Lecture 1
Labor Supply

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Economics 702: Section 1
Spring 2020

REAL TIME ECONOMICS | NEWSLETTER

Newsletter Special Edition: Ten Straight Years of Job Growth

U.S. employers added 145,000 jobs in December, capping a strong decade of labor-market gains. PHOTO: JUSTIN SULLIVAN/GETTY IMAGES

By Jeffrey Sparshott
Jan 10, 2020 12:25 pm ET

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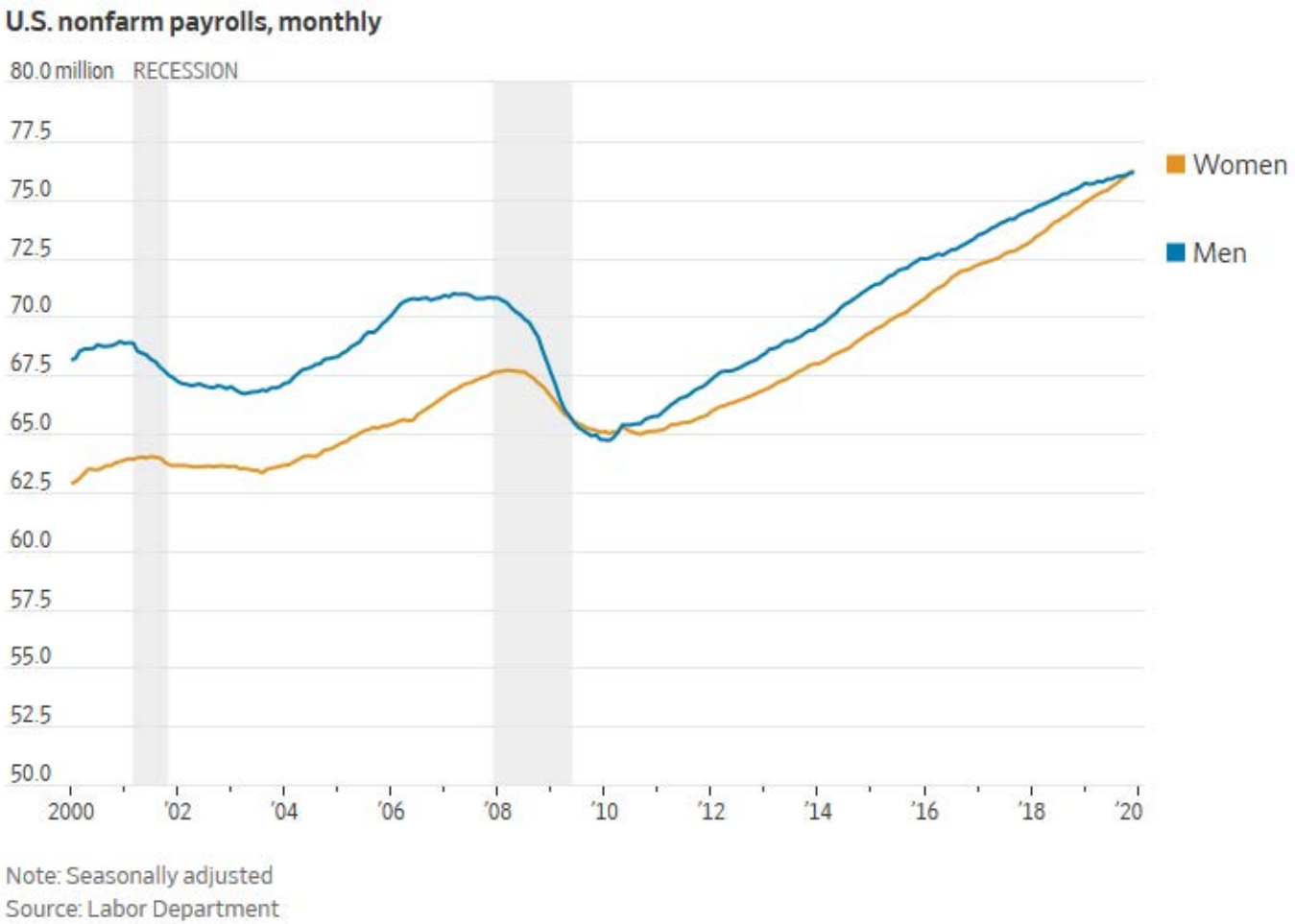
The economy added a seasonally adjusted 145,000 jobs last month and unemployment stayed at a 50-year low of 3.5%, capping a 10th straight year of payroll gains and the longest stretch in 80 years of data. Jeff Sparshott and Greg Ip here to take you through some of the numbers.

The Roaring '10s

The 2010s were the best decade for job growth on record. Since the end of 2009, employers added 22.58 million jobs. That surpassed the 1990s for the most total job growth during a decade. It's a dramatic turnaround from the first decade of the century —which included two recessions—when payrolls fell by nearly 1 million. However, the 2010s' big gain is partly a function of population growth. In terms of percentage


U.S. nonfarm payrolls, monthly
80.0 million
RECESSION
77.5
75.0
72.5
70.0
67.5
65.0
62.5
60.0
57.5
55.0
52.5
50.0
2000
'02
'04
'06
'08
'10
'12
'14
'16
'18
'20
Women
Men
Note: Seasonally adjusted
Source: Labor Department

U.S. unemployment rate and the Federal Reserve's estimate of the natural unemployment rate

Sources: Labor Department, Federal Reserve

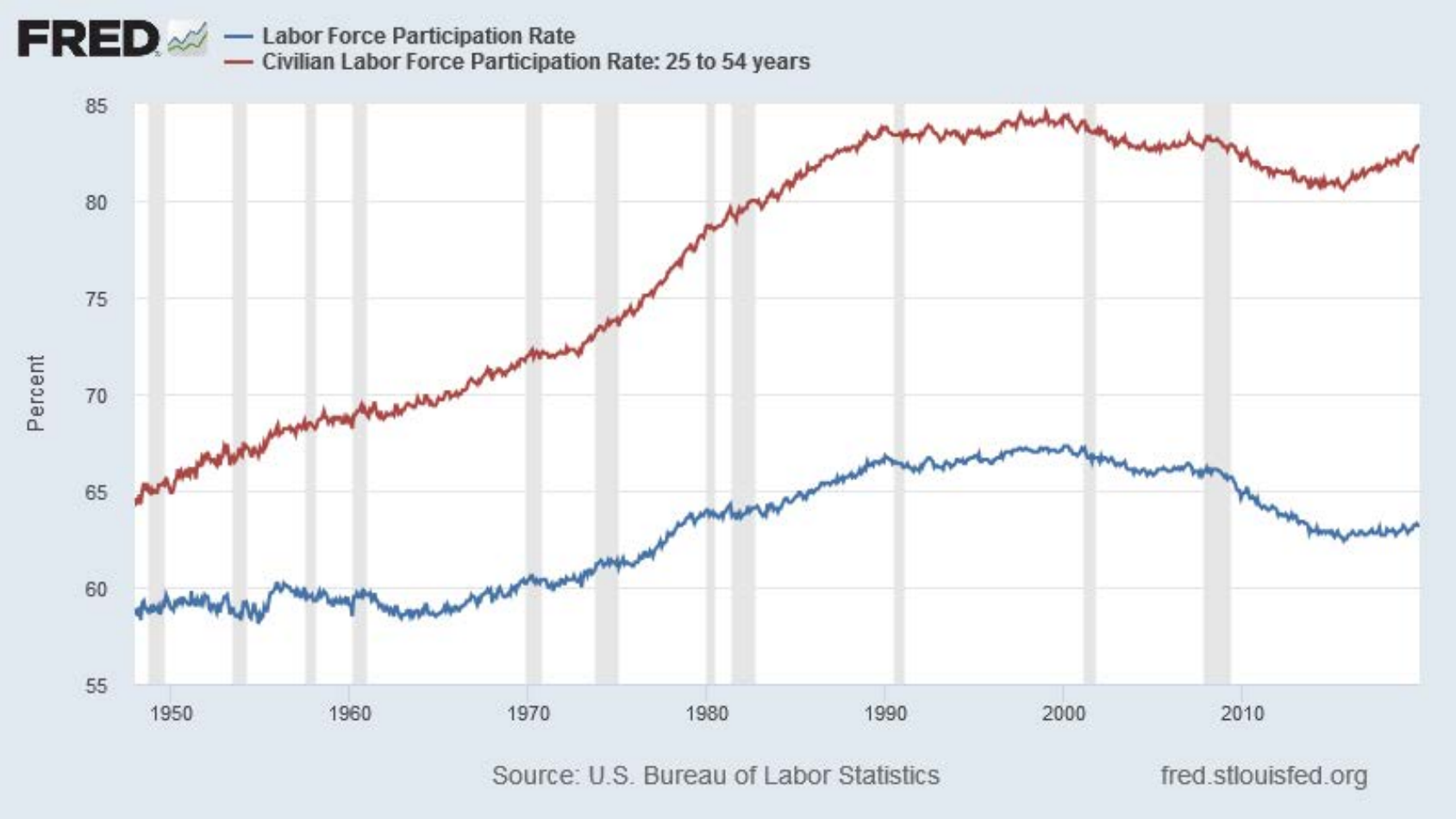
Share of the population age 25-54 that is...

Note: Seasonally adjusted
Source: Labor Department

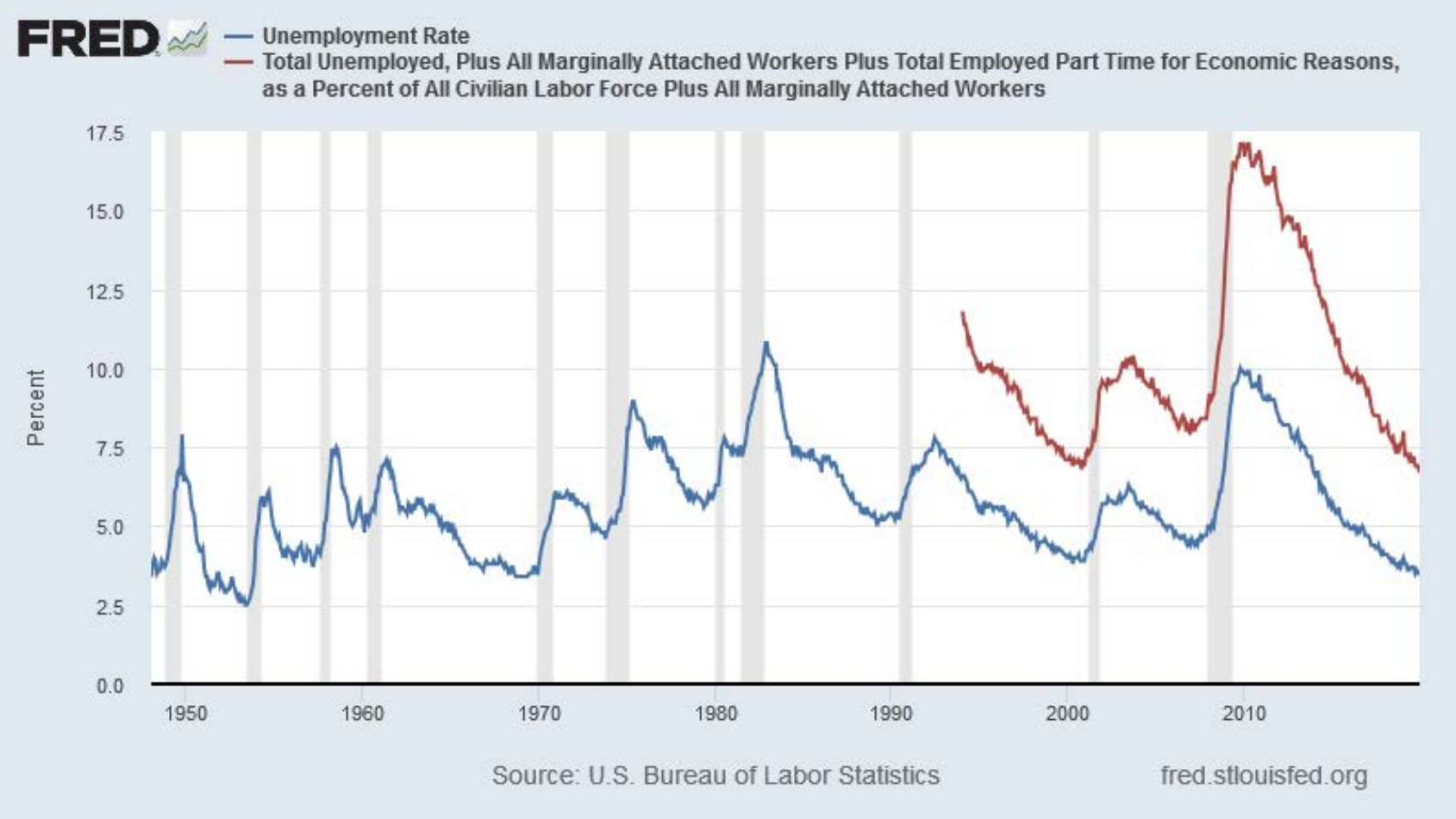
Employment and Unemployment

- Why important: a main determinant of individual experience of workers
- Long-term trends in employment, especially female labor force participation.
- US experience: no strong trend in unemployment rates, mostly cyclical
- European experience: growth in unemployment rates post-WWII
- Downward trend in labor force participation over past decade, recently stabilized

Labor Force Participation Rate, 1948-2019



Unemployment Rate, 1948-2019



Introduction to Macroeconomics

- The study of aggregate economic behavior
- Issues:
  - economic growth
  - employment and unemployment
  - business cycles
  - inflation
  - macroeconomic policy
  - international trade and exchange rates

The Representative Household

- We will now begin formal modeling by considering individual household behavior.
- As an abstraction, we will think of one representative household as a stand in for the whole economy.
- Justification: aggregation. Limitations.
- Will define household preferences.
- Then think about household constraints.
- Finally, what will household do given preferences and constraints.

Commodity Space

- 2 goods, consumption c and leisure l.
- Total time of h hours, N=labor $\Rightarrow N = h - l$.
- Each good's set:
  1. $c \in \mathbb{R}_+$
  2. $l \in [0, h]$
- Then $(c, l) \in \mathbb{R}_+ \times [0, h]$

Preferences

- Preferences: binary relation $\succeq$ defined over pairs (c, l):

$$(c_i, l_i) \succeq (c_j, l_j)$$

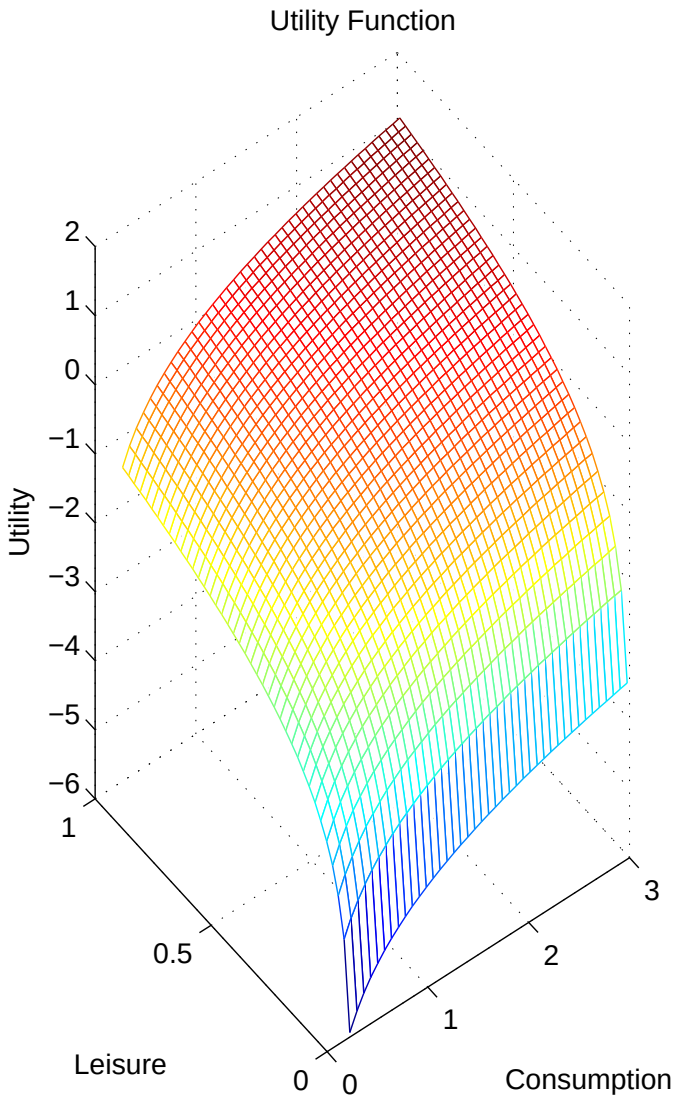
- Working directly with binary relations difficult.
- **Definition:** a real-valued function $u : \mathbb{R}^2 \to \mathbb{R}$ is called a utility function representing the binary relation $\succeq$ defined over pairs (c, l) if for $\forall\ (c_i, l_i), (c_j, l_j) \in \mathbb{R}_+ \times [0, h]$, $(c_i, l_i) \succeq (c_j, l_j) \Leftrightarrow u(c_i, l_i) \geq u(c_j, l_j)$.
- **Theorem:** if the binary relation $\succeq$ is complete, reflexive, transitive, strictly monotone and continuous, there exist a continuous real-valued function u that represents $\succeq$.

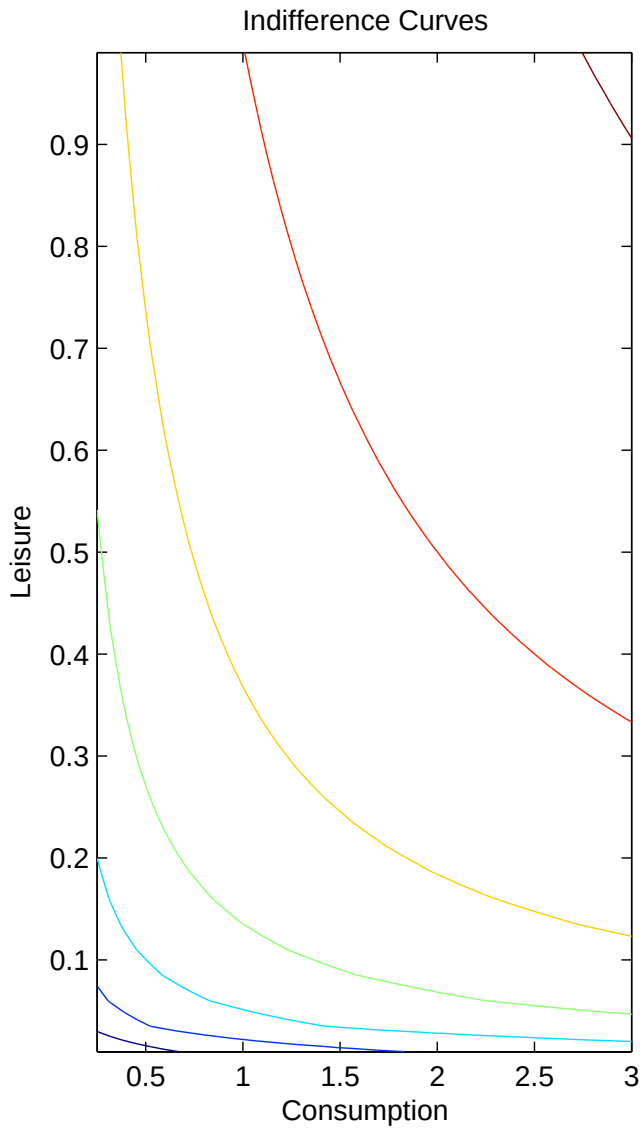
Properties of Utility Functions

- u simply represents the indifference curves. Indifference curves are level sets $\{(c, l) : u(c, l) = \bar{u}\}$.
- We'll always assume u is continuous and differentiable.
- $u(c, l)$ is a function of two variables. To consider properties of u and so optimal choices, we'll need to consider how it varies separately with c and l.
- To do so, we'll use partial derivatives of the utility function. We'll write these in one of two ways:

$$u_c(c, l) = \frac{\partial u}{\partial c}(c, l), \quad u_l(c, l) = \frac{\partial u}{\partial l}(c, l)$$

Utility Function and Indifference Curves





Budget Constraint

- Leisure $l \Rightarrow$labor supply $N = h - l$.
- Wage w. Unearned income π.
- Then

$$c = Nw + \pi = (h - l)w + \pi$$

Household's Problem

- Problem for household is then:

$$\max_{c,l} u(c,l)$$
$$s.t.\ c = (h-l)w + \pi$$

- Form Lagrangian with multiplier $\lambda > 0$ on constraint:

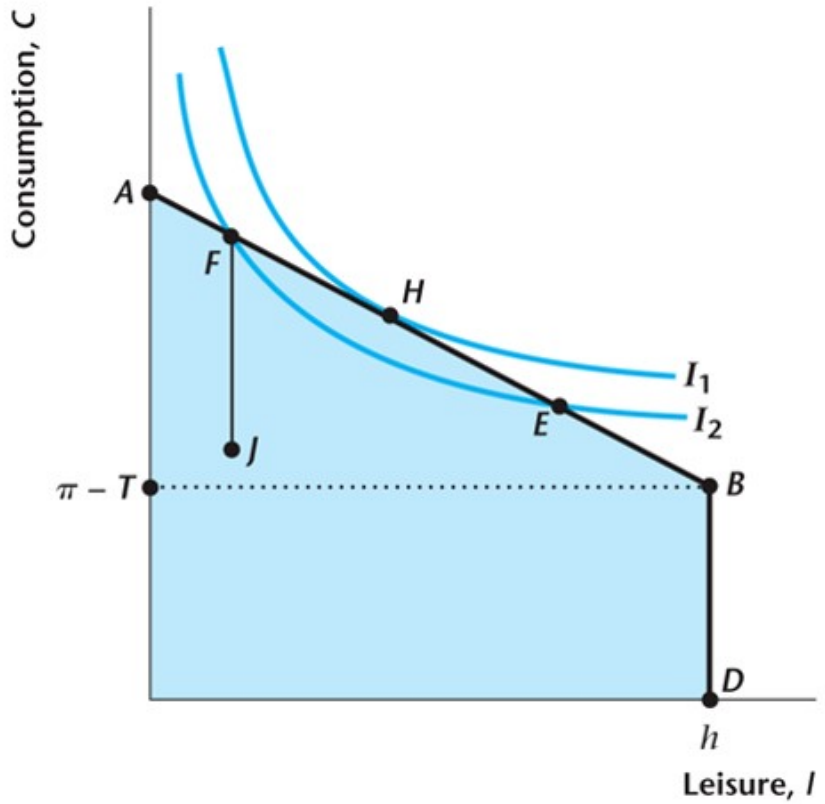
$$\max_{c,l} u(c,l) + \lambda[(h-l)w + \pi - c]$$

- First order conditions:

$$\begin{aligned} u_c &= \lambda \\ u_l &= \lambda w \\ \Rightarrow \frac{u_l}{u_c} &= w \end{aligned}$$

- marginal rate of substitution = relative price of leisure.

Figure 4.5 Consumer Optimization



Non-Participation

- In previous we assumed an interior solution, $l < h$ or $N > 0$. But if $\pi > 0$ there may be corner solutions of individuals who choose not to work.
- Impose additional constraint $l \leq h$ via Kuhn-Tucker multiplier μ. $\mu = 0$ if $l < h$, $\mu > 0$ if $l = h$. (Also possible $\mu = 0$ and $h = 0$ if indifferent between working and not.)

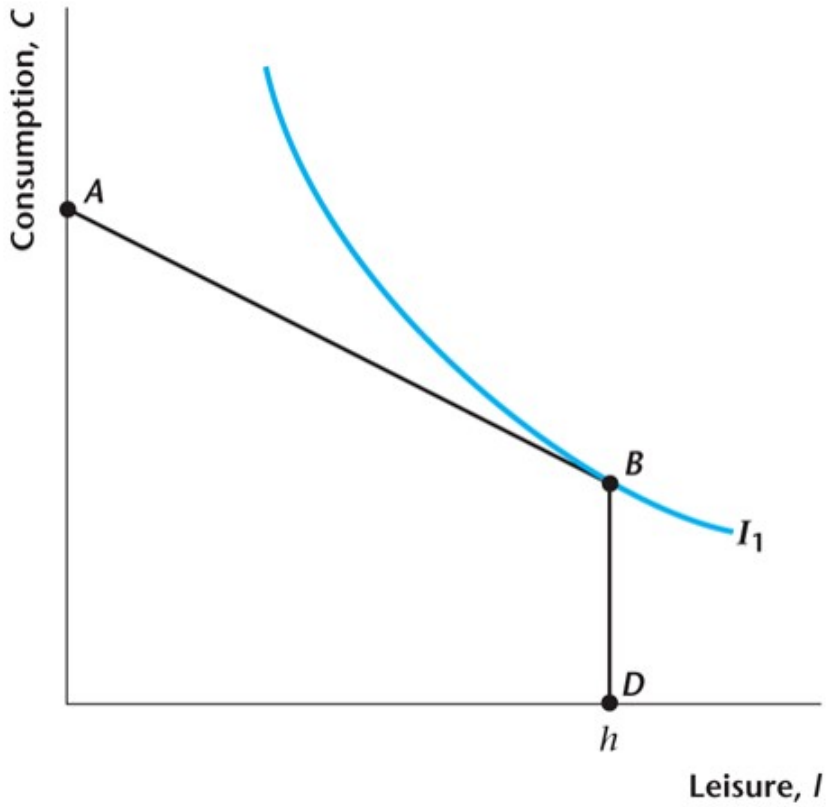
$$\max_{c,l} u(c, l) + \lambda[(h - l)w + \pi - c] + \mu[h - l]$$

- First order conditions:

$$\begin{aligned} u_c &= \lambda \\ u_l &= \lambda w + \mu \\ \Rightarrow \frac{u_l}{u_c} &= w + \frac{\mu}{\lambda} \geq w \end{aligned}$$

- For non-participant, marginal rate of substitution $>$ wage.

Figure 4.6 The Representative Consumer Chooses Not to Work



Pearson

A Parametric Example

- $u(c, l) = \log c + \gamma \log l$

$$MRS = \frac{u_l}{u_c} = \frac{\gamma \frac{1}{l}}{\frac{1}{c}} = \gamma \frac{c}{l}$$

- FOC+Budget constraint:

$$\gamma \frac{c^*}{h - N^*} = w$$
$$c^* = N^* w + \pi$$

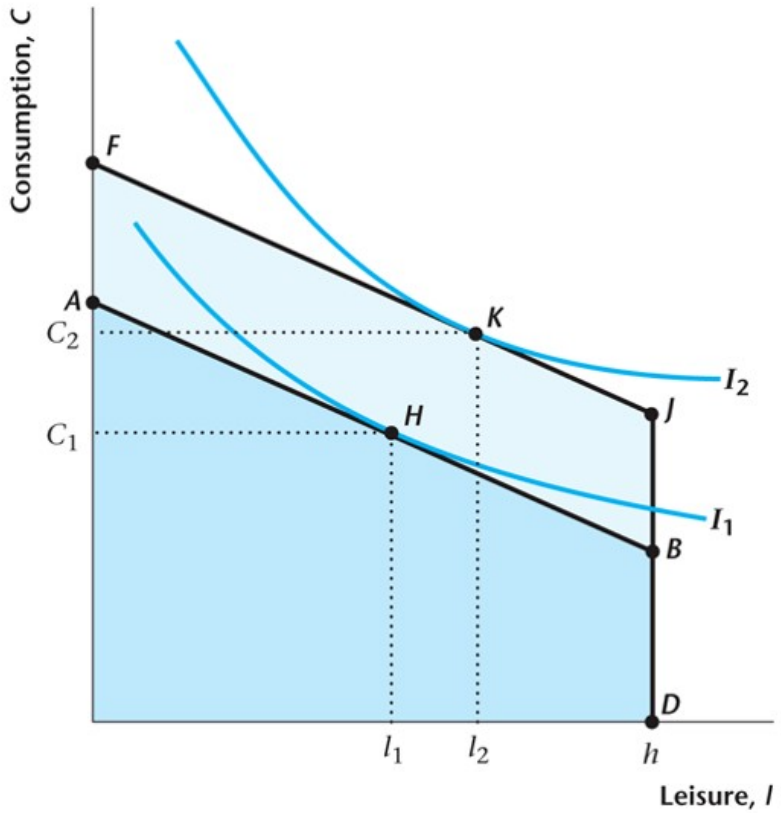
- Then:

$$N^* = \frac{wh - \gamma\pi}{(1 + \gamma)w}$$

Income and Substitution Effect

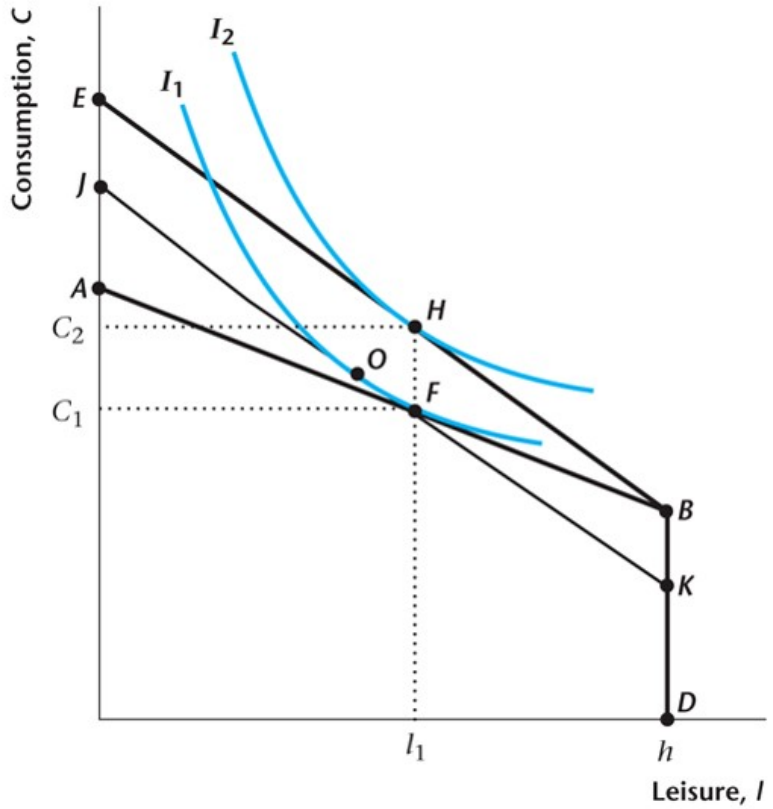
- We will follow the Hicksian decomposition.
- Income Effect: changes in w induce changes in total income even if l^* stays constant. Reduces work incentive: use more income to "buy" leisure.
- Pure income effect: Increase in π.
- Substitution Effect: changes in w make leisure change its relative price with total utility constant. Increases work incentive.
- (Almost) pure substitution effect: One-time change in wage, say in peak sales period.

Figure 4.7 An Increase in π - T for the Consumer



Pearson

Figure 4.8 Increase in the Real Wage Rate–Income and Substitution Effects



Income and Substitution Effects in the Example

$$N^* = \frac{wh - \gamma\pi}{(1+\gamma)w}$$

- Income effect:

$$\frac{\partial N*}{\partial \pi} = -\frac{\gamma}{(1+\gamma)w} < 0$$

- Suppose $\pi = 0$, then

$$N^* = \frac{h}{1+\gamma}$$

  Labor supply does not respond to the wage at all! So income and substitution effects completely offset.

- With $\pi > 0$ income effect only partly offsets substitution effect.

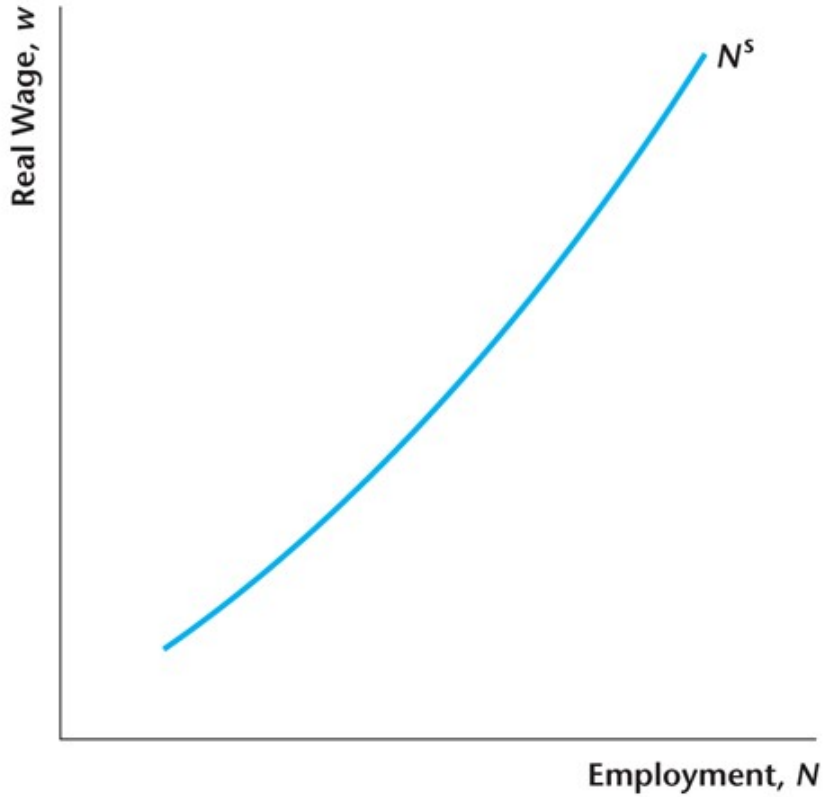
Labor Supply

- Labor supply curve $N(w)$ plots response of labor supplied by households to a change in wage, holding fixed unearned income (and preferences).
- For individual workers, slope of labor supply unclear. Depends on income and substitution effects. For high enough wage, may be backward bending. That is $N'(w) > 0$ for low w but $N'(w) < 0$ for w high enough
- May also be discontinuous if there are fixed costs of work (commuting costs). Won't work low number of hours

Aggregate Labor Supply

- In the aggregate, labor supply supply curve embodies both intensive and extensive margins, and is is upward sloping.
- Intensive margin: for those *already working*, increase in wage has income and substitution effects.
- Extensive margin: increases in wages may induce some *who were not in labor force* to enter and supply labor. Always increasing in w.
- Aggregate labor supply curve also smooths out kinks in individual supply, for example due to fixed costs of work.

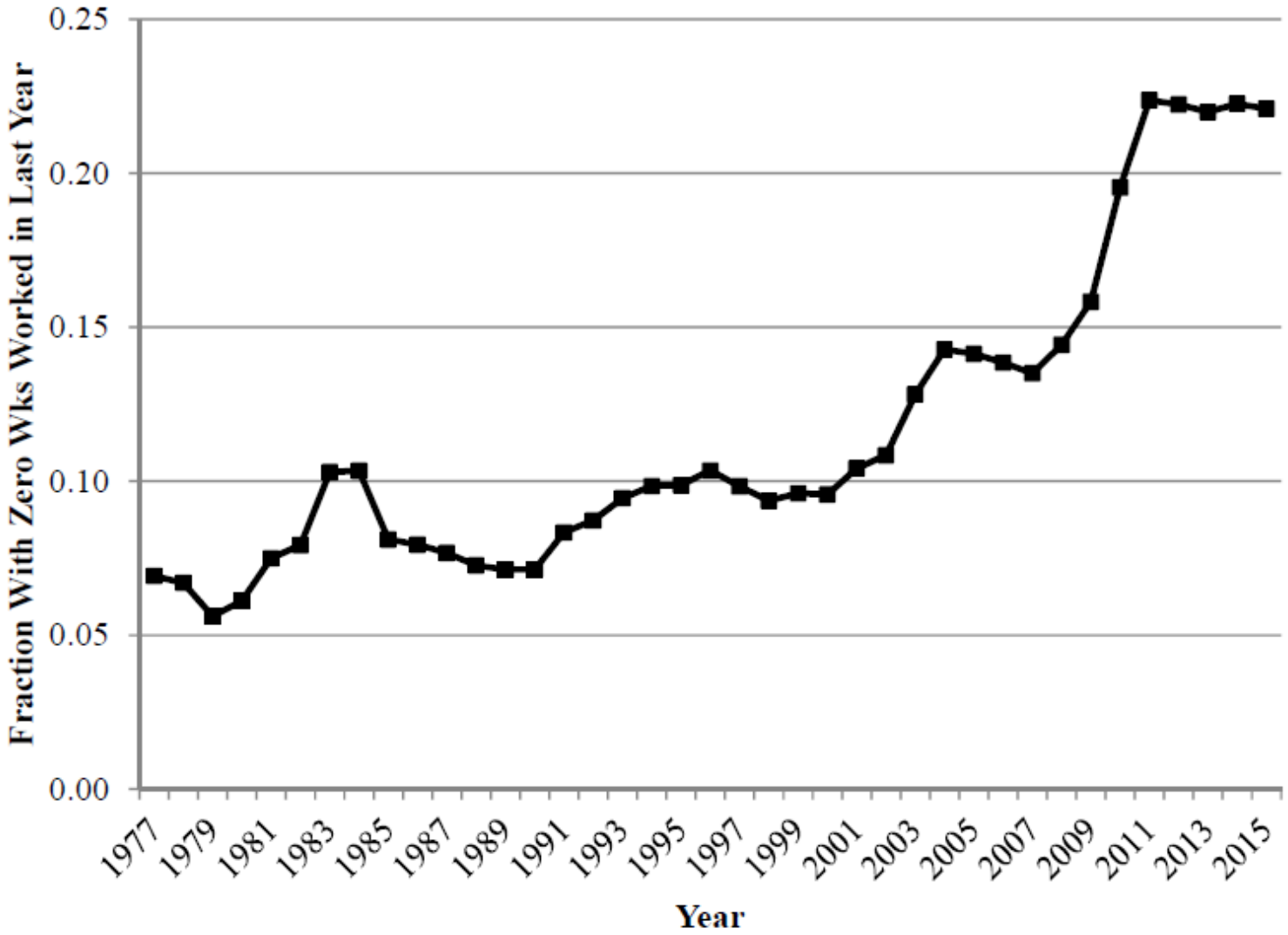
Figure 4.9 Labor Supply Curve



Application: Decline in Employment of Young Men

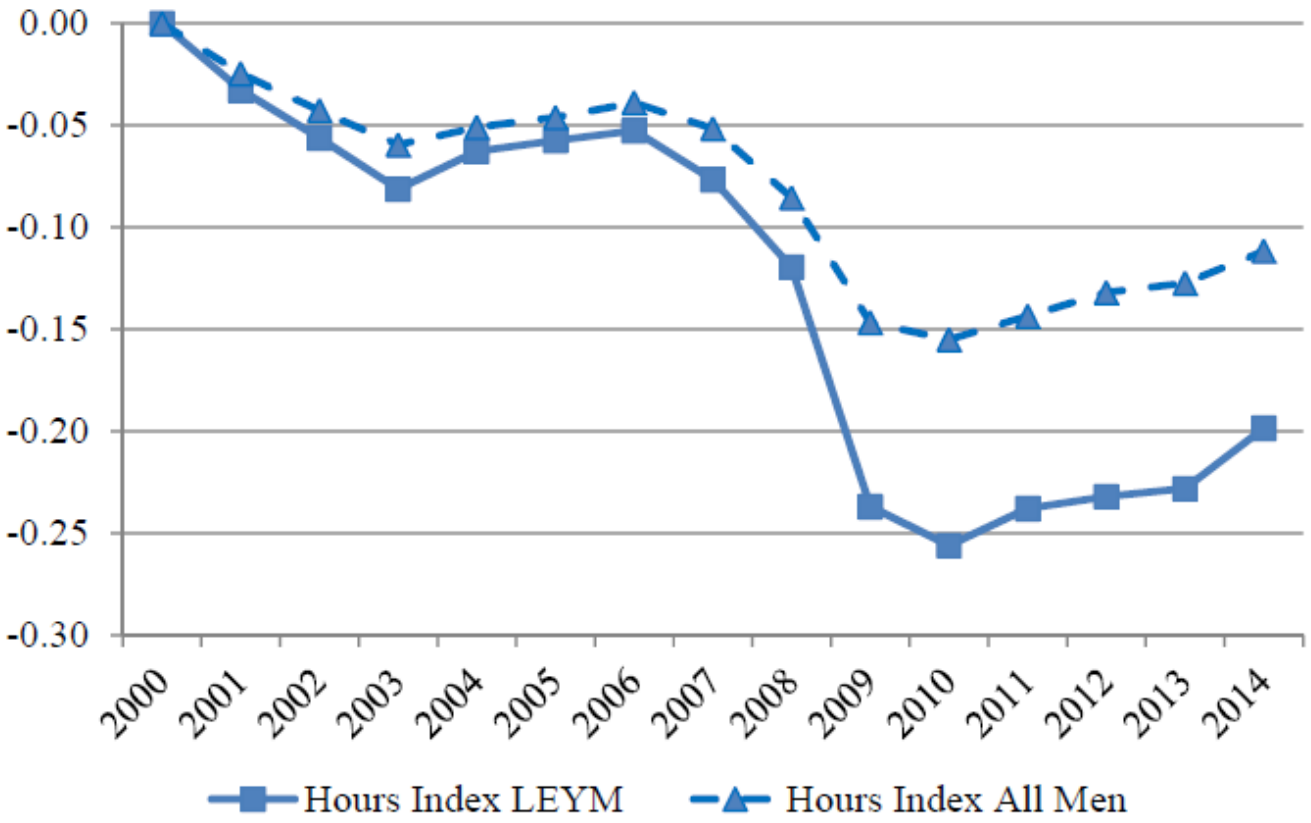
- In recent paper Aguiar, Bils, Charles, and Hurst (2018) document decline in employment and hours worked of young men (21-30) who did not attend college.
- Also document increased leisure time of this same group, and increase in computer and videogame use.
- Argue that improvements in leisure activities (productivity of videogames, taste for leisure) have made non-participation and less work more prevalent.
- Other factors as well: changing job prospects, living with parents

Figure 2: Fraction of Young Non-College Men Who Report Working Zero Weeks During the Prior Year, March CPS



Notes: Figure shows the share of non-college men aged 21-30 who report working zero weeks during the prior year. Non-college refers to individuals with less than a bachelor's degree. Data from the March supplement of the

Figure 3: Annual Hours Index for Less Educated Young Men and All Prime Age Men, March CPS



Notes: Figure shows annual hours index for lower educated young men (squares) and all prime age men (triangles). Annual hours are calculated by multiplying self-reported weeks worked last year by self-reported usual hours worked per week last year. We convert the series to an index by setting year 2000 values to 0. All other years are log deviations from year 2000 values. Data from the March supplement of the Current Population Survey.

Table 2: Leisure Activities for Men 21-30, Hours per Week

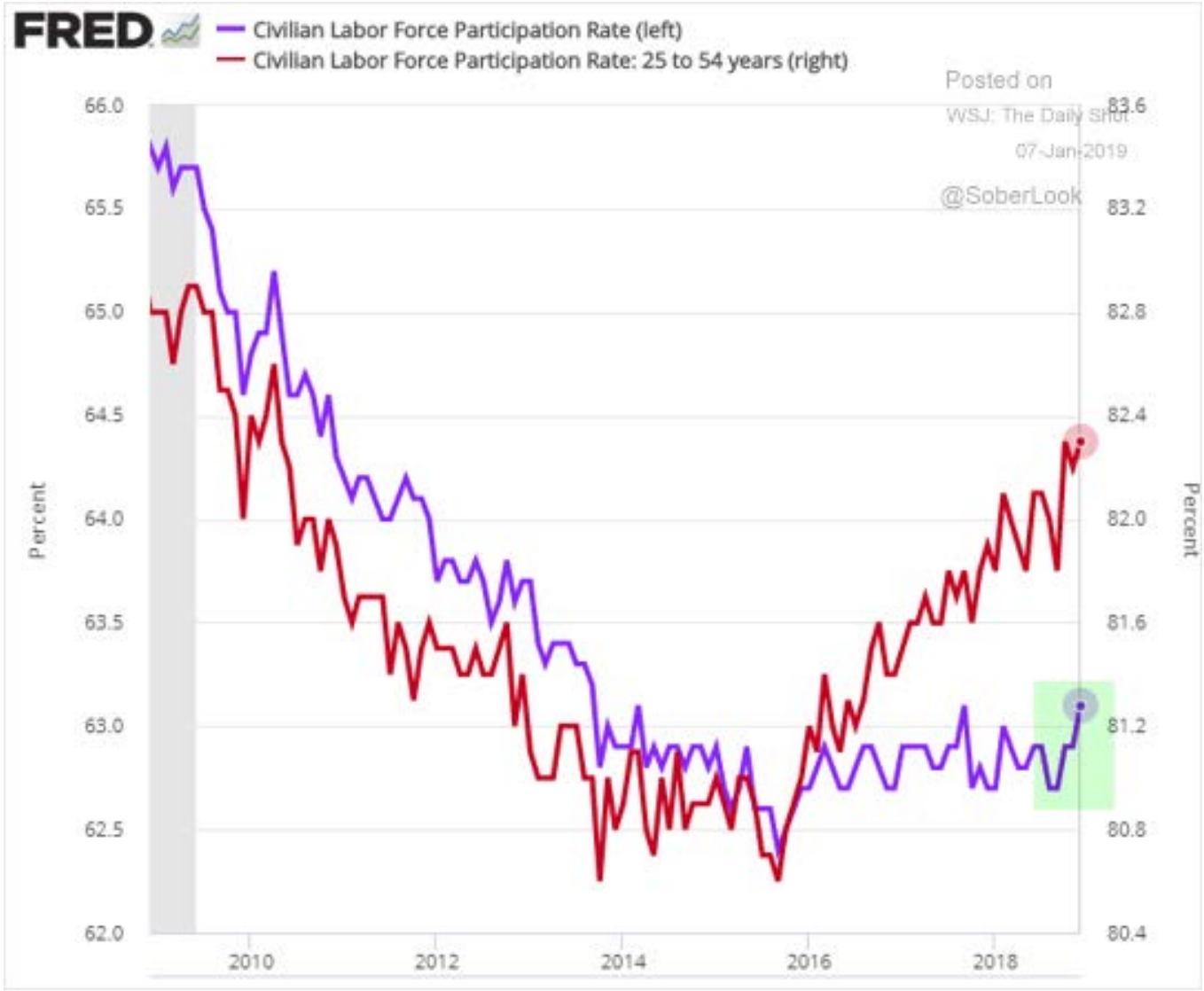
Activity	2004-2007	2012-2015	Change
Total Leisure	61.0	63.4	2.3
Recreational Computer	3.3	5.2	2.0
Video Game	2.0	3.4	1.4
ESP	24.3	24.9	0.5
TV/Movies/Netflix	17.3	17.1	-0.2
Socializing	7.8	7.9	0.1
Other Leisure	8.3	8.2	-0.1

Note: Leisure components sum to total leisure time. Video gaming is a subcomponent of total computer time. ESP refers to eating, sleeping and personal care net of 49 hours.

Table 3: Leisure Activities for Men 21-30 (Hours per Week): By Employment Status

	Employed			Non-Employed		
Activity	2004-2007	2012-2015	Change	2004-2007	2012-2015	Change
Total Leisure	57.6	59.6	2.0	87.0	82.1	-4.9
Recreational Computer	3.0	4.3	1.3	5.4	9.6	4.2
Video Game	1.8	2.9	1.0	3.5	5.9	2.4
ESP	23.6	23.9	0.3	30.2	29.9	-0.2
TV/Movies/Netflix	15.9	15.5	-0.4	27.8	25.0	-2.8
Socializing	7.4	7.8	0.3	10.6	8.9	-1.7
Other Leisure	7.7	8.1	0.5	13.0	8.6	-4.4
Job Search and Education	2.0	1.9	-0.1	9.2	14.1	4.9

Note: Components sum to total leisure time. Video gaming is a subcomponent of total computer time. ESP refers to eating, sleeping and personal care net of 49 hours per week.


FRED
Civilian Labor Force Participation Rate (left)
Civilian Labor Force Participation Rate: 25 to 54 years (right)
Posted on
WSJ: The Daily Shot
07-Jan-2019
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Percent
Percent
66.0
65.5
65.0
64.5
64.0
63.5
63.0
62.5
62.0
83.6
83.2
82.8
82.4
82.0
81.6
81.2
80.8
80.4
2010
2012
2014
2016
2018