The Macroeconomic Costs of Employer-Based Health Insurance

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Abstract

Employer-financed health insurance systems, like that used in the United States, distorts firms' labor demand and adversely affects the economy. Since such costs vary with employment rather than hours worked, firms have an incentive to increase output by increasing worker hours rather than employment. Given that the returns to employment exceed the returns to hours worked, this results in lower levels of employment and output. In this paper we construct a heterogeneous agent general equilibrium model where individuals differ with respect to their productivity and employment opportunities. Calibrating the model to the U.S. economy, we generate steady state results for two models; one in which health insurance is financed primarily through employer contributions that vary with employment, and a second where insurance is funded through a non-distortionary, lump-sum tax. This allows us to estimate the effect of employer-based health insurance on output, employment, hours worked and inequality.

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1 Introduction

Employer-financed health insurance systems, like that used in the United States, distorts firms' labor demand and adversely affects the economy. Unlike most developed countries, health insurance in the United States has long been financed primarily through employers. de Navas-Walt, Proctor and Mills (2004) report that about 60 percent of Americans obtain health insurance through their employers, though this percentage has been steadily declining for decades. According to the Bureau of Labor Statistics (2005), healthcare costs now represent over 7 percent of the average employer's total compensation costs. Since such costs vary only with employment rather than hours worked, firms have an incentive to increase worker hours rather than employment.

While it is clear that the costs of providing health insurance are significant, little attention has been paid to quantifying the macroeconomic costs of such employer-based health insurance (EBHI) systems. The literature is clear on the fact that EBHI affects labor market outcomes. Cutler and Madrian (1998) found that rising healthcare costs accounted for up to a 3 percent increase in hours worked in the U.S. during the 1980s. More recently, Baiker and Chandra (2005) found that rising insurance premiums led to an 8 percent decline in employment between 1996-2002. Given these apparent labor market distortions, is it possible that the U.S.'s reliance on employer-funded health insurance is reducing macroeconomic output? Furthermore, do these distortions have adverse effects on wage inequality?

In this paper we attempt to quantify the macroeconomic costs of EBHI. We construct a heterogeneous agent general equilibrium model where individuals differ with respect to their productivity and employment opportunities. Each period firms make a decision as to how many workers of each type to hire, as well as a decision on hours per worker. The benchmark model is calibrated to match the most pertinent aspects of the U.S. economy. From the benchmark model, aggregate employment, output and asset distribution are computed and compared to those generated from a model where health insurance is funded at the national level through a lump sum tax on employers. The results of this paper could have important implications for influencing ongoing policy debates over healthcare reform.

2 Health Insurance and Employment

Provision of health insurance by employers can affect labor market outcomes for a number of reasons. This can occur through either productivity[1], labor supply[2], or through changes in the structure of employment driven by em-

[1] Health insurance reduces the cost of health. Ultimately, health has been shown to affect labor productivity. However, the empirical literature on the relationship between insurance and health is mixed. For the purposes of this paper, we ignore the possibility of any such productivity effects. For an overview of this literature, see Currie and Madrian (1999).

[2] When the provision of health insurance is tied to employment, it affects workers' supply of labor by increasing the returns to work. Since the elasticity of labor supply for men and

ployer's demand. Because of the empirical controversy surrounding the effects on productivity and labor supply, this paper focuses only on simulating the demand-side effects. Specifically, we concentrate on the firm's choice regarding its optimal levels of employment and the number of hours worked.

In thinking about the demand for labor, the first issue is the extent to which firms are able to shift the cost of providing health insurance to their employees in the form of lower wages. In other words, rising healthcare costs for firms might simply result in a reduction in wages. If firms could make this shift, the cost of providing health insurance benefits would have a negligible effect on labor demand, and no effect on the hours-employment tradeoff. However, this does not appear to be the case. As Currie and Madrian (1999) conclude, there is little empirical evidence to suggest that a tradeoff between insurance costs and wages exists.[3] In fact if anything, the relationship may be positive. For example, based on the RAND Health Insurance Study, Leibowitz (1983) estimates a positive relationship between health expenditures and wages. The reason is that wages and productivity are correlated. But Currie and Madrian (1999) note that even when this omitted variable bias is taken into account, there is little evidence of a tradeoff between health benefits and wages (Smith and Ehrenberg 1983). Overall, the literature indicates that EBHI systems like that of the U.S. do in fact raise the costs of production.

Exactly how are production costs affected by EBHI? The salient feature of EBHI is that the costs vary with the level of employment rather than the number of hours worked. The implication is that these costs should affect the overall structure of employment, leading firms to hire fewer workers to work more hours. The existing literature appears to support just such a tradeoff (Ehrenberg 1971, Ehrenberg and Schumann 1982, Beaulieu 1995, and Cutler and Madrian 1998). The evidence strongly indicates that firms facing higher benefit costs utilize more overtime. In fact, Cutler and Madrian (1998) found that rising health insurance costs accounted for a significant increase in hours worked in the U.S. during the 1980s, while Baiker and Chandra (2005) found that rising insurance premiums led to a large decline in employment between 1996-2002.

Overall, the evidence from the literature suggests that EBHI systems increase firms' costs. As a result, firms reduce their demand for the number of workers

single women in the United States is relatively inelastic, the literature on the relationship between health insurance and labor participation rates have concentrated on retirees (Blau and Gilleskie 2001), poor women (Yelowitz 1995), and married women (Olsen 1998, Buchmueller and Valletta 1999). Overall, the labor supply effects of EBHI systems appear mixed. While older workers and married women are more likely to work when insurance is tied to employment, there are inefficiencies in the system. Because low-paying jobs often fail to provide insurance, poor women are actually less likely to enter the labor market since they would risk losing Medicaid.

[3] There are, however, a few studies that find evidence that employers are able to shift particular parts of the cost of health insurance benefits to those worker groups most expensive to insure. Gruber (1994) finds that when forced by law to cover certain benefits (e.g., pregnancy, birth), the wages for those groups most likely to be affected by the law (women) fell in response to the benefit cost. Sheiner (1997) finds that wages of older workers in high-cost areas are lower than wages of the same workers in low-cost areas.

while increasing their demand for hours worked per employee. The implication is that if firms could reduce the costs associated with employment, the demand for workers would increase and the hours worked would decrease. Furthermore, if the returns to employment exceed the returns to hours worked, such a change would have important implications for the level of domestic output.

3 The Model

The literature has implications for the macroeconomic model developed in this section. First, it is clear that EBHI imposes a distortionary "employment tax" on producers. Firms respond to EBHI by altering the structure of employment, substituting more hours for fewer workers. We begin to analyze the macroeconomic effects of EBHI by constructing a simple, yet realistic model of the U.S. economy. Since the primary purpose of this paper is to estimate the macroeconomic effects generated by changes in employment from moving away from the current EBHI system, we ignore the potential productivity gains related to worker health and reductions in job-lock. For tractability, we also abstract from gender and marital status effects. For simplicity, we assume that all workers prefer to work full time and that all employers have to provide full health insurance benefits for their workers regardless of the number of hours they work. Consideration of any of these effects would require not only a labor supply decision, but the modeling of multiple, complex matching processes beyond the scope of this paper.

3.1 Preferences

The economy is populated by overlapping generations of *ex ante* heterogeneous workers. Workers differ with respect to their age and their human capital (skill level). We assume three different types of human capital denoted by $hc \in HC = \{hc_1, hc_2, hc_3\}$, where hc_1 through hc_3 represent monotonically increasing human capital levels.

Individuals are assumed to live J periods with certainty and each period a new generation is born. Individuals ages are indexed by $j \in \{1, 2, ..., J\}$. The fraction of individuals age j and human capital hc is given by $\mu_{j,hc}$ where $\sum_{j=1}^{J} \sum_{hc=1}^{HC} \mu_{j,hc} = 1$.

Each period, individuals choose the set $\{c_j, h_j, a_{j+1}\}$ in order to maximize their expected utility, which depends on the consumption of a good, consumption of health insurance and the amount of leisure time enjoyed. That is, an individual with human capital hc desires to maximize:

$$\mathrm{E} \sum_{j=1}^{J} \beta^{j-1} \, U(c_{j,hc}, \chi, l_{j,hc}) \tag{1}$$

where $c_{j,hc}$ is the consumption of goods and $l_{j,hc}$ is the amount of leisure time for an individual of age j and human capital hc. χ represents utility derived from the consumption of health insurance and is assumed to be constant across agent types. For simplicity, we also assume that the value of χ is independent of the provider; that is, workers have no preference between employer-based or government-provided health insurance. β is the subjective discount factor, and E is the expectation operator.

The momentary utility function has the form:

$$U(c_{j,hc}, \chi, l_{j,hc}) = \log(c_{j,hc}) + \log(\chi) + \zeta_{j,hc}(l_{j,hc}) \tag{2}$$

where $\zeta_{j,hc}$ represents the utility gained from leisure time. Individuals are assumed to be endowed with one unit of time each period to be allocated between leisure and work. That is,

$$1 = l_{j,hc} + h_{j,hc} \tag{3}$$

where $h_{j,hc}$ represents the number of hours an individual of age j and human capital hc spends working. The utility derived from leisure is written as:

$$\zeta_{j,hc}(l_{j,hc}) = \gamma_{hc} \log(1 - h_{j,hc}) \tag{4}$$

where γ_{hc} is a human capital-dependent parameter representing an individual's preference for leisure.

3.2 Efficiency and Employment of Worker-Agents

The large number of *ex ante* heterogeneous agents differ with respect to their productivity or efficiency in the labor market. Efficiency is both age and human capital dependent. Age-indexed efficiency is denoted η_j, while the human capital dependent efficiencies are denoted ε_{hc}. The wage rate for each type of worker will be determined by simultaneously solving the first-order conditions from both the firm and the individual's choice problems and is denoted w_{hc}. An employed individual of age j and human capital type hc receives the wage income $w_{hc}\eta_j$. If an individual is in the unemployed state (denoted u), he receives unemployment insurance benefits. We denote the unemployment benefit by ν.

The probability of drawing the employed state (denoted e) is endogenously determined by the demand for employment by firms. The demand for labor depends on human capital levels and is denoted n_{hc}, indicating the demand for labor of human capital level hc. Aggregate employment, N, is therefore the sum over the measure of employed individuals by each age and human capital type, or

$$N = n_1 + n_2 + n_3 = \sum_{j=1}^{J} \sum_{hc=1}^{HC} \mu_{j,hc} n_{hc}. \tag{5}$$

3.3 Aggregate Technology

The production technology of this economy is given by a generalized Cobb-Douglas function that is multiplicatively separable in the number of hours employed, h, and the type of worker, hc.

$$Y = f(K, N, h) = AK^{\theta}[h_1^{\psi} n_1^{1-\theta}]^{\varepsilon_1} [h_2^{\psi} n_2^{1-\theta}]^{\varepsilon_2} [h_3^{\psi} n_3^{1-\theta}]^{\varepsilon_3} \tag{6}$$

where $\theta \in (0,1)$ is capital's share of output, K, N are the aggregate inputs of capital and labor respectively, and n_{hc} is the employment level of each type of workers. The parameter A represents total factor productivity and is assumed constant. The capital stock depreciates at the rate δ each period. This production function assumes diminishing returns to capital, labor and hours.

Given a competitive environment, the profit-maximizing behavior of the firm gives rise to the first-order condition which determines the real (net) return to capital.

$$r(K,N,h) = \theta A K^{\theta-1} h_1^{\psi\varepsilon_1} n_1^{(1-\theta)\varepsilon_1} h_2^{\psi\varepsilon_2} n_2^{(1-\theta)\varepsilon_2} h_3^{\psi\varepsilon_3} n_3^{(1-\theta)\varepsilon_3} - \delta. \tag{7}$$

3.4 Individuals' Decision Problem

An individual enters a period knowing their human capital level, employment opportunities, and asset position for the period. We let $a_j \in A$ represent the initial asset position of an individual. We restrict a_j to the discrete set of positive values $\{a_1, a_2, ..., a_M\}$. Each period, individuals choose the set $\{c_j, h_j, a_{j+1}\}$ in order to maximize their utility. For each individual, the individual's state depends on their age, j, their human capital level, hc, asset position, a, and employment situation, s. In addition, τ_u represents the income tax rate. This tax is set so that the revenue collected exactly covers the total cost of unemployment benefits, and is financed by equally taxing both workers and firms. Therefore, each individual's wage income is taxed at a rate of $0.5\tau_u$.

The choice problem for each individual can be expressed as:

$$\begin{aligned} V(j,a,hc,s) &= \max U(\cdot) + \\ &\quad \beta \int V(j+1, a', hc, s')\ \Pi_i(s'|s) ds' \end{aligned} \tag{8}$$

subject to

$$c + a' \leq (1 - 0.5\tau_u) w_{hc} \eta_j h_{j,hc} + (1 + r - \delta)a, \qquad \text{if } s = e \tag{9}$$

$$c + a' \leq \nu + (1 + r - \delta)a, \qquad \text{if } s = u \tag{10}$$

$$a' \geq 0$$

$$r = r(K,N)$$

$$w_{hc} = w_{hc}(K,N,h)$$

The decision rules for c, h and a' for individual i are $C_i(x)$, $H_i(x)$, and $A_i(x)$.

3.5 Firm's Decision Problem

Firms are homogeneous but with allowances for variations in both worker healthcare costs and training costs. Each homogeneous firm rents capital and employs workers. The firm incurs two types of costs that vary only with the level of employment, ϕ and ξ. Each of these costs represent a portion of the costs of hiring an additional employee. In particular, ϕ represents the cost of providing healthcare per worker, while ξ represents all other per worker costs, including training costs, search and paperwork costs, and other benefits (excluding healthcare). In addition, firms incur variable costs associated with worker hours in the form of payroll taxes. Each firm must pay a tax rate of τ_b for each worker-hour employed. That is, if a firm hires a type 1 worker to work 2 total hours, the effective cost of those hours to the firm is $(1+\tau_b)w_1 * 2$. The revenue from these payroll taxes goes into a government savings fund.[4] Firms must also pay a portion of the tax rate τ_u to finance unemployment benefits. Since these benefits are financed by equally taxing both workers and firms, the effective tax rate for the firm is $0.5\tau_u$.

Each period firms must choose both the number of workers of each human capital type, n_{hc}, as well as the number of hours that each type of worker will work, h_{hc}, in order to maximize profits. The choice problem for each firm can be expressed as:

$$\max \left(y_t - r_t k_t - [(1+0.5\tau_u+\tau_b)(\sum_{hc=1}^{3} w_{hc} n_{hc} h_{hc})] - (\phi+\xi) * N \right). \quad (11)$$

As noted earlier, the first-order conditions of this maximization problem deliver the real return to capital as well as an equilibrium condition for hours worked for each type of worker.

3.6 The Government

The government is constructed in such as way as to mimic the most salient features of the U.S. tax system, and allows us to analyze the effects of a change in healthcare costs to employers through taxes. In the benchmark economy the government provides unemployment benefits to non-working individuals and "other programs" that are assumed to benefit each agent equally. We assume the unemployment benefits program is self-financed by equally taxing both workers and firms. The tax rate, τ_u, is set so that the revenue collected covers the cost of paying each unemployed individual the amount ν. Hence given the cross-sectional distribution measure $\lambda(j,a,hc,s)$,

$$\tau_u = \frac{\sum_{j=1}^{J}\sum_{a=1}^{A}\sum_{hc=1}^{HC}[\nu\mu_{j,hc}\lambda(j,a,hc,s=u)]}{\sum_{j=1}^{J}\sum_{a=1}^{A}\sum_{hc=1}^{HC}[w_{hc}\eta_j h_{j,hc}\mu_{j,hc}\lambda(j,a,hc,s=e)]}. \quad (12)$$

[4] Note that the payroll tax in the benchmark model acts purely as an additional (variable) cost to firms and is an attempt to mimic the social security and other payroll taxes paid by employers in the U.S.

The payroll taxes paid by firms in the benchmark model is set to replicate FICA. The revenue from these taxes, G, is assumed to finance other government programs. These benefits are assumed to benefit all agents equally. G also includes spending on government-provided health insurance for unemployed workers since they do not get EBHI. Like EBHI, the benefits from government-provided health insurance enter the agents' utility function through χ.

$$G = \tau_b * \sum_{j=1}^{J} \sum_{hc=1}^{HC} [n_{hc} h_{j,hc} w_{hc}]. \tag{13}$$

Since the purpose of the paper is to measure the distortionary effects of EBHI, a subsequent variation of the model is estimated where the firm's EBHI costs are replaced by a lump sum tax, T, paid to the government. The alternative version allows us to compare the macroeconomic outcomes under EBHI with that generated under a non-distortionary, single-payer system. In the alternative model, in addition to unemployment benefits and other programs, the government also provides health insurance for all individuals. In this version, the firm's choice problem becomes

$$\max \left(y_t - r_t k_t - [(1 + 0.5\tau_u + \tau_b)(\sum_{hc=1}^{3} w_{hc} n_{hc} h_{hc})] - (\xi * N) - T \right). \tag{14}$$

Consequently, the new government budget constraint becomes

$$G = \tau_b * \sum_{j=1}^{J} \sum_{hc=1}^{HC} [n_{hc} h_{j,hc} w_{hc}] + T. \tag{15}$$

where T is set to equal $\phi * N$ from equation (11) in the benchmark model. The reason for determining T this way is to avoid altering the relative burden of financing health insurance when comparing systems. Maintaining constant relative costs allows us to isolate the pure distortion effects when we compare the benchmark to the lump-sum model.

3.7 Determination of Wages and Hours

The wage rate for each worker of human capital type hc is dependent on the equilibrium hours worked, and is determined by simultaneously solving both the individual's and the firm's choice problem. In particular, the individual's optimal choice for hours worked gives rise to the following condition for wages:

$$w_{hc} = \frac{\gamma_{hc} c_{hc}}{(1 - h_{hc})(1 - 0.5\tau_u)} \tag{16}$$

where again, γ_{hc} is the leisure preference and c_{hc} is the level of consumption, each for an agent of human capital type hc.

The firm's optimal employment decisions also require the following equilibrium condition:

$$\frac{\frac{\partial Y}{\partial h_{hc}}}{\frac{\partial Y}{\partial n_{hc}}} = \frac{(1+0.5\tau_u+\tau_b)w_{hc}n_{hc}}{(1+0.5\tau_u+\tau_b)w_{hc}h_{hc}+(\phi+\xi)}. \tag{17}$$

This condition states the familiar outcome that the ratio of the marginal products of the two inputs (i.e. hours per worker, and the number of workers) must equal the ratio of the marginal costs. In addition, since $\frac{\partial Y}{\partial h_{hc}} = \psi \frac{Y}{h_{hc}}$ and $\frac{\partial Y}{\partial n_{hc}} = (1-\theta)\frac{Y}{n_{hc}}$, equation (17) yields a solution for equilibrium hours worked which is independent of employment. In particular, the firm's problem gives rise to the following solution for hours:

$$h_{hc} = \frac{\psi(\phi+\xi)}{w_{hc}(1+0.5\tau_u+\tau_b)(1-\theta-\psi)}. \tag{18}$$

Since both ϕ and ξ are positive parameters representing various employee costs to the firm, a stable solution requires that $(1-\theta-\psi)>0$. In other words, the marginal product of each worker must be greater than the marginal product of worker hours.

Combining the equilibrium conditions from both the individual's and the firm's optimization problems (equations 16 and 18 respectively) yields the solution for equilibrium hours worked:

$$h^*_{hc} = \frac{\psi(\phi+\xi)(1-0.5\tau_u)}{\gamma_{hc}c_{hc}(1+0.5\tau_u+\tau_b)(1-\theta-\psi)+\psi(\phi+\xi)(1-0.5\tau_u)}. \tag{19}$$

Note that these equilibrium conditions hold for both the benchmark and alternative models. The only difference is that under lump-sum financing of health insurance $\phi = 0$.

3.8 Equilibrium

Given a set of fiscal policy arrangements $\{\nu, \tau_u, \tau_b\}$, a stationary equilibrium includes: the value function $V_i(x)$; a set of individual decision rules $C_i(x)$, $A_i(x)$, and $H_i(x)$; and prices for both labor and capital, $\{w_1, w_2, w_3, r\}$. Each of these are determined in an environment where: individuals and firms maximize utility subject to budget constraints as expressed in equations (8) - (11); the government budget constraint is satisfied; the various markets clear; and the cross-sectional distribution measure, $\lambda(x)$, is time invariant. Formally, the following conditions must be satisfied in equilibrium.

(i) Aggregate variables result from the choices of individual agents:

$$K = \sum_{j=1}^{J}\sum_{hc=1}^{HC}\mu_{j,hc}\int_x A(x)d\lambda(j,hc,\cdot)$$

$$K' = \sum_{j=1}^{J} \sum_{hc=1}^{HC} \mu_{j,hc} \int_x A'(x) d\lambda(j, hc, \cdot).$$

(ii) Employment rates are endogenously determined by the choices of firms.

(iii) The relative prices $\{w_1, w_2, w_3, r\}$ solve both the individual's as well as the firm's profit-maximization problem by satisfying equations (8) through (11).

(iv) Given the time-invariant government policy variables, the relative wage rate, interest rate and employment rate yield individual policy rules $C_i(x)$, $A(x)$ and $H_i(x)$ which solve the programming problem of the individual as defined in (8).

(v) The various markets clear at the prices $\{w_1, w_2, w_3, r\}$.

The commodity market clearing equation is:

$$\sum_{j=1}^{J} \sum_{hc=1}^{HC} \mu_{j,hc} C(x) d\lambda(x) + [K' - (1-\delta)K] + G = f(K, N, h). \tag{20}$$

The market clearing equations for worker-hours, by type of worker, are:

$$h_1 = \sum_{j=1}^{J} \mu_{j,1} H_i(x) d\lambda(j, hc = 1, \cdot) \tag{21}$$

$$h_2 = \sum_{j=1}^{J} \mu_{j,2} H_i(x) d\lambda(j, hc = 2, \cdot) \tag{22}$$

$$h_3 = \sum_{j=1}^{J} \mu_{j,3} H_i(x) d\lambda(j, hc = 3, \cdot) \tag{23}$$

where the left-hand side of each market clearing equation represents the total demand of type *hc* worker-hours determined by the firms' profit-maximizing first-order conditions, and the right-hand side represents the total supply of type *hc* hours determined from the individuals' utility-maximizing first-order conditions.

(vii) The government's budget constraint equation is satisfied.

4 Calibration

The model is calibrated to mimic steady state U.S. economic data. These involve production technology, labor-related costs and consumer preferences. The parameters that describe steady state production come from calibration targets consistent with recent data from the Bureau of Labor Statistics (2005, 2006a, 2006b) and existing literature.

4.1 Targets

All of the key parameters that drive the model's most important results have been calibrated using empirical targets. These include the relative efficiencies, leisure preferences, the marginal product of hours worked, and most employment-related costs. The benefit of using these calibration targets is that it allows us to endogenously calibrate certain parameters so that our benchmark model correctly mimics certain characteristics consistent with the U.S. economy.

Targets for employment and hours worked come from the *Current Population Survey* (Bureau of Labor Statistics 2006b). Type 1 workers are those with a high school diploma or less; type 2 workers are those with some post-high school education; type 3 workers are those with a four-year college degree or higher. Targets for relative wages are determined by the median usual weekly earnings for full time workers by education level (Bureau of Labor Statistics 2006a). Note that one cannot simply divide this by the average hours worked per week to obtain an estimate of the average hourly wages, since the hours worked figures also include part-time employees. Nevertheless, the earnings estimates for full time workers provide a reasonable target for establishing the relative wages for each type of worker (1.000, 1.242 and 1.896, respectively). Targets for employment, hours worked and relative wages are summarized in Table 1.

Table 1: Calibration Targets for Employment

Variable	BLS data	Target
Employment		
Type 1 worker	0.5456	0.5456
Type 2 worker	0.6860	0.6860
Type 3 worker	0.7597	0.7597
Hours Worked		
Type 1 worker	37.34 hrs/wk	0.2220
Type 2 worker	39.17 hrs/wk	0.2330
Type 3 worker	42.45 hrs/wk	0.2530
Relative Wages		
Type 1 worker	$543 week	1.0000
Type 2 worker	$674 week	1.2420
Type 3 worker	$817 week	1.8960

Targets for production costs come from a recent Bureau of Labor Statistics' (2005) report on *Employer costs for employee compensation*. There are three key costs that affect firm's optimal decisions in our model: (1) the per-worker cost of health insurance; (2) legally-required wage-related taxes (e.g., FICA); and (3) other costs related to the level of employment (e.g., search costs). The Bureau of Labor Statistics (2005) estimates that costs for employee health insurance per hour worked accounts for 7.5 percent of total worker compensation; legally-required benefits per hour worked (not including unemployment insurance) account for another 7.5 percent of total worker compensations; and other benefits such as paid leave, vacation, sick and holiday leave per hour worked account for another 11.4 percent of total worker compensation. Unfortunately, this 11.4 percent does not include non-compensation costs associated with hiring. For example, Fitzgerald (1996) cites costs like training, search, and paperwork costs. We assume that these costs make up an additional 2 percent of compensation costs. As a result, we calibrate all employment-related costs that are not related to health insurance to be 13.4 percent of total worker compensation costs.[5]

4.2 Benchmark Model

Given the targets discussed above, the benchmark model is calibrated using the parameters listed in Table 2. The marginal product of capital (and employment) comes from recent work by Cassou and Lansing (2004). In their analysis of the output effects of a flat tax, they assume that the marginal product of capital (θ) is 0.36 and the marginal product of employment $(1-\theta)$ is 0.64. The relative efficiency of workers at each age is estimated using data from the Bureau of Labor Statistics on average income by age (Platania and Schlagenhauf 2004). The proportion (π) of each type of worker is obtained from data on average weekly earnings of full time workers by education level (Bureau of Labor Statistics 2006a). Recall that type 1 workers are defined to be those with a high-school education or less; type 2 workers have some college education, but do not posses a degree from a four-year college; type 3 workers are those with at least a college degree.

The level of human capital (hc), marginal product of hours (ψ) and the leisure preferences (γ) for each of the three types of workers are calibrated to hit the targets set for employment, hours worked and relative wages given in Table 1. The values for the cost of healthcare per worker (ϕ), legally-required wage-related benefits (τ_b) and other costs of employment (ξ) are chosen to match the actual employer costs reported by the Bureau of Labor Statistics (2005) discussed above. The percent of income that is paid to unemployed workers (ν) is based on the average wages weekly benefits paid and the average duration of unemployment as of 2003 (U.S. Department of Labor 2004) . Note that since we have no retirees in our benchmark model, we calibrate Ω=0.00. Finally, the rate of time preference (β) is from Altig, et al (2001).

[5] As it turns out, our costs are consistent with Fitzgerald (1996). Using "back-of-the-envelope" estimates, he calibrates total costs per worker to be 0.05. As is seen in Table 2, the sum of our two per-worker costs $(\phi + \xi)$, calibrated to hit the targets obtained from the Bureau of Labor Statistics (2005) equals 0.045.

Table 2: Parameters

Symbol	Description	Value
	Production Technology	
A	Technology Scalar	1.0000
θ	Marginal product of capital	0.3600
η	Relative efficiency of workers at each age	*see appendix*
μ	Relative size of age cohorts	*see appendix*
π_1	Proportion of type 1 workers	0.3887
π_2	Proportion of type 2 workers	0.2782
π_3	Proportion of type 3 workers	0.3331
ε_1	Relative efficiency of type 1 workers	0.2420
ε_2	Relative efficiency of type 2 workers	0.2630
ε_3	Relative efficiency of type 3 workers	0.4950
ψ_1	Marginal product of hours for type 1 workers	0.4650
ψ_2	Marginal product of hours for type 2 workers	0.4950
ψ_3	Marginal product of hours for type 3 workers	0.5380
	Employment and Wage Costs	
ϕ	Cost related to provision of health insurance	0.0177
τ_b	Legally required wage-related costs	0.1050
ξ	Other employment-related costs	0.0318
υ	Percent of wages paid to unemployed workers	0.1170
Ω	Percent of wages paid to retired workers	0.0000
	Consumer Preferences	
β	Time preference	0.9960
γ_1	Leisure preference for type 1 workers	3.1000
γ_2	Leisure preference for type 2 workers	2.6000
γ_3	Leisure preference for type 3 workers	2.4000

Using the parameters in Table 2 we judge the quality of our benchmark model. This evaluation is based on the four key areas of interest: employment, hours worked, relative wages and production costs. Table 3 compares the results from the benchmark with recent U.S. economic statistics in these key areas. As we can see, the parameters in Table 2 generate strikingly accurate results. Only the relative wages of type 3 workers fails to come within 0.01 of its target.

Table 3: Benchmark Results

Variable	Simulated	Actual
Employment		
Type 1 worker	0.5471	0.5456
Type 2 worker	0.6894	0.6860
Type 3 worker	0.7615	0.7597
Hours Worked		
Type 1 worker	0.2283	0.2220
Type 2 worker	0.2367	0.2330
Type 3 worker	0.2566	0.2530
Relative Wages		
Type 1 worker	1.0000	1.0000
Type 2 worker	1.2393	1.2420
Type 3 worker	1.7660	1.8960
Production Costs		
Healthcare costs	0.0753	0.0750
Employment-related costs	0.1353	0.1340
Wage-related costs	0.0764	0.0750

5 Counterfactual Experiment

With a reasonable benchmark economy in place, we are now able to analyze the macroeconomic effects of removing the labor demand distortion caused by EBHI. In addition to its effects on the demand for both worker-hours and employment, the output and distributional effects of the EBHI can now be estimated.

In this version of the model, the per-worker cost of providing heath insurance is removed. Instead, health insurance is now provided by a single payer, the government. As in the benchmark, these costs are ultimately borne by both firms and individuals. In this experiment the relative burden will remain unchanged; firms will pay the same amount in the form of a new lump-sum tax as they paid in total health insurance costs in the benchmark model (T=0.011648441). All this does is transform the cost of providing health insurance into a fixed cost rather than a marginal cost per worker.

Results from this counterfactual experiment are given in Table 4. As expected, the simulation shows a significant increase in employment rates across the distribution of agent-types. Moreover, this labor-demand effect is strongest for workers with lower levels of human capital. The distribution of hours worked also shifts in favor of the lower productivity workers. While hours worked decreases for all workers, it declines most for type 1 workers. Recall that in the benchmark economy the costs associated with hiring workers gives firms a greater incentive to hire the most productive workers and work them for longer hours. Under the lump-sum tax, firms now have a greater incentive to hire additional workers. This is the result of the fact that the marginal productivity of workers is greater than the marginal productivity of hours for all levels of human capital. In the benchmark model, any increase in productivity gained when hiring additional workers was offset by the higher costs associated with hiring, a large part of which were driven by health insurance. Hence, under the lump-sum tax, hours worked decreases substantially for each type of worker and employment increases.

Just as important as the employment results are the implications for inequality. While wages for the lowest-skilled workers increase, they decline for type 2 and 3 workers. As seen in Table 4, wage inequality between the higher and lower-skilled workers declines. The improvement in relative equality is also seen in the change in consumption rates. Type 1 and 2 workers experience an improvement in their total consumption levels while they decline slightly for type 3 workers. Overall, consumption increases for the lower-skilled workers relative to their higher-skilled counterparts.

Table 4: Single Payer Results

Variable	Benchmark	Single Payer	% Change
Employment			
Type 1 worker	0.5471	0.9158	67.4%
Type 2 worker	0.6894	0.9999	45.0%
Type 3 worker	0.7615	0.9999	31.3%
Hours Worked			
Type 1 worker	0.2283	0.1470	-35.6%
Type 2 worker	0.2367	0.1788	-24.0%
Type 3 worker	0.2566	0.1939	-24.4%
Relative Wages			
Type 1 worker	1.0000	1.0000	
Type 2 worker	1.2393	1.0560	-14.8%
Type 3 worker	1.7660	1.5046	-14.8%
Relative Consumption			
Type 1 worker	1.0000	1.0000	
Type 2 worker	1.3694	1.2137	-11.4%
Type 3 worker	2.1950	1.8402	-16.2%
Output	0.2487	0.2674	7.5%

Finally, overall output levels in the economy are significantly higher under the lump-sum tax. Again, this is driven by the substantial change in the structure of employment. Our experiment shows that changing the cost of health insurance from one in which firms pay on a per-worker basis to a lump-sum tax generates an increase in steady-state output of 7.5% percent. For the U.S., this cost represents nearly one trillion 2005 dollars.

6 Conclusion

We have investigated the macroeconomic costs of employer-based health insurance. Such a system, like that which exists in the United States, results in a relatively inefficient allocation of labor resources. Since the costs associated with the provision of insurance vary by employment, firms respond by hiring fewer workers at more hours. By changing the way health insurance is financed it is possible to permanently increase output and employment while reducing the average hours worked. Employer-based systems also exacerbate wage inequality. Since the costs of insurance is equal across workers, these systems increase the incentive for firms to raise the hours worked by higher-skilled workers before hiring lower-skilled workers. But when these costs are paid through a lump-sum tax, employment increases relatively more for the least-skilled workers. Theoretically, if the United States was able to eliminate these labor-demand distortions, the resulting increase in steady state output could be substantial.

While the results of this study seem to have clear and controversial implications for long term healthcare and economic policy in the United States, caution must be taken in interpreting their significance. First and foremost, the estimates generated from this experiment only account for the demand-side distortions. Because we assume all workers are willing to accept a job if offered, many of the benefits of universal healthcare coverage may be obscured. As a result, a number of extensions to the model itself should be considered before policy recommendations are made. For example, there is evidence that poor women are less likely to enter the workforce under employer-based systems for fear of losing government-sponsored services such as Medicaid (Yelowitz 1995). More careful modeling of the complexity of the labor supply decisions that exist under employer-based systems is likely to be one of the more important avenues for future work in this area.

Finally, the alternative model where a single-payer system is financed through a lump-sum tax on employers is not practical from a policy perspective. The lump-sum experiment is only justified in the context of measuring the costs of the employment-hours distortion generated by the existing employer-based system and should not in itself by taken to be a realistic policy proposal. In addition to the extensions suggested above, future work should consider a wide array of alternative policy reforms in order to find the socially optimal tax financing scheme. Policy alternatives could include wage, income, or other marginal-cost related financing. Any consideration of the myriad of alternatives should also explicitly consider transitional dynamics.

7 Appendix

Age and Efficiency Distribution

Age	Distribution	Efficiency	Age	Distribution	Efficiency
18	0.0241	0.3151	41	0.0258	1.0141
19	0.0241	0.3524	42	0.0258	1.0290
20	0.0235	0.3896	43	0.0258	1.0377
21	0.0235	0.4269	44	0.0258	1.0464
22	0.0235	0.4641	45	0.0221	1.0550
23	0.0235	0.5014	46	0.0221	1.0637
24	0.0235	0.5387	47	0.0221	1.0724
25	0.0243	0.5759	48	0.0221	1.0615
26	0.0243	0.6132	49	0.0221	1.0507
27	0.0243	0.6504	50	0.0171	1.0398
28	0.0243	0.6778	51	0.0171	1.0290
29	0.0243	0.7052	52	0.0171	1.0181
30	0.0280	0.7326	53	0.0171	1.0135
31	0.0280	0.7600	54	0.0171	1.0089
32	0.0280	0.7874	55	0.0137	1.0043
33	0.0280	0.8209	56	0.0137	0.9998
34	0.0280	0.8543	57	0.0137	0.9952
35	0.0286	0.8878	58	0.0137	0.9859
36	0.0286	0.9212	59	0.0137	0.9766
37	0.0286	0.9547	60	0.0122	0.9673
38	0.0286	0.9695	61	0.0122	0.9580
39	0.0286	0.9844	62	0.0122	0.9487
40	0.0258	0.9993			

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