Lecture 3
Work and Leisure

Macroeconomics (Quantitative)

Econ 101B

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Work and Leisure

- Choosing a job/career one of most important decisions we make
- Politics: Jobs, jobs, jobs!!!
- Unemployment extremely serious and frightening risk
- But abstracting from unemployment, more work not always better

- For many their job is a means to an end
- Work takes time away from time you have to enjoy fruits of labor
- Important choice: How much should we work?

- We present a model to help us think about this question

Household Behavior

- Our starting point: People act in a purposeful manner
- How should we “model” purposeful choices by households (people)?
- Rational choice model:
  - Assume that people have preferences over, e.g., goods and leisure
  - Represent preferences by a utility function
  - Assume that people maximize utility
  - Recognize that people are constrained by the resources they have at their disposal

Household Utility Function

- Utility over consumption and hours worked:
$$U(C, H)$$
- Very "broad brush" model of preferences
- We ignore all the details associated with different types of job and goods, etc.

Household Utility Function

- For simplicity, we assume separability:
$$U(C) - V(H)$$
  - $U(C)$ represents utility from consumption of goods
  - $V(H)$ represents disutility from supplying labor
- H is hours worked per person.
- Aggregate labor by $L = NH$ where N denotes population
- We can "normalize" the size of the population to $N = 1$ (choice of units, unit coincides with size of population)

Household Utility Function

- Alternative specification:
  - consumption and leisure (Z)

$$U(C) + V\,\underbrace{(1 - H)}_{Z}$$

- Household has time endowment of 1 and leisure of $Z = 1 - H$
- Here, $V(1 - H)$ represents utility from leisure

Household Utility Function

- What properties should $U(C) - V(H)$ have?
- Household likes consumption:

$$\frac{dU(C)}{dC} = U'(C) > 0$$

- But at a diminishing rate: $U''(C) < 0$
  - Extra coconut very valuable when you have few coconuts
  - Extra coconut not as valuable when you already have many

Household Utility Function

- What about $V(H)$? This is disutility of working
- How about assuming household dislikes working (enjoys leisure):

$$\frac{dV(H)}{dH} = V'(H) > 0$$

  - But is that natural? People are miserable when unemployed. Work provides people with meaning
  - Even if people like their jobs, work yields disutility on the margin
- Household's marginal disutility of working is increasing:

$$V''(H) > 0$$

Household Budget Constraint

- Households maximize utility subject to a budget constraint
- Budget constraint:

$$C = wH + T$$

- Left-hand side: Sources of spending
  - Consumption: C
- Right-hand side: Sources of income
  - Labor income: wH
  - Other income: T (gov. transfers, lottery winnings, etc.)

Household's Problem

- Household's problem is a constrained maximization problem
- Maximize utility:

$$U(C) - V(H)$$

- Subject to not violating its budget constraint:

$$C = wH + T$$

Household's Problem: Plug and Chug

1. Plug budget constraint into utility function:
$$U(wH + T) - V(H)$$
2. Differentiate with respect to H and set to zero:
$$wU'(wH + T) - V'(H) = 0$$
3. Use budget constraint to plug C back into U'
$$wU'(C) - V'(H) = 0$$
4. Rearrange:
$$wU'(C) = V'(H)$$

Labor-Leisure: Intuition

$$wU'(C) = V'(H)$$

- Straightforward derivation.
- But do you understand what this equation is saying?
- Useful to adopt a variational perspective to build intuition
  - Suppose the household is considering working H hours
  - To kick the tires on this choice, suppose it contemplates working a little bit more (or a little bit less)

Labor-Leisure: Intuition

- Marginal cost of working a little bit more:
  - $V'(H)$ “utils” per extra hour worked
- Marginal benefit of working a little bit more:
  - w coconuts per extra hours worked
  - Each of these coconuts is worth $U'(C)$ “utils”
  - Overall marginal benefit in “utils” is then $wU'(C)$ “utils” per extra hour worked
- $U'(C)w = V'(H)$ says that at the optimum marginal benefit of working more equal to marginal cost of working more

Labor-Leisure: Intuition

- Suppose the household is supplying very few hours of labor.
  - What does this imply about U'?
  - What does this imply about V'?
  - In this situation, we have:
    $$U'(C)w > V'(H)$$
- Worker better off if they work more

- Suppose the household is supplying very large number of hours.
  - What does this imply about U'?
  - What does this imply about V'?
  - In this situation, we have:
    $$U'(C)w < V'(H)$$
- Worker better off if the work less

Labor-Leisure: Intuition

- Somewhere in between is a “sweet spot” where a little extra effort neither makes household better nor worse off
- At this point we have:

$$U'(C)w = V'(H)$$

- This is the optimum!!

Units: Utils versus Coconuts

$$U'(C)w = V'(H)$$

- Units: utils per hour worked
- RHS is “utils per hour worked” ($V'(H)$)
- LHS is “coconuts per hour worked” (w) times “utils per coconut” ($U'(C)$). Multiplies together these become “utils per hour worked”

$$\frac{V'(H)}{U'(C)} = w$$

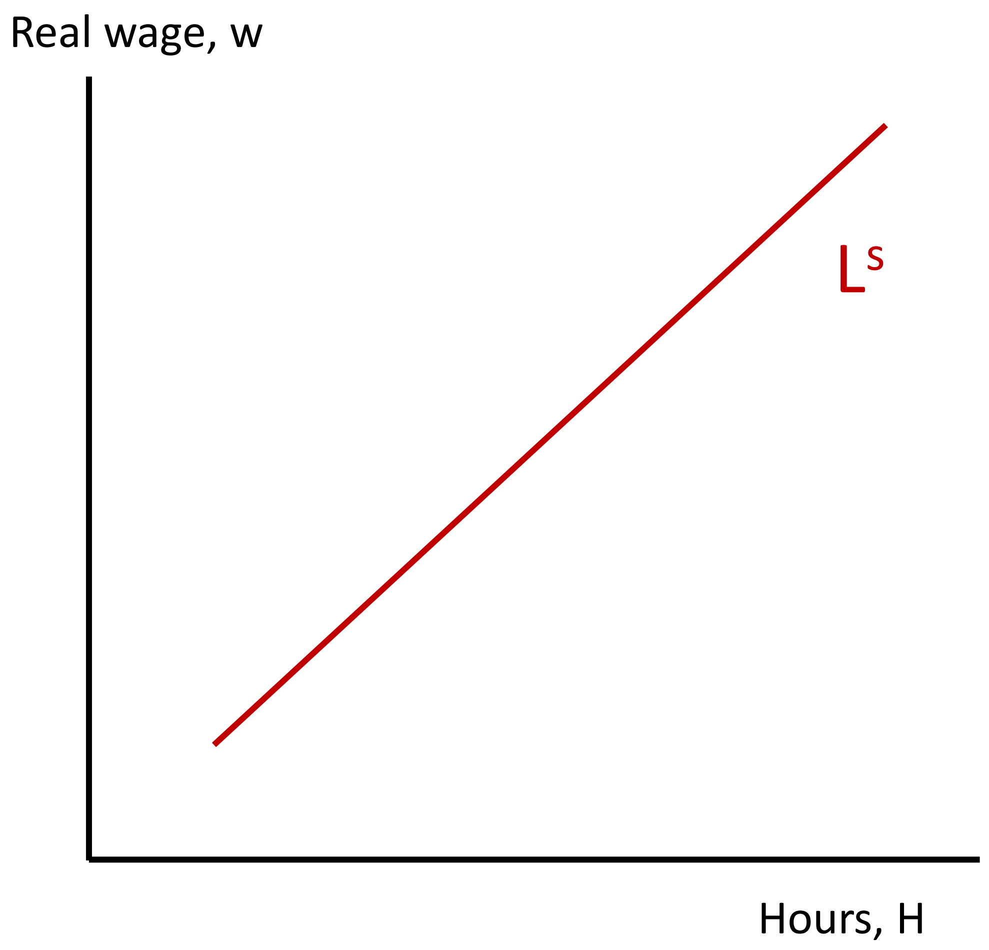
- Units: coconuts per hour worked
- RHS: “coconuts per hour worked” (w)
- LSH: “utils per hour worked” ($V'(H)$) divided by “utils per coconut” ($U'(C)$) or multiplied by “coconuts per util” ($1/U'(C)$). Multiplies to “coconuts per hour worked”

Household's Problem

- This equation can be graphically represented by a "curve" in (H,w) space

$$\frac{V'(H)}{U'(C)} = w$$

- What is the slope of this curve?
  - $V'' > 0$, implies that it is upward sloping in (w,H) space
- Importantly we are holding C fixed when we graph this curve
- Does this curve have a name?
  - Labor supply curve



Labor Market Equilibrium

- Firm's problem yields labor demand:
$$(1-a)AK^{a}L^{-a} = w$$

- Household's problem yields labor supply:
$$\frac{V'(L)}{U'(C)} = w$$

(Recall: $L = H$ when $N = 1$)

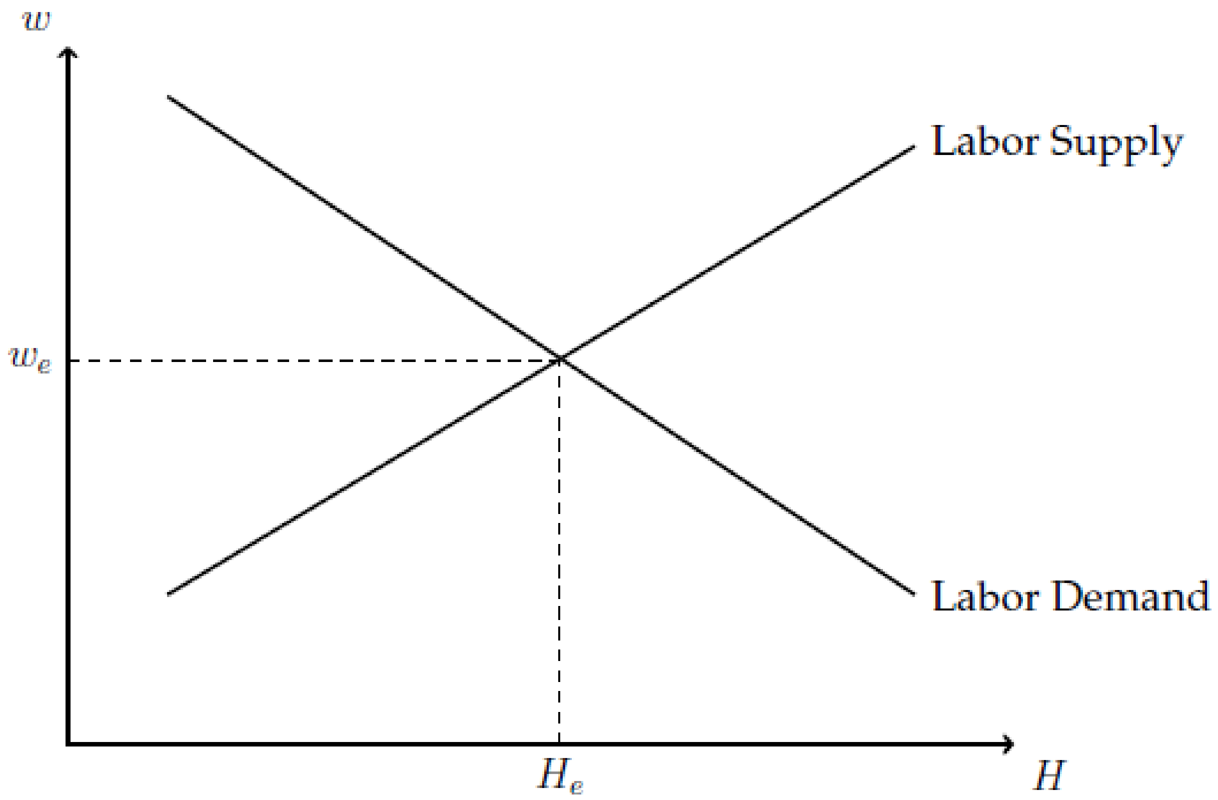


Figure 1: Labor Market Equilibrium Holding Household Consumption Fixed

What Shifts Labor Demand and Labor Supply

- Variables not on the axes shift the curves
- Labor Demand: $(1-a)AK^{a}L^{-a} = w$
  - A and K not on the axes. They shift labor demand
  - w and L are on the axes. They don't shift labor demand
- Labor Supply: $U'(C)w = V'(L)$
  - C not on the axes. Shifts labor supply
  - Increase in population also shifts labor supply
  - w and L are on the axes. They don't shift labor supply

Poll

- Suppose your wage was temporarily high for one week. How would this affect your labor supply

a) I would work more

b) I would work the same amount

c) I would work less

Poll

- Suppose your wage was permanently higher. How would this affect your labor supply

a) I would work more

b) I would work the same amount

c) I would work less

Effect of Wage Increase on Labor Supply

1. Substitution effect:
   - Working more lucrative
   - Leisure more “expensive”
   - Wage is opportunity cost of leisure
   - Households substitute towards lucrative activities and away from expensive activities
   - Work more

2. Income effect:
   - Higher wage means worker is richer
   - Richer workers chooses more consumption and more leisure
   - Leisure is a “normal” good
     (you buy more of it the richer you are)
   - More leisure means less work
   - Work less

Substitution Effect

- Suppose we could vary the wage without effecting consumption
  (i.e., very temporary change in w)
- Increase in wage increases RHS
- Need to increase LHS to balance.
- If C is constant, $V'(H)$ must rise
- This implies that H must rise since $V''(H) > 0$

$$\frac{V'(H)}{U'(C)} = w$$

Income Effect

- How does an increase in consumption affect labor supply holding wages fixed? (e.g., due to winning the lottery)

$$\uparrow C \underset{\substack{\uparrow \\ U''(C) < 0}}{\Rightarrow} \downarrow U'(C) \Rightarrow \uparrow \frac{V'(H)}{U'(C)}$$

$$\frac{V'(H)}{U'(C)} = w$$

- To balance this effect, we must have

$$\downarrow V'(H) \underset{\substack{\uparrow \\ V''(H) > 0}}{\Rightarrow} \downarrow H$$

- Thus, the income effect leads to a fall in hours worked

Increase in the Wage

- Recall that $C = wH + T$ (in our simple model)
- So, we have:

$$\frac{V'(H)}{U'(wH + T)} = w$$

- This mean that an increase in the wage has both an income and substitution effect
  – w on RHS is responsible for substitution effect
  – w on LHS (inside $U'(wH + T)$) is responsible for income effect
- Which is stronger?

Short Run versus Long Run

- For a short run change in wages:
  - Effect on lifetime wealth small
  - Income effect small
  - Substitution effect dominates
- For a long run change in wages:
  - Effect on lifetime wealth large
  - Income effect substantial
  - Not clear whether income or substitution effect is stronger (depends on shape of U and V)

Labor Supply in Practice?

- Two first order facts:
  1. Real wages have risen by roughly 1.5% per year for over 100 years (real wages adjust for changes in prices)
  2. Hours worked per worker in the U.S. have declined gradually

Real Wages and Hours Worked per Worker

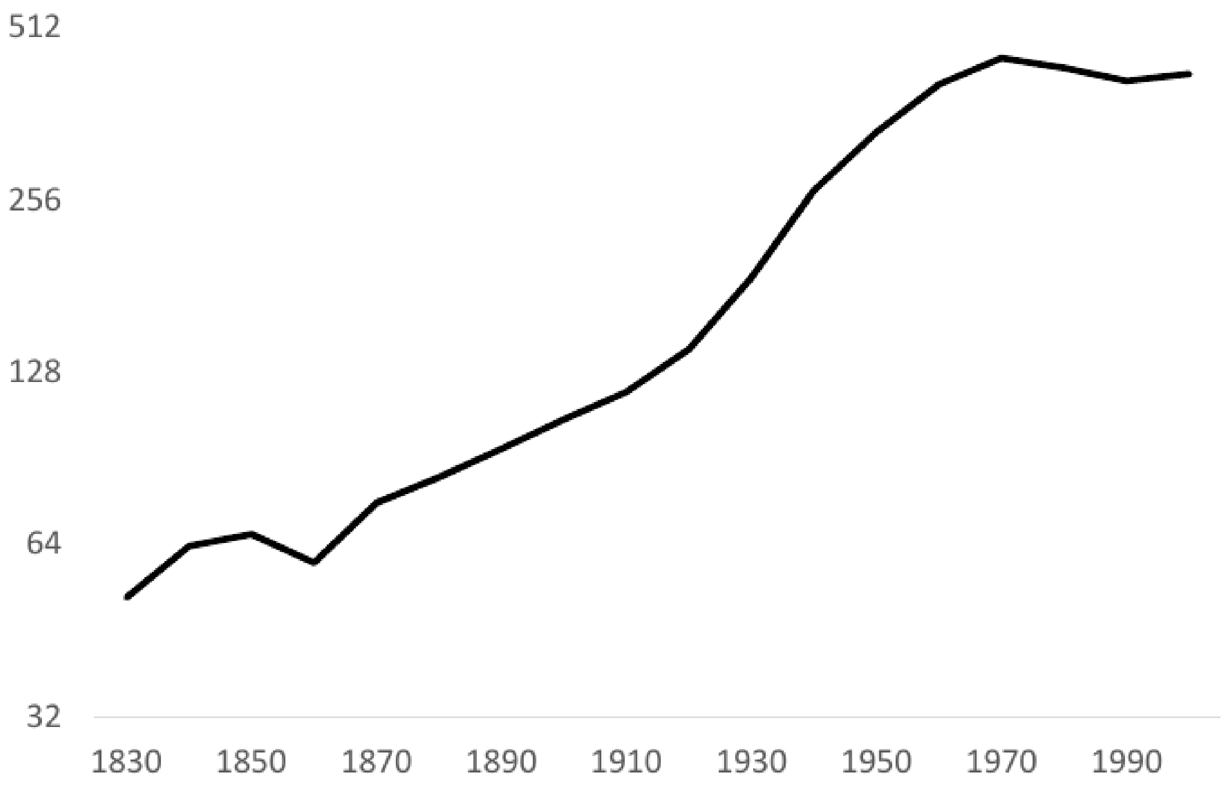


Figure 2: Real Wages in the United States

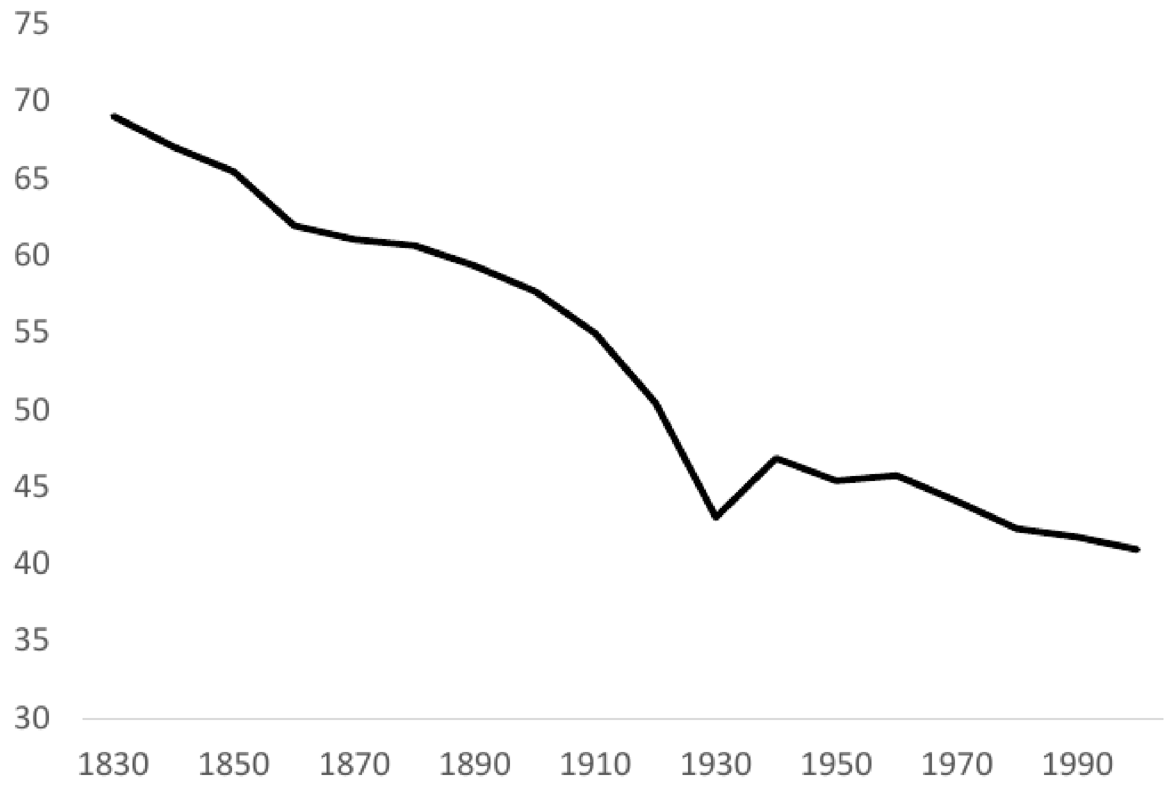


Figure 3: Weekly Hours Worked per Worker in the United States

Over 800% cumulative increase.

Roughly 50% cumulative decrease.

Labor Supply in Practice?

- What do these figures imply about relative size of income and substitutions effects in the long run?
  - Income effect slightly larger than substitution
- Common to ignore income effects and assume wage increases will increase labor supply (e.g., tax cuts)
- But income effects are large over the long run!!

Hours Worked Per Person

- Hours worked per worker have fallen
- But hours worked per person have not
- Why might this be?

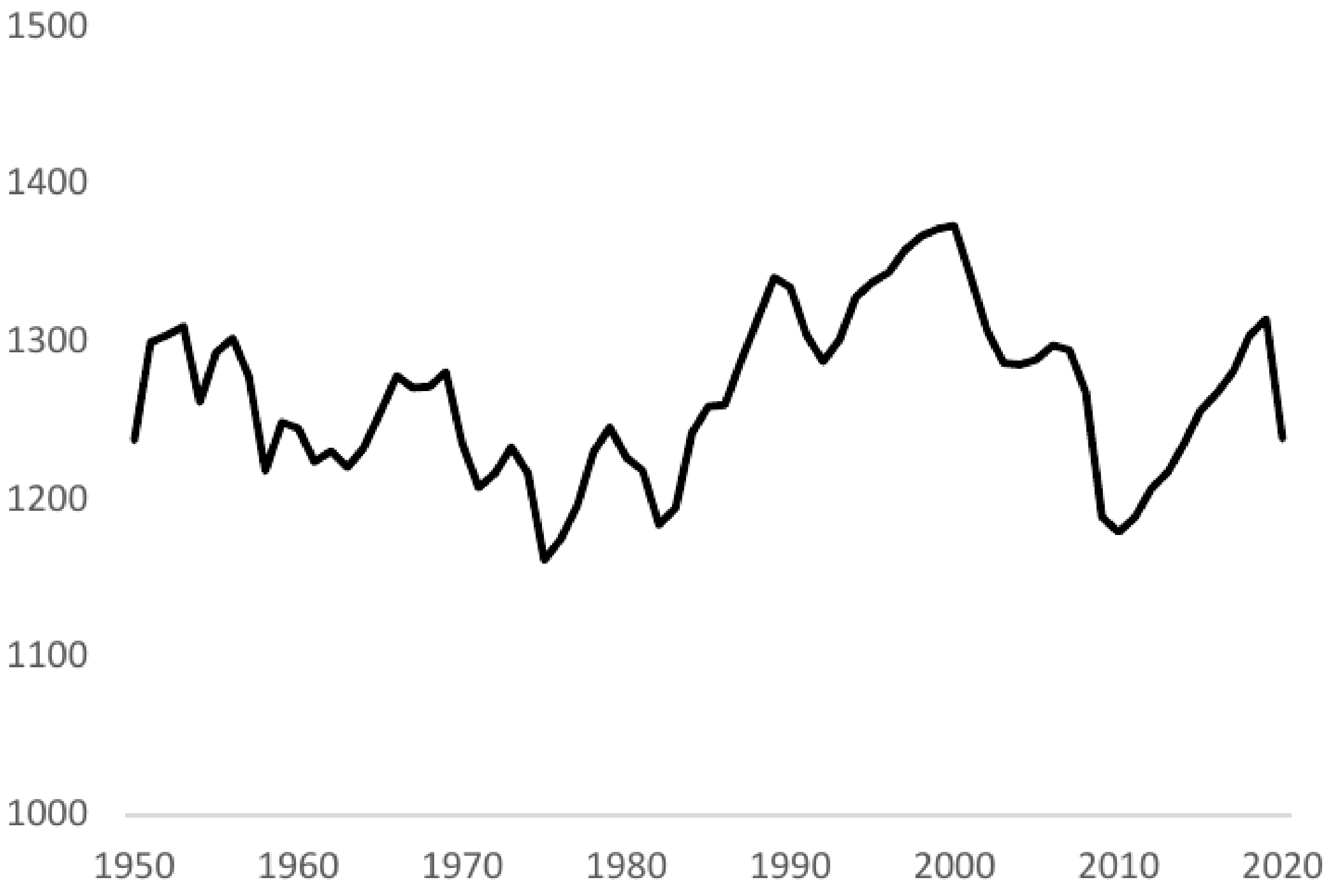


Figure 4: Annual Hours Worked per Person in the United States

Gender Revolution

- Labor force participation rate of men fallen steadily
- Labor force participation rate of women rose rapidly in 2nd half of 20th century
- Changing cultural normal, less discrimination led women to enter labor force
- One-time shock that obscured underlying downward trend

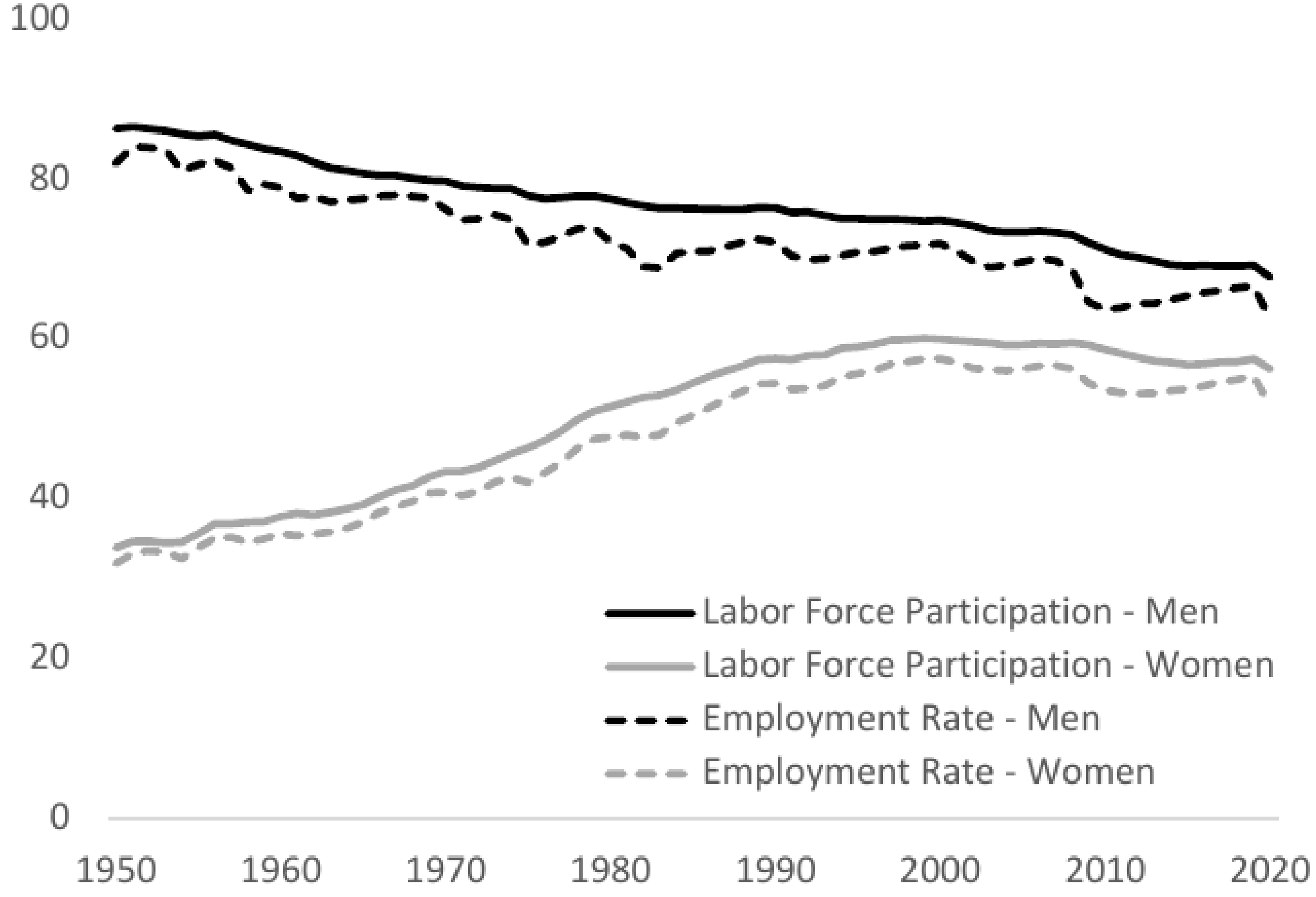


Figure 5: Employment of Men and Women in the United States

What Do We Learn about the Utility Function?

- Suppose:

$$U(C) = \ln C$$
$$V(H) = -\psi \ln(1 - H)$$
$$T = 0$$

- In this case, $\frac{V'(H)}{U'(C)} = w$ becomes

$$\psi \frac{wH}{1 - H} = w$$

- Which simplifies to

$$\frac{H}{1 - H} = \frac{1}{\psi}$$

- Wage has no effect on labor supply!
- Income and substitution effects exactly equal
- This is close to data
- What is it about this functional form that yields this result?
- It is the $U(C) = \ln C$ part
- So, we learn that perhaps $U(C) = \ln C$ is a reasonable functional form

Keynes and Income Effect

- What did Keynes think about the relative strength of the income effect and the substitution effect?
- *Economic Possibilities for Our Grandchildren* written in 1930
- “Suppose that a hundred years hence we are all of us, on the average, eight times better off in the economic sense than we are to-day.” (i.e., 2% annual growth)

Keynes and Income Effect

- Income effect dominant in the long run:
  - “Absolute needs … satisfied”
  - “prefer to devote our further energies to non-economic purposes” (leisure)
  - Main worry “general ‘nervous breakdown’”
  - “need to do some work … to be contented”
  - “Three-hour shifts or a fifteen hour week”
- Clearly, Keynes overestimated the strength of the income effect

Is Europe in a Depression?

- Output per working-age person in Europe 30% lower than in U.S.
- Prescott: Europe is in a depression
- Is this due to major malfunction of economy?
- Is it similar to Great Depression of 1930s?

Table 1: Output Per Working-Age Person: Differences Versus the U.S.

Country	1970	1985	2000	2015
Germany	-39	-42	-27	-17
France	-32	-35	-29	-26
Italy	-51	-41	-29	-35
United Kingdom	-36	-35	-28	-25

Notes: The table reports percentage differences versus the United States in output per working-age person. Data on output and capital are from the Penn World Tables (version 10.1). Data on hours worked and the population of working age are from the OECD. Working age is defined as age 15 to 65.

Accounting for Income Levels

- Useful to break income differences into a few components

$$Y_{it} = A_{it}^{1-a} K_{it}^{a} H_{it}^{1-a} \rightarrow \left(\frac{Y_{it}}{N_{it}}\right)^{1-a} = A_{it}^{1-a} \left(\frac{K_{it}}{Y_{it}}\right)^{a} \left(\frac{H_{it}}{N_{it}}\right)^{1-a}$$

$$\ln y_{it} = \ln A_{it} + \frac{a}{1-a} \ln \frac{k_{it}}{y_{it}} + \ln h_{it}$$

- Decomposes output per working age person into three factors
  – 1) Productivity factor, 2) Capital factor, 3) Labor factor

Accounting for Income Levels

- 1970:
  - Most of difference productivity
  - Hours similar to US
- 2000:
  - Most of difference hours
  - Productivity largely caught up in Germany and France
- 2015:
  - Productivity has fallen off again
  - Hours still much lower in France

Table 2: Decomposition of Output Differences with the U.S.

	Log Difference versus United States $\times$ 100			
	GDP	Productivity	Capital	Labor
Panel A: Germany				
1970	-50	-80	10	20
1985	-55	-56	6	-5
2000	-32	-8	2	-27
2015	-19	-20	13	-12
Panel B: France				
1970	-38	-50	5	6
1985	-43	-27	6	-23
2000	-34	-1	-2	-31
2015	-31	-28	21	-23
Panel C: Italy				
1970	-71	-65	-1	-5
1985	-53	-35	0	-18
2000	-35	-21	7	-21
2015	-43	-60	32	-15
Panel D: United Kingdom				
1970	-44	-48	-2	6
1985	-43	-20	-14	-8
2000	-34	-13	-7	-13
2015	-29	-44	16	-1

Notes: The table reports log differences versus the United States multiplied by 100 for GDP per working-age person and three determinants. Data sources are the same as in Table 1.

Hours in the Europe vs. U.S.

- Europeans worked more than Americans in 1950s and 60s
- Hours in Europe fell dramatically
- Since 1980, Europeans have worked considerably less than Americans

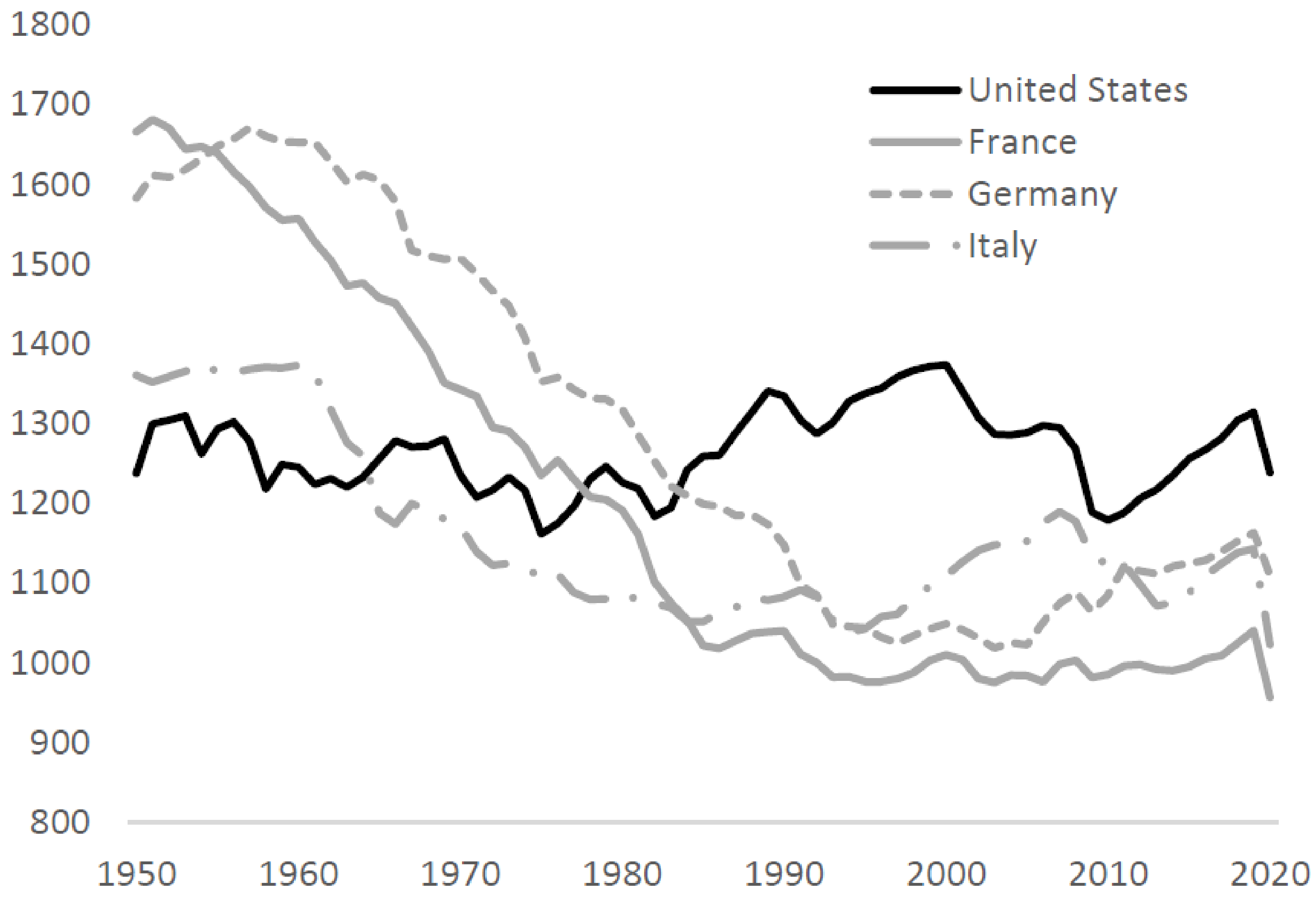


Figure 12: Annual Hours Worked per Working-Age Person

Hours in France vs. U.S.

$$\frac{H_t E_t}{N_{At}} = H_t \frac{E_t}{L_t} \frac{L_t}{N_{At}}$$

$$\Delta \ln\left(\frac{H_t E_t}{N_{At}}\right)$$
$$= \Delta \ln H_t + \Delta \ln\left(\frac{E_t}{L_t}\right)$$
$$+ \Delta \ln\left(\frac{L_t}{N_{At}}\right)$$

Table 3: Decomposition of Hours Worked Per Working-Age Person

	Log Changes since 1970 × 100			
	HE/N_A	H	E/L	L/N_a
Panel A: France				
1985	-29	-19	-7	-3
2000	-28	-25	-6	3
2015	-29	-27	-9	7
Panel B: United States				
1985	5	-4	-2	11
2000	13	-4	1	16
2015	6	-7	0	13

Notes: The table reports log differences versus 1970 multiplied by 100 for hours worked per working age person (HE/N_A), hours worked per worker (H), the employment rate (E/L), and the labor force participation rate among working age people (L/N_A). Data are from the OECD.

Hours in Europe vs. U.S.

- Employment rates comparable for “prime age” workers
- Employment rates lower in Europe for young and older workers

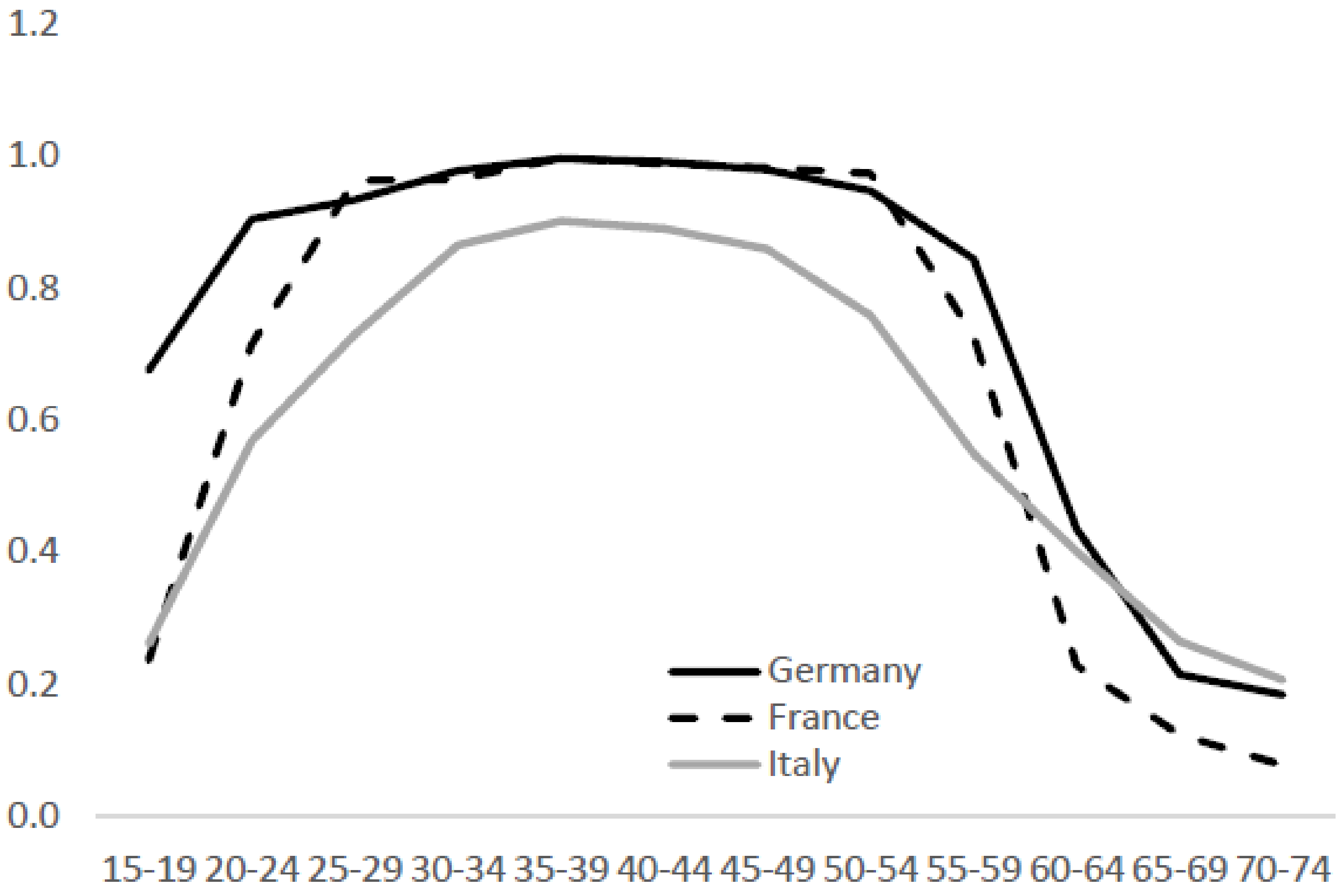


Figure 13: Employment Rates by Age Relative to the U.S.

Why Do Europeans Work So Little?

- Differences in preferences and culture
  (enlightened, women, coordination)
- More generous social safety net (UI, health insurance, etc.)
  (weak incentives)
- Higher minimum wages
- Unions
  (work less – work all, coordination device)
- Labor market regulation (hiring and firing costs)
- Taxes

Taxes and Europe’s “Depression”

- Labor supply is about 30% lower in France than in the US. Why?
- Student A: Perhaps it is because taxes are so high in France?
- Student B: That is ridiculous! There is no way taxes could matter that much.
- How can students A and B make progress in figuring out who is right?

Taxes and Europe’s “Depression”

- Direct empirical evidence not conclusive since taxes correlated with other factors affecting labor supply
- But can we use theory to help us think about what the size of the effect of taxes on labor supply depends on?
- If so, this will allow us to sharpen the debate
- Then we can argue about the key determining factors and seek out evidence about these factors

Taxes and Europe's "Depression"

- Let's augment our model of labor supply to include:
  - Labor income tax τ_l
  - Consumption tax τ_c
- Utility function: $U(C) - V(H)$
- Budget constraint: $(1 + \tau_c)C = (1 - \tau_l)wH + T$
- Labor supply:

$$\frac{V'(H)}{U'(C)} = w\frac{1 - \tau_l}{1 + \tau_c}$$

Labor Supply and Taxes

$$\frac{V'(H)}{U'(C)} = w\,\frac{1-\tau_l}{1+\tau_c}$$

- After tax wage: $w\,\frac{1-\tau_l}{1+\tau_c} < w$
- Why not just $w(1-\tau_l)$, i.e., take-home pay?
- Not wage in dollars that matter, but how much this can buy
- Consumption tax increases price of goods by $(1+\tau_c)$
- $w\,\frac{1-\tau_l}{1+\tau_c}$ is how many coconuts you can buy per hour of work

Tax Wedge

- Let's simplify our notation a little

$$\frac{V'(H)}{U'(C)} = w\,\frac{1-\tau_l}{1+\tau_c}$$

- Define the overall tax wedge as

$$(1-\tau) = \left(1 - \frac{\tau_l + \tau_c}{1+\tau_c}\right) = \frac{1-\tau_l}{1+\tau_c}$$

- Using this overall tax wedge we get

$$\frac{V'(H)}{U'(C)} = w(1-\tau)$$

Taxes and Labor Supply

$$\frac{V'(H)}{U'(C)} = w(1-\tau)$$

- After tax wage: $w(1-\tau)$
- How does this affect labor supply?
- Substitution effect leads to lower labor supply
- Income effect goes in other direction
- However, strength of income effect depends on what the government does with tax revenue (How so?)

Income Effect and Use of Tax Revenue

- Suppose the government threw the tax revenue in the ocean (wasted it, bridges to nowhere, military spending to fight wars on foreign soil)
- Would people feel poorer due to taxes?
  - Yes they would
- Taxes would have income effect
- Income effect might be as large or larger than substitution effect

Income Effect and Use of Tax Revenue

- Suppose the government transferred money back to people though “lump-sum” transfers”
- Would people feel poorer due to taxes?
  - No. (They pay taxes but get same amount back in transfer)
- Suppose the government used tax revenue to buy goods people would have bought anyway (childcare, healthcare, etc.)
  - Income effect depends on quality of the stuff the government buys
  - Taxes would have smaller (possibly no) income effect

Income Effect and Use of Tax Revenue

- Income effect from taxes is large if government wastes money (or spends on things people would not buy, such as military)

- Income effect from taxes is small if government uses revenue for transfers or to provide goods and services people would have bought anyway.

Income Effect and Use of Tax Revenue

- Real world probably somewhere between two polar cases discussed above
- For simplicity, however, we follow Prescott (2002) and assume all tax revenue is transferred back to household lump-sum
- This implies there is no income effect of taxes
- This therefore maximizes the effect of taxes on hours

How Much Do Taxes Depress Labor Supply?

- To make quantitative predictions, we need to be more precise about utility function of households
- We assume:

$$U(C) - V(H) = \ln C - \psi \frac{H^{1-\eta^{-1}}}{1-\eta^{-1}}$$

- This implies

$$U'(C) = \frac{1}{C} \quad \text{and } V'(H) = \psi H^{\eta^{-1}}$$

How Much Do Taxes Depress Labor Supply?

- Labor supply is then:

$$\psi C H^{\eta^{-1}} = w(1-\tau)$$

- In the production chapter we derived labor demand:

$$w = (1-a)\frac{Y}{L}$$

- Combining these we have

$$\psi C H^{\eta^{-1}} = (1-a)\frac{Y}{L}(1-\tau)$$

How Much Do Taxes Depress Labor Supply?

$$\psi C H^{\eta^{-1}} = (1-a)\frac{Y}{L}(1-\tau)$$

- Recall that $L = NH$ and we normalize N to 1
- Since all tax revenue is transferred back lump sum, the household budget constraint becomes $C = wH$
- This and $w = (1-a)\frac{Y}{L}$ implies $C = (1-a)Y$
- Using these expressions we get:

$$\psi C H^{\eta^{-1}} = \frac{C}{H}(1-\tau)$$

How Much Do Taxes Depress Labor Supply?

- Rearranging yields:

$$H^{1+\eta^{-1}} = (1-\tau)\psi^{-1}$$

- Taking logs yields:

$$\ln H = \frac{\eta}{\eta+1}\ln(1-\tau) - \frac{\eta}{\eta+1}\ln\psi$$

- Taking a difference between US and France:

$$\ln H_{Fr} - \ln H_{US} = \frac{\eta}{\eta+1}\left(\ln(1-\tau_{Fr}) - \ln(1-\tau_{US})\right)$$

(note that $(\eta^{-1}+1)^{-1}$=$\frac{\eta}{\eta+1}$)

Key Determinant

$$\ln H_{Fr} - \ln H_{US} = \frac{\eta}{\eta + 1}\left(\ln(1 - \tau_{Fr}) - \ln(1 - \tau_{US})\right)$$

- Clearly η is a key parameter
- η is called the Frisch elasticity of labor supply
  - η is the % change in hours that result from a 1% change in wages holding consumption fixed. (i.e., the strength of the substitution effect)
  - If η is small (i.e., labor is inelastic), taxes have a small effect on labor supply.
  - If, η is large (i.e., labor is elastic), taxes have a big effect on labor supply (assuming no income effects)

Value of Theory

- Student A and B should argue about two things:
  - Value of η (i.e., strength of substitution effect)
  - Whether tax revenue is well spent
    (i.e., do more taxes/spending entail an income effect)
- This is how theory can be useful

Taxes in France and U.S.

- Prescott (2002) reported taxes in U.S. and France in late 1990s
- Reproduced in Table 4
- Taxes much higher in France
- Difference in hours in 2000 was 31 log points
- Can taxes explain this difference?

Table 4: Tax Rates in France and the United States

	France	United States
τ_c	0.33	0.13
τ_l	0.49	0.32
Social-security tax	0.33	0.12
Marginal income tax	0.15	0.20
τ	0.62	0.40

How Much Can Taxes Explain?

- If Frisch elasticity is small (0.1-0.5), taxes can explain modest amount
- If Frisch elasticity is large (say 3), taxes can explain entire amount
- Prescott argued for $\eta = 3$
- This is all assuming no income effect

Table 5: How Much Can Taxes Explain?

Frisch Elasticity (η)	Hours Difference
0	0
0.1	4
0.5	15
1.0	22
2.0	30
3.0	34
Actual Difference in 2000	31

Estimating the Frisch Elasticity is Hard

- Need temporary tax change
  - Frisch elasticity holds consumption fixed
  - Permanent tax changes have potentially large effects on consumption which adds a negative income effect (downward bias)
- Hard to extrapolate from small changes due to frictions
  - Costly adjustment and inattention may prevent response to small tax changes
  - Results in downward biased estimates
  - Also, some adjustment may occur gradually (new jobs / retirement)

Tax Holidays

- Tax holidays provide very appealing "treatments" to estimate Frisch elasticity
  – Temporary / Large
  – Possible to estimate both intensive and extensive margin effects
- Two recent papers on tax holidays:
  – Sigurdsson (2025) -- Iceland
  – Martinez, Saez, and Siegenthaler (2021) – Switzerland

Tax Free Year in Iceland

- In 1988, Iceland moved to pay-as-you-earn tax system (from a system where people paid taxes based on last year's income)
- Income in 1987 never taxed!!

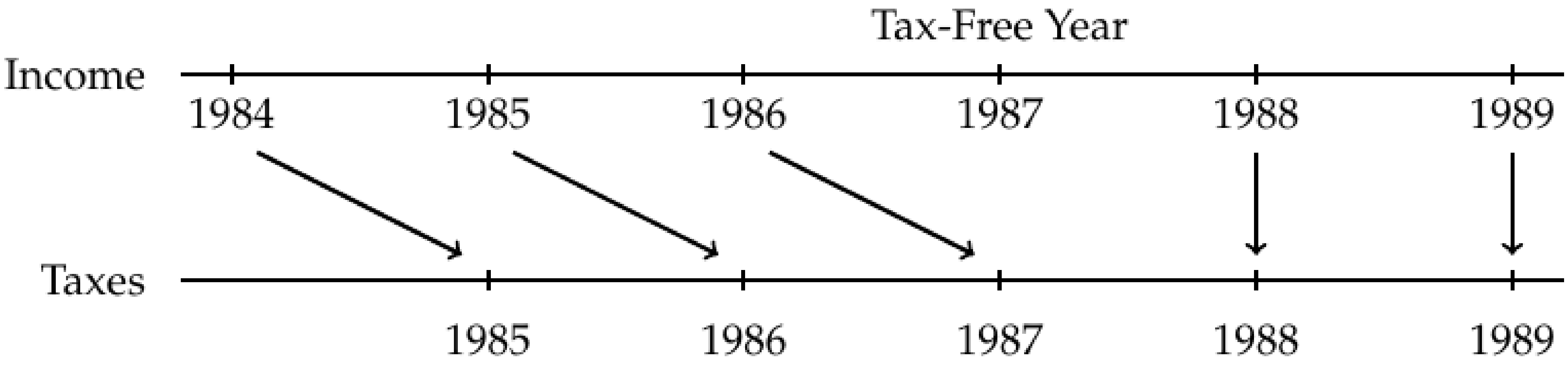


Figure 14: Iceland's 1988 Tax Reform

How to Use Tax Free Year

- We can compare 1987 with surrounding years
- But perhaps there are other things that are different in 1987 from other years
- What is the counterfactual?
  - Trend up before, down after
  - Hard to know
- Icelandic economy volatile due to varying fish stocks and volatile policy

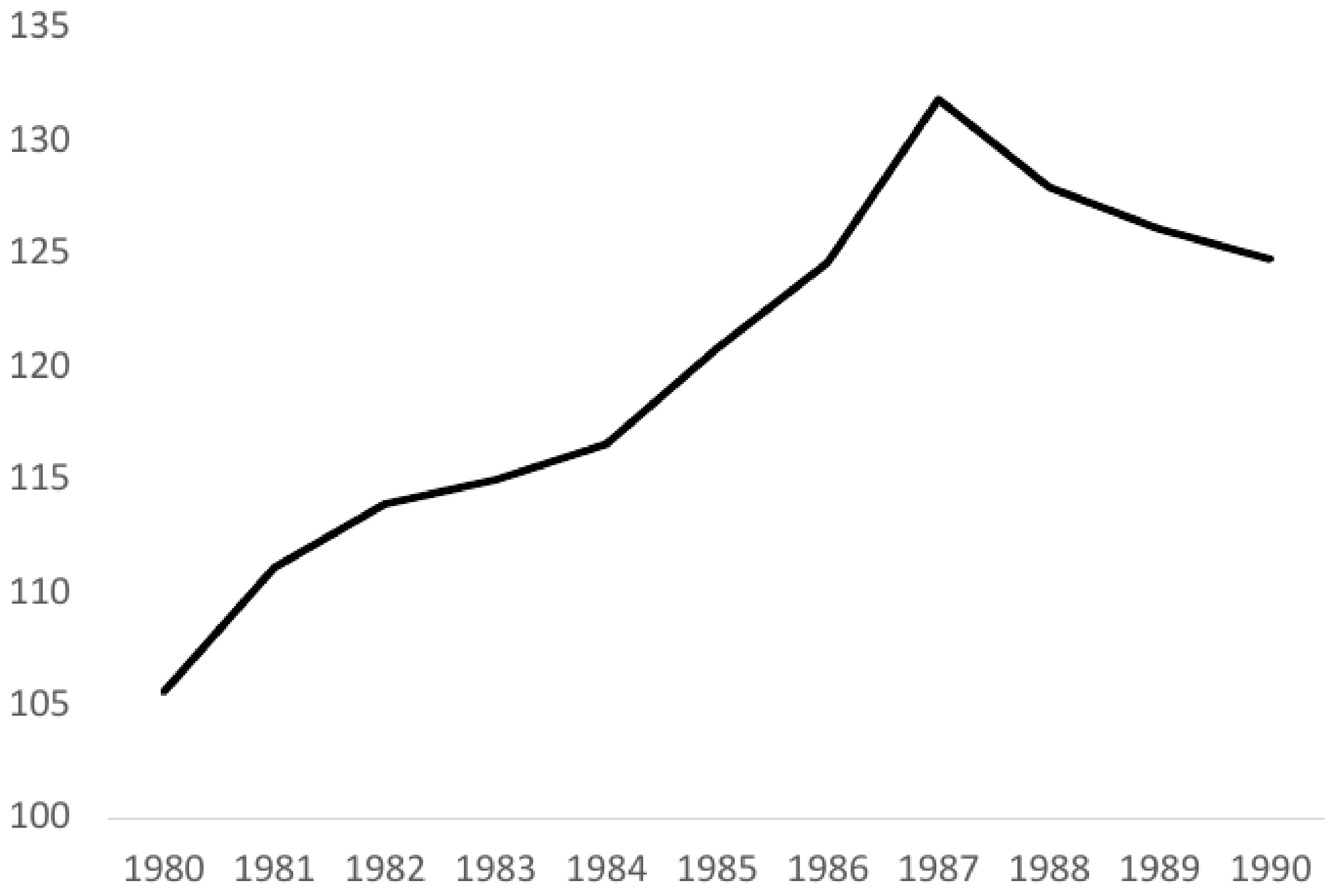
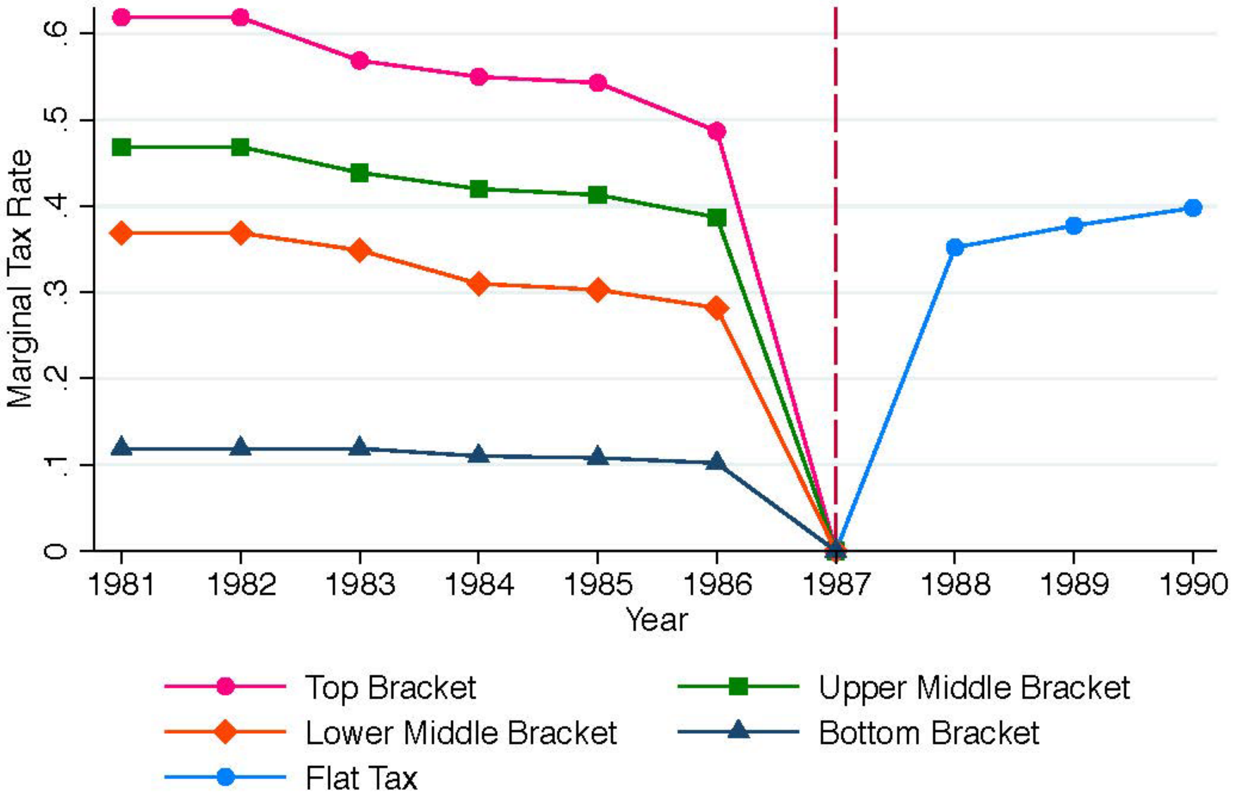


Figure 15: Aggregate Person-Years Worked in Iceland

Difference-in-Difference

- Compare workers in high tax bracket (more affected) with those in low tax bracket (less affected)
- Assumption: Would have followed "parallel trends" (i.e., equally affect by other special factors)
- Looking at difference between groups means effect of other factors cancels out



(a) Marginal tax rate by tax brackets

Source: Sigurdsson (2019)

Tax Free Year in Iceland

- Workers in high tax bracket increased earning by 7% more than workers in low tax bracket
- Sigurdsson converts this into estimate of Frisch elasticity
- His conclusion:
  - Intensive margin: 0.4
  - Extensive margin: 0.1
  - Overall Frisch elasticity of 0.5

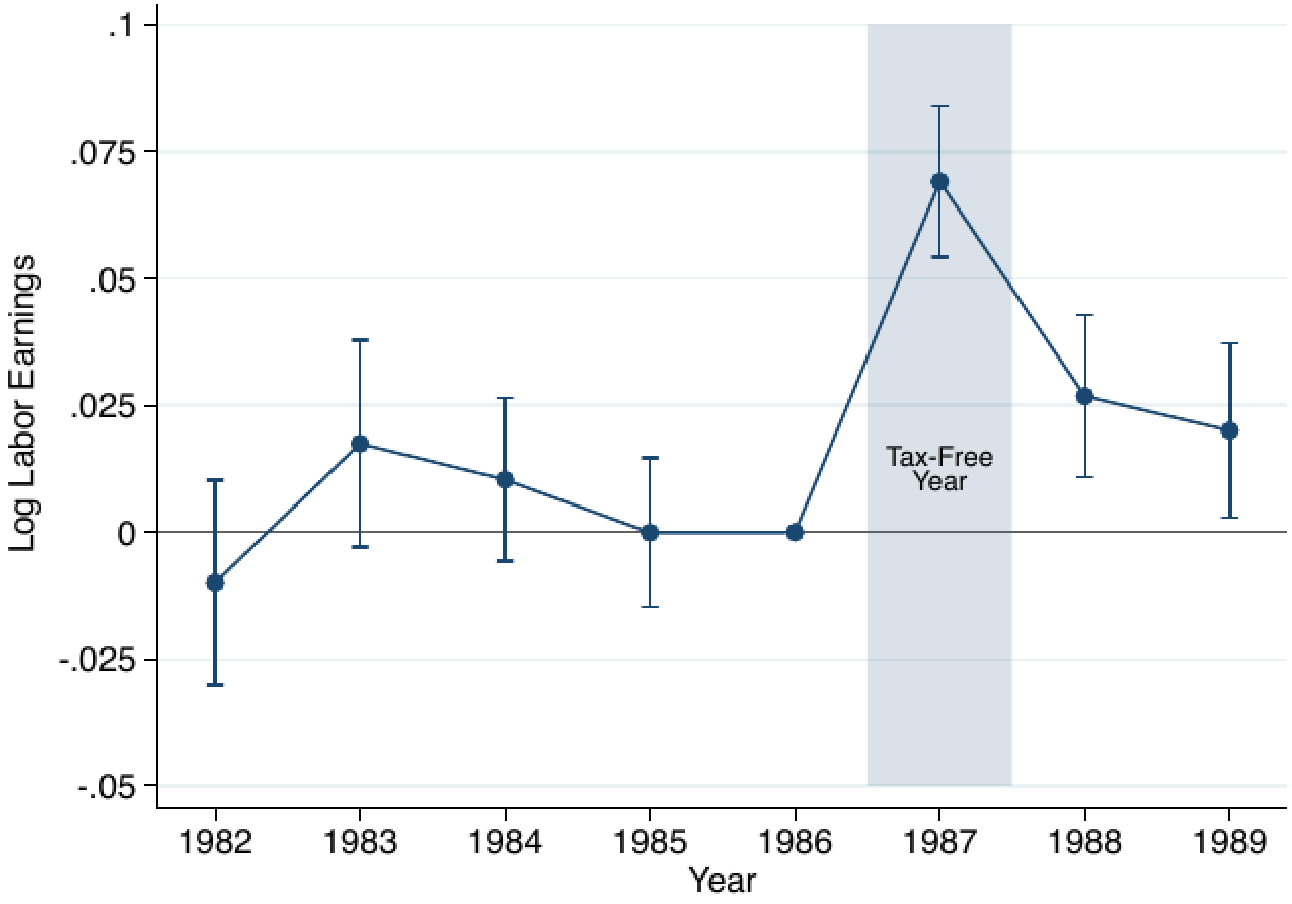


Figure 16: Difference in Labor Earnings: High versus Low Tax Bracket

Tax Free Year in Switzerland

- Martinez, Saez, and Siegenthaler estimate Frisch elasticity close to zero – less than 0.05
- Also Diff-in-Diff, but not across tax brackets, rather across Swiss cantons
- Cantons transitioned to new tax system in different years. So, different tax-free year in different cantons
- Effect on earning very small

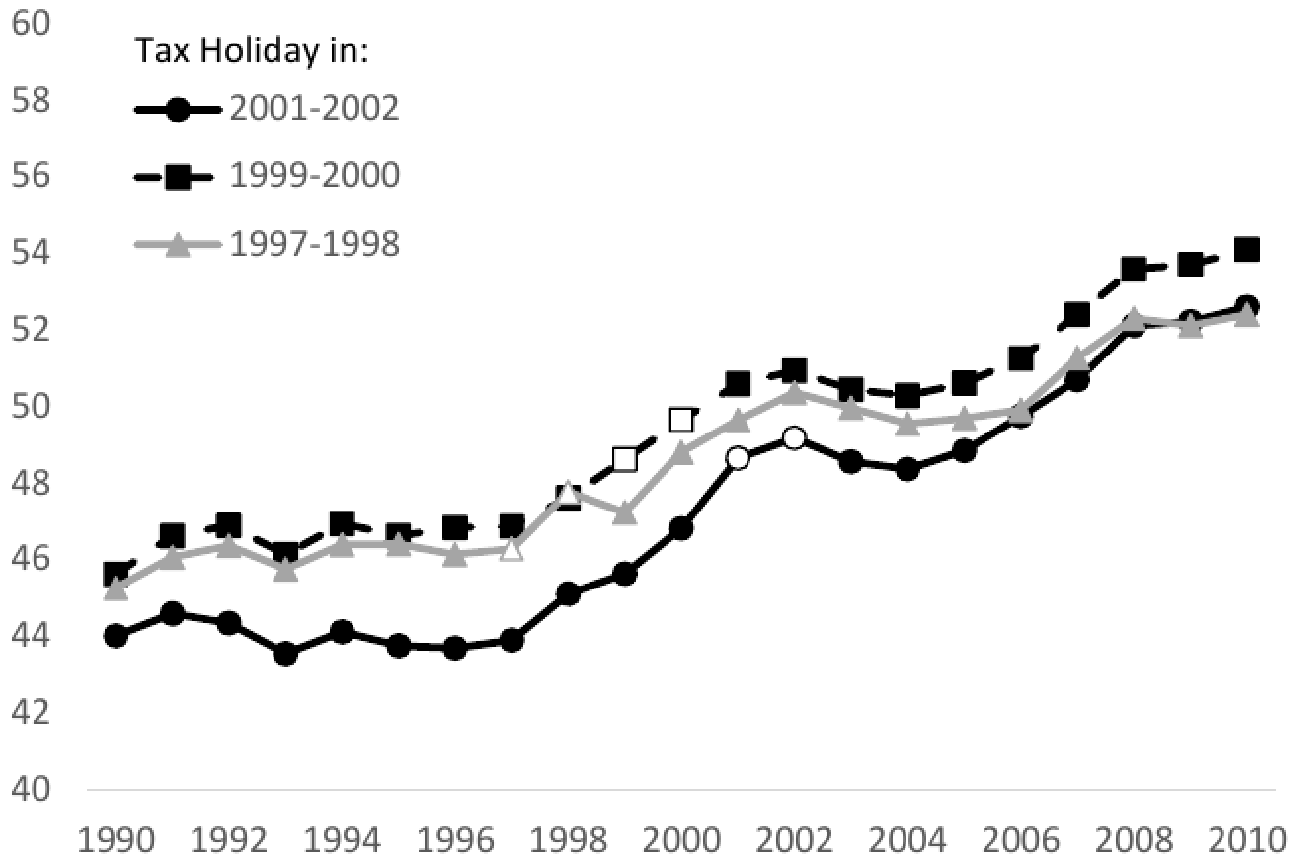


Figure 17: Average Wage Earnings in Swiss Cantons

Tax Holiday Estimates

- Frisch elasticity estimates:
  - Sigurdsson for Iceland: 0.50
  - Martinez, Saez, Siegenthaler for Switzerland: <0.05
- Both much lower than number Prescott used
- Why is Iceland different from Switzerland?
  - Perhaps because labor market is more flexible in Iceland than in Switzerland
  - US labor market arguably even more flexible

The Economics of Marx

- Karl Marx is arguably the most influential labor economist of all time
- Ideas resonate strongly with students today
- Contrast strongly with ideas we have presented
- Worth exploring the difference
- We consider essay *Wage-Labor, and Capital* published in 1849
- Marx and Engels (1848): Communist Manifesto

The Economics of Marx

- Marx writes:

  "the productive power of labor is raised, above all, by the *greater division of labor*

- "division of labor" is Marx' preferred term for labor productivity

The Economics of Marx

“The greater *division of labor* enables *one* worker to do the work of five, ten or twenty”

“It therefore multiplies competition among workers fivefold, tenfold and twentyfold.”

“As the division of labor increases, labor *is simplified*. The special skill of the worker becomes worthless.”

Marx (1849): Wage-Labor and Capital

The Economics of Marx

Let us sum up: *The more productive capital grows, the more the division of labour and the application of machinery expands. The more the division of labour and the application of machinery expands, the more competition among the workers expands and the more their wages contract.*

- Productivity growth (division of labor) leads wages to fall
- What did our model imply about this?

Increase in Productivity

- Increase in productivity shifts labor demand out
$$(1-a)AK^{a}L^{-a} = w$$
  – Increases wage

- Permanent increase in productivity shifts labor supply back (income effect)
$$wU'(C) = V'(H)$$
  – Increases wage even more

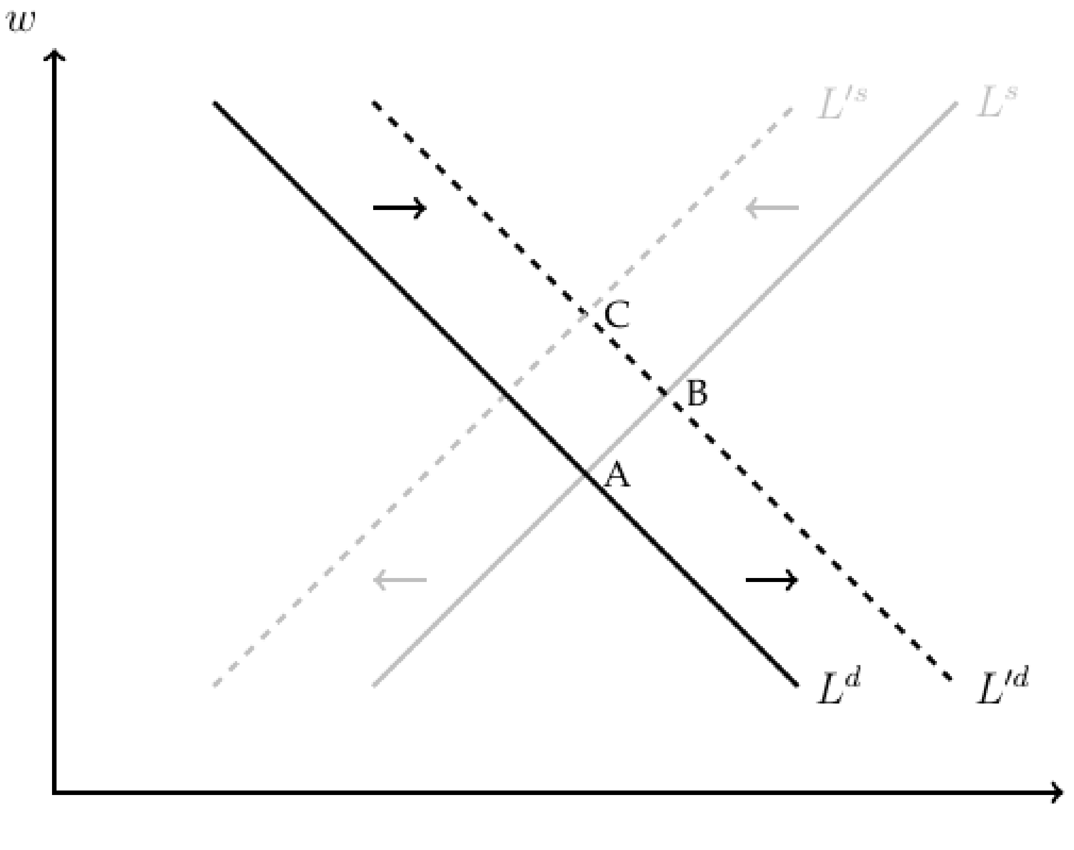


Figure 18: The Effect of an Increase in Productivity on the Labor Market

Empirically Marx Was Dead Wrong

- Labor productivity has increased at a sustained rate for over 200 years

- Real wages of workers have grown at approximately the same rate over this period

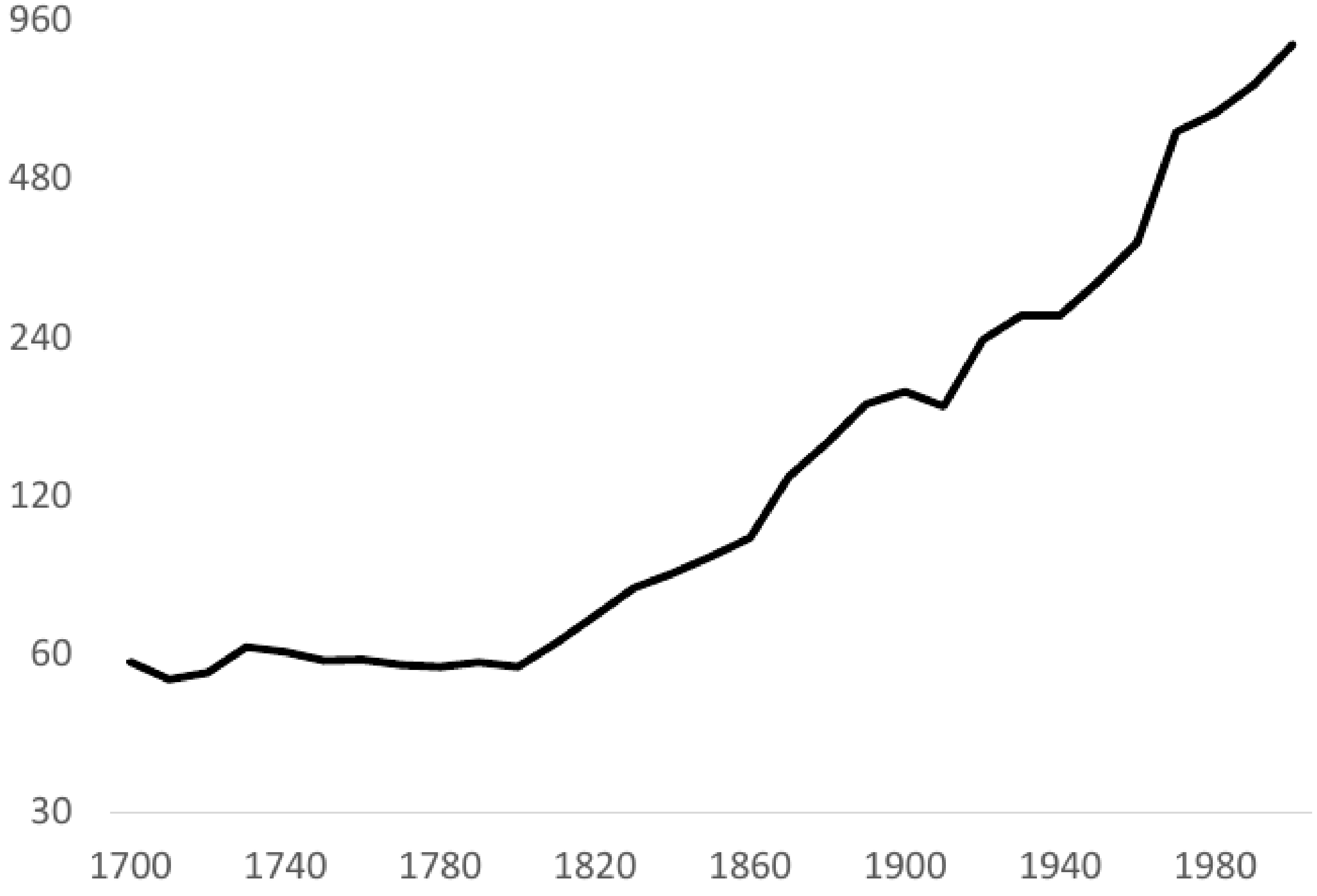


Figure 19: Real Wages of Laborers in England from 1700 to 2000

Was Marx Simply Confused?

- Marx is clear that higher productivity lowers prices of goods
- But doesn‘t this make workers better off
- Neither nominal wage W nor nominal price P determine worker welfare. Rather it is real wage W/P
- If P goes down more than W, W/P will rise and workers are better off
- Not clear Marx understood this point when reading his essay

Can We Make Sense of Marx?

1. Does labor demand shifts out?

- Our model: People get more productive => production increases
- Marx: Higher productivity => less work

  "It therefore multiplies competition among workers fivefold, tenfold and twentyfold."

- This idea resonates strongly with people
  - Technological change destroys jobs and makes workers worse off

Does Labor Demand Shift Out?

- Which view – more output or less works – is correct?
- Depends on demand in the product market.
  I.e., can the firm sell extra output?
- Suppose firm productivity double. Should it:
  - Produce twice as much with same number of workers
  - Fire half of workers
- Suppose firm decides to produce more
  - Who is going to buy the extra goods?
  - Do people have enough income to buy the extra goods?

Circular Flow of Payments

- If someone buys the extra goods, this provides extra income to seller and employees of seller
- Income goes up in tandem with expenditures:
  - One person’s expenditure is another person’s income
  - Circular flow of payments in a market economy
- But there seems to be a chicken and egg problem:
  - If the goods sell, people will have income to buy them
  - But what comes first, the income or the expenditures

Market Clearing

- Basic assumption in neoclassical economics: Markets clear
  - This means everything that is produced will sell
  - And this implies that someone will have enough income to buy it
  - Timing issues about who gets paid first assumed away (everything assumed to happen simultaneously)
  - The real question is at what price it will sell
- This perspective effectively assumes away the Marxist/Keynesian worry of insufficient demand

Do Markets Clear?

- Changes in prices and wages are what clear markets
  - Price of goods goes down, wage goes up, workers have more purchasing power
- But what if prices are sticky?
  - Can’t expand production. Don’t need as many workers.
  - Sticky prices yield insufficient demand (after increase in productivity)
  - Such models are called Keynesian (Keynes, 1936)
- Perhaps Marx was a Keynesian long before Keynes
- Sticky prices more plausible in the short run than long run

Can We Make Sense of Marx?

2. Marx makes a “Malthusian” argument:

- Wages will be determined by:

“*the cost of production of labor power*” …

“*the cost required for maintaining the worker as a worker*” …

“the *cost of existence and reproduction*”

- Wages of unskilled labor driven down to subsistence
- Wages fall due to “division of labor” because work requires less skill and so cost of “developing him into a worker” falls

Can We Make Sense of Marx?

- In our model labor supply shifts back
- In Marx' view, labor supply shifts out due to increased population (Malthusian effect)
- Economy moves from A to C rather than A to B
- Wages stuck at subsistence
- Had been true until shortly before Marx' time

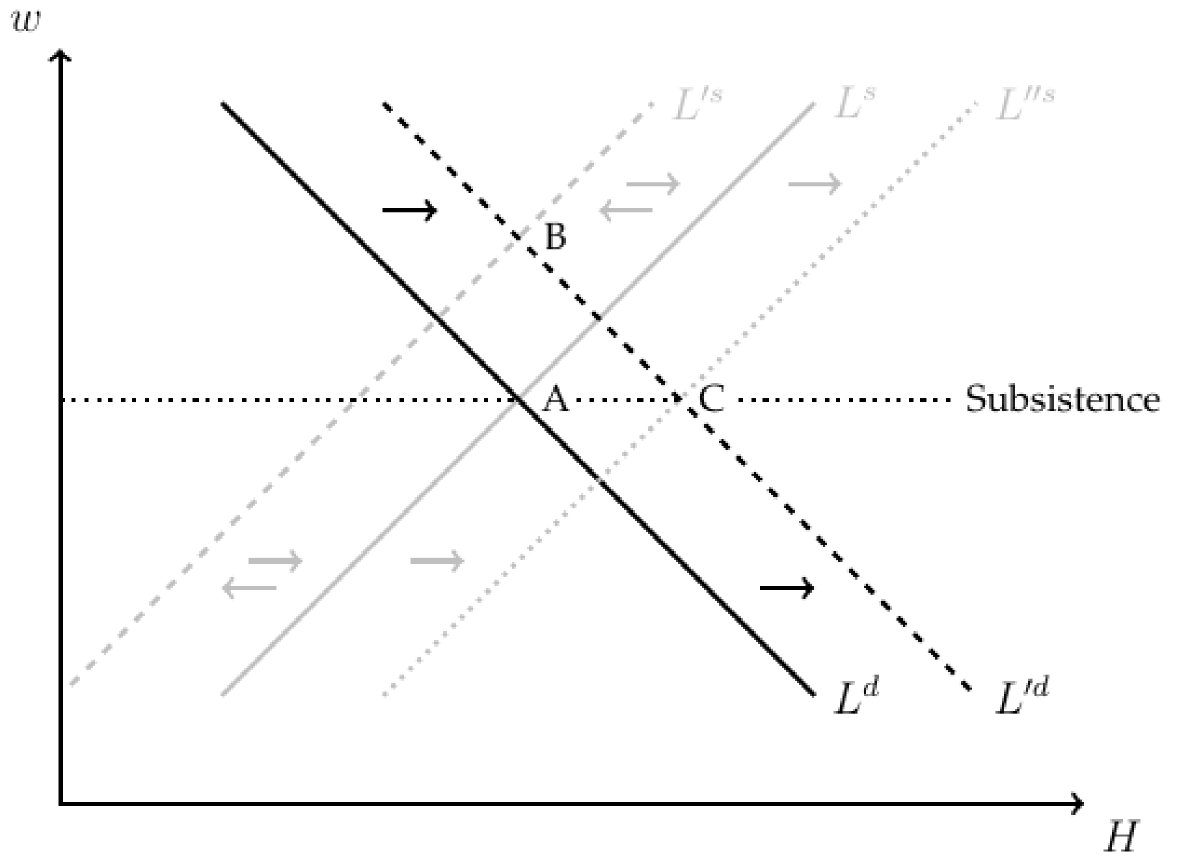


Figure 20: The Effect of an Increase in Productivity on the Labor Market

Real Wages of Laborers in Building Industry in England from Clark (2005, 2010)

Can We Make Sense of Marx?

3. Immiserizing growth

- Can productivity growth make wages go down?
- In one-good economy: No!
  - Worker can always keep using old technology
- In multi-good economy: Yes!
  - Price of good that workers produces may fall relative to price of other goods. This can reduce real wage of workers using old tech
  - Think of hand-loom weavers when mechanized weaving came in

Was Marx Right After All?

- Real wages and productivity move in lock-step 1948-80
- Divergence after this
- Real wages stagnant 1980-96
- Real wages grow after 1996, but not as fast as productivity
- Our labor market model needs modification to explain this
- Active area of research

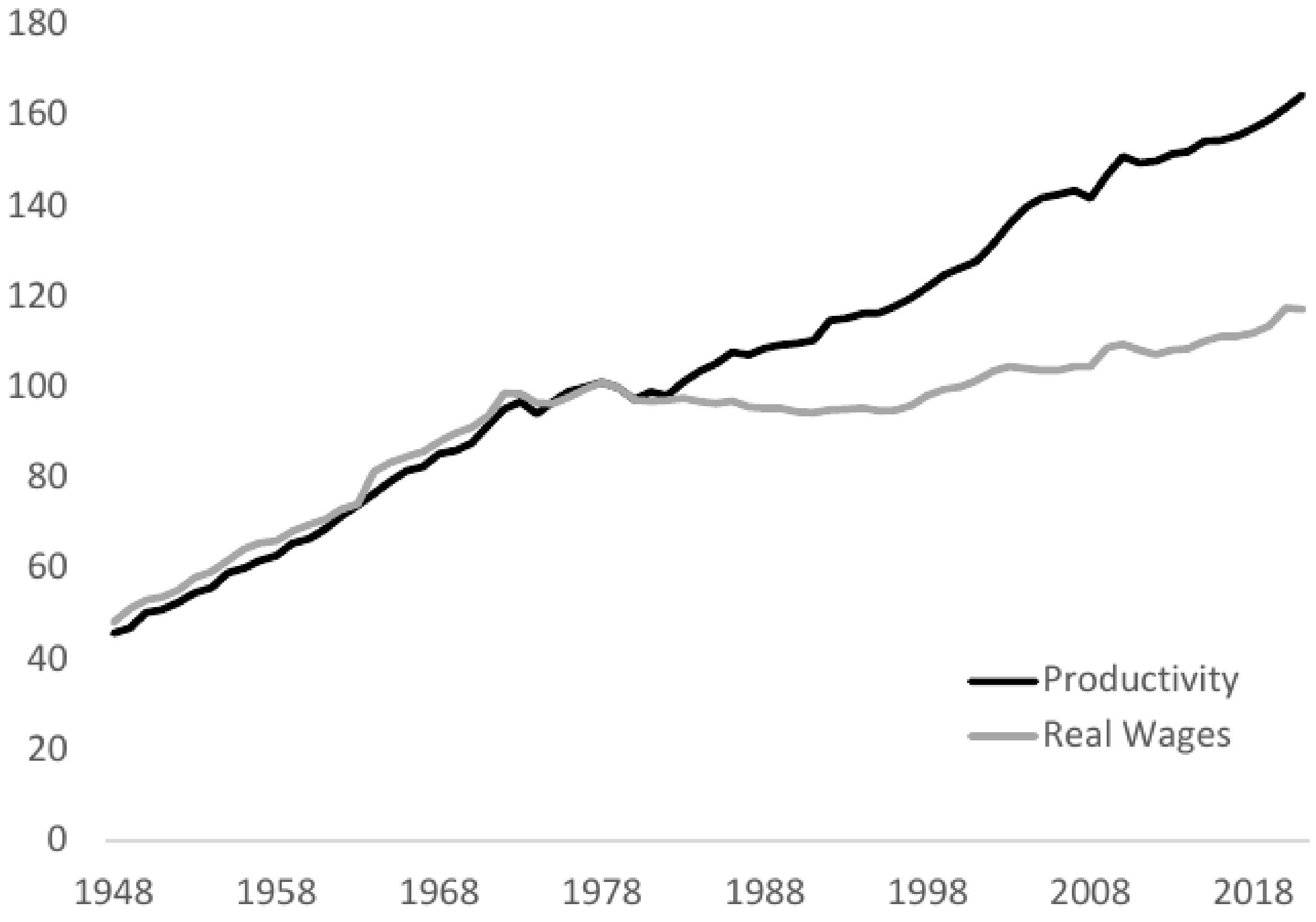


Figure 21: Productivity and Real Wages in the United States