Consumption and Hours between the United States and France

Lei Fang and Fang Yang

Abstract: We document large differences between the United States and France in allocations of consumption expenditures and time by age. Using a life-cycle model, we quantify to what extent tax and transfer programs and market and home productivity can account for the differences. We find that while labor efficiency by age and home-production productivity are crucial in accounting for the differences in the allocation of time, the consumption tax and social security are more important regarding allocation of expenditures. Adopting the US consumption tax decreases welfare in France, and adopting the US social security system increases welfare in France.

---

1 Introduction

While there is a large literature on the differences in labor supply across countries,[1] work on cross-country differences in consumption expenditures is limited. To evaluate the effect of variations in policies on allocation and welfare, it is important to study consumption and labor-supply decisions together in a model that is consistent with data on both types of decision.

In this paper, we study cross-country differences in the life-cycle profiles of both labor supply and consumption expenditures. We examine the allocations of consumption expenditures and time by age across countries not only for market activities but also for home activities. Home production is a critical factor in propagating the effect of policies on labor supply and is also an important component in welfare calculation.[2] We focus on understanding the discrepancy in the life-cycle profiles between the United States and France because the two countries, while at a similar stage of economic development, differ dramatically in their tax and social security systems.

Different tax and transfer programs could create different incentives for households when they allocate their time and expenditures between market and home activities over their life cycle. We observe large differences in such programs between the United States and France. First, the consumption tax rate is 24 percent in France but only 7.5 percent in the United States. Second, the French social security system features a substantially higher tax rate accompanied by a more generous benefit scheme. Lastly, the French income tax is more progressive than that of the United States.

The age profiles of time use and expenditure in the United States and France also differ greatly. Using time-use and consumer-expenditure surveys, we document three important differences. First, the French, at every age, work less in the market but spend more time in home production than Americans and moreover, the difference is larger at older ages. Second, the French have lower expenditure-to-income ratios for spending on both market goods and home inputs (goods used in producing for home consumption), but the difference is larger for market goods than for home inputs. Third, over the life cycle, both Americans and the French shift their allocations of time and expenditures from market to home, but the shift

---

[1]See, for example, Prescott (2004), Ohanian et al. (2008), Rogerson (2008), Olovsson (2009), McDaniel (2011a), Ngai and Pissarides (2011), Erosa et al. (2012), Ragan (2013), Chakraborty et al. (2015), Laun and Wallenius (2016), Duernecker and Herrendorf (2018), and Bick and Fuchs-Schündeln (2018).

[2]See, for example, Benhabib et al. (1991), Rupert et al. (1995), Rogerson (2008), McDaniel (2011a), Ngai and Pissarides (2011), Ragan (2013), Rogerson and Wallenius (2016), Bridgman et al. (2018), and Duernecker and Herrendorf (2018) for the effects of home production on market hours. See, for example, Dotsey et al. (2015). Boerma and Karabarbounis (2020), and Boerma and Karabarbounis (2021) for the importance of home production in assessing the welfare changes.

is faster and stronger in France.

Higher taxes and a larger social security system in France favor home production over market production and may account for the differences in allocations of expenditure and time observed in the data. We develop a model to formally evaluate the quantitative effects of these policies on allocations. Our life-cycle model features home production, endogenous retirement decisions, and uninsurable idiosyncratic productivity shocks. In the model, households derive utility from leisure and a consumption good composited from a market good and a home good. The home good is produced using households' time and home inputs. The model incorporates key realistic features of the tax and transfer programs, including the consumption tax, the income tax, and the social security system.

We calibrate the model to the United States and show that it matches well the data on US expenditure and time allocations by age. In our model, besides the differences in tax and transfer programs, France differs from the United States in households' age-efficiency profile for market production. In particular, France has a lower age-efficiency profile. With these differences in government programs and productivity, the model matches well the data on French allocations of expenditure and hours by age.

The simulated French economy can generate the three documented differences in allocations from the United States. First, a lower efficiency profile and higher taxes in France favor home production over market production and thus increase home hours and reduce market hours. This generates the pattern that the French work less in the market but more at home than Americans. Second, the calibration implies that the substitutability between home goods and market goods is bigger than that between home time and home inputs. Hence the lower efficiency profile and higher taxes in France lead to a stronger substitution from the consumption of market goods to home goods than that from home inputs to home hours, generating a larger drop in the expenditure on market goods than in home inputs in France. Third, the age-efficiency profile is much lower at old age in France, which leads to a stronger shift of hours and expenditures from market to home over the life cycle.

To decompose the effects of policy and productivity, we replace French policies and age-efficiency profile with US values in the simulated French economy. Our first finding is that the combination of consumption tax, social security system, and income tax can account for 65 percent of the total difference in the expenditure on market goods and 69 percent of the total difference in the expenditure on home inputs, while the difference in the efficiency profile can account for 33 percent of the total difference in the expenditure on both market goods and home inputs. Among the policies considered, the consumption tax and social security system

are quantitatively more important than the income tax for determining allocation of expenditures. Second, we find that the difference in the efficiency profile alone can account for 86 percent of the difference in aggregate market hours and 67 percent of the difference in aggregate home hours between France and the United States, while the three policies combined account for 13 percent of the difference in market hours and 37 percent of the difference in home hours.

To evaluate the long-run welfare implications of each policy, we change each policy in France while holding government spending constant, which we achieve by imposing an additional proportional income tax. We find that adopting the US consumption tax leads to a decline in welfare. Adopting the US social security system benefits all French households. The welfare gain is especially large for households with higher productivity because they dislike a larger social security system. The average welfare change from adopting the US income tax, compared to the other policy changes, is small. The welfare gain from adopting the US social security system outweighs the welfare cost from adopting the US consumption tax; thus, adopting all three US policies increases welfare for French households that is equivalent to a onetime asset transfer at age twenty-four in the amount of 91.1 percent of the average income in the benchmark economy.

This paper is related to the literature studying life-cycle consumption profiles in the United States. Carroll (1997) and Gourinchas and Parker (2002) show that precautionary savings, generated by borrowing constraints and idiosyncratic income shocks, can explain the hump-shaped life-cycle consumption profile. Bullard and Feigenbaum (2007) find that including leisure in the utility function helps explain the decline in consumption late in life. A more recent literature studies the subcomponents of consumption over the life cycle. Fernandez-Villaverde and Krueger (2007) document hump-shaped profiles for both durable and nondurable consumption and propose to explain the hump with a model in which durables serve as collateral. Yang (2009) develops a model with illiquid housing and with collateral constraints to study the life-cycle patterns of housing and nonhousing consumption. Aguiar and Hurst (2013) show that the hump shape in market consumption is related to the substitutability of market and home-produced goods. Dotsey et al. (2014) show that a life-cycle model with home production explains well the life-cycle patterns of market and home consumption and time allocation. Our contribution to this literature is to compare consumption-expenditure profiles across countries and study policy impacts on the profiles of expenditure on both market goods and home inputs to account for cross-country differences.

This paper is also related to the literature that quantifies the effects of government policies on labor supply across countries. Prescott (2004) and Ohanian et al. (2008) use a one-sector model to study the roles of taxes in accounting for cross-

country differences in labor supply. Rogerson (2008), Olovsson (2009), McDaniel (2011a), and Duernecker and Herrendorf (2018) highlight the importance of home production in propagating the effect of taxes on labor supply. Ngai and Pissarides (2011) and Ragan (2013) find that subsidies for family care are important in accounting for the differences in market hours between the United States and the Nordic countries. Chakraborty et al. (2015) and Bick and Fuchs-Schündeln (2018) study the role of progressive and nonlinear labor income taxes in accounting for cross-country differences in market hours by gender. None of these papers analyze labor supply by age. Two recent papers, Erosa et al. (2012) and Laun and Wallenius (2016), study cross-country differences in market hours late in life and find that social insurance programs are important drivers of the low labor supply of old households in European countries relative to the United States. In contrast to all these papers on cross-country differences in labor supply, we study cross-country differences in not only the allocation of time but more importantly the allocation of expenditures. Our study also distinguishes home consumption from market consumption and covers the whole adult life cycle. The rich structure of the model enables us to study the welfare implications of tax and transfer programs.

The rest of the paper is organized as follows. Section 2 discusses the expenditure and time allocations by age. Section 3 first presents a static model to demonstrate the importance of the elasticity of substitutions and then presents the full-blown life-cycle model. Section 4 calibrates the model to the US economy. Section 5 applies the model to the French economy and decomposes the total differences in the expenditure and time allocations between the United States and France into contributions from policies and productivity. Section 6 studies the welfare implications of each policy. Section 7 concludes.

2 Expenditure and Time Allocations by Age

2.1 Data Construction

We use the Multinational Time Use Study (MTUS) to construct data for time allocations in the United States and France, the Consumer Expenditure Survey (CEX) to construct data for expenditures in the United States, and the French Household Budget Survey (HBS) to construct data for expenditures in France. We restrict the samples to reference persons of at least twenty-four years of age, as most individuals complete their education by then. The data throughout this paper are averages from 2010 to 2012 whenever possible.[3] The rest of this section summarizes the data-construction process, and Appendix A provides more details.

---

[3]We do so because the HBS is available only for 2010.

We follow Aguiar and Hurst (2007) in classifying the time-use categories as market hours, home hours, and leisure. Market hours comprise time spent on paid work and commuting;[4] home hours comprise time spent on food preparation, cleaning, home and vehicle maintenance, obtaining goods and services, other care, and gardening; the remainder of the time is classified as leisure.[5] Hours for each age are constructed as average weekly hours per adult for that age group.[6] Accordingly, the constructed hours takes into account the labor force participation at that age.

Following Dotsey et al. (2014), we classify consumption expenditures related to home production as home inputs and the rest as market goods. Home inputs include food at home, household operations, household furnishings and equipment, utilities, housing maintenance, and housing expenditures (which consists of actual rents for renters and equivalent rents for homeowners). The CEX and HBS group all transportation expenditures together, and it is not feasible to separate the portion of expenditures for use in home production from the portion for other purposes. Following Dotsey et al. (2014), we prorate transportation expenses by travel time for market and home activities that we obtained from the MTUS.[7]

Research works from the Bureau of Economic Analysis and the Bureau of Labor Statistics find discrepancies in expenditures reported in the CEX and those in the Personal Consumption Expenditures (PCE) of the National Accounts.[8] In order for us to evaluate the aggregate implications of the policies between U.S. and France, we calibrate our model using aggregate variables constructed from the National Accounts. Hence it is important to make sure the aggregate consumption expenditure constructed from the CEX and HBS matches with the PCE from the National Accounts. For this reason, we adjust the life-cycle profiles so that the aggregate consumption expenditure is consistent with the PCE. To do so, we multiply the total expenditure to total income ratio in the CEX by a factor so that the resulted ratio is the same as the PCE-to-GDP ratio. We then adjust both the market and home expenditure for each age group by the same factor. The adjustment shifts the age profiles of expenditure up and down but keeps the relative expenditures constant across age groups and between market and home expenses. The French profiles are adjusted in the same way. Please see Appendix A for the detailed

---

[4]Defining market hours as only time spent on paid work does not affect the results reported in this section because communing time is small relative to time spent on paid work.

[5]Child care time is not included in home hours because we abstract from marriage and child bearing.

[6]Borella et al. (2018) show that to better match the aggregates, it is important to calibrate (or estimate) the model including both men and women in the data.

[7]As a robustness check, we use total market hours and total home hours to prorate the transportation expenditure. The data facts are almost the same as what is reported in Figure 1.

[8]See Passero et al. (2012) for a summary about the differences in the CEX and PCE.

adjustment procedures.

2.2 Data Facts

In this subsection, we document the similarity and differences in the age profiles of expenditure and time allocations between the United States and France. These are the facts we aim to account for with our quantitative model. Figure 1 displays the profiles for expenditure and hours by age in two-year segments. Hours are reported as a fraction of the total available time—one hundred hours per week. Expenditure shares are the ratios of the adjusted expenditures to the average economy-wide income.

Figure 1: Age Profiles of Expenditure and Hours

(a) Expenditure   (b) Hours
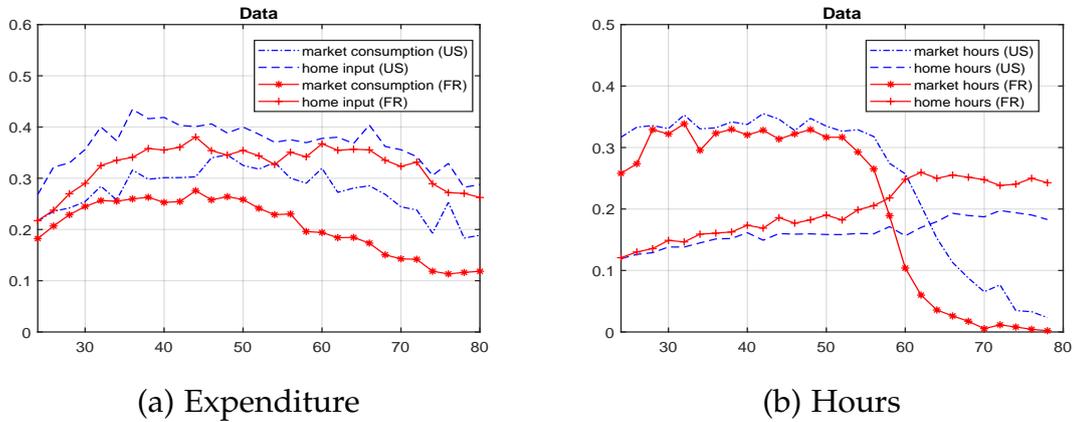
Notes: Hours are reported as a fraction of the total available time—one hundred hours per week. Expenditure shares are the ratios of the adjusted expenditures to the average income. Expenditures are constructed from the Consumer Expenditure Survey for the United States and from the Household Budget Survey for France. Hours are constructed from the Multinational Time Use Study.

The profiles in both countries exhibit similar life-cycle patterns. The profile of expenditures on market goods and home inputs exhibits a typical life-cycle hump shape. In both countries, expenditures on home inputs exceed expenditures on market goods at every age. Market hours, in both countries, increase slightly for people in their thirties relative to those in their twenties and are flat for most of people's working lives before sharply decreasing in the fifties. Home hours, on the other hand, increase with age.

Despite the similarities, the age profiles differ in three important dimensions between the two countries. First of all, market hours are lower and home hours are higher in France than in the United States at every age. Second, although Americans spend a larger share of their income on both market goods and home inputs than French, the difference in the share of expenditure is smaller for home inputs than for market inputs. To highlight those two facts, we report, in Table 1,

aggregate shares of hours and expenditures across all ages. For an average adult, the share of market hours is lower in France by 4 percentage points (four hours per week) and the share of home hours is higher by 3 percentage points (three hours per week). As a result, market hours per adult are 14 percent (0.04/0.28) lower and home hours per adult are 19 percent (0.03/0.16) higher in France than in the United States. From Figure 1, most of these differences are accounted for by the difference at older ages. For expenditures, France has a expenditure share on market goods that is 6 percentage points lower and has a expenditure share on home inputs that is 4 percentage points lower than the values in the United States. The expenditure shares are lower in France for both market goods and home inputs because the reported ratios are expenditures to before-tax income and taxes are higher in France.

Table 1: Data: Aggregate Hours and Expenditure Shares

	N_m	N_h	$\frac{C_m}{Y}$	$\frac{D}{Y}$
US	0.28	0.16	0.28	0.37
FR	0.24	0.19	0.22	0.33
FR - US	-0.04	0.03	-0.06	-0.04

Notes: The reported values are aggregate hours and expenditure shares across all ages. N_m denotes market hours share, N_h denotes home hours share, $\frac{C_m}{Y}$ denotes market-goods expenditure share, and $\frac{D}{Y}$ denotes home-inputs expenditure share.

Table 2: Data: Market Allocation Relative to Home Allocation by Age

Age	Time		Expenditure	
	US	FR	US	FR
28	2.57	2.23	0.74	0.84
38	2.24	1.94	0.72	0.74
48	2.12	1.74	0.82	0.73
58	1.71	0.83	0.81	0.60
68	0.54	0.08	0.72	0.47

Notes: This table reports the ratio of market to home allocation of expenditure and hours for every ten-year age group. For example, age twenty-eight represents the average for ages twenty-four to thirty-three.

Third, as is shown in Figure 1, households in both countries shift their allocations of time and expenditures from market to home over the life cycle and the shift is much faster and stronger in France. To highlight this fact, in Table 2 we report the ratio of market to home allocations for expenditure and hours for every ten-year age group. The values decline with age in both countries, indicating a shift of time and expenditures from market to home as households age. However,

the declines are larger in France than in the United States. Specifically, the reported ratio of hours declines from 2.23 at age twenty-eight (the average of twenty-four and thirty-three) to 0.08 at age sixty-eight (the average of sixty-four and seventy-three) in France, compared with a much smaller decline from 2.57 to 0.54 in the United States. Similarly, the ratio of expenditure in France declines by more than 40% (from 0.84 to 0.47) between ages twenty-eight and sixty-eight while it barely declines in the United States.

In summary, we find three important differences in the allocations of expenditure and hours between the United States and France. First, the French, at every age, work less in the market and more at home than Americans. Second, the cross-country difference in the expenditure share of market goods is larger than that in the expenditure share of home inputs. Third, although both American and French households shift their allocations of time and expenditures from market to home as they age, the shift is much faster and stronger in France.

3   The Model Economy

Before presenting a full-blown life-cycle model to quantify the extent to which both the tax and transfer programs and market productivity can account for the documented differences in the age profiles between the two countries, we first use a static model to show how taxes and wages affect the allocation of hours and expenditures at home and in the market.

3.1   Static Model

In the model, there is one representative household who lives for one period. The representative household is endowed with one unit of time and derives utility from a composite consumption good that consists of a market good and a home-produced good. The representative household also values leisure and allocates her time endowment to market work, home production, and leisure.

The utility function is as follows:

$$U(c,l) = \frac{\left[\omega_3 c^{1-\frac{1}{\zeta_3}} + (1-\omega_3)l^{1-\frac{1}{\zeta_3}}\right]^{\frac{1-\gamma}{1-\frac{1}{\zeta_3}}} - 1}{1-\gamma}, \tag{1}$$

where l is leisure, c is the composite consumption good, $\zeta_3 > 0$ is the elasticity of substitution between l and c, and γ is the relative risk-aversion parameter. The composite consumption good is produced by aggregating the market good c_m and home-produced good c_h through a constant elasticity of substitution (CES)

aggregator:

$$c = [\omega_2 c_m^{1-\frac{1}{\zeta_2}} + (1 - \omega_2)c_h^{1-\frac{1}{\zeta_2}}]^{\frac{1}{1-\frac{1}{\zeta_2}}}, \tag{2}$$

where $\zeta_2 > 0$ is the elasticity of substitution between the market good and the home good. The home good is produced according to the following production function:

$$c_h = [\omega_1 d^{1-\frac{1}{\zeta_1}} + (1 - \omega_1)n_h^{1-\frac{1}{\zeta_1}}]^{\frac{1}{1-\frac{1}{\zeta_1}}}, \tag{3}$$

where n_h is the labor input and d is the market good used in home production and is called the home input.[9] $\zeta_1 > 0$ is the elasticity of substitution between home input d and home time n_h.

Let τ_c be a proportional consumption tax and τ_i be a proportional income tax. The tax revenues are discarded. Normalizing the price of market goods to one, the household's budget constraint is as follows:

$$(1 + \tau_c)(c_m + d) = (1 - \tau_i)wn_m, \tag{4}$$

where w is the wage rate and $n_m = 1 - l - n_h$ is market hours.

The solution to the household's maximization problem yields the following two propositions that characterize the effects of taxes and wages (market productivity) on allocations of hours and expenditure. The derivations are provided in Appendix B.

Proposition 1: $\frac{n_h}{d}$ is decreasing in w and is increasing in τ_i and τ_c.

The intuition is as follows. The ratio of the two inputs in home production, $\frac{n_h}{d}$, is decreasing in the price of home hours relative to home inputs. The price of home hours is the after-tax market wage. An increase in wage rate w, or a decrease in income tax rate τ_i or in consumption tax rate τ_c, increases the price of home hours relative to home inputs and leads to a lower $\frac{n_h}{d}$. The magnitude of these effects depends on the size of the elasticity of substitution between home inputs and home time (ζ_1). A larger ζ_1 generates larger responses of $\frac{n_h}{d}$ to changes in wages and taxes.

Proposition 2: $\frac{c_m}{d}$ is decreasing in τ_c and τ_i and is increasing in w iff $\zeta_2 > \zeta_1$.

The change in the ratio $\frac{c_m}{d}$ depends on the substitution between home goods and market goods (ζ_2) and the substitution between home hours and home inputs (ζ_1). Specifically, a decrease in the consumption tax τ_c or the income tax τ_i or an increase in wage w favors consumption in the market over consumption at home

---

[9]We follow Greenwood and Hercowitz (1991) and McGrattan et al. (1997), among others, and assume that home production takes time and home capital as inputs. In those papers, home capital consists of residential housing and consumer durables. Our definition of home inputs includes residential housing, consumer durables, and some nondurables, such as food at home. See section 2.1 for details.

and leads to substitution from home to market goods. As proven in Proposition 1, these changes in policies and wages also lead to substitution from home hours to home inputs. When $\zeta_2 > \zeta_1$, the substitution from home goods to market goods is stronger than that from home hours to home inputs, generating a rise in $\frac{c_m}{d}$. The larger the difference between ζ_1 and ζ_2 is, the larger the rise in $\frac{c_m}{d}$ is to a decrease in τ_c and τ_i and to an increase in w.

In summary, the static model illustrates the effects of the consumption tax, the income tax, and the wage rate on the allocations of time and expenditure. It also shows the importance of the elasticity of substitution between market goods and home goods (ζ_2) and that between home time and home inputs (ζ_1) in generating these effects. However, it is silent on how allocations vary over the life cycle and how they are affected by the social security system. Next, we introduce a richer life-cycle model to quantify the effects of policies and wages on the allocations.

3.2 Life-Cycle Model

The model is built on Dotsey et al. (2015). It is an overlapping generations model with an infinitely lived government. The government collects taxes on consumption and labor income to provide social security benefits to retirees and to fund government spending. There is no aggregate risk, and households face death shocks and uninsurable idiosyncratic shocks to their market labor productivity.

3.2.1 Market Production

A representative firm produces a final good according to the following production function:

$$Y = F^m(K, L_m) = K^\alpha L_m^{1-\alpha}, \tag{5}$$

where K is the aggregate capital stock and L_m is the aggregate labor input measured in efficiency units. The production function does not contain a TFP term because a change in TFP is isomorphic to re-scaling proportionally the level of the aggregate efficiency unit L_m. To avoid introducing another parameter, we normalize TFP in both countries to be one and incorporate the difference in market production TFP to changes in the aggregate efficiency unit. As will be described in section 3.2.2, efficiency unit over the life-cycle contains a deterministic component. A re-scaling of the life-cycle deterministic profile is isomorphic to changing aggregate TFP in market production.

The final good can be used in four different ways. It can be consumed directly, used as an input in the production of the home good, invested in capital stock, or purchased by the government. The capital stock depreciates at rate δ^k. The representative firm pays a social security tax on its total wage bill at rate τ_f.

Normalizing the price of the final good to one and denoting the interest rate by r and the wage rate per efficiency unit by w, the firm's maximization problem is as follows:

$$r = F_1^m(K, L_m) - \delta^k,$$
$$w = F_2^m(K, L_m)/(1 + \tau_f),$$

where $F_1^m(K, L_m)$ and $F_2^m(K, L_m)$ are the marginal product of capital and the marginal product of labor, respectively.

3.2.2 Households

Households have the same preferences and home-production function as those given in the static model. In the life-cycle model, they also derive utility from government spending. Let g be the exogenous government spending on a household and Q(g) be the utility from g. The household's utility is given by:

$$U(c, l, g) = \frac{\left[\omega_3 c^{1-\frac{1}{\zeta_3}} + (1-\omega_3) l^{1-\frac{1}{\zeta_3}}\right]^{\frac{1-\gamma}{1-\frac{1}{\zeta_3}}} - 1}{1 - \gamma} + Q(g).$$

We assume that the utility from government spending is separable from a household' consumption and leisure time. This implies that the household's allocations of time and expenditures are not affected by g.

Demographics. There are T overlapping generations of households. Each generation is indexed by their age $t = 1, 2, ..., T$. Hence T denotes the maximum possible age. The life span is uncertain, and the exogenous survival probability is denoted by λ_t for households of age t. We assume a constant population growth rate ϕ. Since the evolution of the population is stable, the distribution of households by age is constant at any point.

At birth, a household draws her initial assets from a distribution constant for each generation. The uncertainty of life span may lead to a positive amount of assets at death, which are first used to finance the initial assets of the next generations and then equally distributed to households younger than age fifty as bequest b_t.

Labor Productivity. A worker's labor productivity in the market comprises a deterministic component and a stochastic component. The deterministic component is age dependent and is denoted by e_t. The stochastic component, denoted by

ε^i_t for worker i at age t, follows a Markov process:

$$\ln \varepsilon^i_t = \rho_\varepsilon \ln \varepsilon^i_{t-1} + v^i_t, \ v^i_t \sim N(0, \sigma^2_\varepsilon). \tag{6}$$

The total productivity of worker i at age t is $e_t \varepsilon^i_t$, the product of the worker's age-t deterministic efficiency unit and age-t productivity shock. This parsimonious productivity process follows the literature and captures well the wage dynamics observed in the data.

Borrowing Constraints. Households are borrowing constrained with a debt limit equal to twice their lowest possible labor income next period, assuming that they spend half of their time working in the market. That is, at any given time a household's financial wealth next period, denoted by a', must satisfy the following condition:

$$a' \geq -e'\underline{\varepsilon}'w, \tag{7}$$

where e' is the next period's age-efficiency unit and $\underline{\varepsilon}'$ is the next period's lowest possible labor-efficiency shock.

3.2.3   Tax and Social Security System

The government maintains a pay-as-you-go social security program. In addition to taxing firms, the government imposes a social security tax on households' labor earnings to finance social security payments. Households' labor earnings are subject to a constant tax rate of τ_s up to a maximum income of $y_{\max}$. Retirees receive social security benefits each period. The level of the benefits is determined by a household's average social security earnings y_s and is also adjusted by the claiming age. The government imposes taxes on consumption and labor earnings. The consumption tax is proportional, with a rate of τ_c levied on both market consumption c_m and home input d. We assume that half of the social security payment is subject to the income tax, which is progressive and the average tax rate on labor income y is $\tau(y)$. We further assume that the government uses the total tax revenues from the consumption tax, income tax, and social security tax, net of social security payments, to finance exogenous government spending G and thus balances its budget each period.

3.2.4   Equilibrium

Households' Problem. We focus on a stationary equilibrium with constant interest rate and constant wage rate per efficiency unit of labor. A household's state variables are $x = (t, a, \varepsilon, y_s, t_r)$, where t denotes the household's current age, a denotes financial assets carried over from last period, ε denotes the labor-productivity

13

shock in the current period, y_s denotes average social security earnings up until the previous period, and t_r denotes retirement age, with $t_r = 0$ indicating nonretirement. Let β be the discount factor and f' be the retirement decision for next period with $f' = 1$ indicating retirement and $f' = 0$ indicating nonretirement. The household's problem is given by:

$$V(t, a, \varepsilon, y_s, t_r) = \max_{\{c_m, d, a', n_m, n_h, f'\}} \Big\{ U(c, 1 - n_m - n_h) +$$

$$\beta \lambda_t E_t V(t+1, a', \varepsilon', y'_s, t'_r) \Big\} \tag{8}$$

subject to (2), (3), (7), and

$$y = e_t \varepsilon w n_m \tag{9}$$

$$a' \le b_t + (1+r)a + y + pen(t_r, y_s) - \tau_{ss} \min(y_{max}, y) \tag{10}$$

$$- \tau(y + 0.5 pen(t_r, y_s))(y + 0.5 pen(t_r, y_s)) - (1 + \tau_c)(c_m + d)$$

$$y'_s = \begin{cases} \left[(t-1)y_s + \min(y_{max}, y)\right]/t, & t_r = 0, t \le t_m \\ \left[(t_m - 1)y_s + \min(y_{max}, y)\right]/t_m, & t_r = 0, t > t_m, y_s < \min(y_{max}, y) \\ y_s, & t_r = 0, t > t_m, y_s \ge \min(y_{max}, y) \\ y_s, & t_r > 0, \end{cases} \tag{11}$$

$$t'_r = \begin{cases} 0, & f' = 0, \\ t+1, & f' = 1, \end{cases} \tag{12}$$

$$c_m \ge 0, \ d \ge 0, \ 0 \le n_m, n_h \le 1. \tag{13}$$

In any period, a household's resources consists of her asset holdings a, labor earnings y, received bequests b_t, and the social security benefit $pen(t_r, y_s)$, which is a function of the retirement age and the average social security earnings over the entire working life.

We assume that households receive a pension only after they claim social security benefits ($t_r > 0$), and even after that, they can still work. Following the actual policy, the social security benefits are calculated based on the best t_m years of earnings before retirement. The evolution of average social security earnings, described in equation (11), mimics this feature. Specifically, for a household who has not claimed social security benefits, average social security earnings y_s accumulate in the first t_m years, and from t_m years onward, y_s only accumulates when the current-period earnings y exceed the average social security earnings y_s. For a household who has claimed social security benefits, average social security earnings do not update.

Definition of the Stationary Equilibrium. Let $v(x)$ be the invariant distribution of people over the state space, C_m the aggregate consumption of the market good, D the aggregate home input, I the aggregate investment on capital, N_m the aggregate market hours, N_h the aggregate home hours, and $S = \int pen(t_r, y_s)v(dx)$ the total pension payments. The stationary equilibrium is defined as follows.

Definition 1. A stationary equilibrium is given by value functions $V(x)$; policy functions $c_m(x), d(x), a'(x), n_m(x), n_h(x), f'(x)$; bequest b_t; government policies $\tau_c, \tau(\cdot), \tau_f, \tau_s, pen(t_r, y_s)$, and G; interest rate r and wage rate w; and the invariant distribution $v(x)$, such that the following conditions hold:

(i) Given the interest rate, the wage, the government policies, and the expected bequest, the value functions and policy functions solve the household's maximization problem.

(ii) $v(x)$ is the invariant distribution of households over the state space.

(iii) The expected bequest equals the actual bequest:

$$\int b_t v(dx) + \int_{t=0} [a(1+r)]\, v(dx) = \int (1 - \lambda_t)[(1+r)a']v(dx)$$

(iv) The price of each factor is equal to its marginal product.

(v) The government budget is balanced each period: $\int gv(dx) = G$ and

$$\int [\tau_c(c_m + d) + \tau(y + 0.5pen(t_r, y_s))(y + 0.5pen(t_r, y_s)) + \tau_s \min(y_{max}, y)]\, v(dx)$$
$$+ \tau_f w L_m = G + S$$

(vi) All markets clear.

4 Calibration to the US Economy

We calibrate the model economy to the salient features of the US economy.[10] We set the parameters of our model in two steps. In the first step, we choose parameters that can be cleanly identified outside our model. The calibrated parameters in the first step are reported in Table 3. In the second step, we estimate jointly the remaining parameters by minimizing the difference between the model and data moments for households' allocations of expenditure and time. The calibrated parameters in the second step are reported in Table 4.

---

[10]See Appendix C for details of the computation algorithm.

4.1 First-Stage Calibration

A period in the model is two years. For the purpose of exposition, the reported parameter values are converted to annual frequency, unless stated otherwise. The annual population growth ϕ is 1%. Each person enters the model at age twenty-four. The maximum age T is set to be ninety-eight. The conditional biannual survival probabilities λ_t, shown in the left panel of Figure 2, are taken from the Social Security Administration Life Tables in 2000 with both genders included. We set the risk-aversion parameter γ to 1.5, following Gourinchas and Parker (2002). We set the capital share α to 0.3565, following Dotsey et al. (2015), who calibrate this parameter using National Income and Product Accounts (NIPA) and Fixed Assets Tables from the Bureau of Economic Analysis.

Table 3: First-Stage Calibrated Model Parameters

Parameters		Value	Source
Demographics			
ϕ	annual population growth	1%	
T	maximum life span	98	
λ_t	survival probability	fig. 2	SSA Life Tables
Preference			
γ	risk-aversion coefficient	1.500	Gourinchas and Parker (2002)
Technology			
α	capital share in NIPA	0.3565	Dotsey et al. (2015)
Endowment			
e_t	age-efficiency profile	fig. 2	authors' calculation
ρ_ε	AR(1) coef. of income process	0.96	Huggett (1996)
σ_ε^2	innovation of income process	0.045	Huggett (1996)
σ_1^2	var. of income process at age 1	0.38	Huggett (1996)
Government policy			
t_m	years counted in soc. sec.	36	authors' calculation
t_r	soc. sec. retirement-age range	62–70	authors' calculation
$y_{\max}$	soc. sec. tax cap	2.47	Huggett and Ventura (2000)
$pen(t_r, y_s)$	soc. sec. benefit	see text	Huggett and Ventura (2000)
τ_s	soc. sec. tax rate on employee	5.2%	authors' calculation
τ_f	soc. sec. tax rate on employer	5.2%	authors' calculation
$\tau(\cdot)$	income tax function	see text	Guvenen et al. (2014)
τ_c	consumption tax rate	7.5%	McDaniel (2011b)

The deterministic life-cycle profile of labor productivity for the United States, e_t, is shown in the right panel of Figure 2. Appendix A describes how we use the March supplement of the Current Population Survey (CPS) to construct the age-efficiency profile. The profile is consistent with that in French (2005). It is hump-shaped with a peak around age fifty. Because there are not many people

older than 85 in the data, we fit the age-efficiency profile with a polynomial to obtain efficiency values after age 86. In Figure 2, circles represent data and the solid line is the fit from a polynomial.

We take the idiosyncratic productivity shock from Huggett (1996). In particular, the variance of the initial productivity shock at age twenty-four is set to 0.38, the variance of the stochastic productivity process σ_ε^2 is set to 0.045, and the AR(1) coefficient ρ_ε is set to 0.96. The joint distribution of wealth and initial labor productivity of households is taken from Dotsey et al. (2015), who calculate it using heads of household aged twenty-three to twenty-six in the Survey of Consumer Finances (2001, 2004, and 2007).

Figure 2: US Survival Rate and Efficiency Unit

(a) Survival Rate

(b) Efficiency Unit
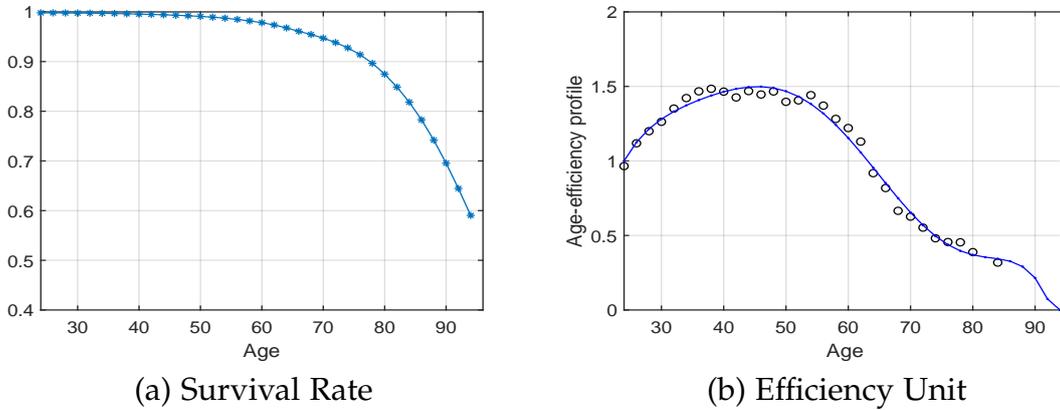
The social security system mimics the Old Age Insurance component of Social Security in the United States. The number of highest-earning years used to calculate the social security benefits, t_m, is thirty-six. The earliest age to claim social security benefit is sixty-two, and the age to receive the full retirement benefit is sixty-six. The retirement benefit at age sixty-six is borrowed from Huggett and Ventura (2000):

$$
pen(t_r = 66, y_s) = \begin{cases} 0.9y_s, & y_s \leq 0.2; \\ 0.18 + 0.32(y_s - 0.2), & 0.2 \leq y_s < 1.24; \\ 0.5128 + 0.15(y_s - 1.24), & 1.24 \leq y_s < y_{max}; \\ 0.6973, & y_s \geq y_{max} \end{cases}
$$

The bend points and the social security earnings cap $y_{\max}$ are expressed as fractions of average earnings. The retirement benefit is adjusted by the claiming age as follows. A household retiring at age sixty-two receives 75 percent of the full pension. A household retiring at age sixty-four receives 87 percent of the full pension. A household retiring after age sixty-six receives 8 percent more pension

17

benefits per year up to age seventy. The social security tax rates for employee τ_s and employer τ_f are both set to 5.2 percent, which are the average since the 1970s.

We borrow the income tax function from Guvenen et al. (2014), who estimate it from the OECD tax-benefit model. Guvenen et al. (2014) lump income tax and social security tax together. Since we model separately social security system, we subtract the social security tax from the estimate of Guvenen et al. (2014) directly to derive the tax rate $\tau(y)$ as a function of income y.[11] The consumption tax rate is set to 7.5 percent, which comes from McDaniel (2011b).

4.2 Second-Stage Calibration

There are eight parameters left for the second-stage calibration: δ^k, β, ζ_1, ζ_2, ζ_3, ω_1, ω_2, and ω_3. We jointly estimate them to match the capital-output ratio, K/Y, of 3.1, the investment-to-output ratio, I/Y, of 0.17, and the US age profiles of hours and expenditures at home and in the market shown in Figure 1. The model is therefore overidentified. The calibrated parameters are reported in Table 4. The resulting depreciation rate δ^k is 0.045, a value within the range of those used in the literature. The implied interest rate on capital (net of depreciation), r, is 0.07.[12] In our model, r is the average return on capital. A 7% average annual return on capital is a value within the range of those used in the literature.

The estimation results in a value larger than one for each of three elasticity of substitution: $\zeta_1 > 1$, $\zeta_2 > 1$, and $\zeta_3 > 1$. This implies that home time and home inputs, home goods and market goods, and consumption and leisure are all substitutes. More importantly, the estimation gives a larger value for ζ_2 than for ζ_1, implying that the substitution between home goods and market goods is stronger than that between home hours and home inputs.

Although the model is quite complex and the parameters and moments do not map one to one, some parameters affect certain moments more than others do. For example, β is largely determined by K/Y and δ^k is mostly related to I/Y. The elasticity and share parameters play crucial roles in determining the changes in the allocations of hours and expenditures over the life cycle. The age variations in home-production time and home-input expenditures help to identify ζ_1 and ω_1. The age variations in expenditures of the market good and the home input help to

---

[11]With social security tax, the estimated tax function from Guvenen et al. (2014) is $\tau(y) = 1.2088 - 0.009420(y/AW) - 0.942610(y/AW)^{-0.102590}$, where AW is the average income. Subtracting a social security tax of 5.2%, as reported in Table 3, gives the income tax function $\tau(y) = 1.1568 - 0.009420(y/AW) - 0.942610(y/AW)^{-0.102590}$.

[12]In the stationary equilibrium, the following two conditions hold: $\frac{I}{Y} = (\delta^k + \phi)\frac{K}{Y}$ and $\frac{\alpha Y}{K} = r + \delta^k$. The first condition means that investment equals to depreciation of capital and increase in capital due to population growth. The second condition means that the return to capital equals to interest rate plus depreciation rate. Given population growth ϕ, capital share α, $\frac{K}{Y}$, and $\frac{I}{Y}$, the above two conditions uniquely determines r and δ^k.

Table 4: Second-Stage Calibrated Model Parameters

| Parameters (8)		Value
δ^k	annual depreciation rate	0.045
β	discount factor	0.9475
ζ_1	sub. betw. home input and n_h	1.3627
ω_1	weight on home input	0.6241
ζ_2	sub. betw. market and home goods	2.7984
ω_2	weight on market goods	0.3259
ζ_3	sub. betw. consumption and leisure	1.3257
ω_3	weight on consumption	0.5946

pin down ζ_2 and ω_2. The age variation in the sum of market hours and home hours is useful in identifying ζ_3 and ω_3 since those two types of hours help determine leisure hours.

4.3 Model Fit for the US Economy

This subsection compares the results of the calibrated model with the actual US economy. Figure 3 compares the model-implied age profiles of expenditure and hours with the targeted profiles, along with the 95 percent confidence interval of the data. The figure shows that the model generally matches the actual allocations of time and expenditure by age both in the market and at home. The hours profiles are mostly sensitive to the age-efficiency profile, with social security also playing a role in old age. The borrowing constraint and precautionary-saving motive suppress the consumption of young households. As households age, these forces are alleviated and consumption expenditures increase until old age, when the increase of mortality risk leads to a decline in the consumption path.

The model also matches the aggregated variables in the data. Table 5 reports the model predictions side by side with the data. In the table, the investment-to-GDP ratio is the only targeted moment, and it is matched exactly. The model also matches very well the untargeted aggregate moments. For example, it matches closely the aggregate hours and expenditure-to-output ratios for both market and home allocations. Moreover, the model-implied ratio of social security expenditure to GDP of 5.8 percent, an untargeted moment, matches the data.

Figure 3: Age Profiles in the United States – Model versus Data

(a) Expenditure

(b) Hours
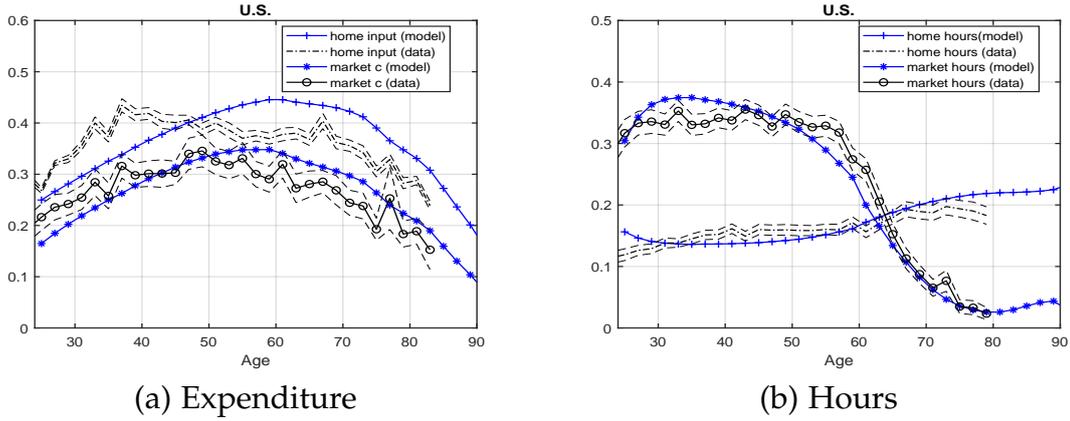
Notes: The dashed lines are the 95 percent confidence intervals of the data.

Table 5: Model and Data Comparison in the Aggregate

	N_m	N_h	$\frac{C_m}{Y}$	$\frac{D}{Y}$	$\frac{I}{Y}$	$\frac{G}{Y}$	$\frac{S}{Y}$
US model	0.2803	0.1565	0.2811	0.3709	0.1697	0.1929	0.0579
US data	0.2795	0.1567	0.2817	0.3716	0.1697	0.1920	0.0580

Notes: The reported values are aggregate shares of expenditures and hours across all ages. N_m denotes market-hours share, N_h denotes home-hours share, $\frac{C_m}{Y}$ denotes market-goods expenditure share, and $\frac{D}{Y}$ denotes home-inputs expenditure share. I/Y and G/Y are investment-to-GDP ratio and government-spending-to-GDP-ratio, respectively. The data values for I/Y and G/Y are the averages in the 2000s, computed from the NIPA tables. S/Y is the social-security-expenditure-to-GDP ratio. The data value for S/Y, from the OECD Social Expenditure Database, is the ratio of public expenditure on old-age pension benefits to GDP.

5   Simulation of the French Economy

In this section, we simulate the French economy. In the simulation, we assume that preferences are the same in France and the United States but policies and productivity differ. In particular, the two countries differ in the age-efficiency profile (market productivity) and tax and benefit systems, including consumption tax, income tax, and social security. We first discuss parameters in France that differ from those in the United States. We then simulate the hours profiles and expenditures profiles for France and compare the predicted profiles with those in the data and in the United States. Lastly, we decompose the model-predicted differences between the United States and France into contributions from policies and productivity.

5.1   French Policies and Productivity

This subsection describes the parameters that have different values from those in the United States. We assume that France, as a small open economy, has the same

Table 6: Parameters That Differ by Country

Government policy		US	FR
τ_c	consumption tax rate	7.5%	24%
$\tau(\cdot)$	income tax function	see section 4.1	see text
τ_s	soc. sec. tax rate on employee	5.2%	9.45%
τ_f	soc. sec. tax rate on employer	5.2%	14.0%
t_m	years counted in soc. sec.	36	32
t_r	soc. sec. retirement-age range	62–70	60-70
y_{max}	soc. sec. tax cap	2.47	3
$pen(t_r, y_s)$	soc. sec. benefit	see section 4.1	see text
Productivity		**US**	**FR**
e_t	efficiency profile	Figure 4	Figure 4

interest rate as the United States. The investment-to-GDP ratio in France is 1.5 percentage points higher. We adjust the depreciation rate to generate that ratio; the resulting depreciation rate is 5.5 percent.[13] As a robust check, we also simulate the French economy using the same depreciation rate as in the United States. The resulted allocations, available upon request, are very similar to the benchmark results reported in this section.

Table 6 compares the policy and productivity parameters that differ between the two countries. The consumption tax and income tax functions come from the same source as those for the United States. The consumption tax rate in France, 24 percent, is much higher than that in the United States, 7.5 percent. The left panel of Figure 4 compares the income tax function in the two countries, where income is normalized by the average household income in a country.[14] As shown in the figure, the income tax is more progressive in France than in the United States. However, the difference is small except for income above four times the average.

The French social security system differs dramatically from the US system. It consists of a public pension and a mandatory occupational pension, both of which we incorporate. We summarize the choice of the policy parameters here and provide more details in Appendix D. The reference earnings to determine the benefit is the best thirty-two years of earnings. The earliest age at which one can claim social security benefits is sixty, and the age at which one can receive the full retirement benefit is sixty-six. If a household retires before age sixty-six, pension

---

[13]Combining the two conditions in footnote 12 gives the equation: $\frac{I}{Y} = (\delta^k + \phi)\frac{\alpha}{r + \delta^k}$. Given the interest rate r, capital share α, population growth ϕ, the depreciation rate δ^k is determined by the investment-to-GDP ratio $\frac{I}{Y}$.

[14]With social security tax, the estimated tax function from Guvenen et al. (2014) is $\tau(y) = 0.5224 + 0.00339(y/AW) - 0.24249(y/AW)^{-0.41551}$, where AW is the average income. Subtracting a social security tax of 9.45%, as reported in Table 6, gives the income tax function $\tau(y) = 0.4279 + 0.00339(y/AW) - 0.24249(y/AW)^{-0.41551}$.

benefits are reduced by 5 percent per year; and if a household retires after age sixty-six, pension benefits are increased by 5 percent per year up to age seventy. Thus, the benefit function in France gives stronger incentives to early retirement, compared with that in the United States. The social security earnings cap is three times average earnings. The tax rate on employees is 9.45 percent, and the tax rate on employers is 14.0 percent.[15] The pension benefit is a linear function of the average life-time earnings subject to the social security tax, and we calibrate the benefit-replacement ratio at age sixty-six to match the ratio of aggregate social security spending to GDP of 11.3 percent.[16] The resulting ratio is 78 percent, thus $pen(t_r = 66, y_s) = 0.78y_s$.

Figure 4: Efficiency Profile and Income Tax Function

(a) Income Tax
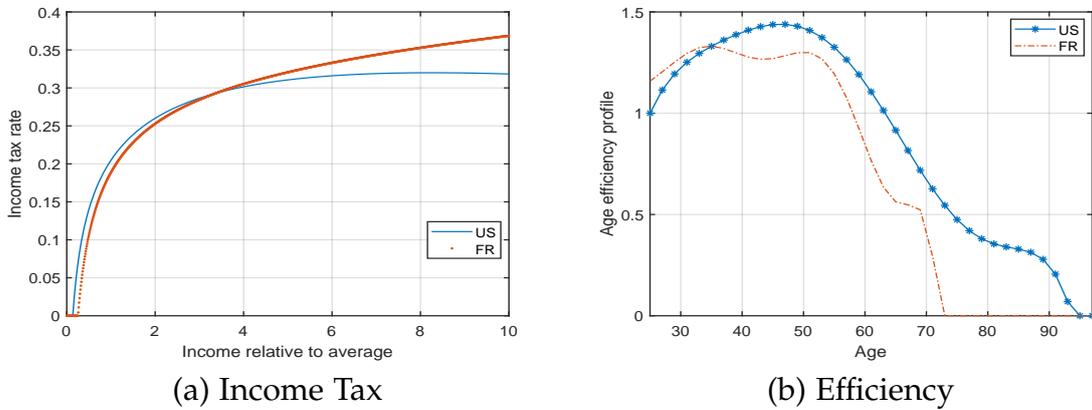
(b) Efficiency

The French age-efficiency profile is constructed from the French Labor Force Survey; the details are described in Appendix A. GDP per capita in France is about 80 percent of that in the United States. We adjust proportionally the level of the French efficiency profile so that the model matches the cross-country difference in GDP per capita found in the data. This is why the French efficiency profile does not start from one at age twenty-four. The right panel of Figure 4 compares the deterministic profiles of labor productivity in the two countries. The French efficiency profile rises slower from young to middle age and decreases faster afterward than the U.S. efficiency profile. As a result, an average worker of age sixty-five is almost as productive as a twenty-four-year-old in the United States, whereas the worker is only half as productive in France.

In our simulation, we take the age-efficiency profiles as exogenous. A solid analysis of why the profiles differ across countries is out of the scope of our analy-

---

[15]The rates are conservative compared to the actual rates.

[16]The data value for the ratio of aggregate social security spending to GDP is again the ratio of public expenditure on old-age pension benefits to GDP from the OECD Social Expenditure Database.

sis. Here we provide some of the possible reasons. First, we adjust proportionally the level of the French efficiency profile to match the cross-country difference in GDP per capita found in the data. As described in section 3.2.1, a re-scaling of the life-cycle deterministic profile is isomorphic to changing aggregate TFP in market production. Second, as for the variations of efficiency unit by age, the slower rise in the French profile might be related to the fact that the rise in wage is faster for college graduates than non-college graduates and the share of workers with a college degree is smaller in France than in the United States. The difference in the two profiles might be also related to the accumulation of human capital through learning by doing: French households work less in the market and therefore accumulate less human capital over their working lives. This implies that policies that reduce market working hours might also reduce the efficiency units, leading to further decline of market hours. Hence the quantitative effects we find in sections 5 and 6 are lower bounds of the policy effects.

5.2   Model Fit for the French Economy

This subsection compares the model's prediction of the allocations of expenditure and hours with the French data.

Hours Profiles and Expenditure Profiles by Age.   Figure 5 compares the model-predicted age profiles of expenditure and hours at home and in the market, which are nontargeted in the simulation, with the data. As the figure shows, the model nearly reproduces the French profiles with the differences from the US in the tax and transfer programs and in the age-efficiency profile.[17,18]

Aggregate Allocations of Hours and Expenditure.   Table 7 reports the model-implied aggregate hours and aggregate expenditure-to-GDP ratio in the two countries together with the data reported in Table 1. The model matches reasonably well the aggregate hours and expenditure share at home and in the market. More specifically, the model is able to generate the first two facts documented in section 2.2: France has less market time and more home time than the United States, and

---

[17]Compared with two recent papers—Erosa et al. (2012) and Laun and Wallenius (2016)—studying cross-country differences in labor supply late in the life cycle, our model can account for more differences in labor supply between the United States and France because we adopt a rich model with home production.

[18]Our model overpredicts market hours at younger ages because France's faster decline in the age-efficiency profile and its lower social security claiming age both incentivize French households to shift market hours from older ages to younger ages. This overprediction implies that French market hours at young ages are also affected by factors other than tax and transfer programs and productivity.

Figure 5: Age Profiles in France—-Model versus Data

(a) Expenditure   (b) Hours
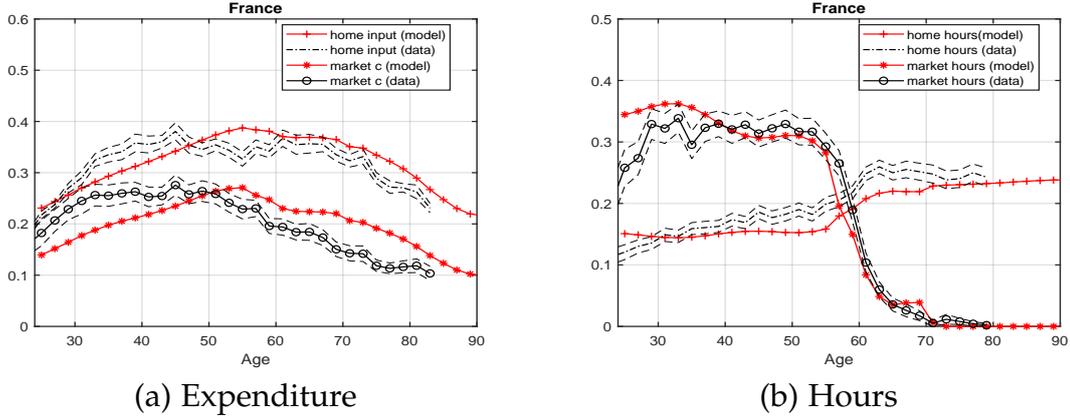
Notes: The dashed lines are the 95 percent confidence intervals of the data.

the cross-country difference in the expenditure share of market goods is larger than that in the expenditure share of home inputs.

Table 7: Aggregate Hours and Expenditure Shares—Model versus Data

	N_m	N_h	$\frac{C_m}{Y}$	$\frac{D}{Y}$
FR model	0.25	0.17	0.21	0.33
FR data	0.24	0.19	0.22	0.33
FR-US model	-0.03	0.01	-0.07	-0.04
FR-US data	-0.04	0.03	-0.06	-0.04

Notes: The reported values are aggregate shares of expenditures and hours across all ages. N_m denotes market-hours share, N_h denotes home-hours share, $\frac{C_m}{Y}$ denotes market-goods expenditure share, and $\frac{D}{Y}$ denotes home-inputs expenditure share.

In the next subsection, we quantify the contribution of each country-specific feature in generating those patterns, while we summarize the key mechanisms here. In the model, lower efficiency units and higher taxes in France favor home production over market production and thus increase home hours and reduce market hours. As for expenditure, higher taxes reduce the expenditure shares of both market goods and home inputs, as more income is directed to tax payments. The estimation implies that the substitutability between home goods and market goods is bigger than that between home time and home inputs ($\zeta_2 > \zeta_1$). Thus Proposition 2 implies that higher taxes and lower efficiency units in France generate a larger decline in expenditures on market goods than on home inputs. These intuitions imply that France's productivity and tax system favor production and consumption at home relative to production and consumption in the market and thus shift hours and expenditures from market to home.

24

Table 8: Market Allocation Relative to Home Allocation by Age—Model versus Data

| | Time | | | | Expenditure | | | |
| Age | US | | FR | | US | | FR | |
	Model	Data	Model	Data	Model	Data	Model	Data
28	2.44	2.57	2.41	2.23	0.71	0.74	0.64	0.84
38	2.69	2.24	2.22	1.94	0.79	0.72	0.68	0.74
48	2.34	2.12	2.00	1.74	0.81	0.82	0.70	0.73
58	1.44	1.71	0.82	0.83	0.78	0.81	0.65	0.60
68	0.45	0.54	0.11	0.08	0.71	0.72	0.60	0.47

Notes: This table reports the ratio of market to home allocation of expenditure and hours by age group in ten-year segments. For example, age twenty-eight represents the average for ages twenty-four to thirty-three.

Allocations of Life-Cycle Hours and Expenditure. Table 8 reports the model-implied ratios of market-to-home allocations for age groups in ten-year segments; the ratios were not targeted in the calibration. As the table shows, the model is consistent with the data in that the expenditures on home inputs exceed the expenditures on market goods at every age and market hours are higher than home hours for prime working ages. More importantly, the model predictions are consistent with the third fact documented in section 2.2—namely, a shift of expenditures and hours from market to home as households age and a larger shift in France than in the United States. In the model, this larger shift is mainly driven by the faster decrease of the French age-efficiency profile at older ages: for one reason, a lower wage gives rise to less market time and more home time; for another reason, Proposition 2 implies that under our parameterizations of elasticities ($\zeta_2 > \zeta_1$), a faster decline in wages leads to a faster decline in market-goods expenditure relative to home-inputs expenditure.

5.3 Decomposition

This subsection evaluates the quantitative effect of each country-specific feature in accounting for the difference in allocations of expenditure and time between the United States and France. We proceed by comparing the changes in the allocations after replacing one of the features in France with that in the United States. Since we assume France is a small open economy, the interest rate and wage rate stay the same. Table 9 reports the percent changes in the allocations of hours and expenditure in the aggregate from the French benchmark economy after changing each factor. As a comparison, the total changes of all factors from the French benchmark economy to the calibrated US economy are reported in the last row. Figure 6 plots the level changes in hours and expenditure by age resulted from policy and efficiency-profile changes, respectively. The corresponding life-cycle

profiles are reported in Appendix E. Expenditures in the figure are normalized by GDP in the benchmark French economy.

Consumption Tax. Row 2 of Table 9 reports the aggregate effect of replacing the French consumption tax with the US consumption tax. Unsurprisingly, when we apply the lower US rate to France, market consumption becomes cheaper and households choose to consume more of it. Because home inputs and home time are substitutes ($\zeta_1 > 1$), a reduction in the home input price leads households to substitute home hours with home inputs. Hence they reduce home hours and increase home inputs. As a result, the reduction in consumption tax raises the consumption of both market goods and home inputs. Because consumption and leisure are substitutes ($\zeta_3 > 1$), the substitution effect is larger than the income effect and therefore the increase in consumption leads to a decrease in leisure time. The decrease in leisure explains why market hours increase more than the decline in home hours.

More interestingly, the increase in expenditure is larger for market goods than for home inputs. This is because the elasticity of substitution between market goods and home goods is larger than that between home inputs and home time ($\zeta_2 > \zeta_1$) and therefore, as demonstrated in Proposition 2, a lower consumption tax rate induces a stronger substitution from home goods to market goods than from home time to home inputs and thereby generates a larger increase in market goods than in home inputs.

As for the magnitude, the consumption tax alone can account for 36 percent (23.62/64.83) of the cross-country difference in market-goods expenditure, 39 percent (16.31/41.74) of the difference in home-inputs expenditure, 27 percent (4.03/14.77) of the difference in market hours, and 35 percent (-2.76/-7.94) of the difference in home hours. In this decomposition, the percent change in output is the same as that in total efficiency units, which is mainly determined by the change in aggregate market hours; thus the change in output has a similar magnitude as that for market hours. Adopting the substantially lower US consumption tax rate leads to a large drop of 28 percent in total government spending.

Panel (a) of Figure 6 plots the changes in the life-cycle profiles of hours and expenditure shares after applying the US consumption tax to France. Although the consumption tax rate is the same for every age group, the changes in allocations are not uniform and are larger for people of prime working age. To understand this, note that the reduction in the consumption tax leads to a lower price of market goods and home inputs for every household. This reduction in price increases market hours and reduces home hours through substitution effects. The substitution is stronger for working age-population because they have higher efficiency-units

26

Table 9: Decomposition: Percent Change in Aggregate Allocations

(1)	N_m	N_h	C_m	D	Y	G
(2) Consumption tax	4.03	-2.76	23.62	16.31	3.52	-28.43
(3) Social security	-2.26	-0.20	14.53	10.55	-0.53	7.75
(4) Income tax	0.35	-0.03	0.71	0.09	1.15	3.48
(5) All policies	1.89	-2.91	42.27	28.60	4.11	-20.69
(6) Efficiency profile	12.64	-5.31	21.43	13.81	24.06	19.19
(7) US benchmark	14.77	-7.94	64.83	41.74	25.06	-8.91

Notes: This table shows the percent changes in each aggregate variable from the French benchmark after adopting US values.

and work more in the market. Thus the changes in allocations for them are larger.

Social Security System. Panel (b) of Figure 6 plots the changes in the life-cycle profiles when applying the US social security system to France. As the combined social security tax rate for workers and firms falls from 23.45 to 10.4 percent, households have more income to spend. As a result, they increase expenditures on both market goods and home inputs at all ages except at the end of their lives. At the end of life, expenditures on market goods and home inputs both decline significantly because households run out of assets and their consumption drops dramatically with the reduction in social security benefits. As can be seen in row 3 of Table 9, differences in the social security system contribute to 25 percent (10.55/41.74) of the cross-country difference in expenditure on home inputs and 22 percent (14.53/64.83) of the difference in expenditure on market goods. The magnitude of the effect is substantial but smaller than that of the effect of the consumption tax.

Panel (b) of Figure 6 also shows that when social security taxes are reduced and social security benefits become less generous, market hours decrease before the mid-fifties and increase afterward. This is driven by two important changes in the social security system. First, the reduction in the tax rate and pension benefit leads households to smooth working hours over their lives and therefore they reduce market hours at prime-ages and increase market hours at older ages. This is mostly responsible for the reduction in market hours and the rise in home hours before the mid-fifties. Second, the number of years for determining social security benefits increases from thirty-two to thirty-six. Hence, to maximize social security benefits, households choose to retire later and work more years. Correspondingly they increase their market hours and decrease their home hours at older ages. Thus, in our model, the difference in the social security system accounts partially

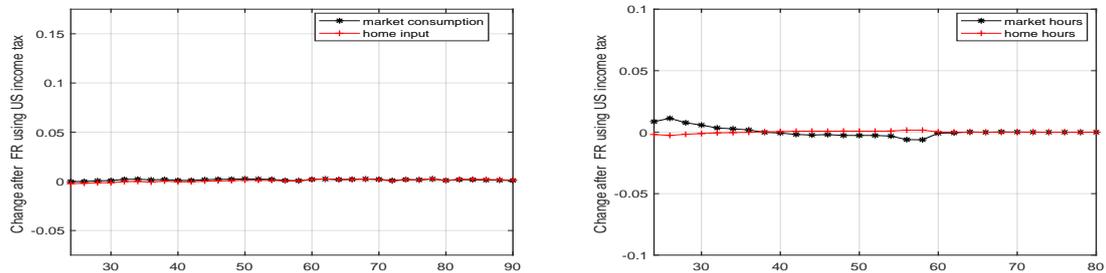# Figure 6: Changes in Allocation With US Policies and Efficiency Profile
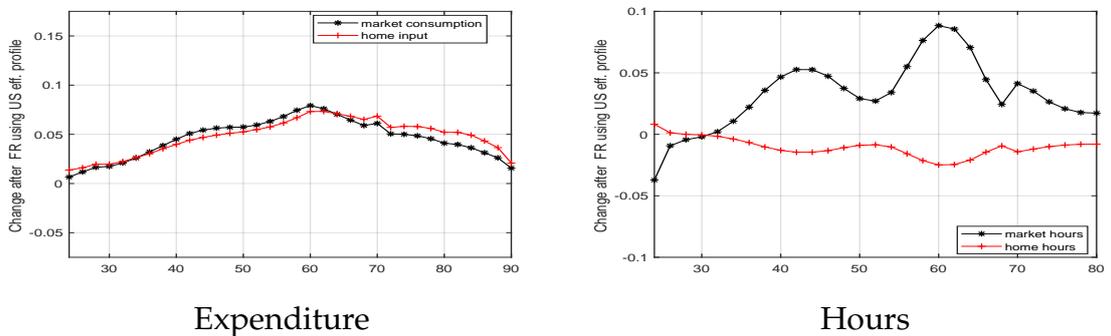
(a) Consumption Tax
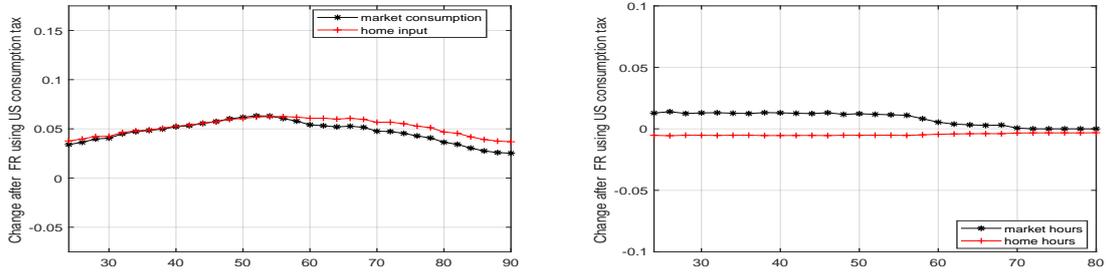
(b) Social Security System
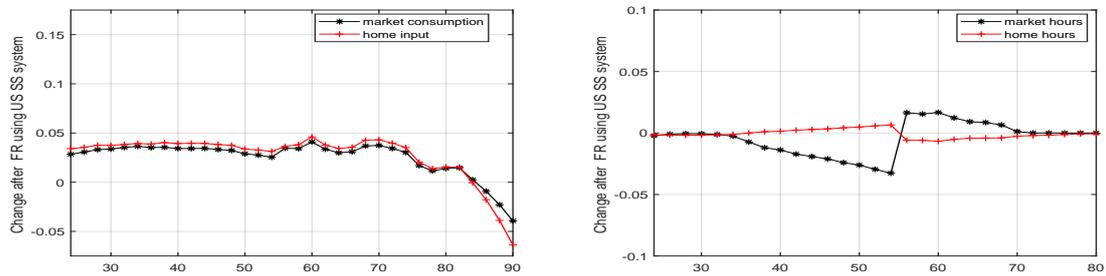
(c) Income Tax

(d) Efficiency Profile

Expenditure   Hours

Notes: This figure plots changes from the French benchmark in hours and expenditure by age after adopting US values. Expenditures are normalized by GDP per worker in the benchmark French economy. Panel (a) shows the changes after applying the US consumption tax to the French economy. Panel (b) shows the changes after applying the US social security system to the French economy. Panel (c) shows the changes after applying the US income tax to the French economy. Panel (d) shows the changes after applying the US efficiency profile to the French economy.

for the lower market time around retirement age in France.

The aggregate effect of the changes in social security system, reported in row 3 of Table 9, is a reduction in both market hours and home hours. The reduction in market hours results in a 0.53 percent reduction in output.[19] Government spending G goes up by 7.75 percent for two reasons. First, the increase in market goods and home inputs generates more revenues from consumption taxation. Second, social security payments by the firm are exempted from the income tax. Hence the reduction in the social security tax rate on the firm leads to higher taxable income and thus higher income tax revenue.

Income Tax.   As shown in Figure 4, the income tax in the US is less progressive than that in France but the two tax functions differ only by a small amount. Hence the quantitative effects of the income tax on allocations are small. After switching to US income taxes, total revenue from the income tax goes up since most households face a higher income tax rate. As a result, total government spending goes up.

All Policies.   In the decomposition exercises discussed so far, we changed only one specific policy to the US level and left all remaining policies at the French level. To separate the effects of policy differences from the effects of efficiency-profile differences, we now conduct decomposition exercises in which we use all US policy variables. Row 5 of Table 9 reports the total effects of all policies. All policies combined can account for 65 percent (42.27/64.83) of the total difference in the expenditure on market goods and 69 percent (28.60/41.74) of the total difference in the expenditure on home inputs between the United States and France. Among the policies, the consumption tax and social security system are more important than the income tax for determining expenditure allocations. Because the US social security system has opposite effect on market hours to the US consumption tax, all policies combined have relatively smaller effect on the difference in market hours between the United States and France. As for home hours, all policies combined can account for 37 percent (-2.91/-7.94) of the total difference.

Efficiency Profile.   Panel (d) of Figure 6 shows the changes in life-cycle profiles when applying the US age-efficiency profile to the French economy. As shown in Figure 4, the US efficiency profile is slightly lower before age thirty and are much higher later in life. This leads to a slight decline in market hours before age thirty

---

[19]The French experiment is a partial equilibrium one with the interest rate fixed. Therefore, output is determined only by the aggregate labor inputs. The reduction in output is thus not at odds with the literature that finds that in a general equilibrium a less generous social security system leads to higher output because of an increase in the capital stock.

and a large increase afterward. Changes in home hours are the reverse of the changes in market hours over the life cycle, but the changes are mitigated because leisure hours change in the same direction as home hours.

Row 6 of Table 9 reports the effects on the aggregate allocations. The higher US efficiency level increases output by 24 percent and generates large increases in expenditures on both market goods and home inputs. As proven in Proposition 2, the ratio of market goods to home inputs is increasing with efficiency units, resulting in a larger percent increase in market goods than in home inputs. The difference in the efficiency profile alone can account for 86 percent of the difference in aggregate market hours and 67 percent of the difference in aggregate home hours between France and the United States, compared to a contribution of 13 percent for market hours and 37 percent for home hours from all policies combined. In addition, the difference in the efficiency profile can account for 33 percent of the total difference in the expenditure on both market goods and home inputs, compared to a contribution of 65 percent for market goods and 69 percent for home inputs from all policies combined. The increases in efficiency units lead to more income and higher consumption and thus more tax revenue and higher government spending.

To summarize, the decomposition shows that policies are more important than the efficiency profile in accounting for the difference in the expenditure on market goods and home inputs between the United States and France while the efficiency profile is more important in accounting for the differences in the allocation of hours.

6   Policy Experiments for France

While the experiments in section 5.3 are useful for decomposing the effects of different policies on expenditure and time allocations, they are unsuitable for evaluating the effects of policy on welfare because government spending G varies after the changes in policy. To evaluate the welfare implications of the discussed tax and transfer policies, we proceed by replacing each French policy with the corresponding US policy while holding constant the government spending on each household as that in the French benchmark economy. This is achieved by imposing an additional proportional tax or subsidy on all kinds of incomes, including labor earnings and pension benefits, so that the government budget constraint is still balanced. This section reports the results of these policy experiments in terms of the allocations of expenditure and hours and evaluates the welfare implications.

6.1   Policies' Implications for Allocations

Table 10 reports for each policy experiment the percent changes to the aggregate allocations and the proportional income tax rate needed to keep government spending constant. The associated life-cycle profiles are provided in Appendix E. The differences in allocations between Tables 10 and 9 reflect the effects of the additional proportional income tax.

Row two in Table 10 shows that, to compensate for the reduction in tax revenue from switching to the US consumption tax, a 16 percent proportional tax on income is needed. It also shows that reducing consumption tax while increasing proportional income tax leads to a decline in market hours, a rise in home hours, and reductions in expenditures on both market goods and home inputs. The signs of the changes in hours and expenditure are the opposite of those in the decomposition experiment on the reduction of consumption tax without changing income tax (Row two in Table 9). Therefore, the comparison between Tables 10 and 9 shows that the additional proportional income tax leads to a decline in market hours, a rise in home hours, and reductions in expenditures on both market goods and home inputs. The reasons are as follows. Because home inputs and home time are substitutes ($\zeta_1 > 1$), a reduction in the effective price for home hours, caused by the proportional income tax, leads households to substitute home inputs with home hours, and therefore home hours increase. In addition, higher income tax leads to a reduction in expenditures for both market goods and home inputs since more income are directed to tax payment. Proposition 2 demonstrates that a rise in the proportional income tax generates a smaller ratio in the expenditures of market goods to home inputs and therefore the decline in the expenditure is smaller for home inputs. Because consumption and leisure are substitutes ($\zeta_3 > 1$), the decline in consumption leads to an increase in leisure time. The rise in both home hours and leisure implies a decline in market hours.

Applying the US social security system to the French economy requires imposing a negative proportional tax of 6 percent. A negative proportional tax, with the opposite effects as the positive proportional tax discussed above, raises market hours and expenditures on both market goods and home inputs, but reduces home hours. As a result, the increase in market-goods expenditures and home-inputs expenditures and the decrease in home hours reported in Row three in Table 10 are even larger compared with the decomposition experiment on the social security system (Row three in Table 9). In contrast, the rise in market hours, caused by the proportional tax, is large enough to overturn the finding of a decline in market hours in the decomposition experiment on the social security system.

Applying the US income tax to France requires imposing a negative propor-

31

tional tax of only 2 percent, the quantitative effects of which are in the same direction as the decomposition experiment on the progressive income tax (Row four in Table 9) and the size of the effects is relatively small.

The policy counterfactual of applying all US policies at once requires imposing a proportional income tax of 11 percent. For hours, the effects of consumption tax dominate those of the social security and income tax and generate a decline in market hours and a rise in home hours. For expenditures, the combined effects of social security and income tax dominate those of the consumption tax and generate an increase in expenditures on both market goods and home inputs. In all experiments, the change in output is again the same as the change in aggregate labor inputs and thus is close to the change in market hours.

Table 10: Policy Experiments: Percent Change in Aggregate Allocation

	τ_p	N_m	N_h	C_m	D	Y
Consumption tax	15.87	-5.37	2.94	-18.02	-12.64	-5.35
Social security	-6.28	0.77	-2.06	30.84	21.46	2.32
Income tax	-2.34	1.40	-0.69	5.97	3.73	2.17
All policies	11.14	-3.57	0.57	9.91	7.18	-1.19

Notes: This table shows the percent changes from the French benchmark economy in each aggregate variable after adopting US values while keeping government spending fixed.

6.2 Policies' Welfare Implications

This subsection discusses the welfare implications of the counterfactual policy experiments. Following De Nardi and Yang (2016), we measure the expected lifetime utility of a newborn conditional on her initial draws of labor productivity and asset position. The change in welfare is measured by the amount of assets that need to be given to a French household at age twenty-four, as a fraction of average income in the benchmark French economy, so that each household is indifferent between living in the benchmark French economy and moving to the counterfactual economy under the US policy regime. Hence negative asset compensation indicates that households are better off in the new French economy under the US policy regime. When reporting the results, however, we reverse the signs for asset compensation so that a positive number indicates a welfare gain of switching from the French policy to the US policy. The welfare measure, derived from the change in a household's utility, reflects not only the changes of market-goods consumption but also the changes in home production and leisure.

Table 11 reports the welfare implications when France adopts the US policies. To better understand the welfare benefits and costs of each policy experiment, we

Table 11: Welfare Implications

| | All | Initial productivity | | | | | Frac. gain | Avg. gain/loss | |
		1st	2nd	3rd	4th	5th		Winner	Loser
Consumption tax	-0.753	-0.214	-0.368	-0.650	-1.100	-1.791	0.000	0.000	0.753
SS system	1.902	0.993	1.210	1.693	2.521	3.819	1.000	1.902	0.000
Income tax	0.129	0.003	-0.011	0.066	0.238	0.583	0.764	0.173	0.011
All policies	0.911	0.591	0.631	0.793	1.145	1.807	1.000	0.911	0.000

Notes: This table reports the welfare effects of changing French policy values to the US values. In the first six columns, a positive number indicates a welfare gain from switching from the French benchmark economy to the economy with US policy. Welfare effects are reported by the amount of assets required relative to the average income in the French benchmark economy. The columns "1st" – "5th" report average welfare change by the quintile of the initial productivity level. The column "Frac. gain" reports the fraction of population who gain from the policy experiment. The last two columns report the average gain or loss for the population who gain or lose, respectively.

also report the fraction of households that gain and the average gains and losses conditional on a newborn's initial productivity draw. Reducing the consumption tax to the US level while keeping government spending fixed leads to a decline in welfare for the entire population. On average, a newborn would need to be compensated with a onetime asset transfer at age twenty-four that is equivalent to 75.3 percent of the average income in the benchmark economy. The welfare loss is driven by the large decreases in expenditure on market goods and home inputs, as reported in Table 10.

Adopting the US social security system benefits all French households. The rise in welfare is driven by the increase in market-goods expenditures, home-inputs expenditures, and leisure time. The welfare gain is especially large for more productive households because they pay more to and benefit less from social security and thus gain more from a less generous system. The result that reducing the size of social security improves welfare is in line with a large literature analyzing the effects of reforming the social security system by using models that include various features, such as liquidity constraints, income and longevity risks, altruism, flexible labor supply, endogenous benefit claims, housing, and home production.[20] The benefits of social security as insurance against labor-income shocks and as an annuity to insure against mortality risk are outweighed by the costs due to a distortional income tax and discouragement of savings. Thus, in our model, as in the literature, reducing the size of the social security system improves welfare.

Despite the small aggregate effects on hours and expenditures, adopting the US income tax has a large distributional impact on welfare. 76 percent of the households gain, and the rest of the households lose. This is because the US income tax is less progressive and the experiment leads to a negative proportional tax. Both

---

[20]See, for examples, Nishiyama and Smetters (2007), Fuster et al. (2007), Hurst and Willen (2007), Chen (2010), Imrohoroglu and Kitao (2012), Laitner and Silverman (2012), Yang (2013), and Dotsey et al. (2015).

policy changes lead to a decrease in the tax rate for the rich. Because of the persistence in the wage process, households that have high initial productivity draws are more likely to have high income over the course of their lives; thus they benefit from a less progressive income tax. In contrast, the less progressive US income tax increases the tax rate for the poor while the additional negative proportional income tax reduces the tax rate for them. Hence some households with low initial productivity draws benefit while others lose from the policy experiment.

Lastly, because the welfare gain from adopting the US social security system is large enough to more than offset the welfare loss from adopting the US consumption tax, when France adopts all the US policies there is a welfare gain for all French households that is equivalent to a onetime asset transfer at age twenty-four in the amount of 91.1 percent of the average income in the benchmark economy.

7 Conclusions

Using time-use and consumer-expenditure surveys, we documented large differences between the United States and France in consumption expenditures and time use by age. More specifically, we found that the French, at every age, work less in the market but spend more time on home production than Americans. In contrast, the French spend smaller shares of their income on market goods and home inputs, with a larger difference for market goods. Moreover both American and French households shift their allocations of time and expenditures from market to home as they age and the shift is faster and stronger in France.

We used a life-cycle model with home production to account for the cross-country differences in the age profiles of expenditure and hours. The model features a borrowing constraint, idiosyncratic income shock, endogenous labor-leisure decision, and endogenous retirement decision. The two countries differ in their consumption taxes, progressive income taxes, social security systems, and age-efficiency profiles. The model simulations showed that while the age-efficiency profile are crucial in accounting for the cross-country differences in allocation of hours, the consumption tax and social security are more important in accounting for the differences in the expenditure profiles. Finally, we studied the welfare implications of the tax and transfer programs. We found that reducing the French consumption tax to the US level decreases welfare, adopting the US social security system increases welfare, and adopting the US income tax has a small but distributional significant effect on welfare in France. The benefit of adopting the US social security system outweighs the cost of adopting the US consumption tax; therefore the net effect of adopting all three US policies is welfare improving.

In building a rich model that quantifies the key difference in the U.S. and

France, we make some important assumptions. First, for tractability, we treat the life-cycle efficiency profiles as exogenous parameters in the analysis. However, as discussed in section 5, the profiles might be affected by policies. Hence it would be interesting to incorporate the endogenous effects of policies on human capital accumulation and thus on the efficiency profiles. Second, due to computational costs, we focus on steady state analysis. It is also interesting to study the changes in allocations and welfare along the transition path due to the changes in policies. We leave these topics for future analysis.

References

Aguiar, M. and Hurst, E. (2007). Measuring Trends in Leisure: The Allocation of Time over Five Decades, *The Quarterly Journal of Economics* **122**(3): 969–1006.

Aguiar, M. and Hurst, E. (2013). Deconstructing Life Cycle Expenditure, *Journal of Political Economy* **121**(3): 437–492.

Benhabib, J., Rogerson, R. and Wright, R. (1991). Homework in macroeconomics: household production and aggregate fluctuations, *Journal of Political Economy* **99**(6): 1166–1187.

Bick, A. and Fuchs-Schündeln, N. (2018). Taxation and labor supply of married couples across countries: A macroeconomic analysis, *Review of Economic Studies* **85(3)**: 1543–1576.

Boerma, J. and Karabarbounis, L. (2020). Labor Market Trends and the Changing Value of Time, *Journal of Economic Dynamics and Control* **115**: 1–19.

Boerma, J. and Karabarbounis, L. (2021). Inferring inequality with home production. Econometrica, *forthcoming*.

Borella, M., De Nardi, M. and Yang, F. (2018). The aggregate implications of gender and marriage, *The Journal of the Economics of Ageing* **11**: 6 – 26. Macroeconomics of Aging.
URL: *http://www.sciencedirect.com/science/article/pii/S2212828X16300494*

Bridgman, B., Duernecker, G. and Herrendorf, B. (2018). Structural Transformation, Marketization, and Household Production around the World, *Journal of Development Economics* **113**: 102–126.

Bullard, J. and Feigenbaum, J. (2007). A leisurely reading of the life-cycle consumption data, *Journal of Monetary Economics* **54**(8): 2305–2320.

Carroll, C. D. (1997). Buffer-Stock Saving and the Life Cycle/Permanent Income Hypothesis, *The Quarterly Journal of Economics* **112**(1): 1–55.

Chakraborty, I., Holter, H. A. and Stepanchuk, S. (2015). Marriage stability, taxation and aggregate labor supply in the U.S. vs. Europe, *Journal of Monetary Economics* **72**: 1–20.

Chen, K. (2010). A life-cycle analysis of social security with housing, *Review of Economic Dynamics* **13**(3): 597–615.

De Nardi, M. and Yang, F. (2016). Wealth inequality, family background, and estate taxation, *Journal of Monetary Economics* **77**: 130 – 145.

Dotsey, M., Li, W. and Yang, F. (2014). Consumption and time use over the life cycle, *International Economic Review* **55**(3): 665–692.

Dotsey, M., Li, W. and Yang, F. (2015). Home production and social security reform, *European Economic Review* **73**: 131–150.

Duernecker, G. and Herrendorf, B. (2018). On the allocation of time – A quantitative analysis of the roles of taxes and productivities, *European Economic Review* **102**: 169–187.

Erosa, A., Fuster, L. and Kambourov, G. (2012). Labor supply and government programs: A cross-country analysis, *Journal of Monetary Economics* **59**(1): 84–107.

Fernandez-Villaverde, J. and Krueger, D. (2007). Consumption over the Life Cycle: Facts from Consumer Expenditure Survey Data, *The Review of Economics and Statistics* **89**(3): 552–565.

French, E. (2005). The effects of health, wealth and wages on labor supply and retirement behavior, *Review of Economic Studies* **72**(2): 395–427.

Fuster, L., Imrohoroglu, A. and Imrohoroglu, S. (2007). Elimination of social security in a dynastic framework, *Review of Economic Studies* **74**(1): 113–145.

Gourinchas, P.-O. and Parker, J. A. (2002). Consumption over the life cycle, *Econometrica* **70**(1): 47–89.

Greenwood, J. and Hercowitz, Z. (1991). The allocation of capital and time over the business cycle, *Journal of Political Economy* **99**(6): 1188–1214.

Guvenen, F., Kuruscu, B. and Ozkan, S. (2014). Taxation of human capital and wage inequality: A cross-country analysis, *Review of Economic Studies* **81**: 818–850.

Huggett, M. (1996). Wealth distribution in life-cycle economies, *Journal of Monetary Economics* **38**(3): 469–494.

Huggett, M. and Ventura, G. (2000). On the distributional effects of social security reform, *Review of Economic Dynamics* **2**: 498–531.

Hurst, E. and Willen, P. (2007). Social security and unsecured debt, *Journal of Public Economics* **91**: 1273–1297.

Imrohoroglu, S. and Kitao, S. (2012). Social security , benefit claiming and labor force participation and long-run sustainability, *American Economic Journal: Macroeconomics* **4**(3): 96–127.

Laitner, J. and Silverman, D. (2012). Consumption, retirement and social security: Evaluating the efficiency of reform that encourages longer careers, *Journal of Public Economics* **96**(7-8): 615–634.

Laun, T. and Wallenius, J. (2016). Social Insurance and Retirement: A Cross-Country Perspective, *Review of Economic Dynamics* **22**: 72–92.

McDaniel, C. (2011a). Forces shaping hours worked in the oecd, 1960-2004, *American Economic Journal: Macroeconomics* **3**(4): 27–52.

McDaniel, C. (2011b). Forces Shaping Hours Worked in the OECD, 1960-2004, *American Economic Journal: Macroeconomics* **3**(4): 27–52.

McGrattan, E. R., Rogerson, R. and Wright, R. (1997). An equilibrium model of the business cycle with household production and fiscal policy, *International Economic Review* **38**(2): 267–290.

Neal, D. and Johnson, W. (1996). The role of premarket factors in black-white wage differences, *Journal of Political Economy* **104**(5): 869–895.

Ngai, R. L. and Pissarides, C. A. (2011). Taxes, Social Subsidies, and the Allocation of Work Time, *American Economic Journal: Macroeconomicss* **3**(4): 1–26.

Nishiyama, S. and Smetters, K. (2007). Does social security privatization produce efficiency gains?, *Quarterly Journal of Economics* **122**(4): 1677–1719.

Ohanian, L., Raffo, A. and Rogerson, R. (2008). Long-term changes in labor supply and taxes: Evidence from oecd countries, 1956-2004, *Journal of Monetary Economics* **55**(8): 1353–1362.

Olovsson, C. (2009). Why do Europeans work so little?, *International Economic Review* **50**(1): 39–61.

Passero, W., Garner, T. I. and McCully, C. (2012). Understanding the relationship: Ce survey and pce. Working Paper.

Prescott, E. C. (2004). Why Do Americans Work So Much More Than Europeans?, *Federal Reserve Bank of Minneapolis Quarterly Review* **28**(July): 2–13.

Ragan, K. S. (2013). Taxes and time use: Fiscal policy in a household production model, *American Economic Journal: Macroeconomics* **5**(1): 168–192.

Rogerson, R. (2008). Structural transformation and the deterioration of european labor market outcomes, *Journal of Political Economy* **116**(2): 235–259.

Rogerson, R. and Wallenius, J. (2016). Retirement, home production and labor supply elasticities, *Journal of Monetary Economics* **78**(C): 23–34.

Rupert, P., Rogerson, R. and Wright, R. (1995). Estimating Substitution Elasticities in Household Production Models, *Economic Theory* **6**: 179–193.

Yang, F. (2009). Consumption over the Life Cycle: How Different is Housing?, *Review of Economic Dynamics* **12**(3): 423–443.

Yang, F. (2013). Social security reform with impure intergenerational altruism, *Journal of Economic Dynamics and Control* **37**: 52–67.

Appendix

A   Data

A.1   Time Use

We use the Multinational Time Use Study (MTUS) to construct market hours and home hours.[21] The latest year for which French time-use data are available is 2010. For the United States, the data are available for more years and we use the averages from 2009 to 2011 so that the data cover similar years to those in France. Time-use data record time diaries from survey respondents. The survey groups time spent on daily activities into twenty-five types of activity, and we further group the twenty-five activities into market hours, home hours, and leisure. The division of the activities follows Aguiar and Hurst (2007). Market and home activities are summarized in Table A.1. The remainder is leisure activities.

Table A.1: MTUS Activities and Categories

MTUS Variable	Category
Paid work	Market work
Commuting to work	Market work
Food preparation	Nonmarket work
Cleaning	Nonmarket work
Home & vehicle maintenance	Nonmarket work
Obtaining goods and services	Nonmarket work
Other care	Nonmarke work
Gardening & pet	Nonmarket work
Remainder	Leisure

The MTUS survey records time diaries for different days of the week and shows that weekdays and weekends have very different time allocations. It is therefore important to weight observations by day of the week. The MTUS provides such weights that incorporate the weights for the days of a week (5/7 for weekdays and 2/7 for weekends) and the population weights. Hence we weight the observations as suggested by the MTUS. The age profiles of market and home hours are constructed as the average weekly hours per adult by two-year age segments for individuals aged twenty-four or above.

---

[21]The data can be obtained from http://www.timeuse.org/mtus/.

A.2 Consumption Expenditure

Consumption Expenditure for the United States. We use the Consumer Expenditure Survey (CEX) to construct consumption expenditures in the United States.[22] To be consistent with French data, we construct the average expenditures between 2009 and 2011. We classify the detailed expenditure categories in the CEX into market and home expenditures following Dotsey et al. (2014). Table A.2 reports the division of expenditures between market goods and home inputs. The CEX groups all transportation expenditures together, and it is not feasible to separate the part dedicated to home production from the other parts, so we prorate transportation expenses by travel time for market and home activities that we obtained from the MTUS.

We use the actual rent for renters and the imputed rent for homeowners for spending on housing. We eliminate the observations for any subsidized or student renters, as their reported expenditures do not reflect the true value of rental costs. The number of observations eliminated is negligible in both countries. To avoid extreme values, we also exclude households with total expenditures belonging to the top and bottom 1 percent of the distribution. We weight the consumption expenditures using the sample-suggested population weights and construct the age profiles of expenditures on market goods and home inputs as the cross-sectional averages for every two-year age group, where the age is that of the head of household.

Consumption Expenditure for France. We use the French Household Budget Survey (HBS) to construct consumption expenditures in France. The data come from the Luxembourg Income Study Database.[23] Similar to the CEX, the HBS is a cross-sectional household survey that collects information on consumption expenditure by detailed categories. The data are available for 2010, and there are over fifteen thousand observations. The categories in the HBS are slightly different from those in the CEX. We divide these categories into market goods and home inputs so that they are comparable to those in the United States. Table A.3 reports the French division of expenditures between market goods and home inputs.

NIPA Adjustment. Let c_{mt} and d_t be the average expenditure levels for age t in the data, $\bar{c}_m$ the average market expenditure, and $\bar{d}$ the average home expenditure. The adjustment procedure is as follows. First, we derive PCE as a share of GDP (from the NIPA) and denote the share by s; second, we derive the ratio of expenditure for each age group to the average expenditure (across all ages) in the

---

[22]Data can be obtained from http://www.bls.gov/cex/.
[23]Access may be obtained at http://www.lisdatacenter.org/.

Table A.2: US Market- and Home-Expenditure Categories

Market-Expenditure Categories

Food away from home
Alcoholic beverages
Apparel and services
Tobacco and smoking supplies
Reading
Personal care
Other lodging
Fees and admissions
Televisions, radios, and sound equipment
Other equipment and services
Medical services, prescription drugs, and medical supplies
Education
Insurance
Transport, weighted by market-time share

Home-Expenditure Categories

Food at home
Maintenance, repairs, and other expenses
Household operations
House furnishings and equipment
Utilities, fuels, and public services
Housing
Transport, weighted by home-time share

data ($\frac{c_{mt}+d_t}{\bar{c}_m+\bar{d}}$); third, the product of s and the expenditure ratio derived in the second step gives the adjusted total expenditure-to-income ratio by age group ($s\frac{c_{mt}+d_t}{\bar{c}_m+\bar{d}}$); fourth, the expenditure shares for market and home are calculated by assigning the total expenditure share from step three according to the ratio between market and home expenditures from the data for each age group ($s_{c_{mt}} = s\frac{c_{mt}+d_t}{\bar{c}_m+\bar{d}}\frac{c_{mt}}{c_{mt}+d_t}$ for market and $s_{d_t} = s\frac{c_{mt}+d_t}{\bar{c}_m+\bar{d}}\frac{d_t}{c_{mt}+d_t}$ for home). The adjustment procedure gives an aggregate expenditure share of the same value as the share in the NIPA and keeps the relative expenditures constant across age groups and across market and home expenses. Figure 1 plots $s_{c_{mt}}$ and s_{d_t}.

Table A.3: French Market- and Home-Expenditure Categories

Market-Expenditure Categories
Alcohol and tobacco
Clothing and footwear
Health consumption
Recreation and culture
Education
Restaurants and hotels
Personal care
Personal goods and services
Insurance
Transport, weighted by market-time share

Home-Expenditure Categories
Consumption of food and nonalcoholic beverages
Consumption of furnishings, equipment, appliances, tools, etc.
Water, electricity, gas, and other fuels
Actual rent for renters and equivalent rent for homeowners
Consumption of communication
Transport, weighted by home-time share
Social protection

A.3 Wages in France and the United States

We use the March supplement of the Current Population Survey (CPS 2010-18) and the French Labor Force Survey (LFS 2010) to construct the age-efficiency wage profiles.[24] We compute hourly wages using earnings and usual hours worked at an individual's main job. For the decision about labor-market participation, it is important to know the potential wage offered if nonworking individuals were to choose to work. But these wage offers cannot be observed. Following Neal and Johnson (1996), we use the least absolute deviations (LAD) estimator to impute wages for individuals who are not working. The LAD estimator is the solution to the following optimization problem:

$$\min_{\beta} \sum |y_i - x_i\beta|$$

Here y_i is wages and x_i is a vector that contains observables such as age, education, race, marital status, and gender. In addition to current marital status, we include

---

[24]French Labor Force Survey: https://www.insee.fr/en/metadonnees/source/serie/s1223/. CPS microdata sets were obtained from IPUMS: http://cps.ipums.org.

an indicator variable representing whether an individual was ever married.

Using the estimated equations, we impute a wage for individuals who do not have an observed wage because they are either unemployed or are out of the labor force. To compute the age-efficiency profile, we average wages by age, where the wage comes from the data for individuals with a wage observation and is imputed from the regression equation for individuals without a wage observation. The average wage for each two-year age group is then normalized to the average wage of individuals aged twenty-four to twenty-five. The generated average wages for prime-aged individuals are quite similar to the actual average wages in the data because of the high labor force participation rate of prime-aged individuals.

B Solution to the Static Model

The representative agent solves the following problem:

$$
\max_{c_m,d,n_h,n_m} U(c,l) = \frac{\left[\omega_3 c^{1-\frac{1}{\zeta_3}} + (1-\omega_3)l^{1-\frac{1}{\zeta_3}}\right]^{\frac{1-\gamma}{1-\frac{1}{\zeta_3}}} - 1}{1-\gamma}
$$

subject to

$$
c = \left[\omega_2 c_m^{1-\frac{1}{\zeta_2}} + (1-\omega_2)c_h^{1-\frac{1}{\zeta_2}}\right]^{\frac{1}{1-\frac{1}{\zeta_2}}} \tag{14}
$$

$$
c_h = \left[\omega_1 d^{1-\frac{1}{\zeta_1}} + (1-\omega_1)(n_h)^{1-\frac{1}{\zeta_1}}\right]^{\frac{1}{1-\frac{1}{\zeta_1}}} \tag{15}
$$

$$
(1+\tau_c)c_m + (1+\tau_c)d = (1-\tau_i)wn_m \tag{16}
$$

$$
l = 1 - (n_h + n_m) \tag{17}
$$

B.1 Solution

Let μ be the Lagrange multiplier on the budget constraint. FOCs are given as follows:

$$
(c_m) \qquad \frac{\partial U}{\partial c}\frac{\partial c}{\partial c_m} = (1+\tau_c)\mu, \tag{18}
$$

$$
(d) \qquad \frac{\partial U}{\partial c}\frac{\partial c}{\partial c_h}\frac{\partial c_h}{\partial d} = (1+\tau_c)\mu, \tag{19}
$$

$$
(n_h) \qquad \frac{\partial U}{\partial c}\frac{\partial c}{\partial c_h}\frac{\partial c_h}{\partial n_h} = \mu(1-\tau_i)w, \tag{20}
$$

$$
(n_m) \qquad \frac{\partial U}{\partial l} = \mu(1-\tau_i)w \tag{21}
$$

From equations (19) and (20), we have the following:

$$\frac{\partial c_h}{\partial d}\frac{1-\tau_i}{1+\tau_c}w = \frac{\partial c_h}{\partial n_h}$$

Plugging in the derivatives gives us the following:

$$\frac{1-\tau_i}{1+\tau_c}w\omega_1 d^{-\frac{1}{\zeta_1}} = (1-\omega_1)n_h^{-\frac{1}{\zeta_1}},$$

$$\left(\frac{(1-\tau_i)w\omega_1}{(1+\tau_c)\,(1-\omega_1)}\right)^{-\zeta_1} d = n_h,$$

or

$$\Delta_{nh} \equiv \frac{n_h}{d} = \left(\frac{(1-\tau_i)w\omega_1}{(1+\tau_c)(1-\omega_1)}\right)^{-\zeta_1} \tag{22}$$

The ratio $\Delta_{ch} \equiv \frac{c_h}{d}$ can be solved from the definition of c_h in equation (15) directly:

$$
\begin{aligned}
\Delta_{ch} \equiv \frac{c_h}{d} &= \left(\omega_1 + (1-\omega_1)\Delta_{nh}^{1-\frac{1}{\zeta_1}}\right)^{\frac{1}{1-\frac{1}{\zeta_1}}} \\
&= \left(\omega_1 + (1-\omega_1)\left(\frac{(1-\tau_i)w\omega_1}{(1+\tau_c)(1-\omega_1)}\right)^{1-\zeta_1}\right)^{\frac{1}{1-\frac{1}{\zeta_1}}} \tag{23}
\end{aligned}
$$

From equations (18) and (19), we get the following:

$$\frac{\frac{\partial c}{\partial c_m}}{\frac{\partial c}{\partial c_h}} = \frac{\partial c_h}{\partial d}$$

Plugging in the derivatives, we find the following:

$$\frac{\omega_2}{1-\omega_2}(\frac{c_h}{c_m})^{\frac{1}{\zeta_2}} = \left(\frac{c_h}{d}\right)^{\frac{1}{\zeta_1}}\omega_1 = \omega_1\Delta_{ch}^{\frac{1}{\zeta_1}}$$

Thus we derive $\Delta_{cm} \equiv \frac{c_m}{d}$ as follows:

$$\Delta_{cm} \equiv \frac{c_m}{d} = \left(\frac{\omega_2}{(1-\omega_2)\omega_1}\right)^{\zeta_2} \Delta_{ch}^{1-\frac{\zeta_2}{\zeta_1}} \tag{24}$$

From the definition of c in equation (14), we get the following:

$$\Delta_c \equiv \frac{c}{d} = [\omega_2\Delta_{cm}^{1-\frac{1}{\zeta_2}} + (1-\omega_2)\Delta_{ch}^{1-\frac{1}{\zeta_2}}]^{\frac{1}{1-\frac{1}{\zeta_2}}} \tag{25}$$

The ratio of $\Delta_l \equiv \frac{l}{d}$ can be solved by first combining equations (18) and (21):

$$\frac{\frac{\partial U_t}{\partial l}}{\frac{\partial U_t}{\partial c}} = \frac{\partial c}{\partial c_m}\frac{1-\tau_i}{1+\tau_c}w$$

Plugging in derivatives, we get the following:

$$\frac{1-\omega_3}{\omega_3}\left(\frac{c}{l}\right)^{1/\zeta_3} = \frac{1-\omega_3}{\omega_3}\left(\frac{\Delta_c\, d}{\Delta_l\, d}\right)^{1/\zeta_3} = \omega_2\frac{c_m^{-\frac{1}{\zeta_2}}}{c^{-\frac{1}{\zeta_2}}}\frac{(1-\tau_i)}{(1+\tau_c)}w$$

Using the definition of Δ_{cm} and Δ_c, we have the following:

$$
\begin{aligned}
\Delta_l \;\equiv\; \frac{l}{d} &= \left(\frac{1-\omega_3}{\omega_3\omega_2 w}\frac{1+\tau_c}{1-\tau_i}\right)^{\zeta_3}\Delta_c\left(\frac{\Delta_c}{\Delta_{cm}}\right)^{\frac{-\zeta_3}{\zeta_2}} \\
&= \left(\frac{1-\omega_3}{\omega_3\omega_2 w}\frac{1+\tau_c}{1-\tau_i}\right)^{\zeta_3}\left(\omega_2 + (1-\omega_2)\left(\frac{\Delta_{ch}}{\Delta_{cm}}\right)^{1-\frac{1}{\zeta_2}}\right)^{\frac{\zeta_2-\zeta_3}{\zeta_2-1}}\Delta_{cm} \\
&= \left(\frac{1-\omega_3}{\omega_3\omega_2 w}\frac{1+\tau_c}{1-\tau_i}\right)^{\zeta_3}\left(\omega_2 + (1-\omega_2)\left(\frac{(1-\omega_2)\omega_1}{\omega_2}\right)^{\zeta_2-1}\Delta_{ch}^{\frac{\zeta_2-1}{\zeta_1}}\right)^{\frac{\zeta_2-\zeta_3}{\zeta_2-1}}\Delta_{cm}
\end{aligned}
$$

Thus, we have solved the ratios of all other variables relative to d. Finally, we solve d from the budget constraint:

$$(1+\tau_c)\Delta_{cm}d + (1+\tau_c)d = (1-\tau_i)w\left(1-(\Delta_{nh}+\Delta_l)\,d\right)$$

This gives us the following:

$$d = \frac{(1-\tau_i)w}{(1+\tau_c)\Delta_{cm} + (1+\tau_c) + (1-\tau_i)w(\Delta_{nh}+\Delta_l)} \tag{26}$$

We solve the rest of the allocations as follows:

$$
\begin{aligned}
n_h &= \Delta_{nh}\, d, & (27) \\
n_m &= 1-(\Delta_{nh}+\Delta_l)\, d, & (28) \\
c_m &= \Delta_{cm}\, d & (29)
\end{aligned}
$$

B.2   Proof of Propositions 1 and 2

Proof of Proposition 1.   Equation (22) gives us the following

$$\log\Delta_{nh} = -\zeta_1\log\left(\frac{(1-\tau_i)w\omega_1}{(1+\tau_c)(1-\omega_1)}\right) \tag{30}$$

Thus, we can solve and determine the sign of the following partial derivatives:

$$\frac{\partial \log \Delta_{nh}}{\partial \log w} = -\zeta_1 < 0; \tag{31}$$

$$\frac{\partial \log \Delta_{nh}}{\partial \log(1 - \tau_i)} = -\zeta_1 < 0; \tag{32}$$

$$\frac{\partial \log \Delta_{nh}}{\partial \log(1 + \tau_c)} = \zeta_1 > 0 \tag{33}$$

Thus, $\frac{n_h}{d}$ is increasing in τ_c and τ_i and is decreasing in w. Moreover, the effects of τ_c, τ_i, and w are increasing in ζ_1.

Proof of Proposition 2. We first solve and determine the sign of the partial derivatives with respect to $\log \Delta_{ch}$. Equation (23) gives us the following:

$$\log \Delta_{ch} = \frac{1}{1 - \frac{1}{\zeta_1}} \log \left(\omega_1 + (1 - \omega_1) \Delta_{nh}^{1 - \frac{1}{\zeta_1}} \right) \tag{34}$$

$$= \frac{1}{1 - \frac{1}{\zeta_1}} \log \left(\omega_1 + (1 - \omega_1) \left(\frac{(1 - \tau_i) w \omega_1}{(1 + \tau_c)(1 - \omega_1)} \right)^{1 - \zeta_1} \right) \tag{35}$$

Note the following:

$$\frac{\partial \log \Delta_{ch}}{\partial \log \Delta_{nh}} = \frac{\partial \log \Delta_{ch}}{\partial \Delta_{nh}} \Delta_{nh} = \frac{(1 - \omega_1) \Delta_{nh}^{1 - \frac{1}{\zeta_1}}}{\left(\omega_1 + (1 - \omega_1) \Delta_{nh}^{1 - \frac{1}{\zeta_1}} \right)} > 0 \tag{36}$$

Combined with the results in the proof of Proposition 1, we further determine the sign of the following partial derivatives:

$$\frac{\partial \log \Delta_{ch}}{\partial \log w} = \frac{\partial \log \Delta_{ch}}{\partial \log \Delta_{nh}} \frac{\partial \log \Delta_{nh}}{\partial \log w} < 0; \tag{37}$$

$$\frac{\partial \log \Delta_{ch}}{\partial \log(1 - \tau_i)} = \frac{\partial \log \Delta_{ch}}{\partial \log \Delta_{nh}} \frac{\partial \log \Delta_{nh}}{\partial \log(1 - \tau_i)} < 0; \tag{38}$$

$$\frac{\partial \log \Delta_{ch}}{\partial \log(1 + \tau_c)} = \frac{\partial \log \Delta_{ch}}{\partial \log \Delta_{nh}} \frac{\partial \log \Delta_{nh}}{\partial \log(1 + \tau_c)} > 0 \tag{39}$$

Moving on to Δ_{cm}, equation 24 gives us the following:

$$\log(\Delta_{cm}) = \zeta_2 \log \left(\frac{\omega_2}{(1 - \omega_2)\omega_1} \right) + \left(1 - \frac{\zeta_2}{\zeta_1} \right) \log \Delta_{ch} \tag{40}$$

We can see easily that $\frac{\partial \log \Delta_{cm}}{\partial \log \Delta_{ch}} = 1 - \frac{\zeta_2}{\zeta_1} < 0$ iff $\zeta_1 < \zeta_2$. Thus, we can see that iff

47

$\zeta_1 < \zeta_2$, the following is true:

$$\frac{\partial \log \Delta_{cm}}{\partial \log w} = \frac{\partial \log \Delta_{cm}}{\partial \log \Delta_{ch}} \frac{\partial \log \Delta_{ch}}{\partial \log w} > 0; \qquad (41)$$

$$\frac{\partial \log \Delta_{cm}}{\partial \log(1 - \tau_i)} = \frac{\partial \log \Delta_{cm}}{\partial \log \Delta_{ch}} \frac{\partial \log \Delta_{ch}}{\partial \log(1 - \tau_i)} > 0; \qquad (42)$$

$$\frac{\partial \log \Delta_{cm}}{\partial \log(1 + \tau_c)} = \frac{\partial \log \Delta_{cm}}{\partial \log \Delta_{ch}} \frac{\partial \log \Delta_{ch}}{\partial \log(1 + \tau_c)} < 0. \qquad (43)$$

C   The Computation Algorithm

This appendix describes the computation algorithm. To solve the steady-state equilibrium numerically, we discretize the stochastic productivity process into a five-state Markov chain. The state space for average social security earnings is discretized into a grid of fifteen points, and the state space for assets is discretized into an unevenly spaced grid of thirty points. The choice variables are searched over a grid of two hundred points for home inputs and fifty points for market hours; they are continuous for other variables. When computing the expected values next period, we use piecewise linear interpolation to approximate value functions for the points not on the state grids.

We solve for the steady-state equilibrium in the United States as follows:

1. Guess the interest rate r and the wage rate w.

2. Guess the amount of accidental bequests.

3. Solve the value function and policy functions for the last period of life. By backward induction, repeat at each age until reaching the first period in life.

4. Starting from the initial distribution at the beginning of the life cycle, compute the stationary distribution of households by forward induction using the policy functions.

5. Check whether the amount of associated accidental bequests equals the initial guess. If not, go back to step 2 and update accidental bequests.

6. Check whether market-clearing conditions hold. If not, go to step 1 and update the initial guesses.

The French economy is solved similarly, except that we do not need to iterate over interest rate and wage rate to check for market-clearing conditions. In the policy experiments in which government spending is fixed to that in the benchmark French economy, we further iterate over the proportional income tax to balance the government budget constraint.

D   French Social Security Tax

The French social security system consists of a public pension and a mandatory occupational pension. The public pension had a flat tax rate of 6.75 percent for employees and 9.9 percent for employers in 2010 and an earnings cap of average earnings. The mandatory occupational pension comprises two schemes. One is for employees (the ARRCO, or Association for Employees' Supplementary Pension Schemes), and the other one is for managerial and executive staff (the AGIRC, or General Association of Retirement Institutions for Executives). We use the first one to calculate the social security tax rate since it covers most workers.

The ARRCO has two income brackets. The tax rate is constant within each bracket and is zero if earnings are higher than the second bracket. The first bracket has an earnings cap equal to average earnings, and the second bracket has an earnings cap ranging between average earnings and three times average earnings. Table D.4 reports the tax rate for each bracket and the total tax rate for public and occupational pensions for average income and for three times the average income. Because there are earnings caps, the tax rate, including both the public pension and the mandatory occupational pension and taking into account the earnings brackets, is decreasing with income. Hence, for earnings between one and three times average earnings, the tax rate for employees is between 10.55 percent and 9.45 percent, and for earnings greater than three times earnings it is less than 9.45 percent. We use 9.45 percent as the value for τ_s in the simulation. This is a conservative value since most of the population earns less than three times average earnings. Similarly, we use a conservative value of 14 percent as the employer tax rate τ_f.

Table D.4: French Social Security Tax Rate, %

	Employee rate	Employer rate
Public		
$\leq$ avg. earnings	6.75	9.9
ARRCO		
$\leq$ avg. earnings	3.8	5.7
1– 3*avg. earnings	8.9	13.3
Total		
1*avg. earnings	6.75+3.8 = 10.55	9.9+5.7=15.6
3*avg. earnings	[(6.75+3.8)*1+8.9*2)]/3=9.45	[(9.9%+5.7%)*1+13.3*2)]/3=14

While the public-pension benefit is based on the best twenty-five years of earnings, the occupational pension is based on average lifetime earnings. Since the retirement age is 65, the length of working life is 65-24=41 in the model. We use

the average of 25 and 41 years as the number of best years that the pension income is tied to.[25]
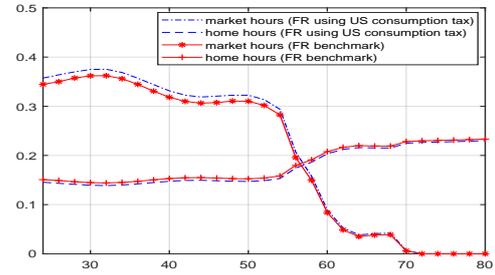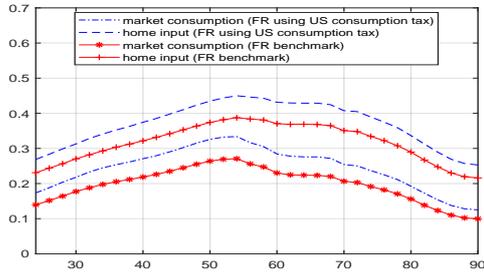
E   Additional Results

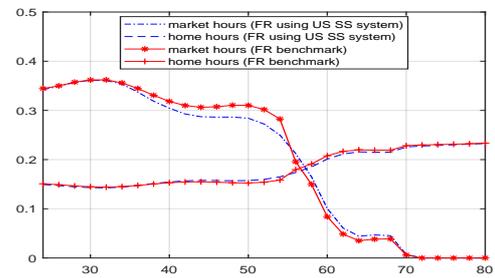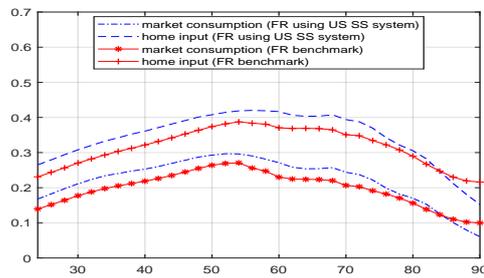## E.1   Life-Cycle Profiles for Decomposition

---

[25]The average is thirty-three years. The model period is two years. Hence we use thirty-two years.

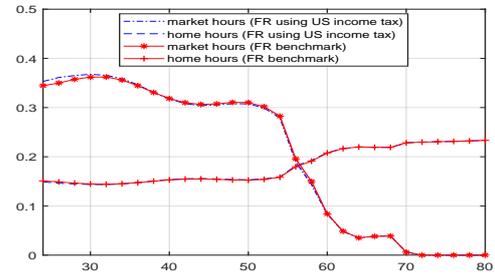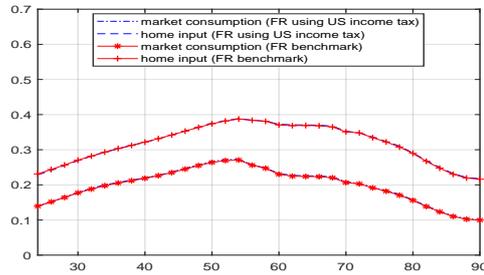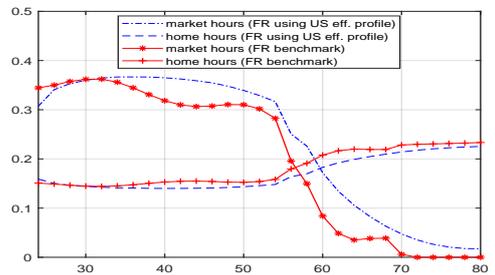## Figure E.1: Life-Cycle Profiles from Decomposition
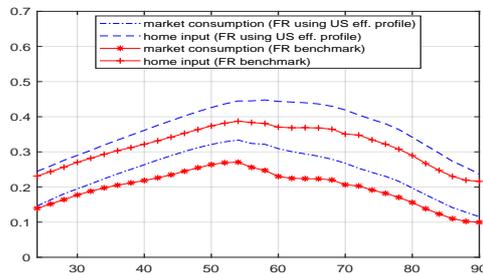
(a) Consumption Tax

(b) Social Security

(c) Income Tax

(d) Efficiency Units

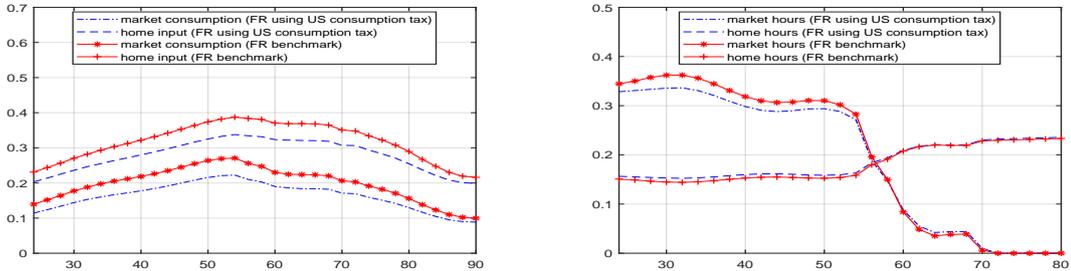Expenditure   Hours

Notes: This figure compares hours and expenditure by age in the French benchmark economy with those after adopting US values. Expenditures are normalized by GDP per worker in the benchmark French economy. Panel (a) shows the changes after applying the US consumption tax to the French economy. Panel (b) shows the changes after applying the US social security system to the French economy. Panel (c) shows the changes after applying the US income tax to the French economy. Panel (d) shows the changes after applying the US efficiency profile to the French economy.
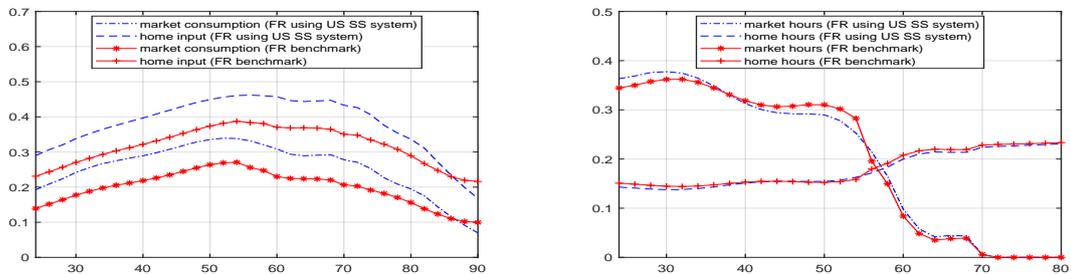
E.2 Life-Cycle Profiles for Policy Experiments

Figure E.2: Life-Cycle Profiles from Policy Experiments Using US Policies
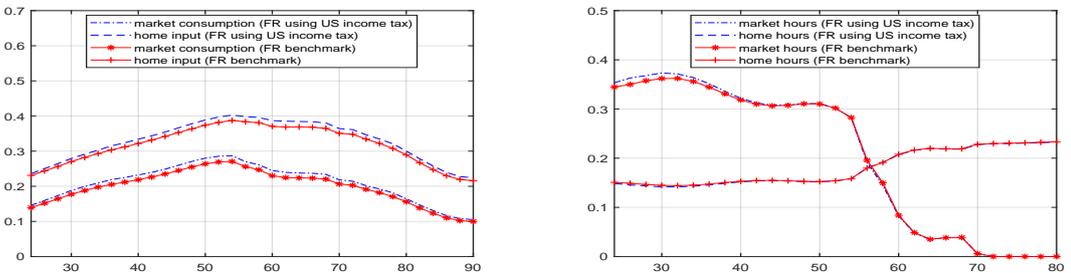
(a) Consumption Tax

(b) Social Security

(c) Income Tax

Expenditure   Hours

Notes: This figure compares hours and expenditure by age in the French benchmark economy with those after adopting US values, holding constant government spending. Expenditures are normalized by GDP per worker in the benchmark French economy. Panel (a) shows the changes after applying the US consumption tax to the French economy. Panel (b) shows the changes after applying the US social security system to the French economy. Panel (c) shows the changes after applying the US income tax to the French economy.