Rising inequality and trends in leisure

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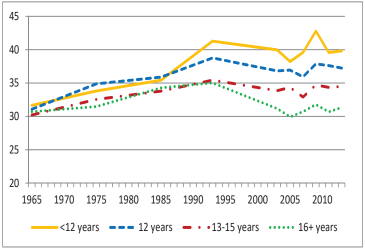
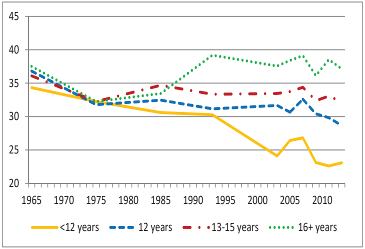
Rising inequality and trends in leisure, 1965-2013

Leisure



Market Hours



Notes: Source: Time use surveys. Following Aguiar and Hurst (2007) methodology, individuals aged 21-65 who are not student nor retired, adjusted for demographics (age, education, sex, presence of child). Leisure refers to Leisure 1 in Aguair and Hurst (2007) which is the usual leisure including socializing, reading, watching TV etc. Aggregate leisure increased from 30.9 to 35.4 hours and aggregate market hours fell from 36.5 to 31.0 in the period 1965-2013.

Objectives

- Develop a growth model that is qualitatively consistent with
  - trends in leisure over time
  - rising leisure inequality across individual
- Show that both facts are consistent with an aggregate balanced growth path
  - growth in aggregate capital, aggregate wage and return to capital are constant.
- Show the model's quantitative predictions

Key Ideas

- Across individual – rising inequality in leisure is due to differences in intertemporal substitution of hours worked (as reflected by rising wage inequality)
- Over time: assuming leisure and non-leisure goods are gross complements, rise in leisure is due to the rise in the implicit relative price of leisure (as reflected in growing wages)

rising wage inequality

Key elements of the model

- Heterogeneous households are born with household-specific market efficiencies per unit of time and initial wealth
- Households derive utility from market goods, home goods and leisure goods
  - A nested-CES utility, elasticity across market and home is σ and elasticity across consumption and leisure is ε .
- Production of all goods require time and capital; and subject to activity-specific TFP growth.
- Households allocate time and capital into market, home and leisure production.

Leisure, home and market production

Both time and capital (leisure durables) are required to generate a leisure output given by the following Cobb-Douglas aggregator:

$$c_{z,i}(t) = k_{z,i}(t)^{\alpha} \left[l_{z,i}(t) \right]^{1-\alpha}.$$

Home production also requires time and capital (home durables):

$$c_{h,i}(t) = k_{h,i}(t)^{\alpha} \left[A_h(t) l_{h,i}(t) \right]^{1-\alpha},$$

where $A_h(t)$ is home TFP growing at a gross rate of $\gamma_h > 1$. The market output good is produced under perfect competition by a representative firm with production function:

$$Y(t) = K_m(t)^{\alpha} \left[A_m(t) L_m(t) \right]^{1-\alpha},$$

where $A_m(t)$ is market TFP growing at a gross rate of $\gamma_h > 1$ and $L_m(t)$ is skill-adjusted aggregate labor input in the market.

Household –market efficiency

Individual wage rates might change over time for two reasons:

- changes in $\bar{w}(t)$ due to aggregate changes like technological change that are common to all households
- changes in the individual-specific market efficiency $e_i(t)$.
- The efficiency $e_i(t)$ follows an exogenous process satisfying two assumptions:
  - Its mean remains constant: $\int_0^1 e_i(t)di = \bar{e}$, $\forall t$
    - Interpretation: $\bar{e}$ is the (normalized) return to a household with an average level of education in the economy and the wage rate for this household is $\bar{w}(t)\bar{e}$.
  - It converges to a stationary distribution: $\lim_{t\to\infty} e_i(t)di = \hat{e}_i$, $\forall i$

Balanced growth path

Proposition

Let $\tilde{k}(t) \equiv \frac{K(t)}{A_m(t)L}$, *there exists a unique globally saddle-path stable balanced growth path with* $\tilde{k}^{\star} = \left[\frac{\alpha}{\gamma_m/\beta - 1 + \delta}\right]^{\frac{1}{1-\alpha}}$.

Along BGP:

- rental rate of capital is constant
- aggregate capital, wage rate, output per hour are growing at the same rate
- c_i is also growing at the same rate.

Leisure along the BGP

$$l_{z,i}(t) = x_{z,i}(t) \frac{c_i(t)}{A_m(t) e_i(t) \left[\frac{K(t)}{A_m(t) L} \right]^{\alpha}}.$$

$$x_{z,i}(t) = \frac{1}{1 + \left(\frac{\omega}{1-\omega} \right)^{\varepsilon} \left(\frac{\tilde{p}_{mh,i}(t)}{p_{z,i}(t)} \right)^{1-\varepsilon}}$$

Assumption

Parameter restrictions: $\gamma_m > \gamma_h > 1$ *and* $\sigma > 1 > \varepsilon$.

Leisure inequality along the BGP

Lemma

For constant efficiency terms $\{e_i\}_{i=0}^{1}$, leisure hours are growing monotonically for all households along the BGP.

- The rise in leisure is driven by the low substituability between lesiure and consumption, and the slower productivity growth for leisure.

Proposition

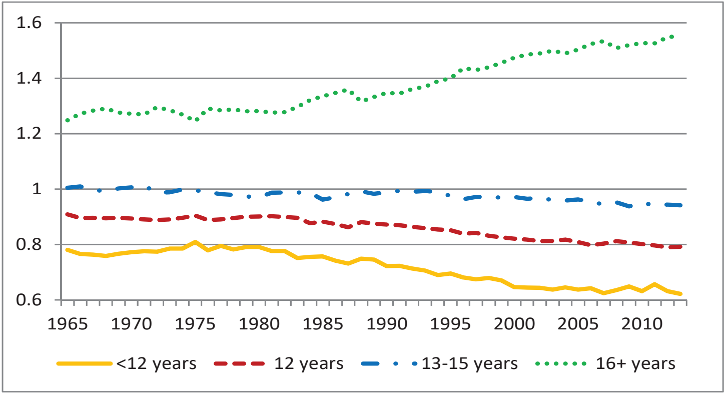
Along the BGP, the growth factor of leisure for an individual i is a decreasing function of the growth in e_i.

- Leisure is growing for household with non-increasing e_i.
- Leisure can be falling (temporarily) for household with very fast growing e_i.

Quantitative Exercise

- Take the aggregate balance growth path of the model and ask:
  - can it account for the parallel rise in leisure hours before 1985 and the subsequent increase in leisure inequality?
  - can it account for the rise in the aggregate leisure hour and the fall in aggregate market hours?
  - can it account for the dynamics of time allocation for each education group?
- Strategy:
  - Calibrate the model's parameters to the time allocation of each education group in 1965.
  - Predict the dynamic of the time allocation for each education group using their relative wages from 1965–2013.

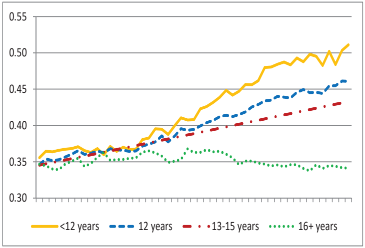
Wages relative to aggregate wage



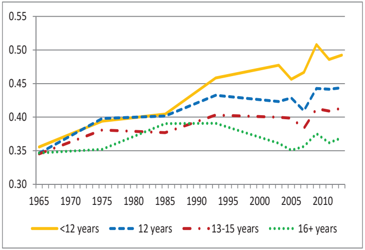
Notes: The figure plots wage relative to average wage 1965-2013 for four education groups.
Source: CPS/March samples. Non-farm working individuals aged 21-65 who are not student. Adjusted for changes in demographic compositions: age, education and sex, following the methodology of Aguair and Hurst (2007)

Quantitative results: leisure

Model Leisure



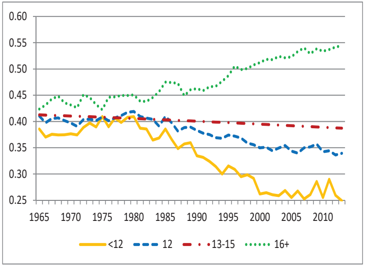
Data Leisure



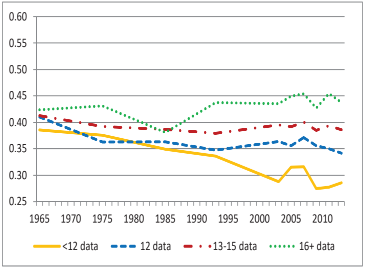
Notes: Figures plot leisure shares predicted by the model and in the data 1965-2013 for four education groups.

Quantitative results: market work

Model Market



Data Market



Notes: Figures plot market shares predicted by the model and in the data 1965–2013 for four education groups.

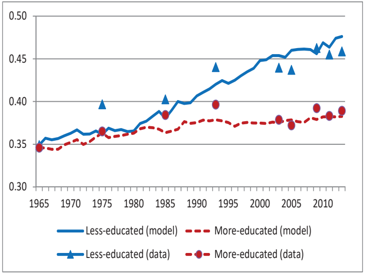
Quantitative results

- The model captures the parallel rise and the subsequent divergence in leisure across the four education groups
- It does a good job for the trend in aggregate leisure and market:
  - model aggregate leisure share increases from 0.35 to 0.37 in 1985 then to 0.43 in 2013 (increases to 0.39 then to 0.42 in the data).
  - model aggregate market share decreases from 0.41 to 0.39 (declines to 0.37 in the data).
- For the dynamics of each education groups:
  - matches time series for the first three groups extremely well
  - overpredicts the rise in market hours for the 16+ group.

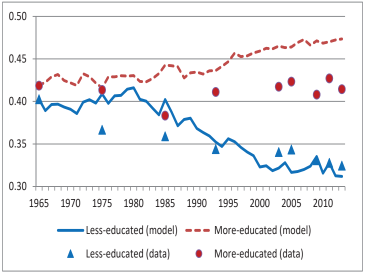
Home Share

More-educated v.s. less educated.

Leisure shares



Market shares



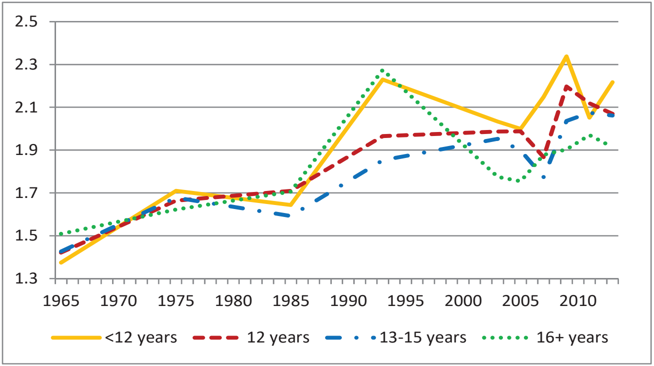
Notes: Figures plot leisure and market shares predicted by the model and in the data 1965-2013 for two education groups. Less-educated include those with 12 or less years of education and more-educated include those with 13 or more years of education

Concluding remarks

- Market efficiency, initial wealth and time are ultimate constraint for household.
- The former two are most likely subject to some exogenous distributions, time constraint is the same for all individual.
- Being able to freely decide time allocation is an important tool for the "less-privileged" household to partly "reverse" the welfare inequality induced by the two exogenous inequalities.
- This is done through both the direct channel of higher leisure time for the less-educated (low market efficiency individuals) and the equilibrium channel where the more-educated (high market efficiency individuals) work more in the market which increases the aggregate market production.

Additional slides

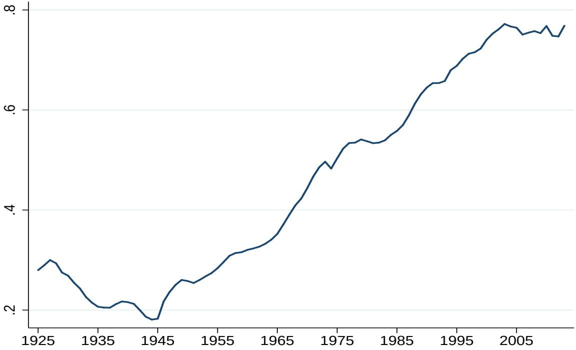
Hours of leisure relative to non-market work



Notes: Source: Time use surveys. Following Aguiar and Hurst (2007a) methodology, individuals aged 21–65 who are not student nor retired. Childcare is excluded from home production and leisure refers to Leisure Measure 1 in Aguair and Hurst (2007a)

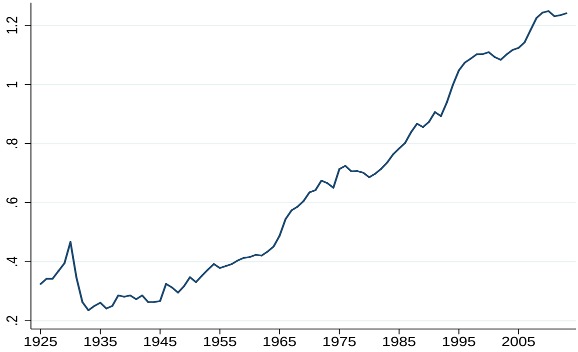
back

Leisure durables relative to home durables – Data



Notes: The figure plots aggregate "recreational" durable goods relative to aggregate "furnishing and household durables" corresponding to $\frac{\int_0^1 k_{z,i}(t)di}{\int_0^1 k_{h,i}(t)di}$ in the model. Source: BEA table 8.1. Back

Expenditures of leisure durables relative to home durables – Data



Notes: The figure plots aggregate personal consumption expenditure of "recreational" durable goods relative to aggregate personal consumption expenditure of "furnishing and household durables" corresponding to $\frac{\int_0^1 \dot{k}_{z,i}(t)+\delta k_{z,i}(t)di}{\int_0^1 \dot{k}_{h,i}(t)+\delta k_{h,i}(t)di}$ in the model.

Source: BEA table 8.7. Back

Asymptotic Equilibrium

Asymptotically, $e_i(t)$ converges to $\hat{e}_i$. Define asymptotic detrended asset and consumption level as $\tilde{a}_i^\star \equiv \lim_{t\to\infty} a_i(t)\gamma_m^{-t}$ and $\tilde{c}_i^\star \equiv \lim_{t\to\infty} c_i(t)\gamma_m^{-t}$

Proposition

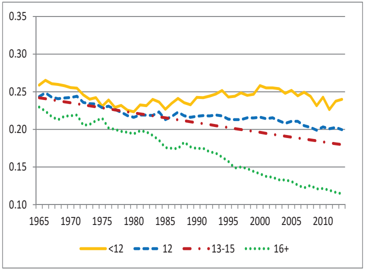
Asymptotically we have

$$l_{z,i} = \frac{1 + R^\star - \delta - \gamma_m}{\hat{e}_i \left(\tilde{k}^\star\right)^\alpha} \tilde{a}_i^\star + (1-\alpha)\bar{l}.$$

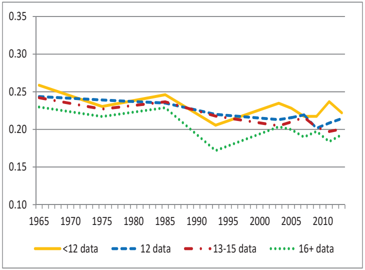
- The proof observed $x_{z,i}$ converges to 1 for all i and $\frac{\tilde{p}_{mh,i}(t)}{p_{z,i}(t)}$ grows asymptotically at rate $\gamma_m^{-(1-\alpha)} < 1$).
- Leisure hours converge asymptotically to a constant for all households.
- In general leisure hours differ even asymptotically.
  - Asymptotic leisure hours are identical only if wealth is proportional to efficiency unit asymptotically.

Quantitative results: home work

Model Home



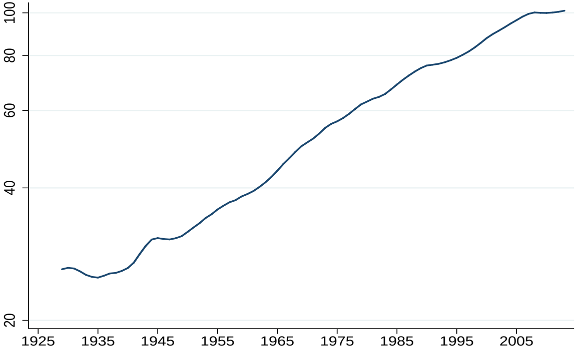
Data Home



Notes: Figures plot home shares predicted by the model and in the data 1965-2013 for four education groups. Back

Properties along BGP – Data on $K(t)$

Data: $K(t)$ – the real capital (including consumer durables) per capita



Notes: The figure plots real fixed assets plus consumer durables per capita (corresponding to $K(t)$ in the model) on a logarithmic scale. The series is normalized to 100 in the year 2009. Source: BEA table 1.2 and 7.1 for the population data.