Cheap Thrills: the Price of Leisure and the Decline of Work Hours

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Canadian Macro Study Group - Spring 2021

Introduction

- Two concurrent trends:
  1. Recreation goods and services are becoming better and cheaper
     - Television, streaming subscriptions, video games
     - Technological innovations
  2. Work hours have been declining
- Did the decline in recreation prices contribute to the decline in work hours?
  - Higher marginal utility of leisure $\rightarrow$ work is relatively less enjoyable

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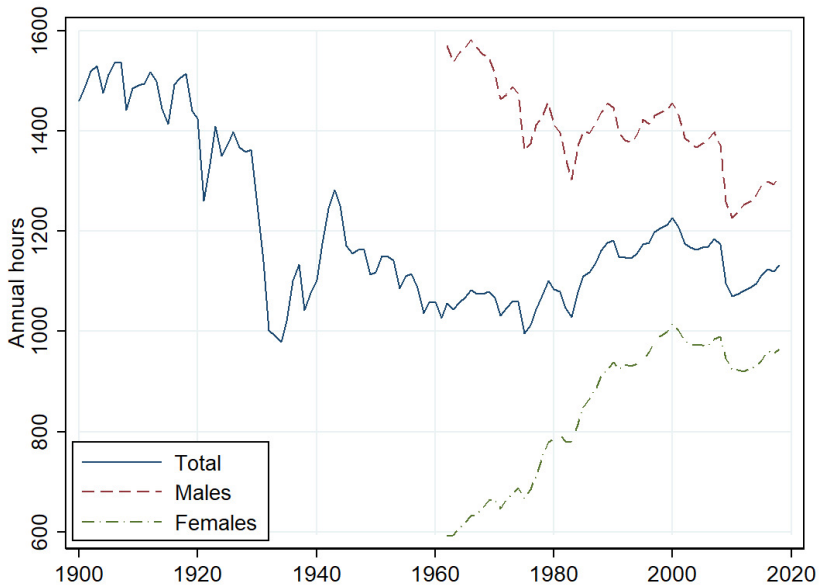
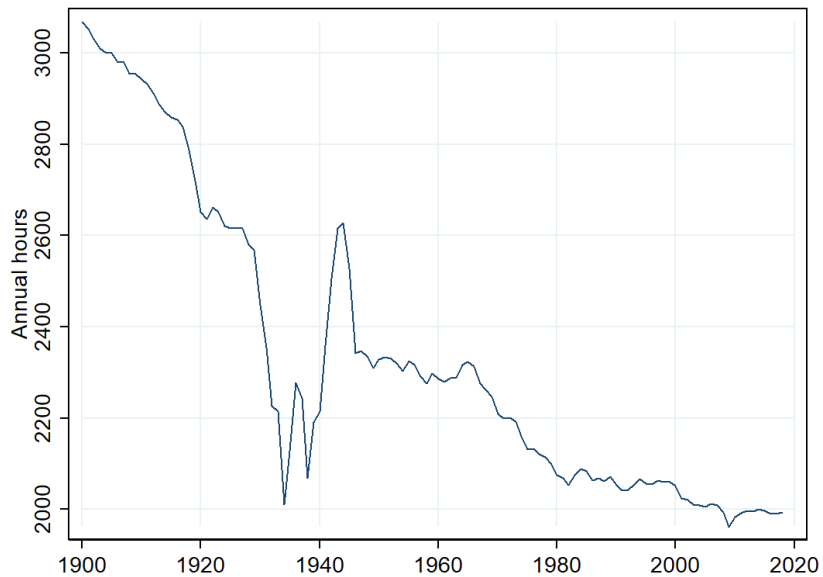
Motivation

- Large decline in work hours observed in the United States



(a) Hours per capita



(b) Hours per worker

Panel (a): Annual hours worked over population of 14 years and older. Source: Kendrick et al., 1961 (hours, 1990-1947); Kendrick et al., 1973 (hours, 1948-1961); Carter et al., 2006 (population, 1900-1961); ASEC (total, male and female hours per capita, 1962-2018). Panel (b): Annual hours worked over number of employed. Source: Bureau of the Census, 1975 (1900-1947); FRED (1947-2018).

- Decline in market + nonmarket work hours for men and women also visible in time use survey data

▸ ATUS

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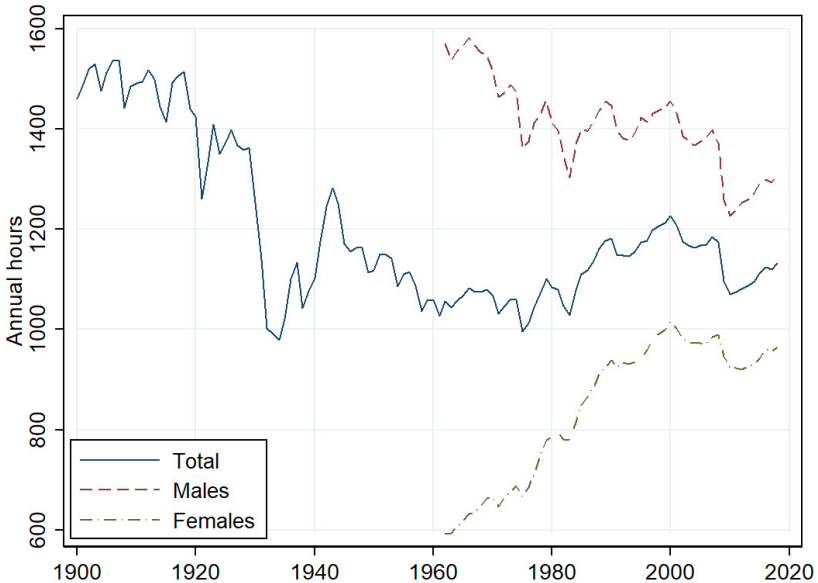
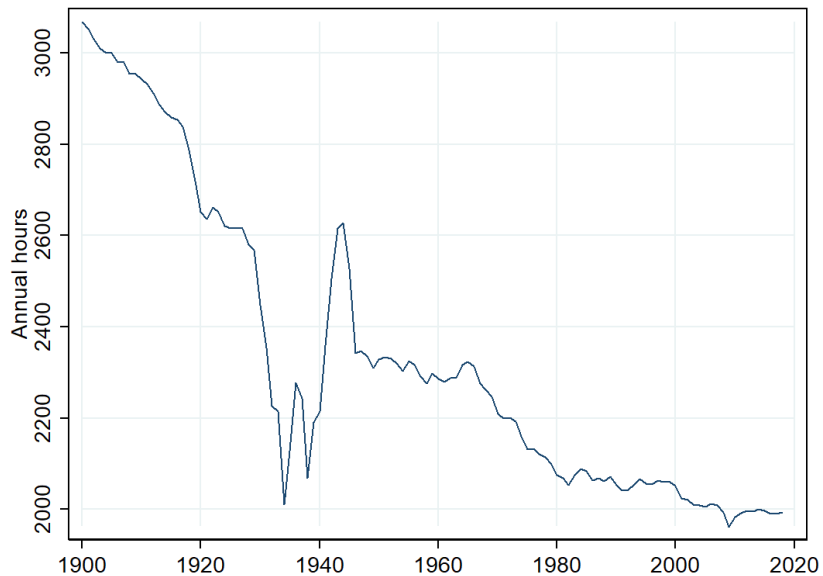


(c) Hours per capita



(d) Hours per worker

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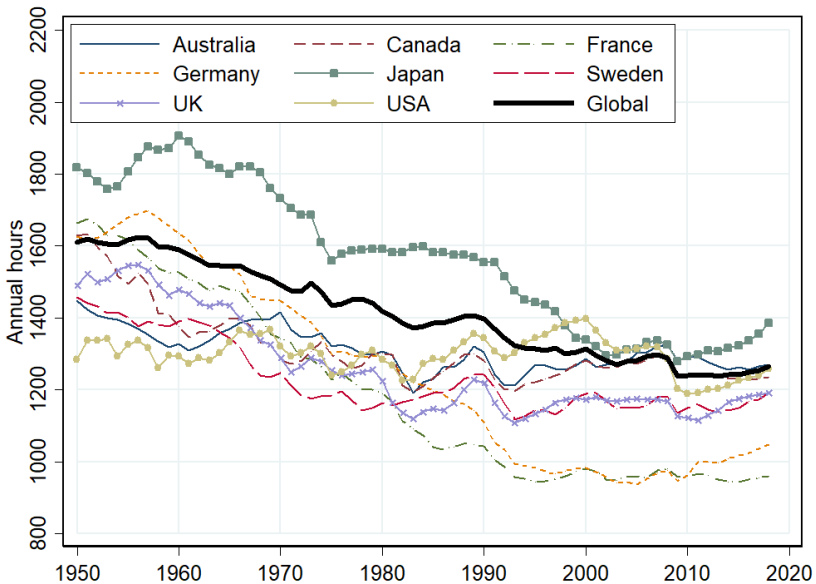
Motivation

- Pattern holds in a cross-section of countries
  - Hours per capita: average growth -0.27% per year
  - Hours per worker: average growth -0.41% per year



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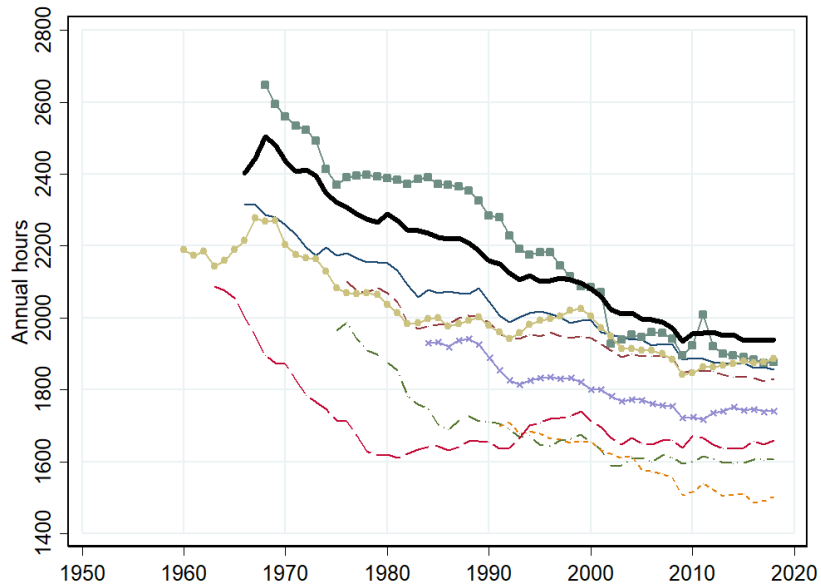

(b) Hours per worker

Panel (a): Annual hours worked over population between 15 and 64 years old. Source: Total Economy Database and OECD. Panel (b): Annual hours worked over number of employed. Source: Total Economy Database.

▸ All countries

Motivation

- One explanation: Higher wages lead to fewer hours worked (Keynes, 1930)
  - Average growth rate: 1.88% per year

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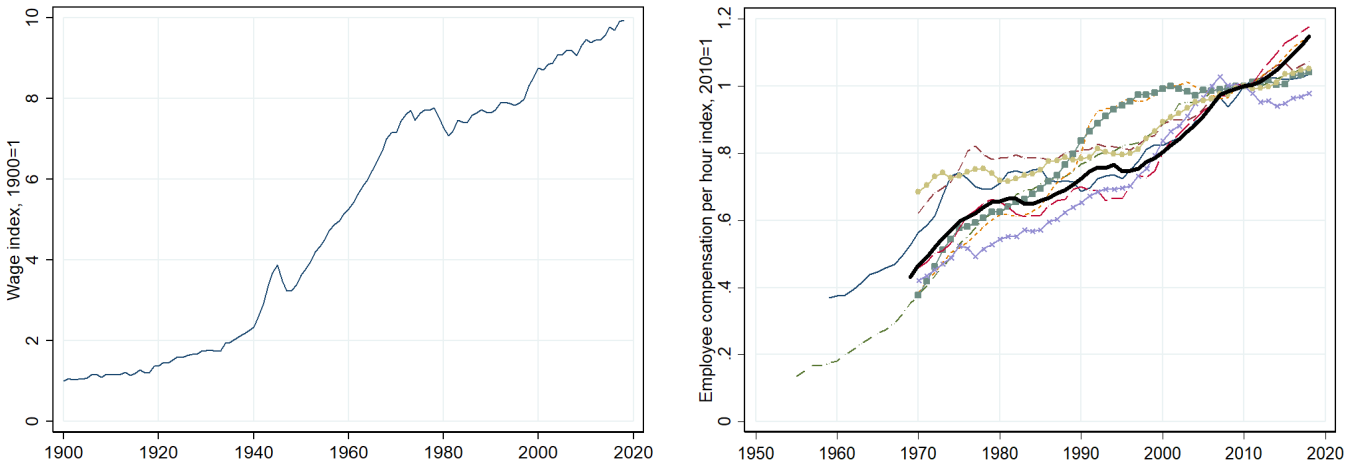

(a) U.S. (b) Selected countries

Panel (a): Real labor productivity. Source: Kendrick et al., 1961 (real gross national product divided by hours, 1900-1928); FRED (1929-2018). Panel (b): OECD Real compensation of employees divided by hours worked.

Figure: Real employee compensation per hour

- If income effect dominates the substitution effect $\rightarrow$ Decline in hours

Motivation

- Alternative and/or complementary explanation: Leisure is becoming cheaper (and better!)
  - Real price of a television divided by 1000 since 1950 (CPI BLS) ▸ Details

  - Now
    - Netflix: \$8.99/month for unlimited movies/shows watching
    - Spotify: \$9.99/month for unlimited music listening
    - Apple iOS Store: 900,000 games, 2/3 are free

▸ c.s. wages

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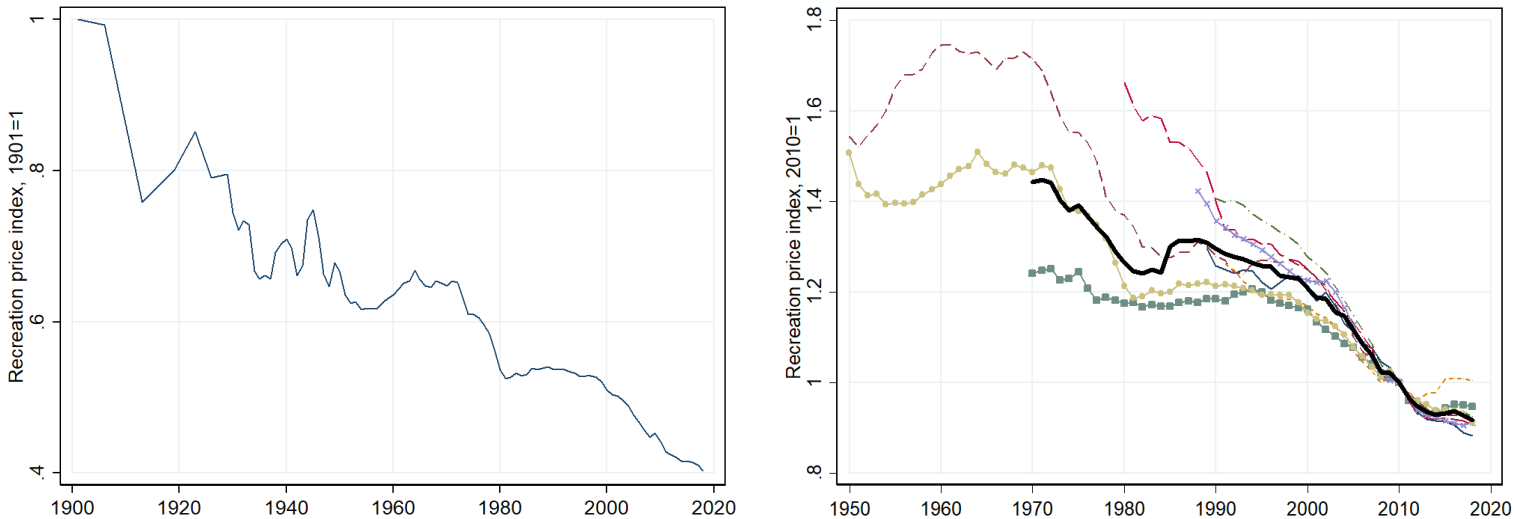
▸ c.s. wages

Motivation

- Real price of recreation goods and services is declining in all countries
  - Average growth rate: -1.07% per year



(a) U.S. (b) All countries

Figure: Real price of recreation goods and services

Panel (a): Real price of recreation goods and services. Source: Owen, 1970 (real recreation price, 1900-1934); Bureau of the Census, 1975 (real price of category 'Reading and recreation', 1935-1966); BLS (real price of category 'Entertainment', 1967-1992); BLS (real price of category 'Recreation', 1993-2018). Series coming from different sources are continuously pasted. Panel (b): Price of consumption for OECD category "Recreation and culture", normalized by price index for all consumption items. Eurostat, Statistics Canada. Base year = 2010.

▸ Recreation items ▸ All countries

This paper

Did the decline in recreation prices contribute to the decline in hours worked?

- Build a macroeconomic model of labor supply in a balanced-growth framework
  - Keep utility function as general as possible
  - Derive structural relationships between hours, wages, recreation prices, consumption
- Structural estimation of the model
  - On country-level data
  - On individual-level data from the United States
- Main findings
  - Cross-country data: Recreation prices are about a third as important as wages in explaining the decline in work hours
  - Cross-individual data: The mechanism can explain all of the the increase in leisure inequality in the last four decades

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Literature

- Trends in hours and leisure: Prescott (2004), Greenwood and Vandenbroucke (2005), Rogerson (2006), Aguiar and Hurst (2007), Ramey and Francis (2009), Bick et al. (2018), Aguiar, Bils, Charles, and Hurst (2021), Boppart and Krusell (2020).
- Recreation prices and hours: Owen (1971), Gonzalez-Chapela (2007), Vandenbroucke (2009), Kopecky (2011), Fenton and Koenig (2018), Aguiar, Bils, Charles, and Hurst (2021)
- Balanced growth path declining hours: Boppart and Krusell (2020)
- Free recreation items: Greenwood, Ma, and Yorukoglu (2020), Rachel (2021)

Model

- Build on standard balanced-growth framework
- Household maximizes

$$\sum_{t=0}^{\infty} \beta^t u\left(c_t, d_t, h_t\right)$$

$$\text{s.t. } c_t + p_{dt} d_t + b_{t+1} = w_t h_t + b_t\left(1 + r_t\right)$$

where c_t is nonrecreation goods, d_t is recreation goods, p_{dt} is their price, and h_t is hours worked

  - Balanced-growth assumptions on primitives
    - p_{dt} and w_t grow at constant rates γ_{p_d} and γ_w
    - interest rate $r_t > 0$ is constant
    - straightforward to write down production sector to microfound these
  - Balanced-growth outcomes
    - c_t, d_t and h_t grow at constant (but perhaps different) rates

▸ BGP data ▸ Recreation shares ▸ Production

Model

- The budget constraint

$$c_t + p_{dt} d_t + a_{t+1} = w_t h_t + a_t (1 + r_t)$$

  imposes restrictions on growth rates

$$g_c = \gamma_{p_d} g_d = \gamma_w g_h$$

- Another restriction must come from preferences.
  - King et al. (1988): $g_c = \gamma_w$
  - Boppart and Krusell (2020): $g_c = \gamma_w^{1-\nu}$
  - Here: $g_c = \gamma_w^{\eta} \gamma_{p_d}^{\tau}$, where η and τ are constants

- Putting the restrictions together:

$$\begin{aligned} g_c &= \gamma_w^{\eta} \gamma_{p_d}^{\tau}, \\ g_h &= \gamma_w^{\eta-1} \gamma_{p_d}^{\tau}, \\ g_d &= \gamma_w^{\eta} \gamma_{p_d}^{\tau-1}. \end{aligned}$$

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Model

Are there preferences that are consistent with the restriction $g_c = \gamma_w^{\eta}\gamma_{p_d}^{\tau}$?

Definition 1 (Balanced-growth preferences)

The utility function u is *consistent with a balanced-growth path* if it has the following properties: for any $w_0 > 0$, $p_{d0} > 0$, $c_0 > 0$, $\gamma_w > 0$ and $\gamma_{p_d} > 0$, there exist $h_0 > 0$, $d_0 > 0$ and $r > -1$ such that for any t

$$-\frac{u_h\left(c_t, h_t, d_t\right)}{u_c\left(c_t, h_t, d_t\right)} = w_0\gamma_w^t,$$

$$\frac{u_d\left(c_t, h_t, d_t\right)}{u_c\left(c_t, h_t, d_t\right)} = p_{d0}\gamma_{p_d}^t,$$

and

$$\frac{u_c\left(c_t, h_t, d_t\right)}{u_c\left(c_{t+1}, h_{t+1}, d_{t+1}\right)} = \beta\left(1 + r\right),$$

where $c_t = c_0\left(\gamma_w^{\eta}\gamma_{p_d}^{\tau}\right)^t$, $h_t = h_0\left(\gamma_w^{\eta-1}\gamma_{p_d}^{\tau}\right)^t$ and $d_t = d_0\left(\gamma_w^{\eta}\gamma_{p_d}^{\tau-1}\right)^t$, and where $\eta > 0$ and $\tau > 0$.

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Proposition 1

The utility function $u(c, h, d)$ is consistent with a balanced-growth path if and only if it is of the form

$$u(c, h, d) = \frac{\left(c^{1-\varepsilon} d^{\varepsilon} v\left(c^{1-\eta-\tau} h^{\eta} d^{\tau}\right)\right)^{1-\sigma} - 1}{1-\sigma},$$

for $\sigma \neq 1$,

$$u(c, h, d) = \log\left(c^{1-\varepsilon} d^{\varepsilon}\right) + \log\left(v\left(c^{1-\eta-\tau} h^{\eta} d^{\tau}\right)\right),$$

for $\sigma = 1$, and where v is an arbitrary function and where $\eta > 0$ and $\tau > 0$.

- General form that u must take to be consistent with BGP
- Utility of King et al. (1988) and Boppart and Krusell (2020) are special cases

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Model

- Structural relationships to be estimated:

$$\log g_c = \eta \log \gamma_w + \tau \log \gamma_{p_d},$$
$$\log g_d = \eta \log \gamma_w + (\tau - 1) \log \gamma_{p_d},$$
$$\log g_h = (\eta - 1) \log \gamma_w + \tau \log \gamma_{p_d}.$$

- Key advantages:
  1. estimation of structural parameters (η and τ)
  2. invariant to a broad class of utility functions
  3. use consumption data to discipline estimation

- Main equation for hours worked

$$\log g_h = \underbrace{(\eta - 1) \log \gamma_w}_{(1)} + \underbrace{\tau \log \gamma_{p_d}}_{(2)}.$$

  1. Impact of growth in wages
     - If $\eta - 1 < 0$, income effect dominates substitution effect
  2. Impact of growth in leisure prices
     - If $\tau > 0$, cheaper recreation goods leads to decline in hours growth

▸ Elasticities

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▸ Elasticities

Structural estimation: cross-country data

- Country-level estimation
- We add error terms and intercepts

$$\Delta \log c_i = \alpha_c + \eta \Delta \log w_i + \tau \Delta \log p_i + \varepsilon_i^c,$$
$$\Delta \log d_i = \alpha_d + \eta \Delta \log w_i + (\tau - 1) \Delta \log p_i + \varepsilon_i^d,$$
$$\Delta \log h_i = \alpha_h + (\eta - 1) \Delta \log w_i + \tau \Delta \log p_i + \varepsilon_i^h,$$

  where i is a country.
- Use only cross-sectional variation in line with BGP framework

GMM estimation

	(1)	(2)
τ	0.290^{***}	0.194^{**}
	(0.090)	(0.087)
$\eta - 1$	-0.459^{***}	-0.420^{***}
	(0.069)	(0.053)
Wages	GDP/hour	Empl. comp./hour
Observations	41	41

Iterative GMM estimation. Robust standard errors in parentheses. *,** ,*** indicate significance at the 10%, 5%, and 1% levels, respectively. Variables are constructed using all years except for 2008 and 2009. Work hours are measured in per capita terms. Population includes individuals between 20 and 74 years old.

Findings

1. $\tau > 0$: Cheaper recreation prices lead to fewer work hours
2. $\eta - 1 < 0$: Income effect dominates, rising wages $\rightarrow$ fewer work hours

Measuring the drivers of the decline in work hours

- The recreation channel is about a third as important at the wage channel

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Robustness

We consider various other exercises

▸ Robust

1. Different definitions of working-age population
2. Using only countries with at least 20 years of data
3. Using hours per worker instead of per capita
4. Model with household appliances

In almost all cases, the results are essentially unchanged

Structural estimation: hard to control for additional mechanisms without deep changes to the model

▸ OLS

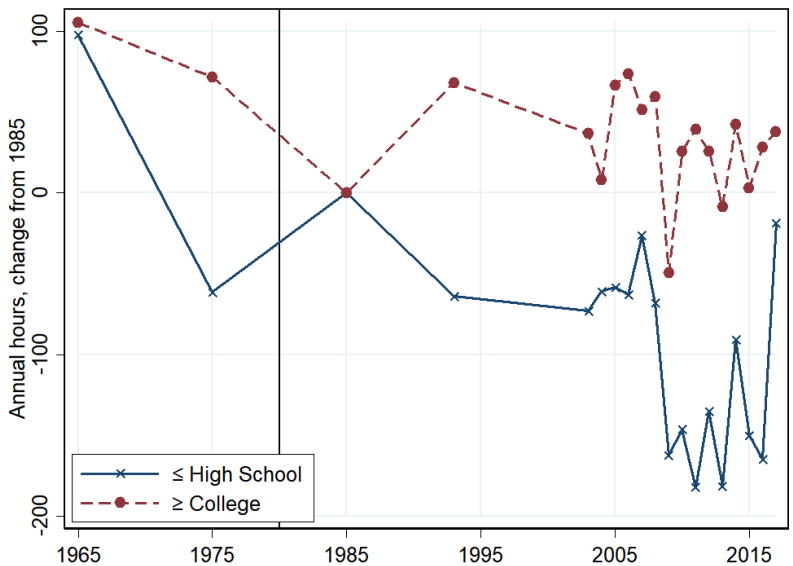
- Reduced-form regression of third equation with controls

$$\Delta \log h_i = \alpha_h + \beta_w \Delta \log w_i + \beta_p \Delta \log p_i + \varepsilon_i^h$$

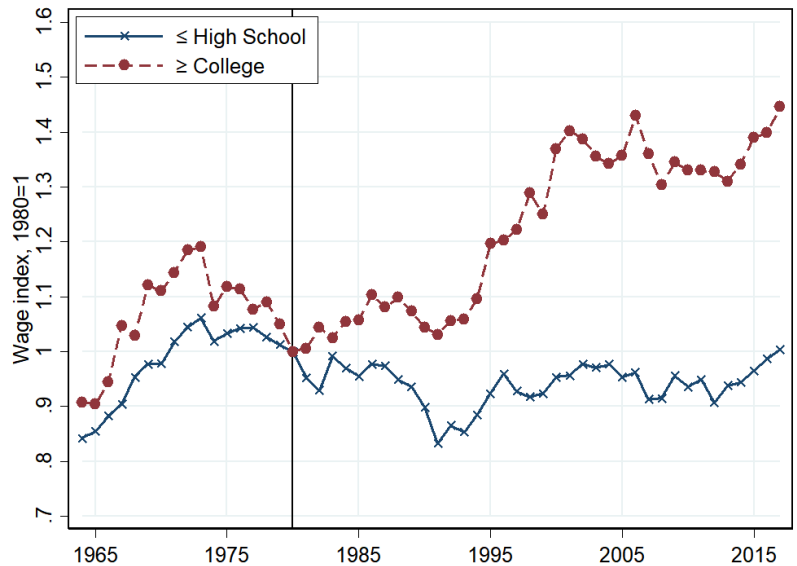
- Mechanism still at work when controlling for female labor force participation and share of young men in population

Structural estimation: cross-individual data

- Mechanism should also be visible in individual-level data
- Puzzling patterns to explain



(a) Market work hours by education

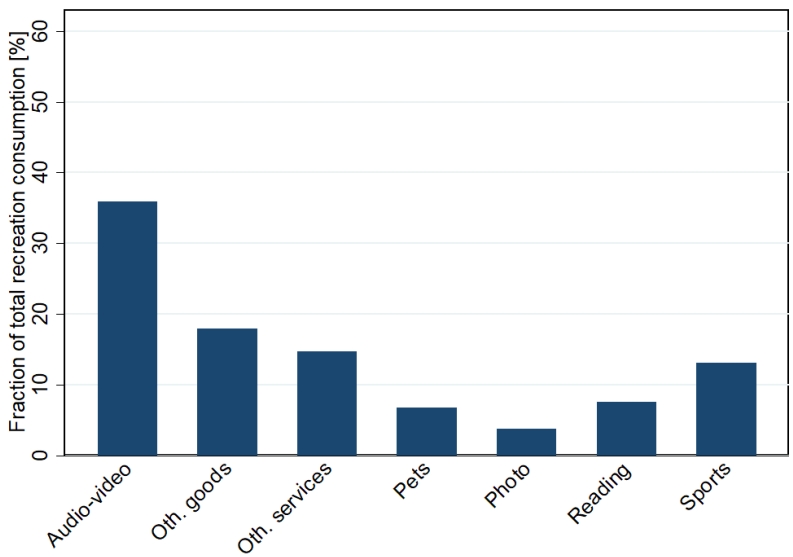


(b) Real wage by education

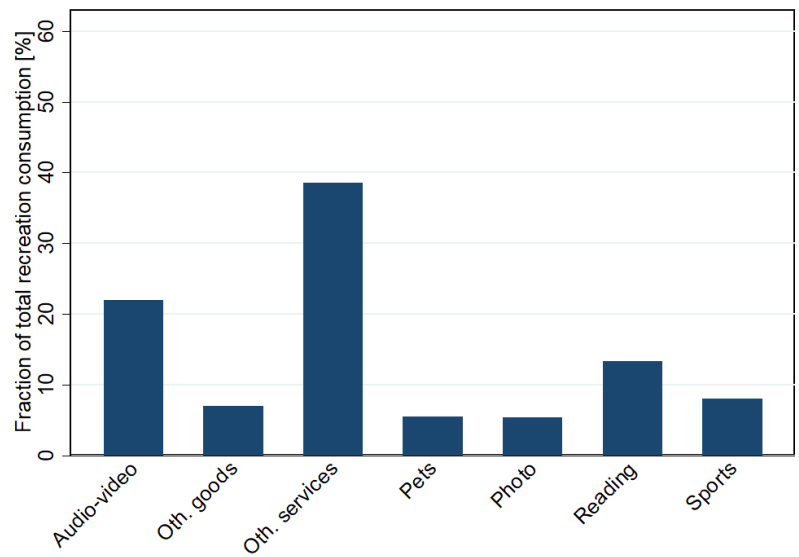
- If income effect dominates, the gap in market hours should have shrunk

Structural estimation: cross-individual data

- Possible explanation
  - Different people consume different types of recreation items
  - The price of these different items evolved differently



(a) No high school diploma, 25-34 years old

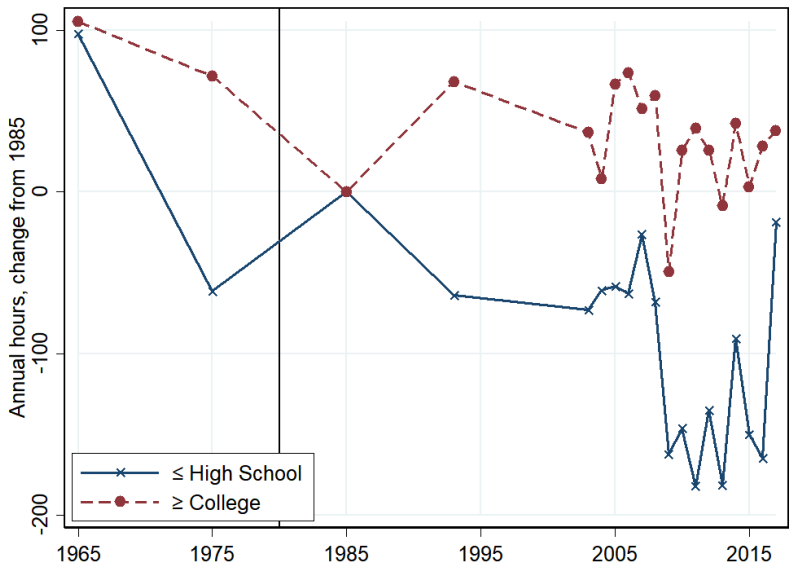


(b) More than college, 50-64 years old

- Younger less-educated individuals consume more recreation commodities
- Older more-educated individuals consume more recreation services

Structural estimation: cross-individual data

Changes in the price of demographic-specific recreation basket could explain the trends



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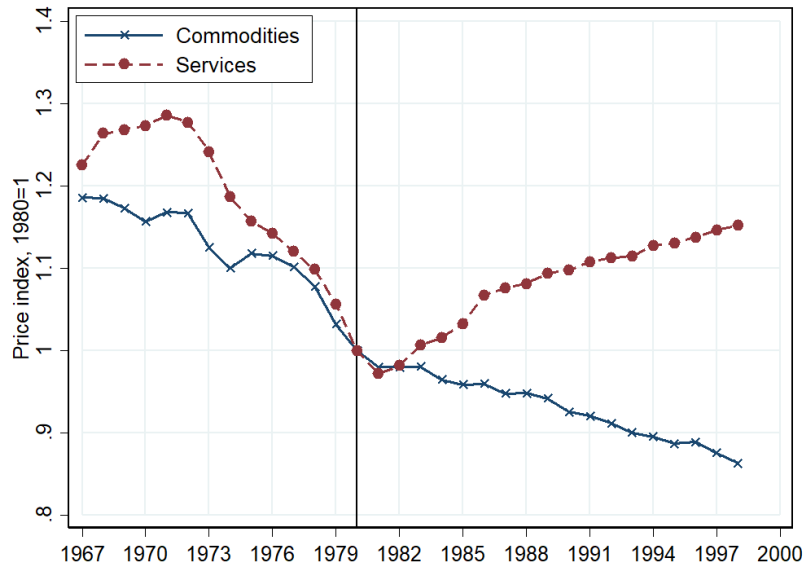

(b) Real prices of recreation comm. and services

Structural estimation: cross-individual data

Main specification:

$$\Delta \log c_g = \alpha^c + \eta \Delta \log w_{gl} + \tau \Delta \log p_g + \varepsilon^c_{gl},$$
$$\Delta \log d_g = \alpha^d + \eta \Delta \log w_{gl} + (\tau - 1) \Delta \log p_g + \varepsilon^d_{gl},$$
$$\Delta \log h_{gl} = \alpha^h + (\eta - 1) \Delta \log w_{gl} + \tau \Delta \log p_g + \varepsilon^h_{gl},$$

where g is a demographic (15 education-age groups), l is a location (741 commuting zones)

Instruments to handle potential endogeneity issues

- Use variation in recreation consumption basket to construct shift-share instrument

$$\Delta \log p_g^{IV} = \sum_j \frac{c^0_{jg}}{\sum_i c^0_{ig}} \Delta \log p_j^{US}$$

  with *national* changes in prices
- Fix consumption shares c^0_{jg} in 1980, and use growth rates between 1990 and 2016
- Instrument for wages: Bartik using variation across industry, location and demographic group

▸ Details

Structural estimation: cross-individual data

Main specification:

$$\Delta \log c_g = \alpha^c + \eta \Delta \log w_{gl} + \tau \Delta \log p_g + \varepsilon^c_{gl},$$
$$\Delta \log d_g = \alpha^d + \eta \Delta \log w_{gl} + (\tau - 1) \Delta \log p_g + \varepsilon^d_{gl},$$
$$\Delta \log h_{gl} = \alpha^h + (\eta - 1) \Delta \log w_{gl} + \tau \Delta \log p_g + \varepsilon^h_{gl},$$

where g is a demographic (15 education-age groups), l is a location (741 commuting zones)
Instruments to handle potential endogeneity issues

- Use variation in recreation consumption basket to construct shift-share instrument

$$\Delta \log p_g^{IV} = \sum_j \frac{c^0_{jg}}{\sum_i c^0_{ig}} \Delta \log p_j^{US}$$

  with *national* changes in prices
- Fix consumption shares c^0_{jg} in 1980, and use growth rates between 1990 and 2016
- Instrument for wages: Bartik using variation across industry, location and demographic group

▸ Details

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▸ Details

GMM estimation: cross-individual data

	(1)	(2)
τ	0.361^{***}	0.397^{***}
	(0.045)	(0.047)
$\eta - 1$	-0.629^{***}	-0.281^{***}
	(0.009)	(0.080)
Instruments	N	Y
Observations	10,469	10,469

Iterative GMM estimation. Whenever iterative procedure does not converge, two-step procedure is used. Standard errors account for an arbitrary correlation within education-age groups and regions. They are reported in parentheses. *,** ,*** indicate significance at the 10%, 5%, and 1% levels, respectively. Column (2) uses Bartik-like instruments for wages and recreation prices.

Findings

1. $\tau > 0$: Cheaper recreation prices lead to fewer work hours
2. $\eta - 1 < 0$: Income effect dominates, rising wages $\rightarrow$ fewer work hours

Measuring the drivers of the rise in leisure inequality

- The recreation channel accounts for the full increase

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Robustness

- The results are robust if we consider married vs single individuals
- As for the country-level exercise: ▸ OLS
  - Reduced-form regression of third equation with controls

$$\Delta \log h_{gl} = \alpha^h + \beta_w \Delta \log w_{gl} + \beta_p \Delta \log p_g + \varepsilon^h_{gl},$$

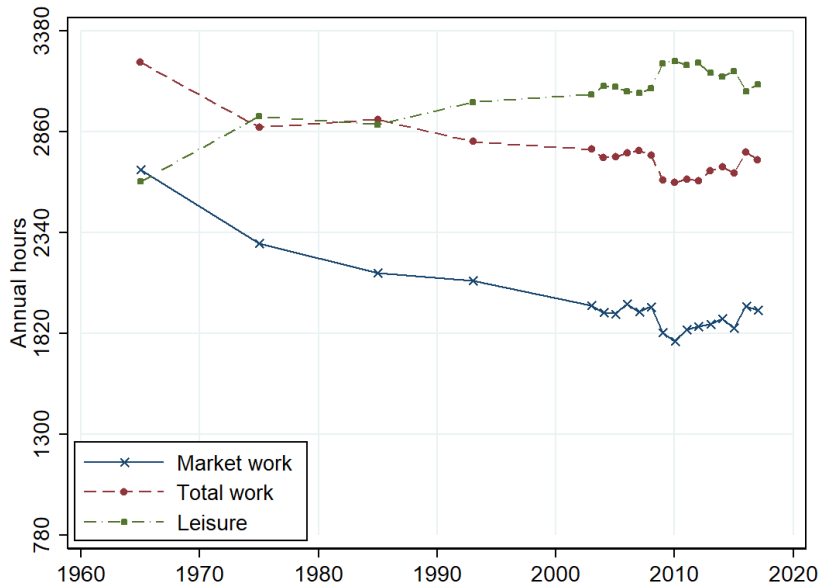
  - Mechanism still at work when controlling for (1) rise in disability, (2) exposure to offshoring, and (3) additional demographic factors.
  - F-stats (> 120) suggest strong instruments.

Conclusion

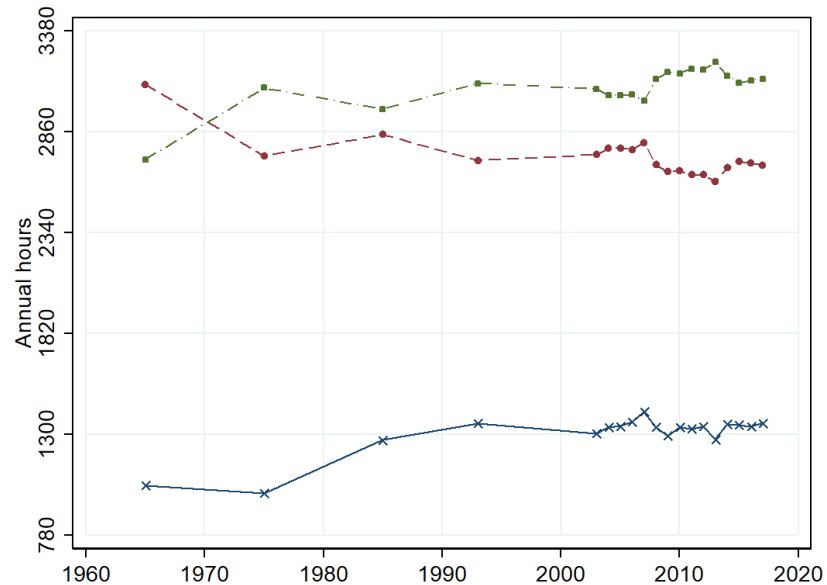
- We build a balanced-growth model with general preferences to explore the impact of falling recreation prices on work hours
- Structural estimation shows that the mechanism can explain
  - large fraction of the country-level decline in hours
  - increase in leisure inequality in the U.S. despite growing skill premium
- Findings are robust to various changes in specifications and additional controls

Appendix

American Time Use Surevy



(a) Male

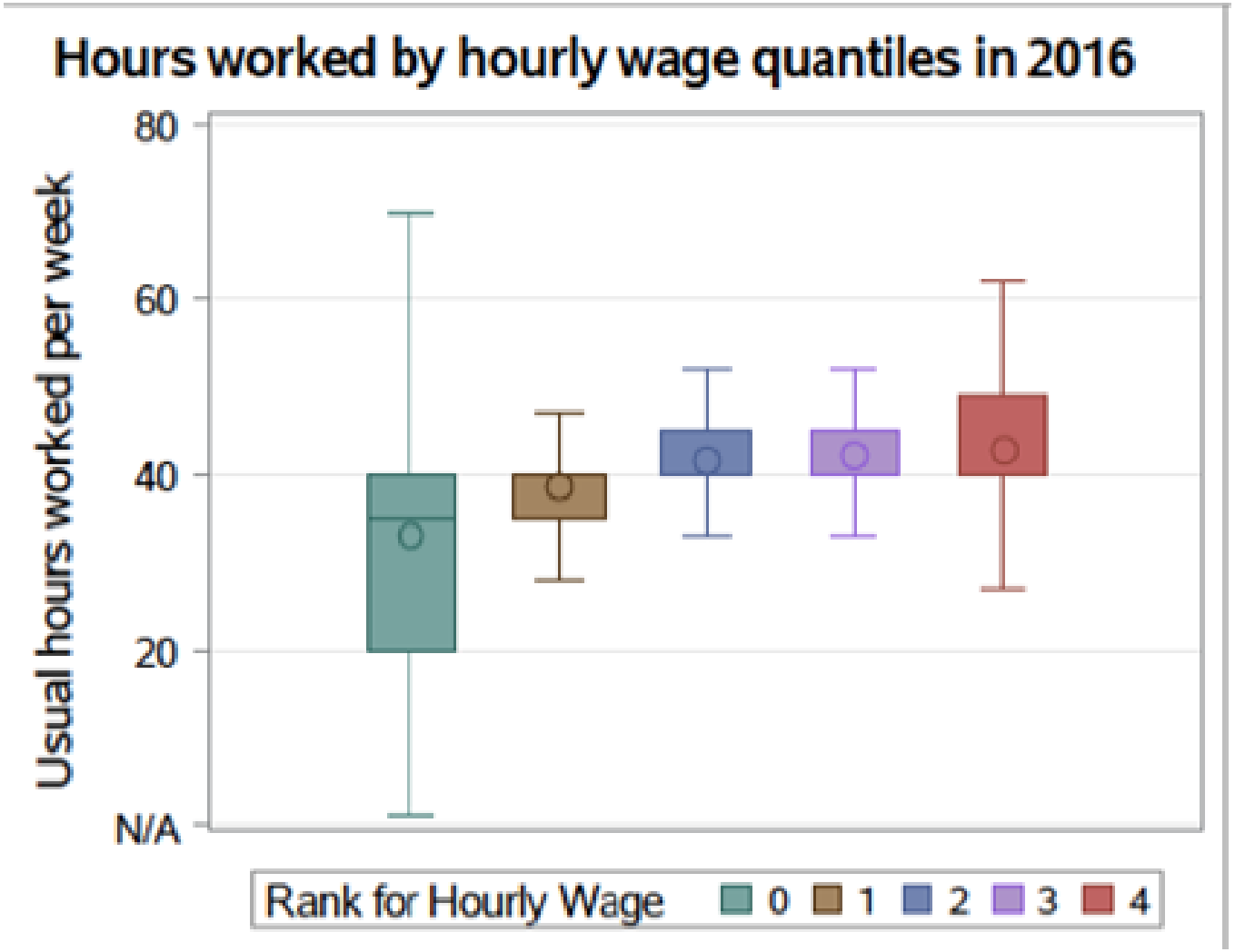


(b) Female

Weekly hours spent on market work, total work and leisure. Market work includes any work-related activities, travel related to work, and job search activities. Total work includes market work, home production, shopping, and non-recreational childcare. Leisure is any time not allocated to market and nonmarket work, net of time required for fulfilling biological necessities (8 hours per day). Sample includes people between 16 and 64 years old who are not full-time students. Source: ATUS, Aguiar and Hurst (2007) and Aguiar et al. (2021).

◂ Back

Hours by income



Source: American Community Survey.

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Real prices

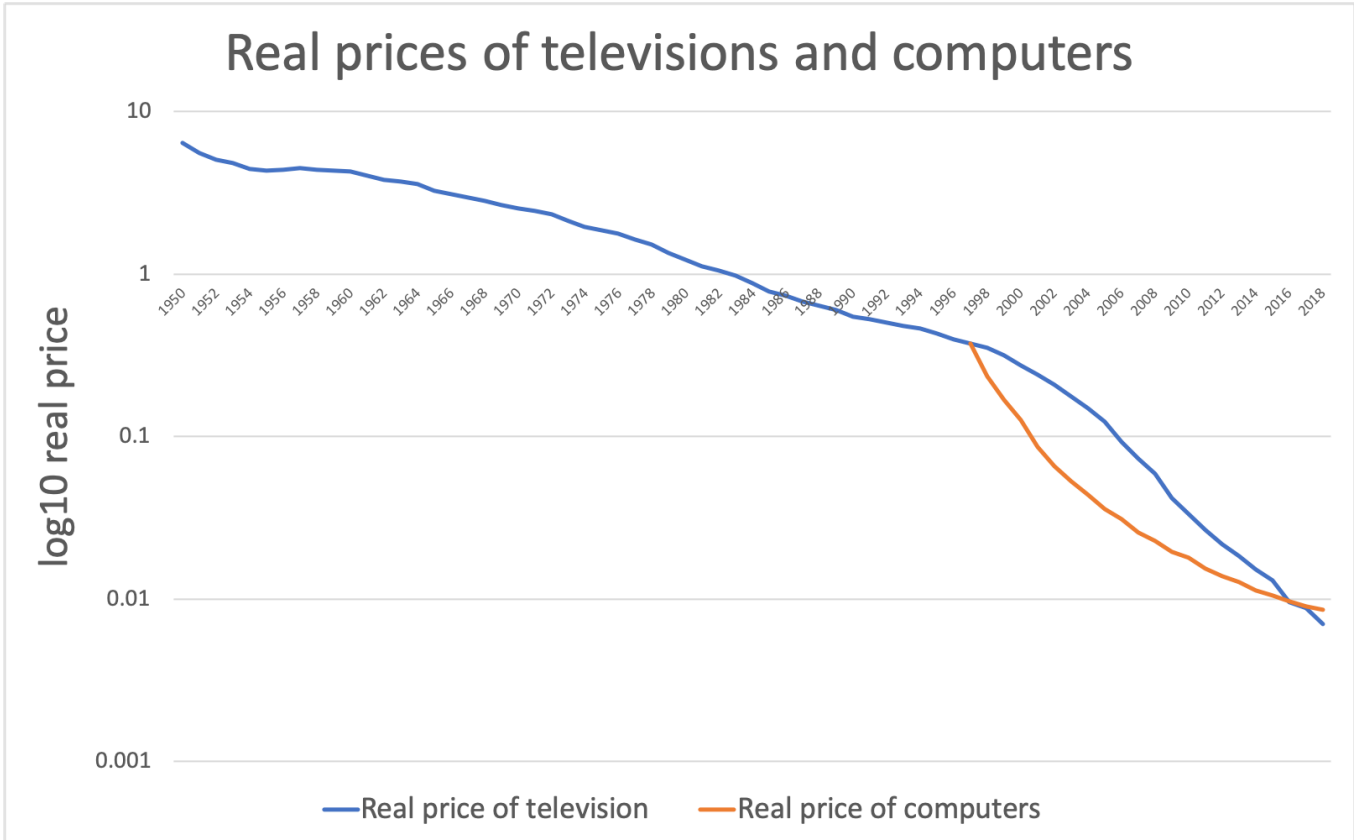

Figure: Source: BLS CPI, All Urban Consumers, U.S. city average

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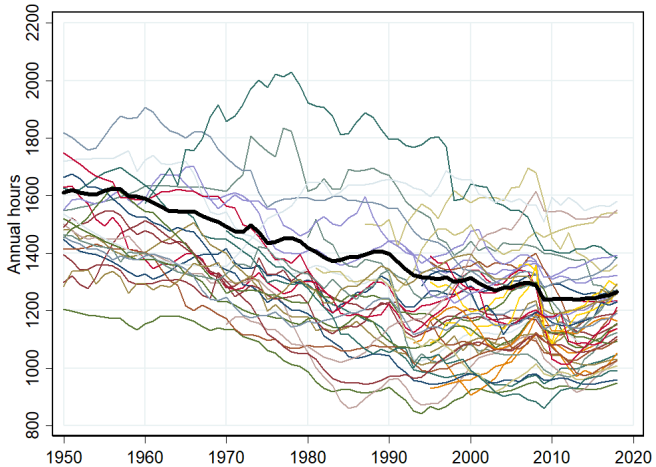
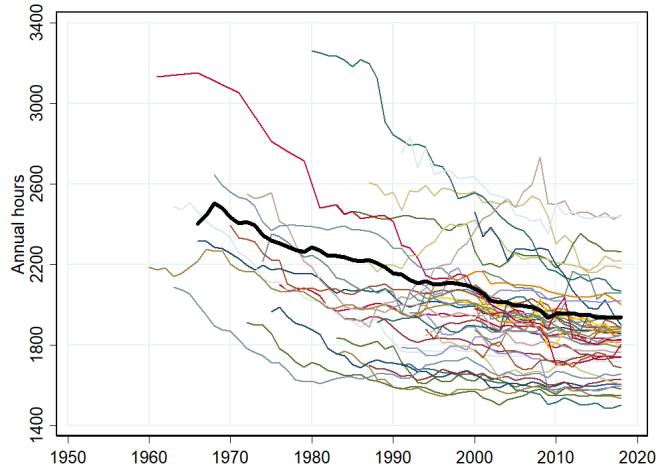
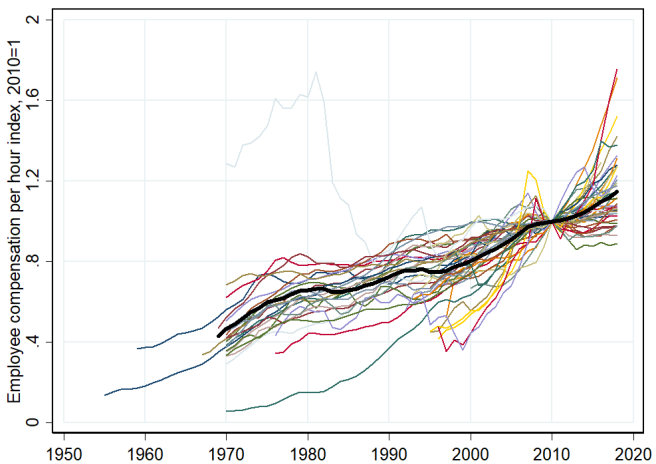
Time series for all countries in the sample



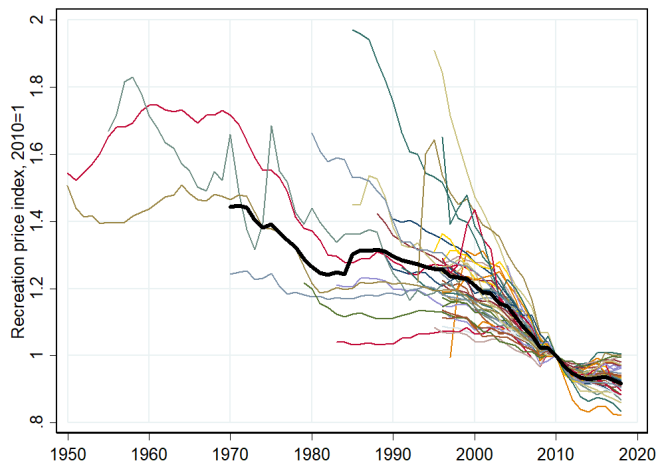
(a) Hours per capita



(b) Hours per worker



(c) Real compensation per hour



(d) Real recreation price

◂ Back to intro ◂ Back recreation

BLS: Basket of recreation goods and services

- Recreation commodities
  - Video and audio products (Televisions, Other video equipment, Audio equipment, Recorded music and music subscriptions)
  - Pets and pet products (Pet food, Purchase of pets, pet supplies, accessories)
  - Sporting goods (Sports vehicles including bicycles, Sports equipment)
  - Photographic equipment and supplies (Film and photographic supplies, Photographic equipment)
  - Recreational reading materials (Newspapers and magazines, Recreational books)
  - Other recreational goods (Toys, Toys, games, hobbies and playground equipment, Sewing machines, fabric and supplies, Music instruments and accessories)
- Recreation Services
  - Video and audio services (Cable and satellite television service, Video discs and other media, including rental of video)
  - Pet services including veterinary (Pet services, Veterinarian services)
  - Photographers and photo processing (Photographer fees, Photo processing)
  - Other recreation services (Club membership for shopping clubs, fraternal, or other organizations, or participant sports fee, Admissions, Fees for lessons or instructions)

◂ Back

Production

The model is agnostic about how prices are determined in equilibrium. One way to close the model:

- Two competitive industries producing non-leisure c and leisure d goods

$$\max_{k_{jt}, l_{jt}} p_{jt} A_{jt} l_{jt}^{\alpha} k_{jt}^{1-\alpha} - w_t l_{jt} - R_t k_{jt}$$

  - $p_{ct} = 1$: non-leisure good is numeraire

- Competitive industry produces investment goods

$$\max_{k_{it}} \underbrace{p_{it} A_{it} k_{it}}_{=y_{it}} - R_t k_{it}$$

- Law of motion of aggregate capital: $K_{t+1} = y_{it} + (1 - \delta) K_t$

Proposition 2

The growth rates of p_{dt} and w_t are

$$\log \gamma_p = \log \gamma_{A_c} - \log \gamma_{A_d},$$
$$\log \gamma_w = \alpha \log \gamma_{A_c}.$$

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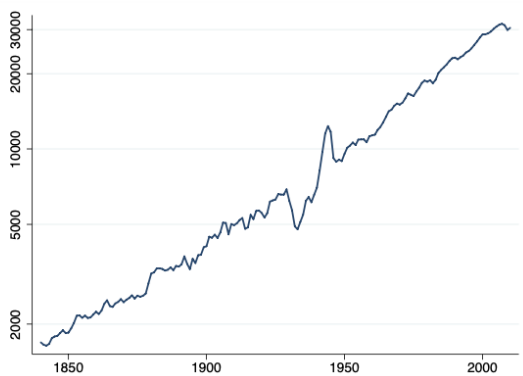
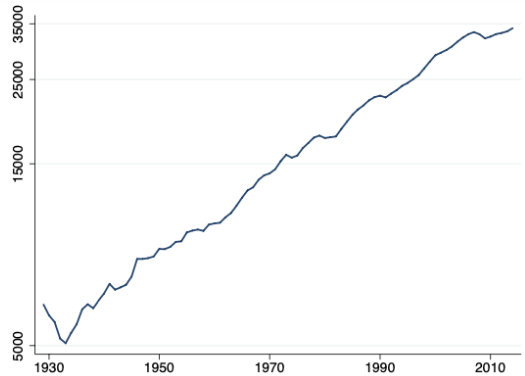
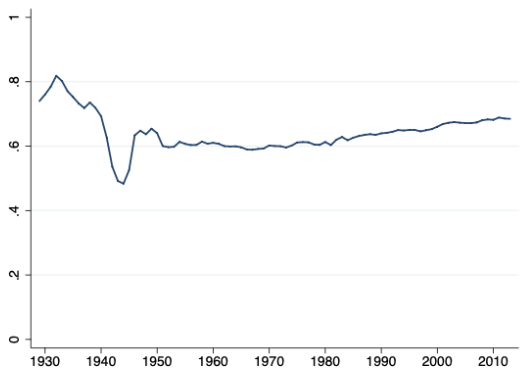
BGP facts: United States



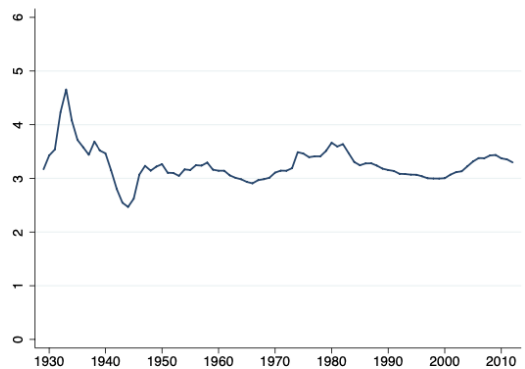
(a) GDP per capita



(b) Consumption per capita



(c) Consumption-output ratio

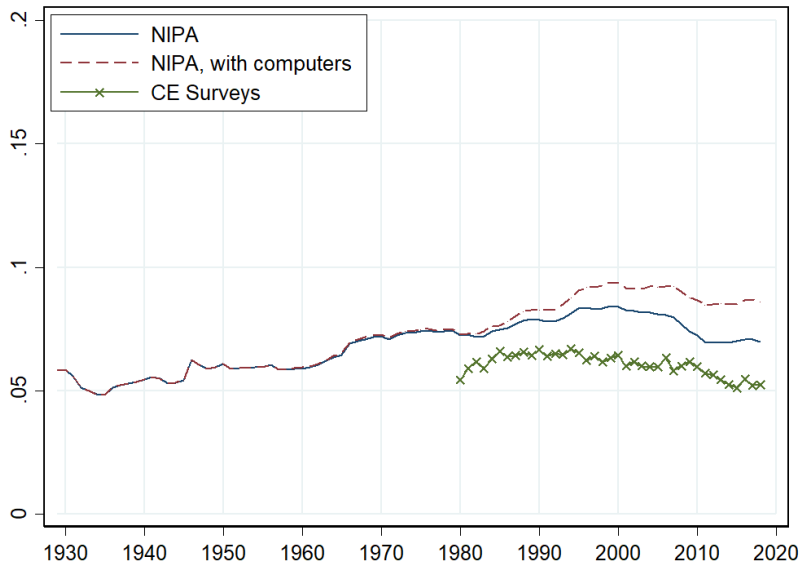


(d) Capital-output ratio

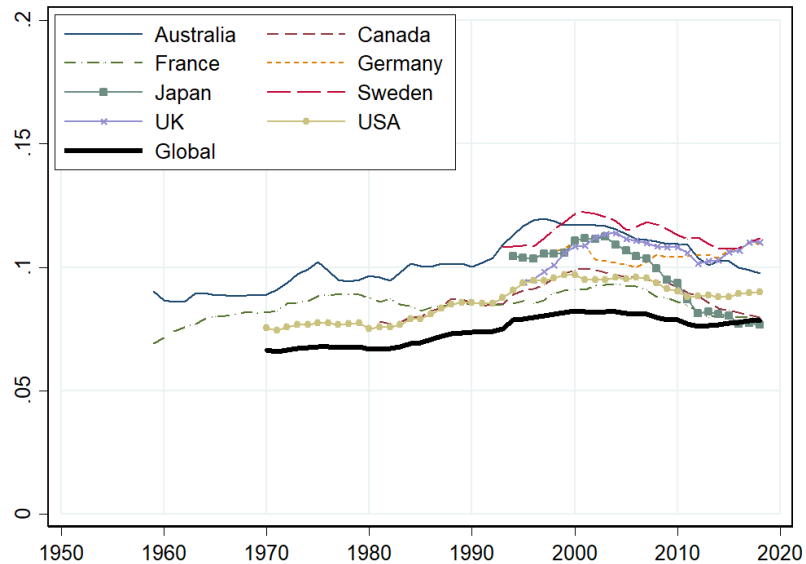
Source: Boppart and Krusell (2020), BEA and Maddison project

◀ Back

BGP facts: Recreation share



(a) Recreation consumption share: United States



(b) Recreation consumption share: International sample

Panel (a): Fraction of recreation consumption in total consumption for the United States. Source: NIPA and CE Surveys. Panel (b): Fraction of recreation consumption in total consumption for a selected group of countries. Source: OECD.

Figure: Income, consumption, and recreation consumption.

◂ Back

Elasticities

- Frisch elasticity is constant along the BGP

$$\epsilon = \frac{1}{h} \frac{u_h u_{cc}}{u_{hh} u_{cc} - u_{hc}^2} = f\left(c^{1-\eta-\tau} h^{\eta} d^{\tau}\right)$$

Back

Robustness 1 of 4

	Working age population		At least 20 years of data	
	(1)	(2)	(3)	(4)
τ	0.307^{***}	0.186^{**}	0.314^{***}	0.191^{*}
	(0.083)	(0.079)	(0.090)	(0.117)
$\eta - 1$	-0.467^{***}	-0.407^{***}	-0.571^{***}	-0.757^{***}
	(0.072)	(0.053)	(0.057)	(0.066)
α^h	0.013^{***}	0.009^{***}	0.015^{***}	0.015^{***}
	(0.002)	(0.002)	(0.002)	(0.002)
Wages	GDP/hour	Comp./hour	GDP/hour	Comp./hour
Obs.	41	41	39	39

Iterative GMM estimation. Robust standard errors in parentheses. * ,** ,*** indicate significance at the 10%, 5%, and 1% levels, respectively. In the benchamrk analysis we focus on hours per capita for population between 20 and 74 years old and exclude 2008 and 2009 when constructing the variables. In columns (1) and (2), working age population (25-64 years old) is used.

◂ Back

Robustness 2 of 4

	Hours per worker		With Great Recession	
	(1)	(2)	(3)	(4)
τ	0.580^{***}	0.138	0.151^{**}	0.125
	(0.197)	(0.128)	(0.076)	(0.084)
$\eta - 1$	-0.411^{***}	-0.588^{***}	-0.181^{***}	-0.273^{***}
	(0.060)	(0.059)	(0.042)	(0.036)
α^h	0.010^{***}	0.007^{***}	0.005^{***}	0.006^{***}
	(0.002)	(0.002)	(0.001)	(0.001)
Wages	GDP/hour	Comp./hour	GDP/hour	Comp./hour
Obs.	40	40	41	41

Iterative GMM estimation. Robust standard errors in parentheses. *,** ,*** indicate significance at the 10%, 5%, and 1% levels, respectively. In the benchamrk analysis we focus on hours per capita for population between 20 and 74 years old and exclude 2008 and 2009 when constructing the variables. In columns (1) and (2), hours per worker is used as the measure of hours worked. In columns (3) and (4), the Great Recession years of 2008 and 2009 are not excluded.

◂ Back

Robustness 3 of 4

Cheaper household items might have push women to enter the labor force.

- Straightforward to extend the model with another type of consumption, denoted by a, with price p_a
- Includes: household appliances, furniture, household textiles and utensils, garden tools and equipment, and goods and services for routine household maintenance

The structural equations become

$$\Delta \log c_i = \alpha^c + \eta \Delta \log w_i + \tau \Delta \log p_i^d + \delta \Delta \log p_i^a + \varepsilon_i^c,$$
$$\Delta \log d_i = \alpha^d + \eta \Delta \log w_i + (\tau - 1) \Delta \log p_i^d + \delta \Delta \log p_i^a + \varepsilon_i^d,$$
$$\Delta \log a_i = \alpha^a + \eta \Delta \log w_i + \tau \Delta \log p_i^d + (\delta - 1) \Delta \log p_i^a + \varepsilon_i^a,$$
$$\Delta \log h_i = \alpha^h + (\eta - 1) \Delta \log w_i + \tau \Delta \log p_i^d + \delta \Delta \log p_i^a + \varepsilon_i^h,$$

◂ Back

Robustness 4 of 4

Estimation outcome

	(1)	(2)
τ	0.137^{**}	0.169^{***}
	(0.063)	(0.058)
δ	-0.173^{*}	-0.123
	(0.095)	(0.088)
$\eta - 1$	-0.406^{***}	-0.266^{***}
	(0.067)	(0.055)
α^h	0.008^{***}	0.006^{***}
	(0.002)	(0.001)
Wages	GDP/hour	Empl. comp./hour
Observations	41	41

Iterative GMM estimation. Robust standard errors in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively. Variables are constructed using all years except for 2008 and 2009. Work hours are measured in per capita terms. Population includes individuals between 20 and 74 years old.

Findings

1. Recreation prices and wages: same impact as before ($\tau > 0$, $\eta - 1 < 0$)
2. Cheaper household items increase work hours ($\delta < 0$)

◂ Back

Reduced-form estimation

	(1)	(2)	(3)	(4)
Dep. var.	Growth in hours per capita			
$\Delta \log p$	0.234**	0.240**	0.247**	0.229**
	(0.109)	(0.109)	(0.112)	(0.110)
$\Delta \log w$				
GDP per hour	0.071		0.078	0.069
	(0.074)		(0.070)	(0.075)
Empl. comp. per hour		0.051		
		(0.066)		
Female labor force part.			0.140	
			(0.168)	
Share of young male in pop.				0.039
				(0.222)
R^2	0.110	0.096	0.144	0.111
Observations	42	42	42	42

Robust standard errors are in parentheses. *,** ,*** indicate significance at the 10%, 5%, and 1% levels, respectively. All variables are in growth rates. Growth rates are annual averages over all years except for 2008 and 2009. Population includes individuals between 20 and 74 years old.

Instrument for wages

- Denote earnings by e and hours by h. Define

$$\Delta \log w_{gl}^{IV} = \sum_i \frac{e_{igl}^0}{\sum_j e_{jgl}^0} \Delta \log e_{ig}^{US} - \sum_i \frac{h_{igl}^0}{\sum_j h_{jgl}^0} \Delta \log h_{ig}^{US},$$

where i is an industry (34 groups), g is a demographic group (age and education, 15 groups) , and l is a locality (741 commuting zones).

◂ Back

Reduced-form estimation 1 of 2

	(1): OLS	(2): OLS	(3): OLS
Dep. var.	Growth in hours per cap.		
$\Delta \log p$	0.427^{***}	0.474^{***}	0.204^{***}
	(0.025)	(0.036)	(0.041)
$\Delta \log w$	-0.048^{***}	-0.093^{***}	-0.094^{***}
	(0.015)	(0.013)	(0.013)
1980 manuf. hours			-0.285^{***}
			(0.023)
Locality F.E.	Y	Y	Y
Addtl. dem. cont.	N	Y	Y
F-statistics	—	—	—
R^2	0.304	0.452	0.469
Observations	10,469	10,469	10,469

Standard errors clustered at the locality level in parentheses. *,** ,*** indicate significance at the 10%, 5%, and 1% levels, respectively. F-statistics are Kleibergen-Paap. The regressions are across people sorted by locality/education-age group. Columns marked by "IV" use Bartik-like instruments for wages and recreation prices. Controls include manufacturing hours share in 1980 and a rich set of additional demographic controls (see text for details).

Demographic controls include the 1980 shares of male, white, household heads with disabilities within each demographic-locality bin, as well as the 1990-2016 changes in these variables. In addition, we also control for the number of co-living children by computing the 1980 shares and the 1990-2016 changes in

Reduced-form estimation 2 of 2

	(1): IV	(2): IV	(3): IV
Dep. var.	Growth in hours per cap.		
$\Delta \log p$	0.763^{***}	0.761^{***}	0.466^{***}
	(0.047)	(0.062)	(0.066)
$\Delta \log w$	-0.713^{***}	-0.539^{***}	-0.529^{***}
	(0.074)	(0.070)	(0.068)
1980 manuf. hours			-0.286^{***}
			(0.025)
Locality F.E.	Y	Y	Y
Addtl. dem. cont.	N	Y	Y
F-statistics	145.1	124.7	124.8
R^2	—	—	—
Observations	10,469	10,469	10,469

Standard errors clustered at the locality level in parentheses. *,** ,*** indicate significance at the 10%, 5%, and 1% levels, respectively. F-statistics are Kleibergen-Paap. The regressions are across people sorted by locality/education-age group. Columns marked by "IV" use Bartik-like instruments for wages and recreation prices. Controls include manufacturing hours share in 1980 and a rich set of additional demographic controls (see text for details).

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