Why Do Americans Work So Much More than Europeans? The Role of Employer-Sponsored Health Insurance and Uncertain Health Expenses

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Abstract

This paper proposes a new explanation for the fact that Americans work much more than Europeans. We argue that an important cause of the difference in aggregate labor supply is the different health insurance systems in the US and Europe. In contrast to Europeans who get universal health insurance from the government, most working-age Americans get health insurance through their employers. Since employers usually only offer health insurance to full-time workers, working-age Americans have a stronger incentive to work and work *full-time* than Europeans. Because health expenses are large and extremely volatile, and there is lack of good alternative health insurance in the individual market, risk-averse individuals would highly value employer-sponsored health insurance (much more than its actuarially fair cost). In a quantitative dynamic general equilibrium model with endogenous labor supply and uncertain health expenses, we show that different health insurance systems can account for two thirds of the difference in aggregate hours worked between the US and Europe. In addition, we find that the extra hours worked by Americans are mainly from low productive workers who work primarily to secure health insurance; therefore, the aggregate effective labor in the US is not significantly higher, though Americans work more hours than Europeans. This result suggests that the reason why Americans are richer than Europeans is not that they work more. Instead, the difference in output per capita between the US and Europe may still be driven by the different levels of technology in the two areas.

Keywords: Labor Supply, Employer-sponsored Health Insurance, General Equilibrium.
JEL Classifications:

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1. Introduction

It is well-known that Americans work much more than Europeans (see Prescott, 2004; Rogerson, 2006). For instance, the aggregate hours worked per person (age 15-64) in the United States are approximately a third higher than in the major European economies (see Table 1).[1] Why do Americans work so much more than Europeans? This question has attracted increasing attention from macroeconomists, partly due to the extreme importance of aggregate labor supply in the macroeconomy.[2] The main existing hypothesis in the literature says that different tax rates on labor income can explain the difference in aggregate hours worked between the US and Europe.[3] However, this explanation has often been criticized for making strict assumptions about labor supply elasticity and how tax revenues are spent. In this paper, we contribute to the literature by proposing a new explanation for the US-Europe difference in aggregate hours worked that do not necessarily need these assumptions.

We argue that the unique employer-based health insurance system in the US is an important reason why Americans work more than Europeans. In contrast to the Europeans who get universal health insurance from the government, most working-age Americans get health insurance through their employers. Since employers usually only offer health insurance to full-time workers, working-age Americans have a stronger incentive to work and work *full-time* than Europeans. Since health care expenses are large and extremely volatile, and there is no good alternative health insurance available in the individual market, employer-sponsored health insurance can be extremely valuable to risk-averse agents (much more than its actuarially fair cost). Therefore, the work incentive provided by the employer-based health insurance system can be strong. In addition, the labor supply effect of employment-based health insurance is amplified by a unique feature of the US tax policy, that is, the employer-sponsored health insurance premiums are exempted from taxation. The tax exemption benefits are only available for the full-time workers with employment-based health insurance, thus providing additional incentive for working-age Americans to work and work full-time.

The paper is also motivated by the fact that there are much more Americans that are working *full-time* than Europeans. Using data from the OECD Labor Market Database, we document

[1]Here the major economies include France, Germany, UK, and Italy, which are the four largest economies in Europe. They are also the European countries studied in Prescott(2004).

[2]For example, Prescott (2004), Rogerson (2006, 2007), Ohanian, Rafo, and Rogerson (2008), Rogerson and Wallenius (2009).

[3]See Prescott (2004), and Rogerson (2006, 2007) for a detailed description of this hypothesis.

that a larger share of American working-age population are working, and a larger share of American workers are working *full-time*. As shown in Table 2, the employment rate in the US is 74.1%, while it is only 63.5% on average in 4 major European countries. In addition, among all American workers, 88.1% of them are working full-time, but this number is only 83.6% in these European countries. As a result, the full-time employment rate in the US is much higher than in these European countries, that is, 65% versus 53%. By comparing the last two columns in Table 2, it can be seen that the differences in full-time employment rate closely track the differences in aggregate hours worked per person. On average, the aggregte hours worked in 4 Europeans countries is 75.6% of that in the US, while the full-time employment rate in these countries is 80.7% for annual hours worked. As also shown in Table 2, when the comparison is extended to the rest of the European countries, similar conclusions can be obtained. To further understand the causes of the difference in aggregate hours worked between the US and Europe, we conduct a simple decomposition calculation in the appendix, and find that over two thirds of the difference in aggregate hours worked between the US and these European countries are due to the differences in employment rate and full-time worker share.

To formalize the ideas described previously, we develop a dynamic general equilibrium incomplete markets model with heterogenous agents and endogenous labor supply. Different from standard incomplete markets models, our model is extended to include uncertain health expenses and health insurance decisions.[4] We use the model to assess to what extent different health insurance structures can account for the aggregate labor supply difference between the US and Europe. First, we calibrate the model to the key moments of the current US economy. In particular, our benchmark model economy captures a key feature of the US health insurance system, that is, the employment-based health insurance for working-age population and the universal government-provided Medicare for elderly population. Then, we construct a counterfactual economy by replacing the employment-based health insurance in the model with a government-financed universal health insurance program that mimics the European system. By comparing the two model economies, we find that the employment-based health insurance system has a large labor supply effect. When the employment-based health insurance system is replaced by a universal health insurance system, the aggregate hours worked in the model decrease by 19%, which suggests that different health insurance structures can account for a

[4]To this end, this paper is closely related to a number of recent papers that study an extended incomplete markets model with uncertain health expenses, such as Jeske and Kitao (2009), De Nardi, French, and Jones (2010), Kopecky and Koreshkova (2011), Hansen, Hsu, and Lee (2012), Pashchenko and Porapakkarm(2013).

significant portion of the difference in aggregate labor supply between the US and Europe. In addition, the model can generate changes in employment rate and full-time worker share that are also consistent with the differences between the US and Europe in the data.

Our quantitative results also show that the decrease in aggregate hours worked is mainly from low productive agents when the employment-based health insurance system is replaced by a universal health insurance system. These agents choose to work in the model with the employment-based health insurance system primarily to secure health insurance. This result suggests that the extra hours worked by Americans may be mainly from low productive workers and thus the aggregate effective labor in the US may not be significantly higher than that in the European countries. In our computational experiment, when the employment-based health insurance system is replaced by a universal health insurance system, the aggregate effective labor only drops by 5% while the aggregate raw labor (aggregate hours worked) decreases by 19%. As a result, the output per person only drops by 6%. It is worth noting that this result has an interesting implication for the difference in output per capita between the US and Europe. As is well known, while the aggregate hours worked in the US is about 30% higher than in Europe, the US output per capita is also about 30-40% higher than these European countries. This fact has led people to wonder whether Americans are richer than Europeans simply because they work much more. The finding of our exercise suggests that it is not the case. Though Americans work much more, the effective labor supply in the US is not significantly higher than in Europe because the extra hours worked are mainly from low productive workers. Therefore, the difference in output per capita between the US and Europe may still be due to the different levels of technology.

1.1. Empirical Evidence

There exist an extensive empirical literature examining the relationship between health insurance and the labor market. Many studies in this literature find that health insurance plays an important role in working-age households' labor supply decisions. Using U.S. data, Buchmueller and Valletta (1999), Olson (1998), Schone and Vistnes (2000) and Wellington and Cobb-Clark (2000) estimate that the availability of spousal health insurance reduces the labor force participation of married women by a magnitude between 6 and 20 percentage points. These researches also find that the health insurance impacts the intensive margin of labor supply. Buchmueller and Valletta (1999) estimate that spousal health insurance increases the probability of working in a part-time job by 2.8 to 3.3 percentage points. Wellington and Cobb-Clark (2000) estimate an annual hours reduction of 8- 17% for married women. Olson (1998) estimates an average decline in weekly hours of 20% for married women whose husbands have health insurance. In addition, a recent contribution by Garthwaite, Gross and Notowidigdo (2014) identifies that some workers (especially, low income workers) are employed primarily in order to secure employer-based health insurance.

The strong labor market effect of health insurance has been also identified by examining non-US data. Using Taiwan data, Chou and Staiger (2001) find that the labor force participation rate of women married to government employees declined by about 3% after they were able to obtain coverage as spousal dependents relative to the labor force participation rate of women married to other private-sector workers, who have obtain health insurance independently.

Health insurance also affect the timing of retirement (see Rust and Phelan, 1997; Blau and Gilleskie, 2006, 2008). For example, Rust and Phelan (1997) find that retiree health insurance (some employers provides health insurance to retiree before workers are eligible for Medicare) can reduce the probability of working full-time by up to 16% for individuals near retirement.

The empirical literature suggests that health insurance can have significant impact on labor supply decisions. However, in order to fully assess the effect of different health insurance systems on aggregate labor supply, it is necessary to have a model of aggregate labor supply and health insurance system. In addition, it is important to note that a change in aggregate labor supply as a response to changing health insurance structure will also have general equilibrium effects (i.e. affecting factor prices). To this end, we study a dynamic general equilibrium of labor supply and health insurance.

The rest of the paper is organized as follows. We specify the model in section 2 and calibrate it in section 3. We present the results of the main quantitative exercise in section 4 and provide further discussion on related issues in section 5. We conclude in section 6.

2. The Model

2.1. The Individuals

Consider an economy inhabited by overlapping generations of agents whose age is $j = 1, 2, ..., T$. Agents are endowed with one unit of time in each period that can be used for either work or leisure. They face idiosyncratic labor productivity shocks ϵ, and health expense shocks m in each period over the life cycle. An agent's state in each period can be characterized by a vector $s = \{j, a, m, e_h, h, \epsilon, e\}$, where j is age, a is assets, e is the education level, e_h indicates whether employer-provided health insurance is accessible to the agent, and h indicates whether is currently covered by employer-sponsored health insurance. Before the retirement age R ($j \leq R$), agents simultaneously make consumption, labor supply, and health insurance decisions in each period to maximize their expected lifetime utility, and this optimization problem can be formulated recursively as follows:

$(P1)$

$$V(s) = \max_{c,l,h'} u(c,l) + \beta E[V(s')] \tag{1}$$

subject to

$$\frac{a'}{1+r} + c + (1-\kappa_h)m = w(l)e\epsilon l(1-\tau) - ph' + ph'\tau + a + b_1 + b_2 \tag{2}$$

$$l \in \{0, l_h, l_f\},\ c \geq 0, \text{ and } a' \geq 0$$

$$\begin{cases} h' \in \{0,1\} & \text{if} \quad l = l_f \quad \text{and} \quad e_h = 1 \\ h' \in \{0\} & \text{otherwise} \end{cases} \tag{3}$$

Here V is the value function, and $u(c,l)$ is the utility flow in the current period, which is a function of consumption c and labor supply l. Equation (2) is the budget constraint. There are three labor supply choices, i.e. full-time, part-time, and no work. Equation (3) captures the key feature of the model. That is, if the agent chooses to work full-time and the job comes with employer-based health insurance ($e_h = 1$), the agent would be eligible to buy employer-sponsored health insurance for the next period, which cover a κ_h fraction of the total health expenses and requires a premium payment p. Note that the premium payment is exempted from taxation (as shown in the right-hand side of the budget constraint before retirement).[5] Following Rogerson and Wallenius (2013), we adopt the concept of nonlinear wage. The wage rate depends on the labor supply decision, i.e. $w(l) = wl^\theta - c_e$ if employer-sponsored health insurance is offered, and $w(l) = wl^\theta$ if otherwise. Here c_e represents the fraction of the health insurance cost paid by the employer, which is transferred back to the worker via reduced wage rate.

Note that in this economy agents face mortality risks after retirement, and thus may die with positive assets, i.e. accidental bequests. We assume that they are equally redistributed back to

[5]This is an important feature of the US tax policy. For a detailed analysis of this issue, please see Jeske and Kitao (2009), Huang and Huffman (2010).

everyone alive in the economy in each period, which is captured by b_1. The last term in the budget constraint, b_2, is the transfer from the social welfare program which guarantees a minimum consumption floor for agents, and will be discussed in details later.

After retirement ($j > R$),agents live on his own savings and Social Security payments $SS(e)$, which depend on his education level. Agents are also insured by Medicare, which covers a κ_m fraction of the total health expenses. In addition, agents face mortality risk. The conditional survival probability to the next period is denoted by $P(s)$. In each period, the retiree makes the consumption and saving decision to maximize his expected lifetime utility,

$(P2)$

$$V(s) = \max_c u(c, 0) + \beta P(s) E[V(s')] \tag{4}$$

subject to

$$\frac{a'}{1+r} + c + (1 - \kappa_m)m = SS(e) + a + b_1 + b_2 \tag{5}$$

$$c \geq 0, \text{ and } a' \geq 0$$

The health expense shock m is assumed to be governed by a 6-state Markov chain which will be calibrated using the Medical Expenditure Panel Survey (MEPS) dataset. The log of the idiosyncratic labor productivity shock ϵ is determined by the following equation,

$$\ln \epsilon = a_j + y,$$

where a_j is the deterministic age-specific component, and y is the persistent shock that is governed by a 5-state Markov chain. The Markov chain is approximated from the AR(1) process

$$y' = \rho y + u', u' \sim N(0, \sigma_u^2), \tag{6}$$

where ρ is the persistence coefficient.

The distribution of the individuals is denoted by $\Phi(s)$, and it evolves over time according to the equation $\Phi' = R_\Phi(\Phi)$. Here R_Φ is a one-period operator on the distribution, which will be specified in the calibration section.

2.2. The Government

There are three government programs. They are Social Security, Medicare, and the social welfare program. The Social Security program provides annuities to agents after retirement, which are financed by a payroll tax rate τ_s. The Medicare program provides health insurance to agents after retirement by covering a κ_m portion of their health expenses, and it is financed by a payroll tax rate τ_m. The welfare program imposes a proportional tax τ_w on labor income, and guarantees a minimum consumption floor $\underline{c}$ for everyone by conditioning the welfare transfer b_2 on each agent's total available resources. That is,

$$\begin{cases} b_2(s) = \max\{\underline{c} - (w(l(s))\epsilon l(s)(1-\tau) + a + b_1), 0\} & \text{if } j \leq R \\ b_2(s) = \max\{\underline{c} - (SS(e) + a + b_1), 0\} & \text{if } j > R \end{cases}$$

By construction, $\tau \geq \tau_w + \tau_s + \tau_m$.

The budget constraints for each of these three government programs can be written respectively as follows,

$$\int b_2(s)\Phi(s) = \int \tau_r[w(l(s))\epsilon l(s) - ph'(s)]\Phi(s) \tag{7}$$

$$\int SS\Phi(s) = \int \tau_s[w(l(s))\epsilon l(s) - ph'(s)]\Phi(s) \tag{8}$$

$$\int \kappa_m m I_{j\geq R}\Phi(s) = \int \tau_m[w(l(s))\epsilon l(s) - ph'(s)]\Phi(s) \tag{9}$$

2.3. The Production Technology

On the production side, we assume that the production is taken in competitive firms and is governed by the following standard Cobb-Douglas function,

$$Y = K^{\alpha}(AL)^{1-\alpha}. \tag{10}$$

Here α is the capital share, A is the labor-augmented technology, K is capital, and L is labor. Assuming capital depreciates at a rate of δ, the firm chooses K and L by maximizing profits $Y - wL - (r+\delta)K$. The profit-maximizing behaviors of the firm imply,

$$w = (1-\alpha)A(\frac{K}{AL})^{\alpha} \tag{11}$$

$$r = \alpha(\frac{K}{AL})^{\alpha-1} - \delta \tag{12}$$

2.4. Employer-sponsored Health Insurance Market

Employer-provided health insurance is community-rated. That is, its premium is the same for everyone covered. In addition, we assume that it is operated by competitive insurance companies. Note that the total cost of employer-sponsored health insurance is shared between the employer and the employee. Let π represent the fraction of the cost paid by the employee. Then, the price of the insurance paid by the employee, p, can be expressed as follows,

$$p = \pi \kappa_h \frac{\int E(m'(s))h'(s)\Phi(s)}{1+r}. \tag{13}$$

The rest of the cost is paid by the firm with c_e, that is,

$$\int c_e \epsilon l(s) I_e \Phi(s) = (1-\pi)\lambda\kappa_h \frac{E \int P_j m'(s) I_{h'(s)=3}\Phi(s)}{1+r}. \tag{14}$$

Here I_e is the indicator function for whether employment-sponsored health insurance is offered.

2.5. Market Clearing Conditions

The market clearing conditions for the capital and labor markets are respectively as follows,

$$K' = \int a'(s)\Phi(s) \tag{15}$$

$$L = \int l(s)^{\theta} e \epsilon l(s)\Phi(s) \tag{16}$$

2.6. Stationary Equilibrium

A stationary equilibrium is defined as follows,

Definition: A **stationary equilibrium** is given by a collection of value functions $V(s)$, individual policy rules $\{a', l, h'\}$, the distribution of individuals $\Phi(s)$; aggregate factors $\{K, L\}$; prices $\{r, w\}$; Social Security, Medicare, the social safety net; private health insurance contracts defined by pairs of price and coinsurance rate $\{p, \kappa_h, c_e\}$, such that,

1. *Given prices, government programs, and private health insurance contracts, the value function $V(s)$ and individual policy rules $\{a', l, h'\}$ solve the individual's dynamic programming problem (P1) and (P2).*

2. *Given prices, K and L solve the firm's profit maximization problem.*

3. *The capital and labor markets clear, that is, conditions (15-16) are satisfied.*

4. *The government programs, Social Security, Medicare, and the transfer program are self-financing, that is, conditions (7-9) are satisfied.*

5. *The health insurance companies are competitive, and thus the insurance contracts satisfy condition (13-14).*

6. *The distribution $\Phi(s)$, evolves over time according to the equation $\Phi' = R_{\Phi}(\Phi)$, and satisfies the stationary equilibrium condition: $\Phi' = \Phi$.*

7. *The amount of initial assets of the new born cohort is equal to the amount of accidental bequests from the last period.*

We focus on stationary equilibrium analysis in the rest of the paper, and numerical methods are used to solve the model as analytical results are not obtainable. Since agents can only live up to T periods, the dynamic programming problem can be solved by iterating backwards from the last period.

3. Calibration

The benchmark model is calibrated in this section. We calibrate the benchmark model to match the current US economy. The calibration strategy adopted here is the following. The values of some standard parameters are predetermined based on previous studies, and the values of the rest of the parameters are then *simultaneously* chosen to match some key moments in the current US economy.

3.1. Demographics and Preferences

One model period is one year. Individuals are born at age 21 ($j = 1$), retire at age 65 ($R = 45$), and die at age 85 ($T = 65$).

The utility function is assumed to take the following form,

$$u(c, l) = \ln(c) + \zeta \frac{(1-l)^{1-\gamma}}{1-\gamma}.$$

The value of γ is set to 2 in the benchmark so that the implied labor elasticity is 0.5, which is the consensus value for labor elasticity in the literature (see Chetty, 2012). In addition, we also explore a variety of other values for γ as robustness checks. The disutility parameter for labor supply ζ is calibrated to match the employment rate in the data, that is, 74.1%. The discount factor β is set to match a 4% annual interest rate, and the resulting value is $\beta = 0.96$.

3.2. Production

The capital share α in the production function is set to 0.36, and the depreciation rate δ is set to 0.06. Both are commonly-used values in the macro literature. The labor-augmented technology parameter A is calibrated to match the current US GDP per capita.

3.3. Health Expenditure Shock and Employment-sponsored Health Insurance

We use the Medical Expenditure Panel Survey (MEPS) dataset to calibrate the health expenditure process, and the probabilities of being offered employer-sponsored health insurance.[6] The data on total health expenditures is used to calibrate the distribution of health expenditures and 6 states are constructed with the bins of the size $(25\%, 50\%, 75\%, 90\%, 95\%)$ for the health expenditure shock m. To capture the life-cycle profile of health expenditures, we assume that the health expense shock m is age-specific and calibrate the distribution of health expenditures for each 10 or 15 years group. The health expenditure grids are reported in Table 4.

We assume that agents are hit by a permanent shock at the beginning of time, which determines the value of e_h, that is, whether employment-based health insurance is available when the agent chooses to work full-time. Since higher-income jobs are more likely providing employer-sponsored health insurance, we assume that the probability for accessing to employment-sponsored health insurance depends on the agent's education level e, that is, $Prob(e_h = 1|e)$, which are calibrated using the MEPS dataset.

3.4. Labor Supply, Education and Labor Productivity Shock

Since a full-time job requires approximately 2000 hours of work per year and total hours available per year (excluding sleeping time) is about 5000 hours, we set the value of $h_f = 0.4$. The number of working hours for a part-time job is approximately half of that for a full-time job,

[6] Specifically, we use the 2008/2009 MEPS panel.

therefore we set the value of h_p to 0.2. Note that we following the literature and adopt the concept of no-linear wage here. That is, the wage rate is a function of labor supply ($w(l) = wl^{\theta}$). The value of θ controls the relative wage rate of the part-time worker compared to the full-time worker. Thus, we calibrate θ to match the part-time worker share in the data. The resulting value for θ is 0.1.

There are three education levels in the model, i.e. $e \in \{e^1, e^2, e^3\}$, which represent agents with no high school, high school graduates, and college graduates, respectively. The value of e^2 is normalized to one, and the values of e^1 and e^3 are calibrated to match the relative wage rates for individuals with no high school and college graduates in the data. The resulting values are $e^1 = 0.70$ and $e^3 = 1.73$.

The age-specific deterministic component a_j in the labor productivity process is calibrated using the average wage income by age in the MEPS dataset. The random labor productivity component, y, follows a 5-state Markov chain that is approximated from the AR(1) process specified by equation (6). The AR(1) process is governed by two parameters $\{\rho, \sigma_{\mu}^2\}$. Following Alonso-Ortiz and Rogerson (2010), we set the persistence coefficient, ρ, to 0.94 which is also the intermediate value in the range of empirical estimates in the literature. We set the variance, σ_{μ}^2, to 0.205.

3.5. Government

The tax rate on labor income, τ, is set to 40% based on the estimation in Prescott (2004). The tax revenues are used to finance the three government programs, i.e. Social Security, Medicare, and the welfare program.

Social Security in the model is designed to capture the main features of the US Social Security program. The Social Security payroll tax rate is set to 12.4%, according to the SSA (Social Security Administration) data. The Social Security payments are endogenously chosen so that the Social Security program is self-financing.[7]

The Medicare program provides health insurance to every individual aged 65 and above. According to the CMS data, approximately 50% of the elderly's health expenditures are paid by Medicare, thus we set the Medicare coinsurance rate k_m to 0.5.[8] The Medicare payroll tax rate τ_m is endogenously determined by Medicare's self-financing budget constraint.

[7]This simple specification is only for now. The Social Security payment will be assumed to be dependent on the agent's lifetime earnings history, such as in Following Fuster, Imrohoroglu, and Imrohoroglu (2007).

[8]See Attanasio, Kitao, and Violante (2008) for a detailed description of Medicare.

The welfare program is supposed to capture the means-tested programs that are available for the US population, e.g. food stamps, SNAP, SSI, Medicaid. It insures the poor elderly against large negative shocks by guaranteeing a consumption floor. We set the value of the consumption floor $\underline{c}$ to $2663 in the benchmark model based on the estimation by De Nardi, French, and Jones (2010). The corresponding payroll tax rate τ_w for the social safety net is endogenously chosen such that the social safety net is self-financing.

Note that the value of τ is higher than the sum of τ_s, τ_w, and τ_m. That is, the tax revenues are more than enough to finance the three public programs. We assume that the extra tax revenues are thrown away in each period.

3.6. Employer-sponsored Health Insurance

The values of κ_h represent the fraction of health expenditures covered by employer-sponsored health insurance. We set its value to 0.8 in the benchmark calibration because the coinsurance rates of most private health insurance policies in the US fall in the range from $65\% - 85\%$.

The key results of the benchmark calibration are summarized in table 5. This calibration generates an interest rate of 4%. The key statistics of the calibrated economy are summarized in table 6. Figures 1-4 plot the life cycle profiles of consumption, saving, labor supply for an average agent in the benchmark economy.

4. Preliminary Quantitative Results

In this section, we use the calibrated model to assess the quantitative importance of the effects of employer-based health insurance on labor supply. Specifically, we answer the quantitative question: to what extent can different health insurance systems account for the difference in average annual hours worked between the US and Europe?

In specific, we run the following thought experiment. We construct a counterfactual economy (Counterfactual I) by replacing the employment-based health insurance system with a universal government-financed health insurance that looks like the European system. Then, we compare this counterfactual economy to the benchmark economy to identify the effect of different health insurance structures on labor supply, and other variables of interest. The comparison of the key statistics in the two model economies are listed in table 7.

As can be seen, the aggregate labor supply decreases significantly after the employment-based health insurance system is replaced with the universal government-financed health insurance. The average annual hours worked (aggregate labor supply) in the economy with the European system is only 81.5% of that in the benchmark economy with the US system. Since the average annual hours worked in 4 major European countries is on average 75.6% of that in the US, the quantitative result obtained here suggests that approximately 76% of the difference in aggregate labor supply between the US and Europe is due to the different health insurance systems in the two areas.

In addition, the computational experiment also generates changes in employment rate and full-time worker share that are consistent with the differences between the US and Europe in the data. As shown in table 7, the employment rate and the full-time worker share in the economy with the European system are only 62.4% and 84.3% of that in the benchmark economy with the US system, respectively. Both are consistent with the data.

Figures 5-8 compare the key life cycle profiles between the two economies.

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4.1. The Tax Rate Hypothesis

Now we extend our analysis to include the main existing explanation for the difference in average hours worked between the US and Europe, that is, the tax rate hypothesis. This hypothesis says that different tax rates on labor income may be the cause of the different labor supply between the US and Europe (see Prescott, 2004; Rogerson, 2006). In this section, we ask the question: can the model account for the entire difference in average annual hours worked between the US and Europe when different tax rates are also included?

As estimated by Prescott (2004), the US tax rate is approximately 40%, while the average tax rate in Europe is 60%. To include the tax rate mechanism, we construct another counterfactual economy (Counterfactual II) by raising the tax rate on labor income, τ, from 40% to 60%. Then, we compare this counterfactual economy to the benchmark economy to identify the joint effect of different health insurance structures and different tax rates on labor supply, and other variables of interest. The key statistics in this counterfactual economy are also listed in table 7.

As can be seen, the aggregate labor supply decreases further after the tax rate on labor income is raised from 40% to 60%. The average annual hours worked in this counterfactual is only 77.3% of that in the benchmark economy. Since the average annual hours worked in 4 major European countries is on average 75.6% of that in the US, the quantitative result obtained here suggests that different health insurance structures together with different tax rates on labor income can account for almost the entire difference in aggregate labor supply between the US and Europe.

4.2. Difference in Output per person

Our quantitative results also have an interesting implication for the difference in output per capital between the US and Europe. It is well known that the output per person in the US is also significantly higher than in Europe. For instance, the average GDP per capita in 4 major Europeans countries is only approximately 71% of that in the US. This fact has led people wonder whether Americans richer than Europeans simply because they work much more. According to our preliminary results, the answer is no.

Our computational experiment shows that the decrease in aggregate hours worked is mainly from low productive agents who choose to work primarily to secure health insurance in the employment-based health insurance system. This result suggests that the extra hours worked by Americans may not have added much to the aggregate effective labor in the US. For instance, when the employment-based health insurance system is replaced by a universal health insurance system, the aggregate raw labor (aggregate hours worked) decreases by 19%, but the aggregate effective labor only drops by 5% and thus the output per person only drops by 6%. These preliminary quantitative results suggest that though Americans work much more, the effective labor supply in the US may not be significantly higher than in Europe. Therefore, the difference in output per capita between the US and Europe may still be due to other factors, such as technology.

5. Further Discussion

5.1. Labor Elasticity and the Effect of Health Insurance

It is well-known that the quantitative importance of the tax rate hypothesis depends on the value of the labor elasticity assumed in the model. In this section, we explore some other values for γ to check whether our results are also sensitive to the value of labor elasticity. In specific, at each value of γ we recalibrate the model to the same moments as in the benchmark case, and then replicate our main quantitative exercises. The results are reported in table 9.

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6. Conclusion

It is well-known that Americans work much more than Europeans (see Prescott, 2004; Rogerson, 2006). In this paper, we provide a new explanation for the dramatic difference in aggregate labor supply between the US and Europe. We argue that the unique employer-based health insurance system in the US is an important reason why Americans work more than Europeans. In contrast to the Europeans who get universal health insurance from the government, most working-age Americans get health insurance through their employers. Since only full-time workers are possible to be offered employer-sponsored health insurance, working-age Americans have a stronger incentive to work and work *full-time* than Europeans.

In a quantitative dynamic general equilibrium model with endogenous labor supply and uncertain health expenditures, we quantitatively assess to what extent different health insurance systems account for the labor supply difference between the US and Europe. Our preliminary quantitative results suggest that different health insurance systems can account for a significant portion of the difference in average hours worked between the US and Europe. In addition, we find that the extra hours worked by Americans are mainly from low productive workers who work primarily to secure health insurance. Therefore, the aggregate effective labor in the US is not significantly higher, even though Americans work much more than Europeans. This result suggests that the higher output per person in the US is not due to that Americans work more hours. Instead, the difference in output per person between the US and Europe may still be driven by different TFP levels.

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7. Appendix

7.1. A Simple Decomposition Calculation

To further understand the causes of the difference in average annual hours worked between the US and Europe, we conduct the following simple decomposition calculation. By definition, the average hours worked per person can be calculated as follows,

$$h = e[s_f h_f + (1 - s_f) h_p],$$

where h_f and h_f are the average hours worked per full-time worker and part-time worker, respectively. e is the employment rate and s_f is the share of the workers that are working full-time. This equation shows that the difference in average hours worked comes from two sources: (1) the difference in employment rate and full-time worker share, and (2) the difference in average hours worked per full-time and part-time worker. To assess the contribution from the first source, we construct a counterfactual measure $\widehat{h}$ for each country by plugging in the country-specific employment rates and full-time worker shares but the same h_f and h_p.[9] The results are reported in Table 9. As can be seen, using this counterfactual measure, the differences in annual hours worked between the US and Europe are very similar with that in the data. In specific, the annual hours worked in 4 major European countries is on average 0.83 of that in the US. It suggests that over two thirds of the aggregate labor supply difference between the US and these European countries are due to the differences in employment rate and full-time worker share.

[9] Here we assume that average hours worked per full-time worker is 2000 hours, and the number is 1000 hours for a part-time worker. These numbers are approximately consistent with the averages of all countries in the data.

Table 1: Aggregate Labor Supply: US vs. Europe

	Annual Hours Worked per person (age 15-64)	Compared to the US (US=1)
US	1360	1
France	940	0.69
Germany	965	0.71
Italy	980	0.72
UK	1227	0.90
Average (Major 4)	1028	0.76
Austria	1258	0.92
Belgium	941	0.69
Ireland	1119	0.82
Netherlands	1035	0.76
Spain	994	0.73
Switzerland	1323	0.97
Portugal	1223	0.90
Greece	1191	0.88
Norway	1133	0.83
Sweden	1220	0.90
Finland	1182	0.87
Denmark	1208	0.89
Averge (exclude Scan.)	1100	0.81
Average (all)	1121	0.82

Data source: OECD Labor Market Data (2000).

Table 2: Full-time Workers: US vs. Europe

	Employment Rate	FT Worker (% of All Workers)	FT Employment Rate	FT Employment Rate (relative to the US)	Annual Hours Worked (relative to the US)
US	74.1%	88.1%	65.31%	1	1
France	61.7%	85.9%	53.0%	0.81	0.69
Germany	65.6%	82.8%	54.3%	0.83	0.71
Italy	53.9%	87.9	47.4%	0.73	0.72
UK	72.2%	77.8%	56.2%	0.86	0.90
Average(Major 4)	63.4%	83.6%	53.0%	0.81	0.76
Austria	68.3%	87.8%	60.0%	0.92	0.92
Belgium	60.9%	81.0%	49.3%	0.76	0.69
Ireland	65.1%	81.9%	53.3%	0.82	0.82
Netherlands	72.1%	67.9%	48.9%	0.75	0.76
Spain	57.4%	92.3%	53.0%	0.81	0.73
Switzerland	78.4%	75.6%	59.3%	0.91	0.97
Portugal	68.3%	90.6%	61.9%	0.95	0.90
Greece	55.9%	94.6%	52.9%	0.81	0.88
Norway	77.9%	79.8%	62.2%	0.95	0.83
Sweden	74.3%	86.0%	63.9%	0.98	0.90
Finland	67.5%	89.6%	60.5%	0.93	0.87
Denmark	76.4%	83.9%	64.1%	0.98	0.89
Average(exclude Scan.)					
Average(all)					

Data source: OECD Labor Market Data (2000).

Table 3: Health Expenditure Grids

Health exp. shock	1	2	3	4	5	6
Age 21-35	0	143	775	2696	6755	17862
Age 36-45	5	298	1223	4202	9644	29249
Age 46-55	46	684	2338	6139	12596	33930
Age 56-65	204	1491	3890	9625	20769	58932
Age 66-75	509	2373	5290	11997	21542	50068
Age 76-80	750	2967	7023	16182	30115	53549

Data Source: MEPS.

Table 4: The Benchmark Calibration

Parameter	Value	Source
α	0.36	Macro literature
δ	0.06	Macro literature
γ	2	Chetty(2012)
A	30000	US GDP per capita: $36467
τ	40%	Prescott(2004)
τ_s	12.4%	US Social Security tax rate
κ_m	0.5	Attanasio et al.(2008)
κ_h	0.8	
β	0.96	Annual interest rate: 4.0%
π	0.15	Sommers(2002)
ζ	1.15	Employment rate: 74.1%
θ	0.1	Part-time worker share: 11.9%
ρ	0.94	Alonso-Ortiz and Rogerson (2010)
σ_μ^2	0.205	Alonso-Ortiz and Rogerson (2010)

Table 5: Key Statistics of the Benchmark Economy

Statistics	Model	Data
Output per person	$38396	$36467
Interest rate	4.3%	4.0%
Aggregate hours worked	0.282 (1410 hours)	1360 hours
Aggregate effective labor	0.629	..
Employment rate	74.3%	74.1%
Full-time worker share	90.0%	88.1%
Employment-sponsored HI	55.0%	59.4%
(% of working-age popu.)		
Take-up rate	87.7%	90.7%

Table 6: The Main Quantitative Results

	Employment Rate	Full-time Worker Share	Average Hours Worked (relative to Benchmark (US))
Benchmark (US HI, $\tau = 40\%$)	74.3%	90.0%	1
Counterfactual I (European HI, $\tau = 40\%$)	62.4%	84.3%	81.5%
Data (4 major European countries)	63.4%	83.6%	75.6%

Table 7: Output per person and Average Hours Worked

	Average Hours Worked (relative to US)	Output per person (relative to US)	Effective labor (relative to US)
Benchmark (US HI)	0.282	$38396	0.629
Counterfactual (European HI)	0.230 (81.5%)	$35989 (93.7%)	0.601 (95.5%)

Table 8: Labor Elasticity and the Average Hours Worked

$\gamma =$	1 (log utility)	2 (benchmark)	4	10
Labor elasticity	1	0.5	0.25	0.1
Benchmark (US HI)	1	1	1	1
Counterfactual (European HI)	81.0%	81.5%	82.2%	83.6%

Table 9: Aggregate Labor Supply: Decomposition

	Actual Annual Hours Worked: h (relative to the US)	Constructed annual hours worked: $\widehat{h}$ (relative to the US)
US	1	1
France	0.69	0.82
Germany	0.71	0.86
Italy	0.72	0.73
UK	0.90	0.92
Average (Major 4)	0.76	0.83
Other European Countries ..		

Data source: OECD Labor Market Data (2000).

Figure 1: Life Cycle Profile in the Benchmark Economy: Consumption

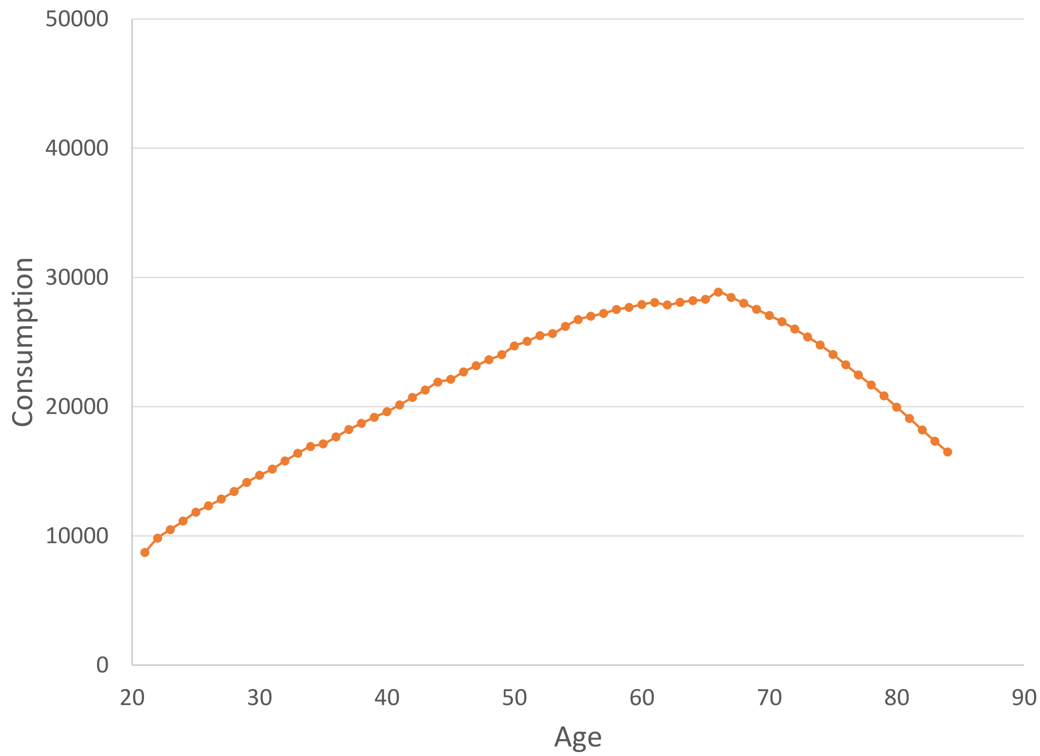

Figure 2: Life Cycle Profile in the Benchmark Economy: Saving

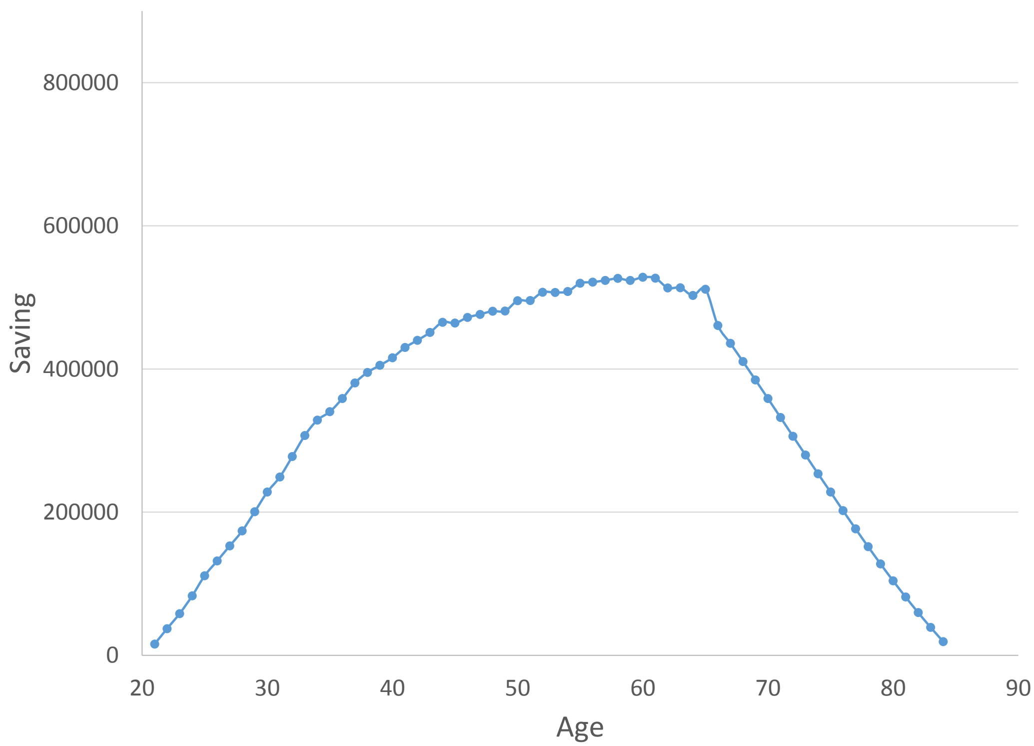

Figure 3: Life Cycle Profile in the Benchmark Economy: Employment Rate

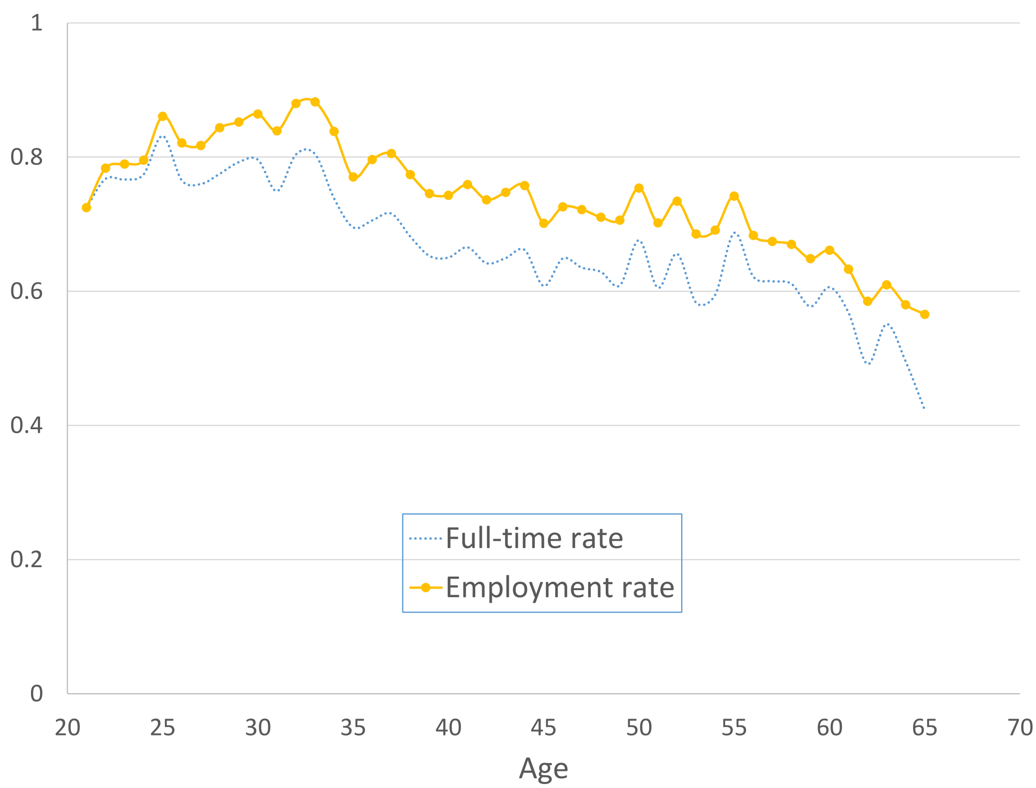

Figure 4: Life Cycle Profile in the Benchmark Economy: Labor Supply (hours worked)

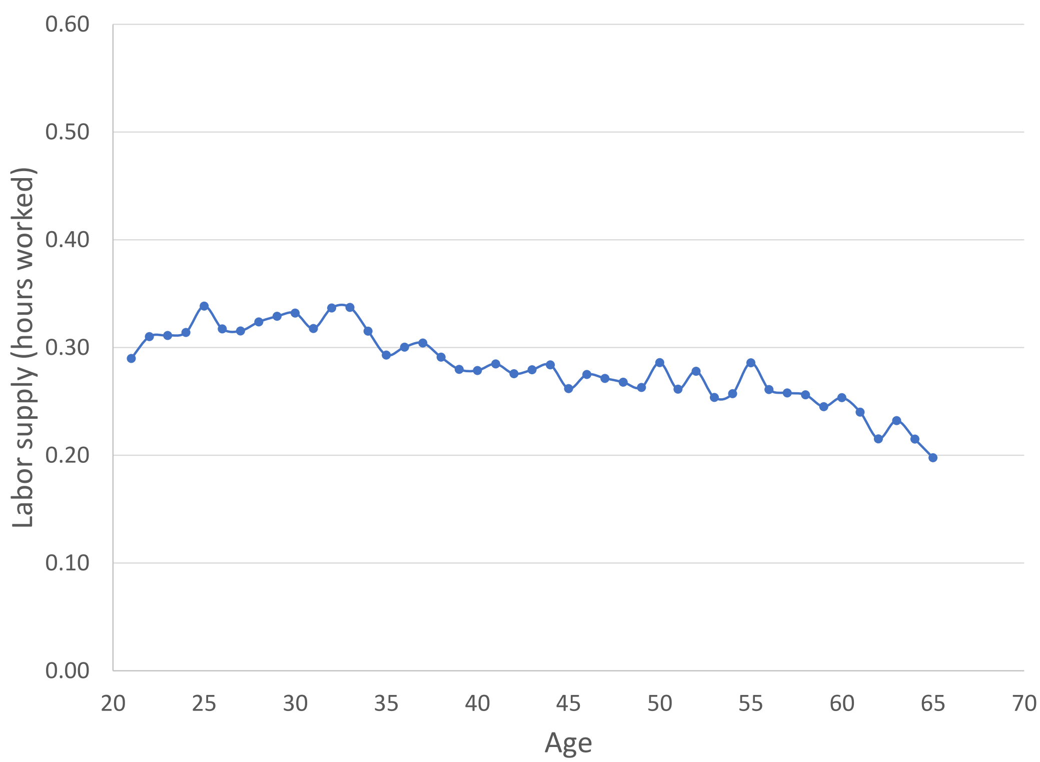

Figure 5: Benchmark vs Counterfactual (US vs EUR): Consumption

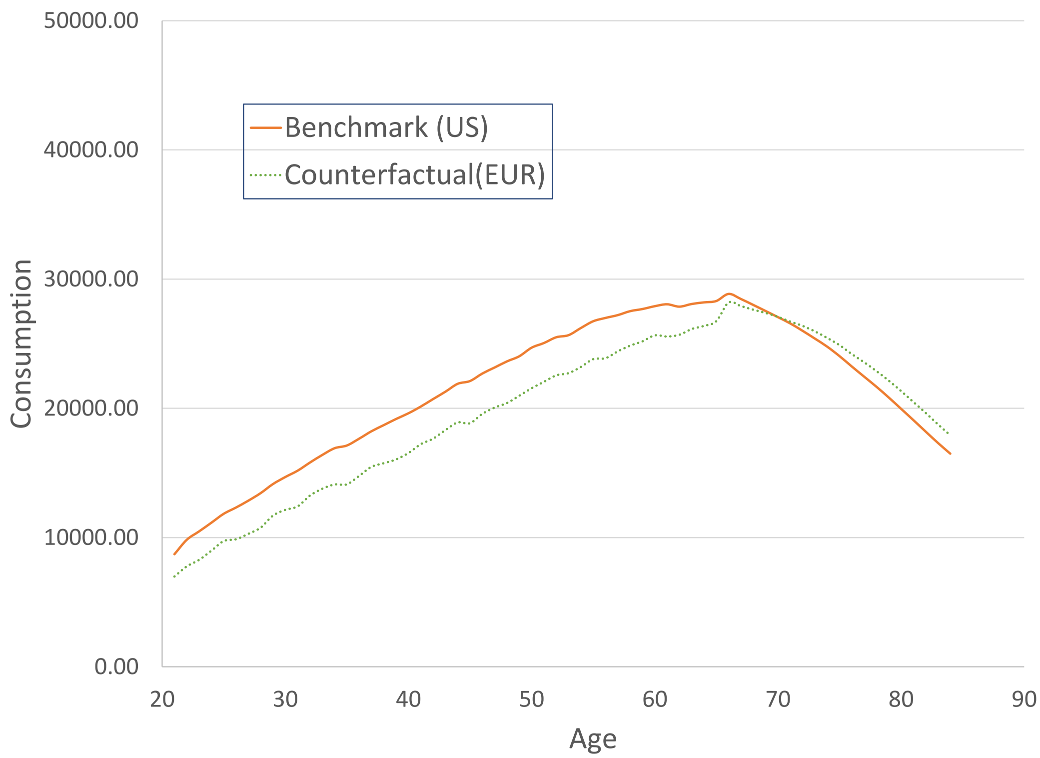

Figure 6: Benchmark vs Counterfactual (US vs EUR): Saving

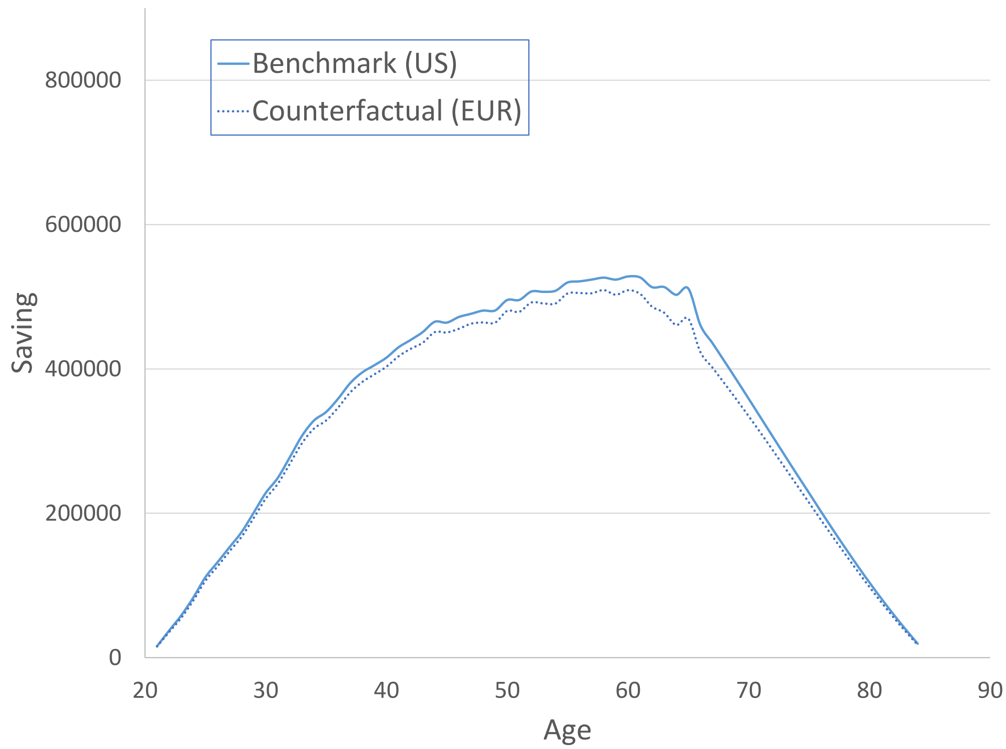

Figure 7: Benchmark vs Counterfactual (US vs EUR): Employment Rate

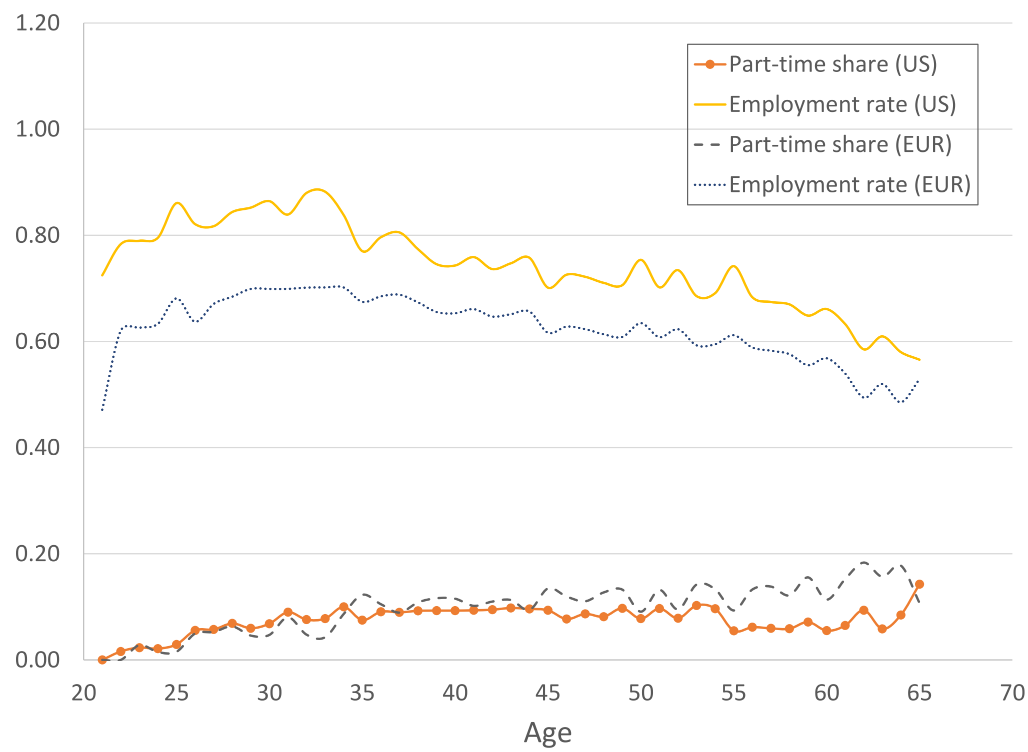

Figure 8: Benchmark vs Counterfactual (US vs EUR): Labor Supply (hours worked)