-consumption-equivalence measure of welfare loss relative to the level of welfare in the baseline economy, and the labor income tax rate that would be required in order to finance the government medical program. Again, the figure covers a range of different levels of government medical program, from $\pm 25\%$ of the level of medical spending in the baseline economy.

As the upper panel of the figure indicates, this government regime would result in a substantial increase in unemployment rate. In fact, the rate of unemployment would rise monotonically with the level of government medical program, from 6.54% up to 6.87%, as the level of government medical spending increases from 25% below to 25% above the level of medical spending in the baseline economy. To provide public medical services at a level comparable to that of medical spending in the benchmark economy, this government regime would have an unemployment rate of 6.66%, a substantial increase over the level of unemployment rate of 5.1% in the benchmark economy.

As the lower panel of the figure reveals, one of the reasons for such substantial increase in unemployment rate is that the labor income tax rate is raised to finance the government medical program. Again, as the level of government medical spending increases from 25% below to 25% above the level of medical spending in the baseline economy, the labor income tax rate must be raised precipitously, from 44.2% to up to 54.7%, creating a huge disincentive in the labor market. Similarly, to provide public medical services at a level comparable to that of medical spending in the benchmark economy would necessitate raising the labor income tax rate from 35% to 50%.

The middle panel of the figure shows that this government regime would result in a

substantial reduction in welfare for any level of public medical services provided. The loss in welfare would be 1.05% from the level in the baseline economy, if government medical program is run at a level comparable to that of medical spending in the baseline economy, but would be considerably greater if decreases or small to large increases in the level of government medical spending are contemplated. Again, as in the prior figure, in this example if the government is going to attempt to maximize welfare then it should provide an amount of the medical commodity that is *greater* than in the benchmark economy.

As is clear from the above analysis, this option of raising the labor income tax rate to finance government medical program would lead to much worse outcomes compared with the outcomes obtained from the first (though perhaps even less realistic) option through cutting the existing government spending, with much higher unemployment rate, and much lower output and welfare.[18]

9 Final Remarks

Empirical evidence suggests that the US has had for some time higher expenditure on medical care relative to other commodities and lower rate of unemployment, when compared with most European countries. We have shown in this paper that these two observations may be related to each other, and a key to understanding the relationship may have to do with a unique feature of the US tax system in which most working families obtain their health care tax free, through their employers. Whereas this special tax shelter may lead to an overconsumption of medical services relative to other goods, it may at the same time create an incentive that workers have to seek and maintain employment.

To this end, we have developed a general equilibrium model with endogenous health accumulation and labor market search to capture various salient features of the current US system, including the special tax structure. The model can jointly account for US long term unemployment rate and medical expenditure to aggregate consumption ratio. We have used the model to demonstrate that eliminating the preferential tax treatment of employment-based

[18] There is yet another finance option that could be contemplated. One could imagine the government providing the medical commodity to all households, and financing it by increasing the capital income tax rate. Since the capital tax results in rather high welfare costs, such a policy seems destined to result in a substantial reduction in output, and welfare. The results from this could be very harmful.

medical benefits, while maintaining all other institutional features and government policies, would lower medical expenditure to aggregate consumption ratio and raise unemployment rate.[19]

Importantly, we have shown that, quite contrary to the conventional wisdom, such a simple reform would result in a welfare *loss* rather than gain through the general equilibrium labor market effect, and that having the government raise taxes to finance the provision of medical care may lead to even worse outcomes.

A crucial point of our analysis is that, although it creates a distortion in the goods market, the preferential tax treatment of employment-based medical benefits partially corrects for several other existing distortions: these distortions in the labor market are created by the labor income tax, and a distortion in the capital market that is emerging from a general equilibrium connection between labor and capital and that is magnified by the capital income tax. These labor and capital market wedges can be large due to the general equilibrium factor interaction and the intertemporal linkage through endogenous investment and capital accumulation. Hence, without removing these large distortions in the first place, simply eliminating a counteracting factor, such as a tax shelter on medical insurance or care purchased through employers, may move the economy to an inferior equilibrium.[20]

[19] Although declining considerably, the post-reform ratio of medical expenditure to aggregate consumption would not go all the way down to a level typically observed in most European countries. In a similar vein, although increasing remarkably, the post-reform unemployment rate would not increase to a level typically observed in most European countries. These should not be surprising, given that our counterfactual analysis is abstracted from other cross-country technological and institutional differences than the preferential tax treatment of employer-provided medical benefits, such as differences in tax wedges or unemployment insurances, which may also play some important roles in shaping the cross-country differences in medical expenditure to aggregate consumption ratio or in unemployment rate.

[20] The welfare result that we have demonstrated in this paper may even be strengthened by recognizing that, in a more general context, there may be similar additional benefits to tying the provision of medical insurance or care to employment. The general point is that, to the extent that there exist impediments to individuals obtaining and maintaining employment, the fact that employers may offer relatively inexpensive medical insurance or care may be a sufficiently attractive reward to motivate the individuals to seek and retain employment. For example, one impediment or hindrance to having able-bodied individuals seeking employment might be unemployment insurance, or other relevant government programs. To the extent that these programs result in higher unemployment, it may be desirable to have another program, such as a tax

In light of the analysis that we have conducted in this paper, the current US system seems to fare better than the partial reform and the government regime. However, one should not take this as suggesting that the current US practice is the most desirable one. Clearly, it is not. The model implies that a laissez faire system in which there were no government intervention at all would be optimal. While this seems to be a far-fetched system to contemplate, perhaps some more systematic and more fundamental reforms than the ones considered in the counterfactual experiments in the current paper can lead to a system that is superior to the current one. These might include both government spending and tax cuts, in conjunction with eliminating the preferential tax treatment of employment-based medical benefits. Thus one can take the analysis of the current paper as issuing a word of caution that, before such a superior system can be identified and implemented, the current US practice may be a reasonably sensible policy alternative to various easily contemplated alternative policies.

References

[1] Abowd, John and Arnold Zellner, "Estimating gross labor-force flows," *Journal of Business and Economic Statistics* 3(3), (1985) pages 254–283.

[2] Andolfatto, David, "Business Cycles and Labor-Market Search," *American Economic Review*, 86(1), (March 1996), pages 112-132.

[3] Bassanini, Andrea, and Pascal Marianna, "Looking Inside the Perpetual-Motion Machine: Job and Worker Flows in OECD Countries," Discussion Paper No. 452, Institute for Study of Labor, Bonn (September, 2009).

[4] Blanchard, Olivier and Peter Diamond, "The Cyclical Behavior of the Gross Flows of U.S. workers," *Brookings Papers on Economic Activity,* 2, (1990), pages 85–143.

[5] Boskin, Michael J., "Get Ready for a 70% Marginal Tax Rate," *The Wall Street Journal*, (July 18, 2011).

[6] Burdett, Kenneth, and Dale T. Mortensen, "Labor Supply under Uncertainty," Discussion Paper No. 297, Northwestern University, Chicago (August 1977).

[7] Chen, Kaiji, Ayse Imrohoroglu, and Selahattin Imrohoroglu, "A Quantitative Assessment

incentive for medical insurance or care purchased through employers, to raise the incentive to individuals to seek employment.

of the Decline in the U.S. Current Account," *Journal of Monetary Economics*, 56(8), (2009), pages 1135-1147.

[8] Clark, Kim B., "Unemployment Insurance and Labor Market Transitions," In: Lawrence Summers (eds.), *Understanding Unemployment*, (1990) MIT Press (Cambridge, MA).

[9] Congressional Budget Office, "The Effects of Two Specified Policy Options to Health Care on the Federal Budget Deficit," *Letter to the Honorable Paul Ryan,* (2009), http://www.cbo.gov/ftpdocs/105xx/doc10563/09-21-RyanLtr.pdf.

[10] Employee Benefit Research Institute, "Sources of Health Insurance and Characteristics of the Uninsured," *Employee Benefit Research Institute: Washington DC,* (2000).

[11] Fang, Hanming, and Alessandro Gavazza, "Dynamic Inefficiencies in an Employment-Based Health-Insurance System: Theory and Evidence," Forthcoming in *American Economic Review*.

[12] Feldstein, Martin, and Bernard Friedman, "Tax Subsidies, The Rational Demand For Insurance and the Health Care Crisis," *Journal of Public Economics*, 7, (April, 1977), pages 155-178.

[13] Fonseca, Raquel, Pierre-Carl Michaud, Titus Galama, and Arie Kapteyn, "Retirement and the Demand for Health," Working Paper, RAND, Santa Monica, (November 2008).

[14] Gould, Elise, "The Chronic Problem of Declining Health Coverage: Employer-Provided Health Insurance Falls for a Third," Economic Policy Institute, (September, 2004).

[15] Grossman, Michael, "On the Concept of Health Capital and the Demand for Health," *Journal of Political Economy,* 80(2), (1972), pages 223-255.

[16] Gruber, Jonathan, and Brigitte C. Madrian, "Health Insurance, Labor Supply, and Job Mobility: A Critical Review of the Literature," *NBER Working Papers*, 8817, (2002).

[17] Guler, Bulent, Fatih Guvenen, and Giovanni L. Violante, "Joint-Search Theory: New Opportunities and New Frictions, " Working Paper, University of Minnesota, Minneapolis (March 2011).

[18] Hall, Robert E., "Employment Efficiency and Sticky Wages: Evidence From Flows in the Labor Market," *Review of Economics and Statistics,* 87(3), (2005a), pages 397–407.

[19] Hall, Robert E., "Job Loss, Job finding, and Unemployment in the U.S. Economy over the Past Fifty Years," *NBER Macroeconomics Annual,* 20, (2005b), pages 101–137.

[20] Halliday, Timothy J., Hui He, Hao Zhang, "Health Investment over the Life-Cycle," Working Paper, University of Hawaii, Manoa, (May 2011).

[21] Jung, Juergen, and Chung Tran, "Market Inefficiency, Insurance Mandate and Welfare: U.S. Health Care Reform 2010," Working Paper, Towson University, Towson, (January 2011).

[22] Layard, Richard, Stephen Nickell, and Richard Jackman, *Unemployment: Macroeconomic Performance and the Labour Market,* Oxford University Press, Oxford (1991).

[23] Lucas, Robert E. Jr., *Models of Business Cycles*. Oxford: Basil Blackwell, (1987).

[24] Lucas, Robert E. Jr, and Edward C. Prescott, "Equilibrium Search and Unemployment," *Journal of Economic Theory*, 7(2), (February, 1974), pages 188-209.

[25] Mankart, Jochen, and Rigas Oikonomou, "Household Search and the Aggregate Labor Market, " Job Market Paper, London School of Economics, London (January 2011).

[26] McGratten, Ellen R. and Edward C. Prescott, "Is the Stock Market Overvalued?" *Federal Reserve Bank of Minneapolis Quarterly Review*, (Fall, 2000), pages 20-40.

[27] Merz, Monika, "Search in the Labor Market and the Real Business Cycle," *Journal of Monetary Economics*, 36, (1995), pages 269-300.

[28] Mortensen, Dale T., "Search Equilibrium and Real Business Cycles," Northwestern University Working Paper, (1990).

[29] Ohanian, L., A. Raffo, and R. Rogerson, "Long-term Changes in Labor Supply and Taxes: Evidence from OECD Countries, 1956-2004," *Journal of Monetary Economics,* 55, (2008), pages 1353-1362.

[30] Olovsson, Conny, "Why Do Europeans Work So Little?" *International Economic Review,* 50(1), (2009), pages 39-61.

[31] Prescott, Edward C., "Prosperity and Depression," *American Economic Review*, (May 2002), pages 1-15.

[32] Prescott, Edward C., "Why Do Americans Work So Much More Than Europeans?" *Federal Reserve Band of Minneapolis Quarterly Review,* 28 (1), (2004), 2-13.

[33] Pries, Michael, and Richard Rogerson, "Hiring Policies, Labor Market Institutions, and Labor Market Flows," *Journal of Political Economy,* 113(4), (August, 2005), pages 811-839.

[34] Rogerson, Richard, "The Employment of Nations – A Primer," *Federal Reserve Bank of Cleveland Quarterly Review,* (2001).

[35] Rogerson, Richard, "Two Views on the Deterioration of European Labor Market Outcomes," *Journal of the European Economic Association*, Vol. 2, No. 2-3, (April/May 2004), pages 447-455.

[36] Rogerson, Richard, "Understanding Differences in Hours Worked," *Review of Economic Dynamics*, 9, (2006), pages 365-409.

[37] Rogerson, Richard, "Structural Transformation and the Deterioration of European Labor Market Outcomes," *Journal of Political Economy*, 116(2), (2008), pages 235-259.

[38] Scholz, John Karl, and Ananth Seshadri, "Health and Wealth in a Life-cycle Model," Working Paper 2010-224, University of Michigan, Ann Arbor (September 2010).

[39] Shimer, Robert, "Reassessing the Ins and Outs of Unemployment," NBER Working Papers 13421, (2007).

[40] Wang, Cheng, and Stephen Williamson, "Unemployment Insurance with Moral Hazard in a Dynamic Economy," *Carnegie-Rochester Conference Series on Public Policy,*44, (1996), pages 1-41.

[41] Yogo, Motohiro, "Portfolio Choice in Retirement: Health Risk and the Demand for Annuities, Housing, and Risky Assets," NBER Working Papers 15307, National Bureau of Economic Research, Inc., (September 2009).

[42] Zhao, Kai, "Social Security and the Rise in Health Spending: A Macroeconomic Analysis, " Working Paper, University of Western Ontario, (May 2010).

Table 1 [21]

	Unemployment Rate	Average Annual Hours Worked per Worker
Austria	4.3%	1650
Belgium	7.7	1565
Canada	6.9	1744
Czech Republic	7.2	2001
Denmark	4.5	1586
Finland	8.3	1725
France	8.7	1555
Germany	8.7	1443
Greece	8.0	1827
Hungary	6.6	2008
Italy	8.0	1827
Japan	4.6	1792
Korea	3.6	2421
Netherlands	3.4	1374
Norway	3.5	1421
Poland	15.7	1981
Portugal	6.4	1754
Slovak Republic	15.9	1759
Spain	10.2	1684
Sweden	6.0	1610
Switzerland	3.6	1654
UK	5.2	1683
US	5.1	1806

[21] Source: Organisation for Co-operation and Economic Develoment. Data are annual averages from 2000 until 2008.

Table 2

Baseline Parameters

Preferences:	$\beta = 0.9702$, $\phi = 0.3$, $\eta = 0.7$
Production technology:	$\alpha = 0.4$
Capital depreciation:	$\delta = 0.076$
Health depreciation:	$\rho = 0.04$
Search technology:	$\theta_1 = 13.9$, $\theta_2 = 2.6$
Government policy:	$\tau_n = 0.35$, $\tau_k = 0.35$, $\gamma = 1$

Table 3

Baseline Results and Counterfactual Experiments

	Baseline	Partial reform	Laissez faire
Variables:			
Transition rate (e → u)	0.0356	0.0394	0.0292
Transition rate (u → e)	0.6625	0.6424	0.7085
Unemployment rate	5.1%	5.8%	3.96%
Fraction of "m" in total consumption	16.06%	12.6%	12.6%
% change in output from benchmark	—	-0.71	11.4
% change in welfare relative to benchmark	—	-1.98	4.4

Figure 1

Medical Consumption as a Percentage of Total Private Consumption in the US

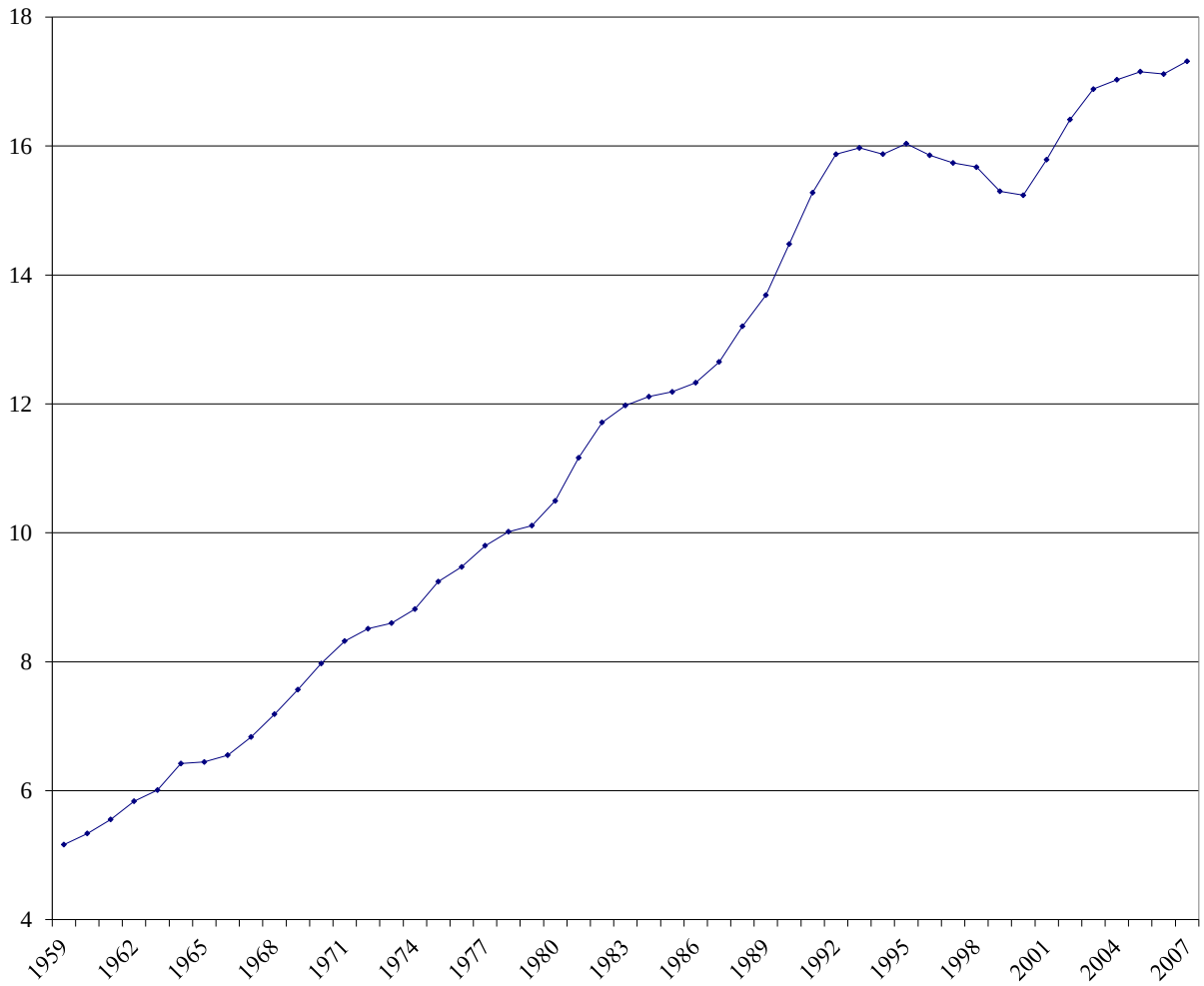


Figure 2

Growth Rates of Real Wages, and Health Benefits and Costs (%)

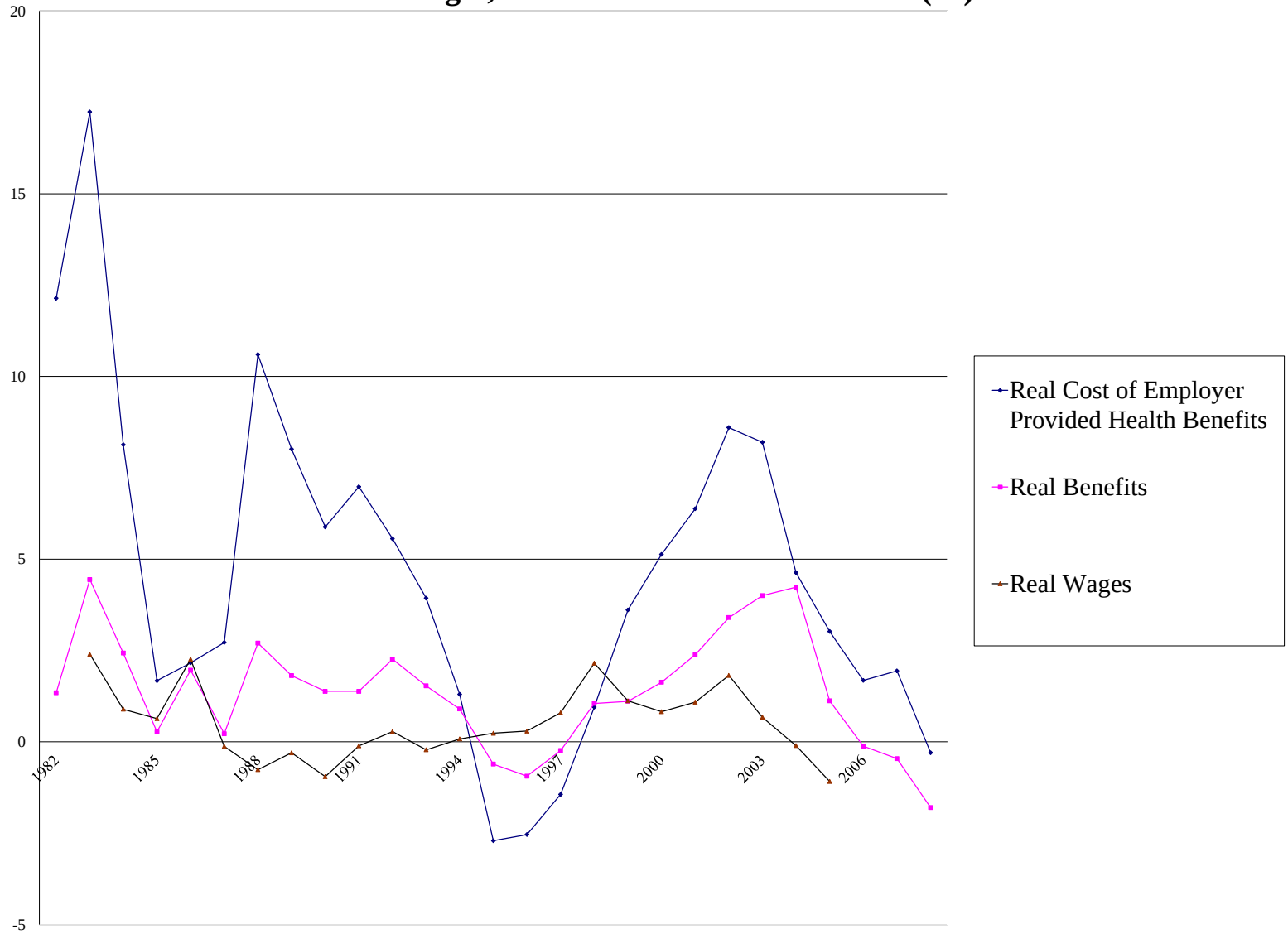


Figure 3
Total Health Care Expenditure as a Percentage of GDP

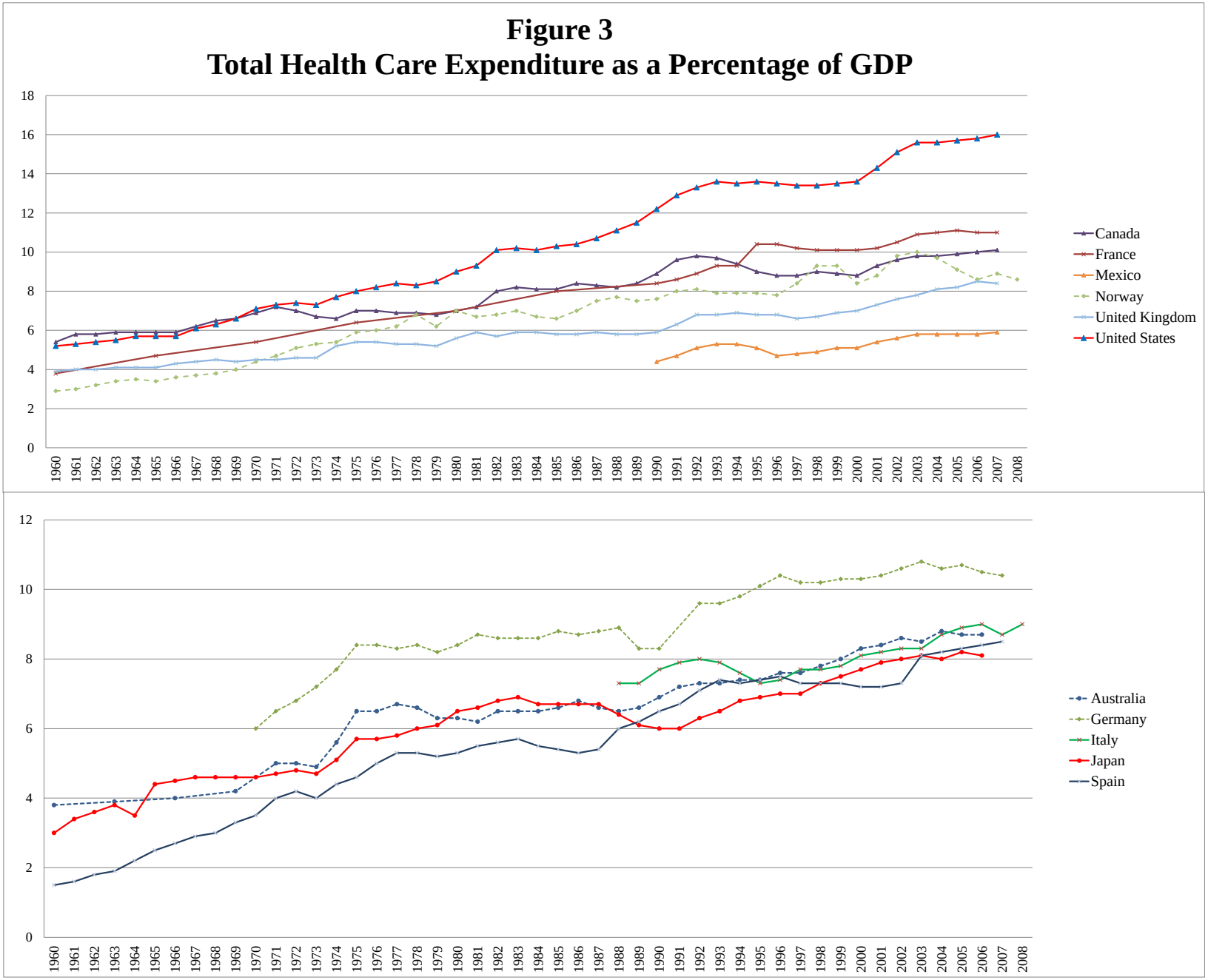
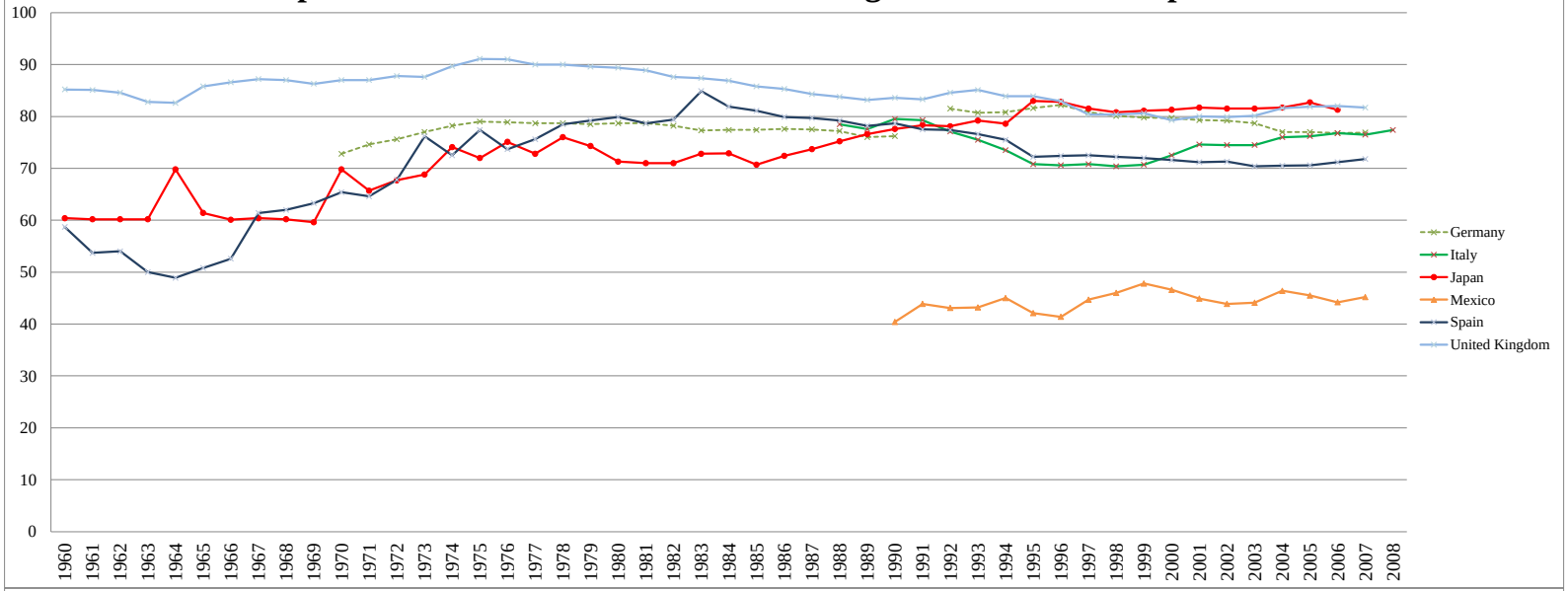


Figure 4
Public Expenditure on Health Care as a Percentage of Total Health Expenditure



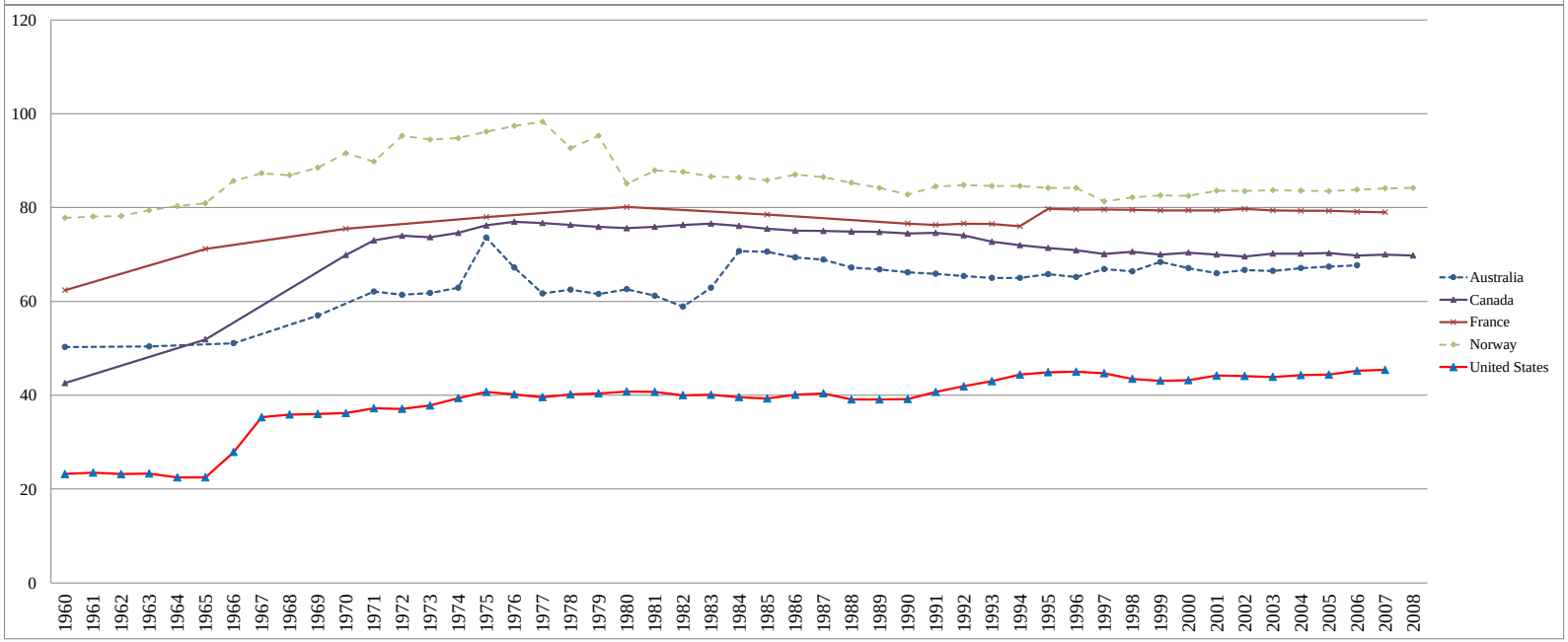
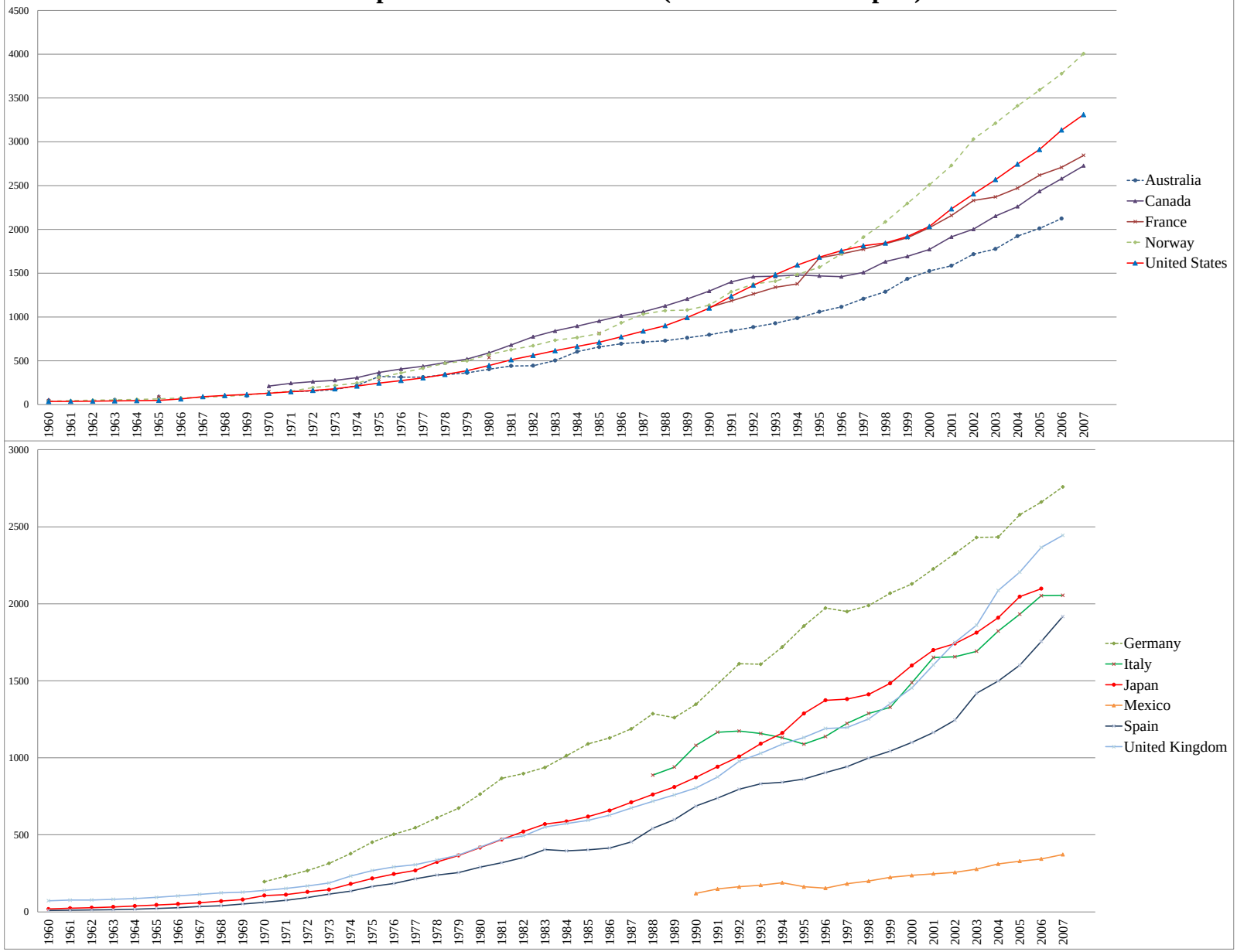


Figure 5
Public Expenditure on Health Care (US Dollars/Per Capita)



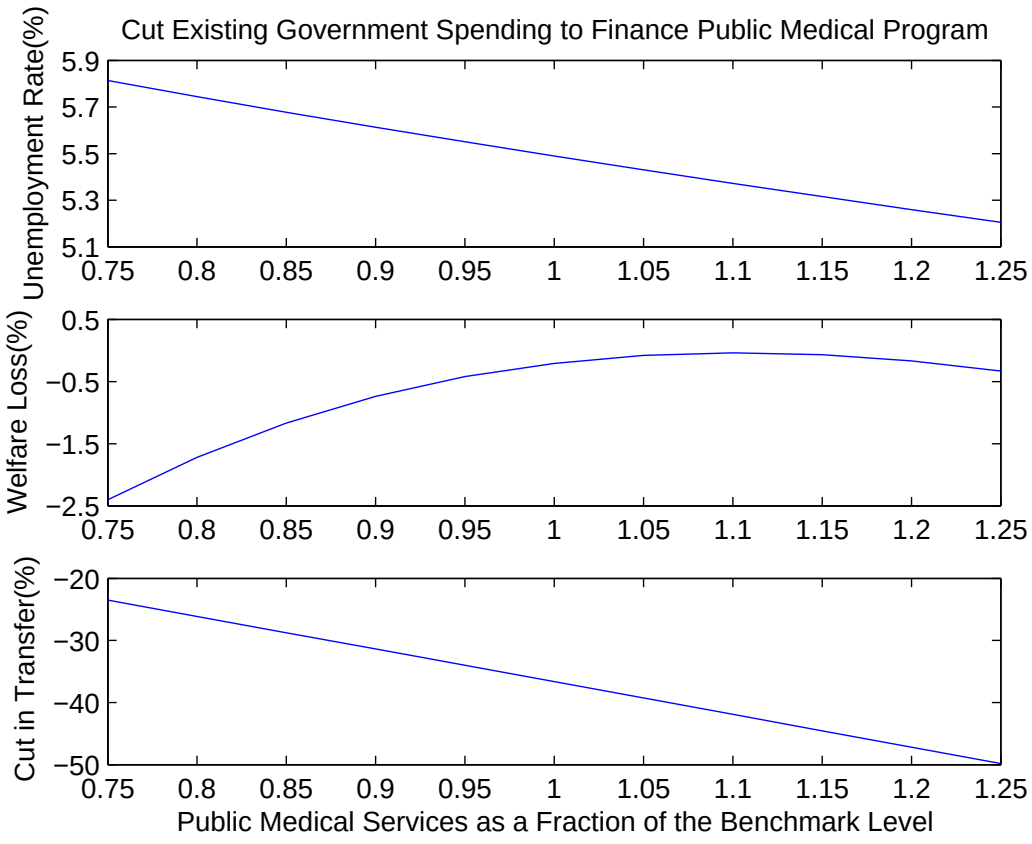


Figure 6. Unemployment rate (upper panel), welfare loss (middle panel), and required cut in existing government spending (lower panel) for financing various levels of government medical program

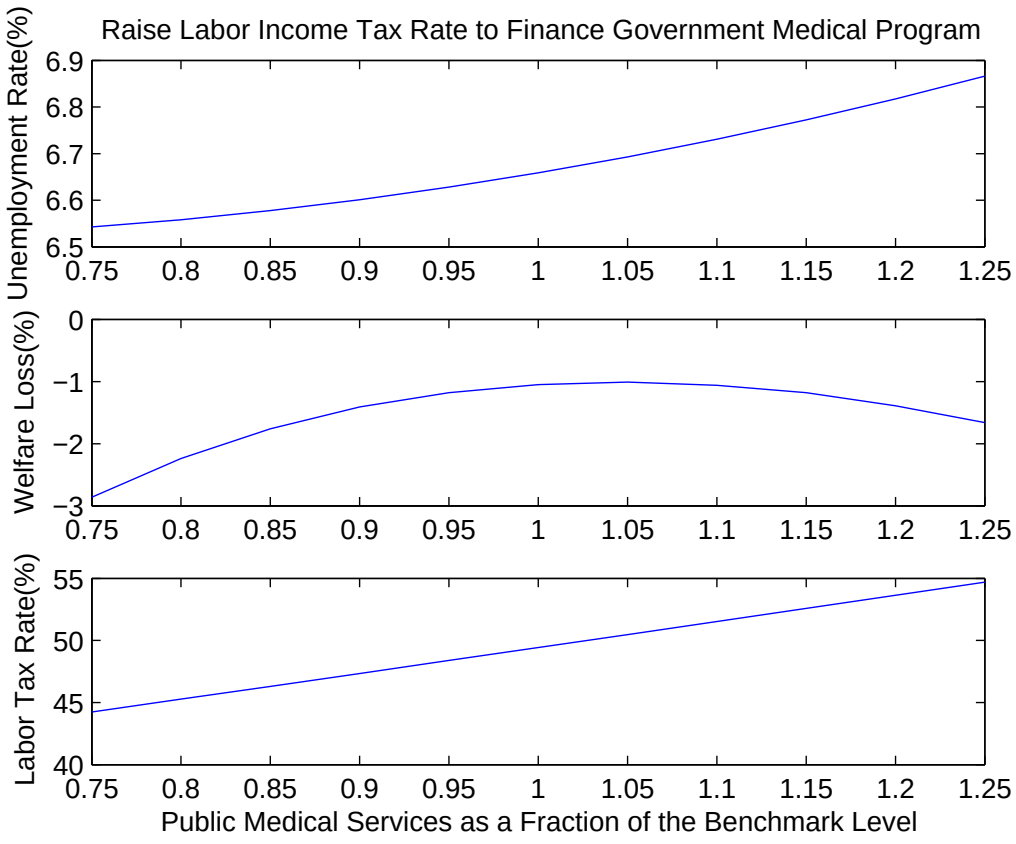


Figure 7. Unemployment rate (upper panel), welfare loss (middle panel), and required labor income tax rate (lower panel) for financing various levels of government medical program