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

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This paper is about the well-known fact:

- Americans work much more than Europeans. (Prescott (2004))

The main goal of this paper: to provide a new explanation for this fact.

Specifically, we ask:

- can different health insurance systems account for the difference in aggregate labor supply between the US and Europe?
A well-known fact: Americans work much more than Europeans.
- Aggregate hours worked per person (age 15-64): one third more in the US. (e.g. Prescott (2004), Rogerson (2006)) (see Table 1)

Important to understand this fact:
- Aggregate labor supply plays a central role in macroeconomic analyses.
  - E.g. labor income share accounts for two thirds of total output.
- This cross-country difference is large compared to:
  - Hours worked changes over the business cycle since WWII: deviations from the trend < 5%. (Rogerson (2006))

The main existing explanation: different tax rates on labor income.
- Tax on labor income. US: 40%, Europe: 60%.

However, this explanation is often criticized for strict assumptions on
- labor elasticity. (high elasticity)
- how tax revenues are spent. (revenues paying back: no income effect)
## Aggregate Labor Supply: US vs. Europe

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


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Kai (Jackie) Zhao
Why Do Americans Work So Much More than Europeans?
We propose a new explanation: different health insurance systems.
- Europe: universal health insurance financed by government.
  - no link between health insurance and labor supply decision.
- US: employer-based health insurance (EHI).
  - health insurance available only if you work and work full-time.

EHI provides a strong incentive to work as it is extremely valuable in US.
- Health expenses: large and extremely volatile.
- No good substitute from the individual market.
- Tax benefits: insurance premiums are exempted from taxation.
- Risk-averse agents value it much more than its actuarially-fair value.
More motivating facts:

- More working-age Americans are working.
- More Americans workers are working full-time.

<table>
<thead>
<tr>
<th></th>
<th>Employment Rate</th>
<th>FT share</th>
<th>FT Employment Rate</th>
<th>Annual Hours Worked (relative to the US)</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>74.1%</td>
<td>88.1%</td>
<td>65.31% (1)</td>
<td>1</td>
</tr>
<tr>
<td>France</td>
<td>61.7%</td>
<td>85.9%</td>
<td>53.0% (0.81)</td>
<td>0.69</td>
</tr>
<tr>
<td>Germany</td>
<td>65.6%</td>
<td>82.8%</td>
<td>54.3% (0.83)</td>
<td>0.71</td>
</tr>
<tr>
<td>Italy</td>
<td>53.9%</td>
<td>87.9</td>
<td>47.4% (0.73)</td>
<td>0.72</td>
</tr>
<tr>
<td>UK</td>
<td>72.2%</td>
<td>77.8%</td>
<td>56.2% (0.86)</td>
<td>0.90</td>
</tr>
<tr>
<td>Average</td>
<td>63.4%</td>
<td>83.6%</td>
<td>53.0% (0.81)</td>
<td>0.76</td>
</tr>
</tbody>
</table>

Motivation (continue)

**Empirical evidence:**
- Rust and Phelan (1997): health insurance is the reason why some workers postpone retirement.
- Garthwaite, Gross and Notowidigdo (2014): some workers are employed primarily to secure health insurance.
- Married women with spousal health insurance tend to work part-time or not work. (Buchmueller and Valletta (1999), Wellington and Cobb-Clark (2000), Olson (1998), etc.)

**To capture the aggregate effect of health insurance:** a macro model of aggregate labor supply, general equilibrium.
Plan and Preview of the Results

- We develop an OLG, GE model with labor supply and health expenses

- Use it to quantitatively assess
  - to what extent different health insurance systems account for the aggregate hours worked between US and Europe.

  (Answer: account for over two thirds of the difference in hours worked)

- Implications for the cause of the difference in GDP per capita.
  - Are Americans richer than Europeans simply because they work more?

  (Answer: no)
The Model

- A 65-period OLG model with one period is one year.
  - Born in 21, retire in 65 and die in 85.

- Endogenous labor supply:
  - one unit of time endowed each period
  - choose full-time, part-time, or no work $l \in \{0, l_h, l_f\}$.

- The US health insurance structure:
  - working-age: partial coverage by employment-based health insurance.
  - old-age: universal coverage from Medicare

- Health expense ($m$): an exogenous expense shock.

- Other elements:
  - Social Security program
  - government-financed consumption floor
  - idiosyncratic income shock
The individual’s state in each period: \( s = \{j, a, m, e_h, h, \epsilon, e\} \)

- Age: \( j \). Asset: \( a \). Health expense: \( m \). Idiosyncratic income shock: \( \epsilon \).
- Education: \( e \). EHI offer \( e_h \): 0 (not offered), 1 (offered).
- Health insurance status \( h \): 1 (uninsured), 2 (insured by EHI).

Working-age individual’s problem \((P1)\)

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

subject to

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

\[
l \in \{0, l_h, l_f\}, \quad c \geq 0, \quad \text{and} \quad a' \geq 0
\]

\[
\begin{cases} 
    h' \in \{0, 1\} & \text{if} \quad l = l_f \quad \text{and} \quad e_h = 1 \\
    h' \in \{0\} & \text{otherwise}
\end{cases} \tag{3}
\]
The Individual’s Problem (continue)

- Wage:
  \[
  \begin{cases}
  w(l) = wl^\theta - c_e & \text{if } e_h = 1 \\
  w(l) = wl^\theta & \text{otherwise}
  \end{cases}
  \tag{4}
  \]

- No-linear wage (e.g. Rogerson and Wallenius (2013)).

- Retiree’s problem \((P2)\)
  \[
  V(s) = \max_c u(c, 0) + \beta P(s) E[V(s')]
  \tag{5}
  \]

subject to

\[
\frac{\alpha'}{1 + r} + c + (1 - \kappa_m)m = SS(e) + a + b_1 + b_2(s)
\tag{6}
\]

\[c \geq 0, \text{ and } \alpha' \geq 0\]
The Health Insurance System

- Employer-sponsored health insurance:
  - community rated: no pre-existing conditions, same price for all ($p_h$).
  - premiums are exempted from taxation.
  - insurance companies are competitive: prices are actuarially-fair values with a markup $\lambda$.

- Medicare
  - covers a $\kappa_m$ fraction of health expense for the elderly.
  - financed by payroll taxes.
Other Public Programs and the Transfers

- **Pay-as-you-go Social Security**
  - SS payment to the elderly: $SS(e)$
  - financed by payroll taxes.

- **Consumption floor:** $c$ (via $b_2$).

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

- **Accidental Bequests:** collected by the government, and redistributed back equally to everyone ($b_1$).

- **Government tax revenues:** from $\tau$, used to finance Medicare, SS, and the welfare program.
  - The extra revenues are thrown away.
The firm’s profit maximization problem:

$$\max_{L,K} Y - wL - (r + \delta)K,$$

with

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

- $K$: capital; $L$: labor; $Y$: output; $\delta$: capital depreciation rate.
- $A$: Labor-augmented technology.

Firm’s FOCs imply,

$$w = (1 - \alpha)A \left( \frac{K}{AL} \right)^\alpha,$$

$$r = \alpha \left( \frac{K}{AL} \right)^{\alpha-1} - \delta.$$
Definition: A stationary equilibrium is given by a collection of value functions $V(s)$, individual policy rules $\{a', l, h'\}$, the distribution of individuals $\Phi(s)$; aggregate factors $\{K, L\}$; prices $\{r, w\}$; Social Security, Medicare, the social safety net; private health insurance contracts defined by pairs of price and coinsurance rate $\{p, \kappa_h, c_e\}$, such that,

1. Given prices, government programs, and private health insurance contracts, the value function $V(s)$ and individual policy rules $\{a', l, h'\}$ solve the individual’s dynamic programming problem (P1) and (P2).
2. Given prices, $K$ and $L$ solve the firm’s profit maximization problem.
3. The capital and labor markets clear.
4. The government programs, Social Security, Medicare, and the transfer program are self-financing.
5. The health insurance companies are competitive.
6. The distribution $\Phi(s)$, evolves over time according to the equation $\Phi' = R_\Phi(\Phi)$, and satisfies the stationary equilibrium condition: $\Phi' = \Phi$.
7. The amount of bequest transfers is equal to the amount of accidental bequests from the last period.
The quantitative question:

- To what extent can different health insurance systems account for the difference in aggregate hours worked between the US and Europe?

Quantitative strategy: (steady-state comparison)

- Calibrate the benchmark model to match the current US economy.
  - A key feature: employment-based health insurance.
- Construct a counterfactual economy by
  - replacing the employment-based health insurance in the benchmark economy with a government-financed universal health insurance that mimics the European system.
- Comparing: benchmark(US system) vs. counterfactual(European system)
Health expense shock $m$.
- Calibrated using Medical Expenditure Panel Survey (MEPS) dataset
- Governed by a 6-state markov chain.
- Categorize the distribution of total health expenditure into 6 bins (25%, 50%, 75%, 90%, 95%). (by each age group)
- E.g. for age 46-55, > 95%: $33930; 25% - 50%: $684.

Labor supply choices: $l_f = 0.4, l_h = 0.2$
- Total time available: 5000 hours. Full-time job: 2000 hours

Labor productivity $\epsilon$: $ln\epsilon = a + y$.
- $a$: age-specific deterministic component.
- $y$: the shock, governed by 3-state Markov chain discretized from the AR(1) process.

\[
y' = \rho y + u', u' \sim N(0, \sigma_u^2),
\]

\[
\rho = 0.94, \sigma_u^2 = 0.205. \text{(Alonso-Ortiz and Rogerson (2010))}
\]

Education: no high school, high school graduate, college graduate.
- $e^1 = 0.7, e^2 = 1, e^3 = 1.7$
Preliminary Calibration (continue)

- Preference: \( u(c, l) = \log(c) + \zeta \frac{(1-l)^{1-\gamma}}{1-\gamma} \)
- \( \gamma = 2.0 \), the census value (Chetty (2012)).
- \( \zeta = 1.15 \), to match the US employment rate, i.e. 74.1%.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \alpha )</td>
<td>0.36</td>
<td>Macro literature</td>
</tr>
<tr>
<td>( \delta )</td>
<td>0.06</td>
<td>Macro literature</td>
</tr>
<tr>
<td>( \gamma )</td>
<td>2</td>
<td>Chetty(2012)</td>
</tr>
<tr>
<td>( A )</td>
<td>30000</td>
<td>US GDP per capita: $36467</td>
</tr>
<tr>
<td>( \tau )</td>
<td>40%</td>
<td>Prescott(2004)</td>
</tr>
<tr>
<td>( \tau_s )</td>
<td>12.4%</td>
<td>US Social Security tax rate</td>
</tr>
<tr>
<td>( \kappa_m )</td>
<td>0.5</td>
<td>Attanasio et al.(2008)</td>
</tr>
<tr>
<td>( \kappa_h )</td>
<td>0.8</td>
<td>Data: 65-85%</td>
</tr>
<tr>
<td>( \beta )</td>
<td>0.96</td>
<td>Annual interest rate: 4.0%</td>
</tr>
<tr>
<td>( \pi )</td>
<td>0.15</td>
<td>Sommers(2002)</td>
</tr>
<tr>
<td>( \zeta )</td>
<td>1.15</td>
<td>Employment rate: 74.1%</td>
</tr>
<tr>
<td>( \theta )</td>
<td>0.1</td>
<td>Part-time worker share: 11.9%</td>
</tr>
<tr>
<td>( \rho )</td>
<td>0.94</td>
<td>Alonso-Ortiz and Rogerson (2010)</td>
</tr>
<tr>
<td>( \sigma^2 )</td>
<td>0.205</td>
<td>Alonso-Ortiz and Rogerson (2010)</td>
</tr>
</tbody>
</table>
### Key Statistics of the Benchmark Economy

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Model</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output per person</td>
<td>$38396</td>
<td>$36467</td>
</tr>
<tr>
<td>Interest rate</td>
<td>4.3%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Aggregate hours worked</td>
<td>0.282 (1410 hours)</td>
<td>1360 hours</td>
</tr>
<tr>
<td>Employment rate</td>
<td>74.3%</td>
<td>74.1%</td>
</tr>
<tr>
<td>Full-time worker share</td>
<td>90.0%</td>
<td>88.1%</td>
</tr>
<tr>
<td>Employment-sponsored HI (% of working-age popu.)</td>
<td>55.0%</td>
<td>59.4%</td>
</tr>
<tr>
<td>Take-up rate</td>
<td>87.7%</td>
<td>90.7%</td>
</tr>
</tbody>
</table>
Life-cycle Profiles in the Benchmark Economy

(a) Consumption profile
(b) Saving profile
(c) Employment rate

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Construct a counterfactual economy with the European HI system.

European system: universal health insurance financed by lump-sum tax.

<table>
<thead>
<tr>
<th>Model</th>
<th>Employment Rate</th>
<th>Full-time Share</th>
<th>Average Hours Worked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benchmark (US system)</td>
<td>74.3%</td>
<td>90.0%</td>
<td>1</td>
</tr>
<tr>
<td>Counterfactual (EUR system)</td>
<td>62.4%</td>
<td>84.3%</td>
<td>81.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data</th>
<th>Employment Rate</th>
<th>Full-time Share</th>
<th>Average Hours Worked</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>74.1%</td>
<td>88.1%</td>
<td>1</td>
</tr>
<tr>
<td>Europe (major 4)</td>
<td>63.4%</td>
<td>83.6%</td>
<td>75.6%</td>
</tr>
</tbody>
</table>

We find: different health insurance systems account for 75.8% of the difference in aggregate hours worked between the US and Europe.

Two channels: why US system increases labor supply?

- The link between health insurance and job status
- Americans have less insurance. Earnings: alternative insurance for health expenses.
### By productivity shock.

<table>
<thead>
<tr>
<th>Average hours worked by productivity</th>
<th>$\epsilon_1$</th>
<th>$\epsilon_2$</th>
<th>$\epsilon_3$</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benchmark (US system)</td>
<td>0.144</td>
<td>0.302</td>
<td>0.392</td>
<td>0.282</td>
</tr>
<tr>
<td>Counterfactual (EUR system)</td>
<td>0.001 (0.4%)</td>
<td>0.281 (93.0%)</td>
<td>0.387 (98.7%)</td>
<td>0.230 (81.5%)</td>
</tr>
</tbody>
</table>

### By whether employment-based health insurance is accessible.

<table>
<thead>
<tr>
<th>Average hours worked by EHI offer $e_h$</th>
<th>$e_h = 0$</th>
<th>$e_h = 1$</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benchmark (US system)</td>
<td>0.264</td>
<td>0.283</td>
<td>0.282</td>
</tr>
<tr>
<td>Counterfactual (EUR system)</td>
<td>0.230 (87.1%)</td>
<td>0.230 (81.2%)</td>
<td>0.230 (81.5%)</td>
</tr>
</tbody>
</table>
While aggregate hours worked are much higher in the US, Americans are also much richer.

- GDP per capita in Europe is much lower: 70.6% of US.
- Recall: aggregate hours worked in Europe: 75.6% of US.

Are Americans richer simply because they work more?
- If yes, it implies: technology level is not lower in Europe.

<table>
<thead>
<tr>
<th></th>
<th>Average Hours Worked (relative to US)</th>
<th>Effective labor (relative to US)</th>
<th>Output per person (relative to US)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benchmark (US HI)</td>
<td>0.282</td>
<td>0.629</td>
<td>$38396</td>
</tr>
<tr>
<td>Counterfactual (European HI)</td>
<td>0.230 (81.5%)</td>
<td>0.601 (95.5%)</td>
<td>$35989 (93.7%)</td>
</tr>
</tbody>
</table>
The main result: stable for a wide range of elasticities.

<table>
<thead>
<tr>
<th>$\gamma$</th>
<th>1 (log utility)</th>
<th>2 (benchmark)</th>
<th>4</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor elasticity</td>
<td>1</td>
<td>0.5</td>
<td>0.25</td>
<td>0.1</td>
</tr>
<tr>
<td>Benchmark (US HI)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Counterfactual (European HI)</td>
<td>81.0%</td>
<td>81.5%</td>
<td>82.2%</td>
<td>83.6%</td>
</tr>
</tbody>
</table>
Conclusion

The model provides an quantitative explanation for a puzzling fact: Americans work much more than Europeans.

- Different health insurance systems account for over two thirds of the difference in aggregate hours worked.
- The result is not sensitive to the labor elasticity
- The cross-country difference in GDP per capita is not due to labor supply.

Future research:
- Understanding the different time trends in hours worked since 1950.
Life-cycle Profiles: Benchmark vs. Counterfactual

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