Employer-Based Health Insurance, Uncertain Medical Expenses, and Aggregate Labor Supply

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Abstract

Using a general equilibrium life cycle model with idiosyncratic risks in income and medical expenses and endogenous labor supply, we argue that employment-based health insurance and uncertain medical expenses are important reasons why Americans work much more than Europeans. In contrast to Europeans who get universal health insurance from the government, most working-age Americans get health insurance through their employers. Since medical care expenses are large and extremely volatile, and there is no good alternative health insurance available in the market, employer-sponsored health insurance can be extremely valuable to risk-averse individuals (much more than its actuarially fair cost), thus providing them extra incentive to work. Our quantitative results suggest that different health insurance systems and uncertain medical expenses can account for over a half of the difference in aggregate hours worked between the US and Europe. Furthermore, our model also matches some key life-cycle patterns of hours worked, that is, the difference in hours worked between the US and Europe is larger for individuals at the beginning of career and those near retirement. When our model is extended to include the main existing explanation, the taxation hypothesis, the extended model can account for a major portion of the difference in aggregate labor supply between the US and Europe.

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] In this paper, we contribute to the literature by proposing a new explanation for the difference in aggregate hours worked between the US and Europe.

We argue that the unique employer-based health insurance system in the US and uncertain medical expenses are important reasons why Americans work much 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 medical care expenses are large and extremely volatile, and there is no good alternative health insurance available in the market, employer-sponsored health insurance (hereafter ESHI) can be extremely valuable to risk-averse agents (much more than its actuarially fair cost). In addition, the value of ESHI is amplified by a unique feature of the US tax policy, that is, its cost is exempted from taxation. Since only *full-time* workers are possible to be offered ESHI, working-age Americans have a stronger incentive to work and work full-time than Europeans.

An important motivating fact for our hypothesis is that there are much more full-time workers in the US than in Europe. Using data from the OECD Labor Market Database, we document 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 employ-

[1] Here the major economies include France, Germany, UK, and Italy, which are the four largest economies in Europe. As shown in Table 11, the fact remains true when the comparison is extended to include other developed European countries.

[2] For example, Prescott (2004), Rogerson (2006, 2007), Ohanian, Rafo, and Rogerson (2008), Rogerson and Wallenius (2009), Erosa, Fuster, and Kambrourov (2012).

ment rate in the US is much higher than in these European countries, that is, 65% versus 53%.[3] In addition, a simple decomposition calculation suggests 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.[4]

To formalize the mechanisms described previously, we develop a general equilibrium life cycle model with idiosyncratic risks in income and medical expenses and endogenous labor supply.[5] We use a calibrated version of the model to assess to what extent different health insurance systems and uncertain medical expenses can account for the difference in aggregate labor supply 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 Public health insurance 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. We find that when the employment-based health insurance system is replaced by a universal health insurance system, the aggregate hours worked in the model decrease by 14%, which suggests that different health insurance systems can account for over a half of the difference in aggregate labor supply between the US and the 4 major European countries. 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.

Furthermore, our model can also match some important life-cycle patterns with regard to the hours worked in the US and Europe. That is, the difference in hours worked is much larger for individuals at the beginning of career and those near retirement. As shown in Table 3, for individuals in age 20-24 and those in age 55-64, the hours worked in Europe are only 57% and 66% of those in the US respectively, while the ratio is 90% for individu-

[3]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. As shown in Table 12, the fact remains true when the comparison is extended to include other developed European countries.

[4]The details of the decomposition calculation can be found in the appendix.

[5]In terms of modelling, this paper is closely related to a number of recent papers that study an extended incomplete markets model with uncertain medical 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).

als in age group 25-54. Our quantitative results show that different health insurance systems and uncertain medical expenses can also generate these life-cycle patterns of hours worked. The intuition behind this result is the following. On the one hand, individuals at the beginning of their careers do not have time to accumulate enough precautionary saving so they are particularly vulnerable to uncertain medical expense. On the other hand, medical expenses increase rapidly as individuals are approaching retirement, but they do not get the government-financed Public health insurance until the retirement age 65. Aa a result, the labor supply decisions of individuals in early stage of life and near retirement are more affected by employment-based health insurance.

We also extend our analysis to include the taxation hypothesis, the main existing explanation for the different aggregate labor supply between the US and Europe. As is well known in the literature, the average tax rate on labor income in Europe is approximately 20% higher than that in the US. The higher labor income tax rate lowers the after-tax wage rate and thus discourages work. In a computational experiment, we introduce both the European health insurance system and the European income tax rate into the benchmark economy, and find that the aggregate hours worked in the model decreases by 21%. This result suggests that the health insurance hypothesis together with the existing taxation explanation can account for a major portion of the difference in aggregate hours worked between the US and Europe.

Recently, there has been a growing literature that uses quantitative macroeconomic models to account for the different aggregate hours worked in the US and Europe. Several explanations have been proposed. The most well-known explanation says that different tax rates on labor income can explain the difference in aggregate hours worked between the US and Europe (see Prescott (2004), and Rogerson (2006, 2007) for a detailed description of this hypothesis). However, this explanation has often been criticized for making strict assumptions about labor supply elasticity and how tax revenues are spent. Another important explanation is from Erosa, Fuster and Kambourov (2012), who study the effects of governmental programs on labor supply. They find that the difference in public pension and disability insurance programs is important for understanding the cross-country difference in aggregate hours worked, but their model does not include health insurance programs. Our paper complements to the study by Erosa, Fuster and Kambourov (2012) by studying the role of health insurance for understanding aggregate labor supply. We argue that health insurance may be quantitatively important because aggregate health expenditure has recently risen dramatically in developed countries, and the US health insurance system is unique compared to its European counterparts.[6] In addition, there exists extensive empirical evidence suggesting that health insurance plays an important role in working-age households' labor supply decisions.[7]

The rest of the paper is organized as follows. In section 2, we summarize existing empirical evidence on the labor supply effect of health insurance. We specify the model in section 3 and calibrate it in section 4. We present the results of the main quantitative exercise in section 5 and provide further discussion on related issues in section 6. We conclude in section 7.

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 medical 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-sponsored health insurance is provided, and h indicates whether is currently covered by ESHI. Before the retirement age R ($j \leq R$),

[6]According to OECD health dataset (2014), aggregate health expenditure currently accounts for approximately 10-20% of GDP in these countries.

[7]For instance, 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. 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.

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

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

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

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

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 ESHI for the next period, which cover a κ_h fraction of the total medical 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).[8]

We assume that the wage rate is simply $\widetilde{w} = w - c_e$ if ESHI is purchased, and $\widetilde{w} = w$ 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.[9]

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 all working-age agents alive in the next period, which is captured by b. The last term in the budget constraint, tr, is the transfer from the social welfare program which guarantees a minimum consumption floor for agents, and will be discussed in details later.

[8]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).

[9]The assumption that the part-time worker faces a discounted wage rate is in fact consistent with the concept of nonlinear wage in the literature (see Rogerson and Wallenius (2013) for example).

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 Public health insurance, which covers a κ_m fraction of the total medical 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

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

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

The medical 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, Public health insurance, 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 Public health insurance program provides health insurance to agents after retirement by covering a κ_m portion of their medical 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 tr on each agent's total available resources. That is,

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

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,

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

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

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

2.3. The Production Technology

On the production side, the economy consists of two sectors: the consumption goods sector and the health care sector. The production in the two sectors is governed by the same (Cobb-Douglas) production function but with sector-specific total productivity factor (TFP). Assuming that the production is taken in competitive firms and factors can move freely between the two sectors, it is easy to obtain that the model can be aggregated into an one-sector economy, and that the relative price of health care is inversely related to the relative TFPs in the two sectors.[10] For simplicity, we assume that the TFPs in both sectors are the same so that the relative price of health care is equal to one. Let the aggregate

[10]Specifically, the relative price of health care q is equal to $\frac{A_c}{A_m}$, where A_c and A_m are the sector-specific TFPs.

production function take the following form,

$$Y = AK^{\alpha}L^{1-\alpha}.$$

Here α is the capital share, A is the TFP, 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,

$$w = (1-\alpha)A(\frac{K}{L})^{\alpha}$$

$$r = \alpha A(\frac{K}{L})^{\alpha-1} - \delta$$

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 ESHI 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,

$$p = \pi\kappa_h \frac{\int E(m'(s))h'(s)\Phi(s)}{1+r}. \tag{10}$$

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

$$\int c_e e\epsilon l(s) I_e \Phi(s) = (1-\pi)\lambda\kappa_h \frac{E\int P_j m'(s) I_{h'(s)=1}\Phi(s)}{1+r}. \tag{11}$$

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,

$$K' = \int a'(s)\Phi(s) \tag{12}$$

$$L = \int l(s) e \epsilon l(s) \Phi(s) \tag{13}$$

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, Public health insurance, 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, Public health insurance, 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).[11]. 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 an annual interest rate of 4%, and the resulting value is $\beta = 0.975$.

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. Medical Expense 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 employment-sponsored health

[11]In addition, we explore a variety of other values for γ as robustness checks in appendix

insurance. The data on total medical expenses is used to calibrate the distribution of medical expenses and 6 states are constructed with the bins of the size $(25\%, 50\%, 75\%, 90\%, 95\%)$ for the medical expense shock m. To capture the life-cycle profile of medical expenses, we assume that the medical expense shock m is age-specific and calibrate the distribution of medical expenses for each 10 or 15 years group. The medical expense grids are reported in Table 4.

The value of e_h determines whether employment-based health insurance is available when the agent chooses to work full-time. We assume that this variable follows a two-state Markov chain. Since higher-income jobs are more likely providing ESHI, we assume that the transition matrix for e_h is specific to each education level. The transition matrices 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 $l_f = 0.4$. The number of working hours for a part-time job is approximately half of that for a full-time job, therefore we set the value of l_p to 0.2. Note that full-time and part-time workers face a same wage rate except that the full-time workers may access to ESHI.

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 3-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, public health insurance, 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. Following Fuster, Imrohoroglu, and Imrohoroglu (2007), the Social Security payment is a non-linear function of the agent's lifetime earnings history. Specifically, we choose the values of $SS(\cdot)$ so that the Social Security marginal replacement rates are consistent with the estimates in Fuster et al. (2007). In addition, we rescale every beneficiary's payments so that the Social Security program is self-financing.

The public health insurance program provides health insurance to every individual after age 65 by covering a κ_m fraction of their medical expenses. Here we assume that the public health insurance and ESHI provide the same coinsurance rate, i.e., $\kappa_m = \kappa_h$. The payroll tax rate τ_m for public health insurance is endogenously determined by the program's self-financing budget constraint.

The welfare program is supposed to capture the means-tested programs that are available for the US population, e.g. food stamps, SNAP, and SSI. 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 welfare program 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 medical expenses covered by ESHI. 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 $65\% - 85\%$.

3.7. Baseline Economy

The key results of the benchmark calibration are summarized in table 5. Our model succeeds in matching several aspects of the macroeconomy, including consumption, hours worked over the life cycle and and the patterns of health insurance coverage. Table 6 summarizes the key statistics of the benchmark model. Aggregate hours worked are 0.29 (approximately 1445) and the employment rate is 76.1%, both are consistent with the data. In addition, the share of full-time workers in the model is also consistent with the data (90.0% vs. 88%). This result gives us additional confidence on the model as the full-time share is not used in our calibration exercise. On the health insurance side, there are 58.9% of working-age population that are covered by employment-based health insurance, and the take-up rate is 97.0%. Both are consistent with what we observe in the data.

Figures 1 and 2 present consumption and saving profiles in the baseline economy. Both profiles reproduce the empirically observed hump shaped and track each other (see Gourinchas and Parker(2002)). The model also generates life-cycle profiles for employment rate and hours worked that are consistent with empirical observations. Based on Figure 3 and 4, both labor force participation and hours worked increase as agents move into their 20s. They peaked in their early 30s and remain there until their 50s. Both decline as the mandatory retirement age approaches.

4. Quantitative Results

In this section, we use the calibrated model to assess the quantitative importance of the effect of different health insurance systems on aggregate labor supply. We answer the following quantitative question: to what extent can different health insurance systems account for the difference in aggregate hours worked between the US and the 4 major European countries?

4.1. Employment-based Health Insurance v.s. Universal Health Insurance

Specifically, we run the following thought experiment. We construct a counterfactual economy (experiment I) by replacing the employment-based health insurance system in the benchmark model with a universal government-financed health insurance that mimics the European system. Then, we compare this counterfactual economy to the benchmark economy to identify the effects of different health insurance systems on labor supply, and other variables of interest. The comparison of the key statistics in the two model economies are listed in table 7. Figures 5-8 plot the key life cycle profiles in the benchmark economy and the counterfactual economy.

As can be seen, the aggregate labor supply decreases substantially 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 86% of that in the benchmark economy with the US system. Since the data shows that the average annual hours worked in 4 major European countries is on average 76% of that in the US, the quantitative result obtained here suggests that over a half of the difference in aggregate labor supply between the US and the 4 major European countries is due to the different health insurance systems.

The intuition for the labor supply effect of employment-sponsored health insurance is as follows. Since medical care expenses are large and extremely volatile, and there is no good alternative health insurance available for working-age Americans, ESHI can be extremely valuable to risk-averse individuals (much more than its actuarially fair cost). As a result, the employment-based health insurance system provides working-age Americans extra incentive to work. On the other hand, the European system offers universal health insurance coverage to working age population, and thus it does not provide this type of work incentive.

4.2. Hours Worked By Age

It is noteworthy that there are interesting life-cycle patterns with regard to the hours worked in the US and Europe. That is, the difference in hours worked is much larger for individuals at the beginning of career and those near retirement. As shown in Table 3, for individuals in age 20-24 and those in age 55-64, the hours worked in the 4 major European countries are only 57% and 66% of those in the US respectively, while the ratio is 90% for individuals in age group 25-54.

We argue that it is important that the potential explanations of the difference in aggregate labor supply between the US and Europe are also consistent with these life-cycle patterns. Table 8 decomposes the hours worked into different age groups in both the benchmark economy and the counterfactual economy. As can be seen, the effect of different health insurance systems on labor supply is unequal across the age distribution. As the employment-based health insurance system is replaced with the universal government-financed health insurance, the average hours worked by agents in age 20-24 and in age 55-64 decrease by 16% and 18% respectively, while the hours worked by agents in age 25-54 only decrease by 12%. As a result, the model results are qualitatively consistent with the life-cycle patterns of hours worked documented in the data. The intuition behind this result is simple. On the one hand, agents in early stage of life do not have time to accumulate enough precautionary saving so they are particularly vulnerable to uncertain medical expense. On the other hand, medical expenses increase rapidly as agents are approaching retirement, but they do not get the government-financed Public health insurance until the retirement age 65. Aa a result, the labor supply of agents near retirement are also affected more by health insurance.

4.3. Difference in Aggregate Effective Labor

It is noteworthy that our quantitative results have an interesting implication for the difference in aggregate effective labor 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 quantitative results, it is not the case.

We find 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. As shown in table 7, when the employment-based health insurance system is replaced by a universal health insurance system, the aggregate raw labor (aggregate hours worked) decreases by 14%, but the aggregate effective labor only drops by 3% and thus the output per person also drops by 3%. These quantitative results suggest that though Americans work much more, the difference in effective labor supply between the US and Europe may be much smaller. Therefore, the difference in output per capita between the US and Europe may be also due to other factors, such as technology.

5. Further Discussion

5.1. Intermediate Economies

In order to better understand the different labor supply results in the two economies, the benchmark as opposed to the counterfactual with the European system, we analyze several intermediate economies. The results are presented in the following.

In the first intermediate economy, we remove the linkage between the job status and the availability of employer-sponsored health insurance, but remain the rest of the economy the same as in the benchmark. That is, regardless of their labor supply choices, individuals are allowed to purchase ESHI as long as $e_h = 1$. The key statistics of the intermediate economy are presented in table 7. As can be seen, the aggregate labor supply decreases substantially after the linkage between employment-based health insurance and labor supply choices is removed. The average annual hours worked (aggregate labor supply) in this intermediate case is only 92% of that in the benchmark economy. This result highlights the key mechanism of the paper. That is, many individuals in the US economy work full-time primarily to secure health insurance. When the availability of health insurance is not tied to the job status, many of them stop working full-time.[12]

It is noteworthy that the cost of employment-sponsored health insurance is exempted from taxation in the US. What impact does this unique feature of the US tax policy have on labor supply? To address this question, we consider the second intermediate case in which we remove the tax exemption policy for ESHI and keep the rest of the economy the same as

[12]Note that individuals in the benchmark economy face more risks than in the counterfactual economy. For instance, approximately over one third of working-age population are without health insurance in the benchmark economy, and thus they face extra medical expense risk. In addition, the availability of health insurance e_h is a random variable, which also means extra risk to individuals in the benchmark. To shed some lights on the importance of these extra risks facing individuals in the benchmark, we also consider another counterfactual economy in which the value of e_h is assumed to be determined at the beginning of life and remain constant over the life cycle, and the rest of the economy is the same as in the first intermediate case. We find that the results do not significantly change, which suggests that the extra risks from the random variable e_h is not important for understanding labor supply.

in the benchmark. The key statistics of the second intermediate economy are also reported in table 7. As can be seen, the aggregate labor supply decreases substantially after the tax exemption policy is removed. The average annual hours worked (aggregate labor supply) in this intermediate case is only 91% of that in the benchmark economy. The removal of the tax exemption policy discourages labor supply because it reduces the attractiveness of ESHI. Note that there are two channels through which the tax exemption policy affects the value of ESHI. First, the tax exemption policy provides tax benefits to individuals with ESHI and thus implicitly increases the value of ESHI. Second, the tax exemption policy helps overcome the adverse selection problem in the group insurance market and thus increases the attractiveness of the insurance policy.[13] As can be seen, the adverse selection problem is very limited in the benchmark economy mainly due to the tax exemption policy. The take up rate for ESHI is near 100% (i.e. 97%) in the benchmark, but it drops to 72% when the tax exemption policy is removed. As a result, the health insurance premium increases from $3181 to $4410, and the share of working-age population holding ESHI drops from 59% to 37%.

5.2. The Taxation Hypothesis

In this section, we extend our analysis to include the main existing explanation for the difference in aggregate labor supply between the US and Europe, that is, the taxation hypothesis. This hypothesis says that different tax rates on labor income can account for the difference in hours worked between the US and Europe (see Prescott, 2004; Rogerson, 2006). The tax rate on labor income discourages work because it reduces the after-tax wage rate. In the rest of the section, we ask the following quantitative question: can the model account for the entire difference in aggregate hours worked between the US and the 4 major European countries 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 taxation mechanism, we construct another counterfactual economy (experiment II) by changing both the health insurance system and the labor income tax rate. That is, we replace the employment-based health insurance system with a universal government-financed health insurance, and raise the tax rate on labor in-

[13]Note that ESHI is group-rated, and thus it may suffer from adverse selection.

come, τ, from 40% to 60%.[14] We compare this counterfactual economy to the benchmark economy to identify the joint effect of different health insurance systems and different tax rates on labor supply, and other variables of interest. The key statistics in this counterfactual economy are reported in table 9.

As can be seen, the aggregate labor supply decreases further after the taxation mechanism is incorporated. The average annual hours worked in this counterfactual is only 79% of that in the benchmark economy. Since the average annual hours worked in 4 major European countries is on average 76% of that in the US, the quantitative result obtained here suggests that different health insurance systems together with the taxation hypothesis can account for a major portion of the difference in aggregate labor supply between the US and the 4 major European countries.

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 substantial difference in aggregate labor supply between the US and Europe. We argue that the unique employer-based health insurance system in the US together with uncertain medical expenses are important reasons 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 medical expenses, we quantitatively assess to what extent different health insurance systems account for the labor supply difference between the US and Europe. Our quantitative results suggest that different health insurance systems can account for over a half of the difference in average hours worked between the US and Europe. When the different tax rates on labor income are alo included, the model accounts for a major

[14] Following the tradition in the literature (e.g., Prescott (2004), we equally redistribute the tax revenues resulted from the increase in tax rate back to the working-age population.

portion of the difference in aggregate labor. Furthermore, our model can also match some interesting life-patterns of hours worked. That is, the difference in hours worked is much larger for individuals at the beginning of career and those near retirement.

Lastly, we find that the extra hours worked by Americans are mainly from low productive workers who work primarily to secure health insurance. Therefore, the difference in aggregate effective labor between the US and Europe may be much smaller. This result suggests that the higher output per capita in the US may not be mainly due to that Americans work more hours. Instead, the different per capita outputs may still be driven by other factors such as different productivity levels.

References

ALONSO-ORTIZ, J., AND R. ROGERSON (2010): "Taxes, transfers and employment in an incomplete markets model," *Journal of Monetary Economics*, 57, 949–958.

ATTANASIO, O., S. KITAO, AND G. L. VIOLANTE (2008): "Financing Medicare: A General Equilibrium Analysis," in Demography and Economics, edited by J. Shoven, NBER.

BLAU, D. M., AND D. GILLESKIE (2006): "Health Insurance and Retirement of Married Couples," *Journal of Applied Econometrics*, 21, 935–953.

——— (2008): "The Role of Retiree Health Insurance in the Employment Behavior of Older Men," *International Economic Review*, 49(2), 475–514.

BUCHMUELLER, T. C., AND R. G.VALLETTA (1999): "The Effect of Health Insurance on Married Female Labor Supply," *Journal of Human Resources*, 34(1), 42–70.

CHETTY, R. (2012): "Bounds on Elasticities with Optimization Frictions: A Synthesis of Micro and Macro Evidence on Labor Supply," *Econometrica*, 80(3), 969–1018.

DE NARDI, M., E. FRENCH, AND J. B. JONES (2010): "Why do the Elderly Save? The Role of Medical Expenses," *Journal of Political Economy*, 118 (1), 37–75.

EROSA, A., L. FUSTER, AND G. KAMBOUROV (2012): "Labor Supply and Government Programs: A Cross-Country Analysis," *Journal of Monetary Economics*, 59(1), 84–107.

FRENCH, E., AND J. B. JONES (2011): "The Effects of Health Insurance and Self-Insurance on Retirement Behavior," *Econometrica*, 79(3), 693–732.

FUSTER, L., A. IMROHOROGLU, AND S. IMROHOROGLU (2007): "Elimination of Social Security in a Dynastic Framework," *Review of Economic Studies*, 74(1), 113–145.

GARTHWAITE, C., T. GROSS, AND M. NOTOWIDIGDO (2014): "Public Health Insurance, Labor Supply, and Employment Lock," *Quarterly Journal of Economics*, forthcoming.

GOURINCHAS, P.-O., AND J. A. PARKER (2002): "Consumption over the Life Cycle," *Econometrica*, 70(1), 47–89.

GRUBER, J., AND B. C. MADRIAN (2002): "Health Insurance, Labor Supply, and Job Mobility: A Critical Review of the Literature," *NBER WP 8817*.

HANSEN, G. D., M. HSU, AND J. LEE (2012): "Health Insurance Reform: The impact of a Medicare Buy-In," unpublished manuscript.

JESKE, K., AND S. KITAO (2009): "U.S. tax policy and health insurance demand: Can a regressive policy improve welfare?," *Journal of Monetary Economics*, 56(2).

KOPECKY, K. A., AND T. KORESHKOVA (2011): "The Impact of Medical and Nursing Home Expenses on Savings," unpublished manucript, University of Western Ontario.

OHANIAN, L., A. RAFFO, AND R. ROGERSON (2008): "Long-Term Changes in Labor Supply and Taxes: Evidence from OECD Countries," *Journal of Monetary Economics*, 55(8), 1353–1362.

OLSON, C. A. (1998): "A Comparison of Parametric and Semiparametric Estimates of the Effect of Spousal Health Insurance Coverage on Weekly Hours Worked by Wives," *Journal of Applied Econometrics*, 13(5), 543–565.

PASHCHENKO, S., AND P. PORAPAKKARM (2013): "Quantitative Analysis of Health Insurance Reform: Separating Regulation from Redistribution," *Review of Economic Dynamics*, 16(3), 383–404.

PRESCOTT, E. C. (2004): "Why Do Americans Work So Much More Than Europeans?," *Federal Reserve Bank of Minneapolis Quarterly Review*, 28(1).

ROGERSON, R. (2006): "Understanding Differences in Hours Worked," *Review of Economic Dynamics*, 9, 365–409.

——— (2007): "Taxation and Market Work: Is Scandinavia an Outlier?," *Economic Theory*, 32(1), 59–85.

ROGERSON, R., AND J. WALLENIUS (2009): "Micro and Macro Elasticities in a Life Cycle Model with Taxes," *Journal of Economic Theory*, 144(6), 2277–2292.

RUST, J., AND C. PHELAN (1997): "How Social Security and Medicare Affect Retirement Behavior in a World of Incomplete Markets," *Econometrica*, 65(4), 781–831.

SCHONE, B. S., AND J. P. VISTNES (2000): "The Relationship Between Health Insurance and Labor Force Decisions: An Analysis of Married Women," unpublished Paper (Agency for Healthcare Research and Quality).

WELLINGTON, A. J., AND D. A. COBB-CLARK (2000): "The Labor-Supply Effects of Universal Health Coverage: What Can We Learn From Individuals with Spousal Coverage?," in Simon W. Polachek, ed., Worker Well-Being: Research in Labor Economics, Volume 19 (Elsevier Science: Amsterdam).

7. Appendix: 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.[15] The results are reported in Table 10. 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.

[15]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. 4 Major European Countries

	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

Data source: OECD Labor Market Data (2000).

Table 2: Full-time Workers: US vs. 4 Major European Countries

	Employment Rate	FT Share (% of All Workers)	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

Data source: OECD Labor Market Data (2000).

Table 3: Annual Hours Worked By Age: US vs. 4 Major European Countries

	All age (15-64)	Age 20-24 (relative to the US)	Age 25-54 ..	Age 55-64 ..
US	1	1	1	1
France	0.69	0.39	0.89	0.52
Germany	0.71	0.67	0.90	0.68
Italy	0.72	0.42	0.84	0.54
UK	0.90	0.78	0.95	0.88
Average(Major 4)	0.76	0.57	0.90	0.66

Data source: OECD Labor Market Data (2000).

Table 4: 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 5: The Benchmark Calibration

Parameter	Value	Source
α	0.36	Macro literature
δ	0.06	Macro literature
γ	2	Chetty (2012)
A	680	US GDP per capita: $36467
τ	40%	Prescott(2004)
τ_s	12.4%	US Social Security tax rate
κ_h, κ_m	0.8	US data
β	0.975	Annual interest rate: 4.0%
π	0.2	Sommers(2002)
ζ	0.85	Employment rate: 74.1%
ρ	0.94	Alonso-Ortiz and Rogerson (2010)
σ_μ^2	0.205	Alonso-Ortiz and Rogerson (2010)

Table 6: Key Statistics of the Benchmark Economy

Statistics	Model	Data
Output per person	$37482	$36467
Interest rate	3.9%	4.0%
Aggregate hours worked	0.29 (appr. 1445 hours)	1360 hours
Employment rate	76.1%	74.1%
Full-time worker share	90.0%	88.1%
% of working-age popu. with ESHI	58.9%	59.4%
ESHI take-up rate	97.0%	96%

Table 7: The Main Quantitative Results

Statistics	Benchmark (US HI)	Experiment I (Eur HI)	Inter. I (no link to job)	Inter. II (no tax exemp.)
Output per person	$37482	$36455	$ 36541	$36005
Interest rate	3.9%	3.9%	3.9%	4.0%
Aggregate hours worked	0.290	0.250	0.266	0.263
(relative to the benchmark)	(1)	(86%)	(92%)	(91%)
Employment rate	76.1%	67.2%	72.9%	74.6%
Full-time worker share	90.0%	85.6%	82.8%	79.1%
Aggregate effective labor	0.680	0.660	0.662	0.659
% of working-age popu. (with ESHI)	58.9%	..	70.5%	36.9%
ESHI take-up rate	97%	..	83%	72%
ESHI premium	$3181	..	$3048	$4410

Table 8: Aggregate Hours Worked By Age: Model vs. Data

	All age	Age 20-24	Age 25-54	Age 55-64
Data				
4 major European countries (relative to the US)	0.76	0.57	0.90	0.66
Model				
Benchmark	0.29	0.28	0.3	0.27
Counterfactual (with Eur HI)	0.25	0.24	0.26	0.22
(relative to the benchmark)	86%	84%	88%	82%

Table 9: The Other Hypotheses

Statistics	Benchmark	Experiment I (Eur HI)	Exp. II (Eur HI+ Eur tax)	Exp. III (Eur HI+ Eur tax +0.6×HS)
Output per person	\$37482	\$36455	\$33310	\$35596
Interest rate	3.9%	3.9%	4.5%	4.5%
Aggregate hours worked	0.29	0.25	0.23	0.27
(relative to the benchmark)	(1)	(86%)	(79%)	(94%)
Employment rate	76.1%	67.2%	68.9%	71.6%
Full-time worker share	90.0%	85.6%	66.5%	86.6%
Aggregate effective labor	0.680	0.660	0.626	0.669

Table 10: 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

Data source: OECD Labor Market Data (2000).

Table 11: 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
Average (exclude Scan.)	1100	0.81
Average (all)	1121	0.82

Data source: OECD Labor Market Data (2000).

Table 12: 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.)	65%	84%	54%	0.83	0.81
Average(all)	67%	84%	56%	0.86	0.82

Data source: OECD Labor Market Data (2000).

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

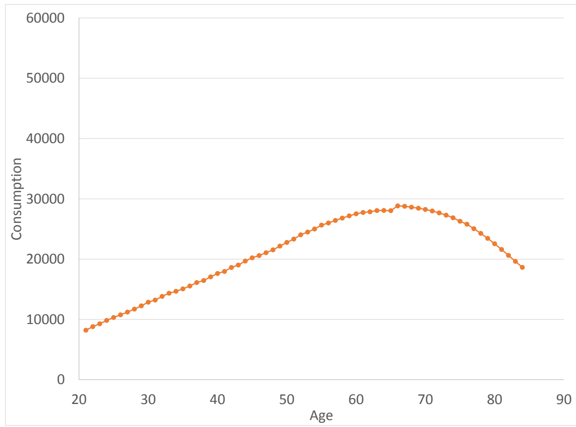

Figure 2: Life Cycle Profile in the Benchmark Economy: Saving

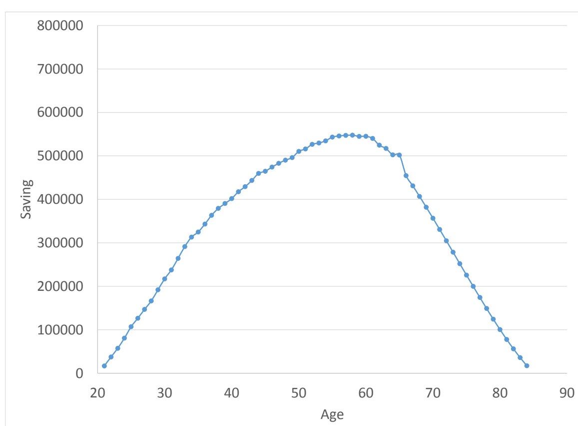

Figure 3: Life Cycle Profile in the Benchmark Economy: Employment Rate

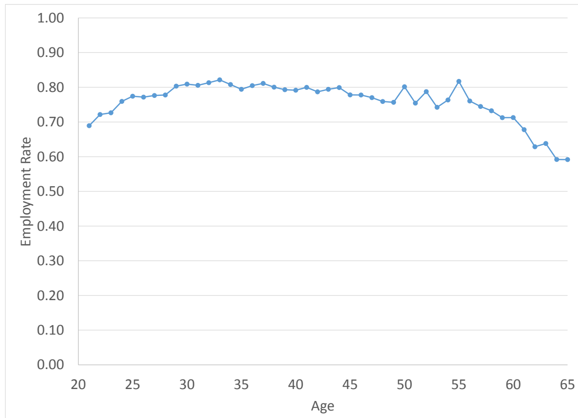

Figure 4: Life Cycle Profile in the Benchmark Economy: Labor Supply (hours worked)

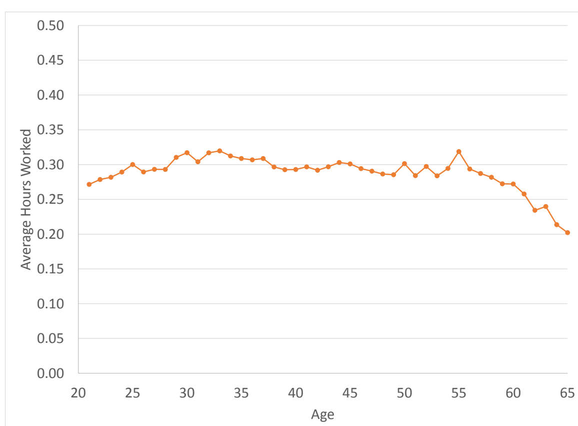

Figure 5: Benchmark vs Counterfactual (US vs EUR): Consumption

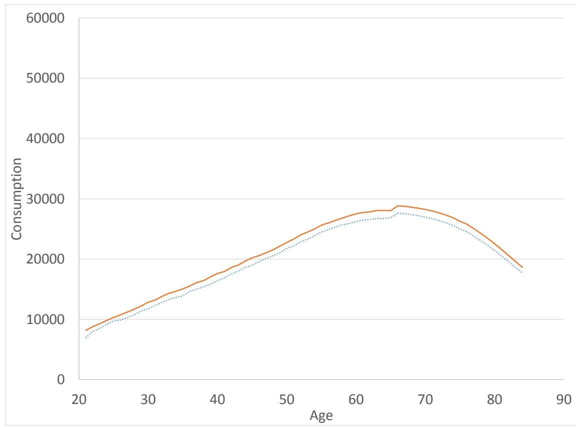

Figure 6: Benchmark vs Counterfactual (US vs EUR): Saving

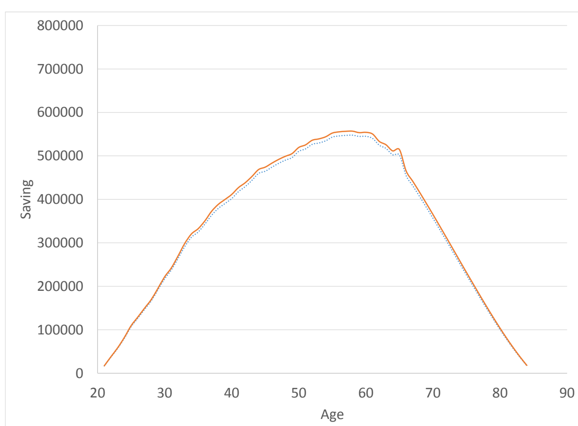

Figure 7: Benchmark vs Counterfactual (US vs EUR): Employment Rate

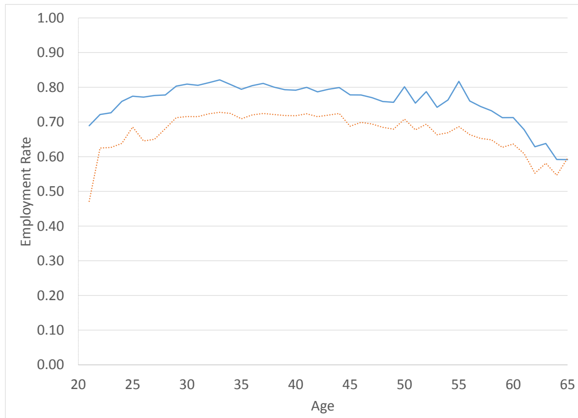

Figure 8: Benchmark vs Counterfactual (US vs EUR): Labor Supply (hours worked)