Lecture 14: Taxes

See Barro Ch. 13

Trevor Gallen

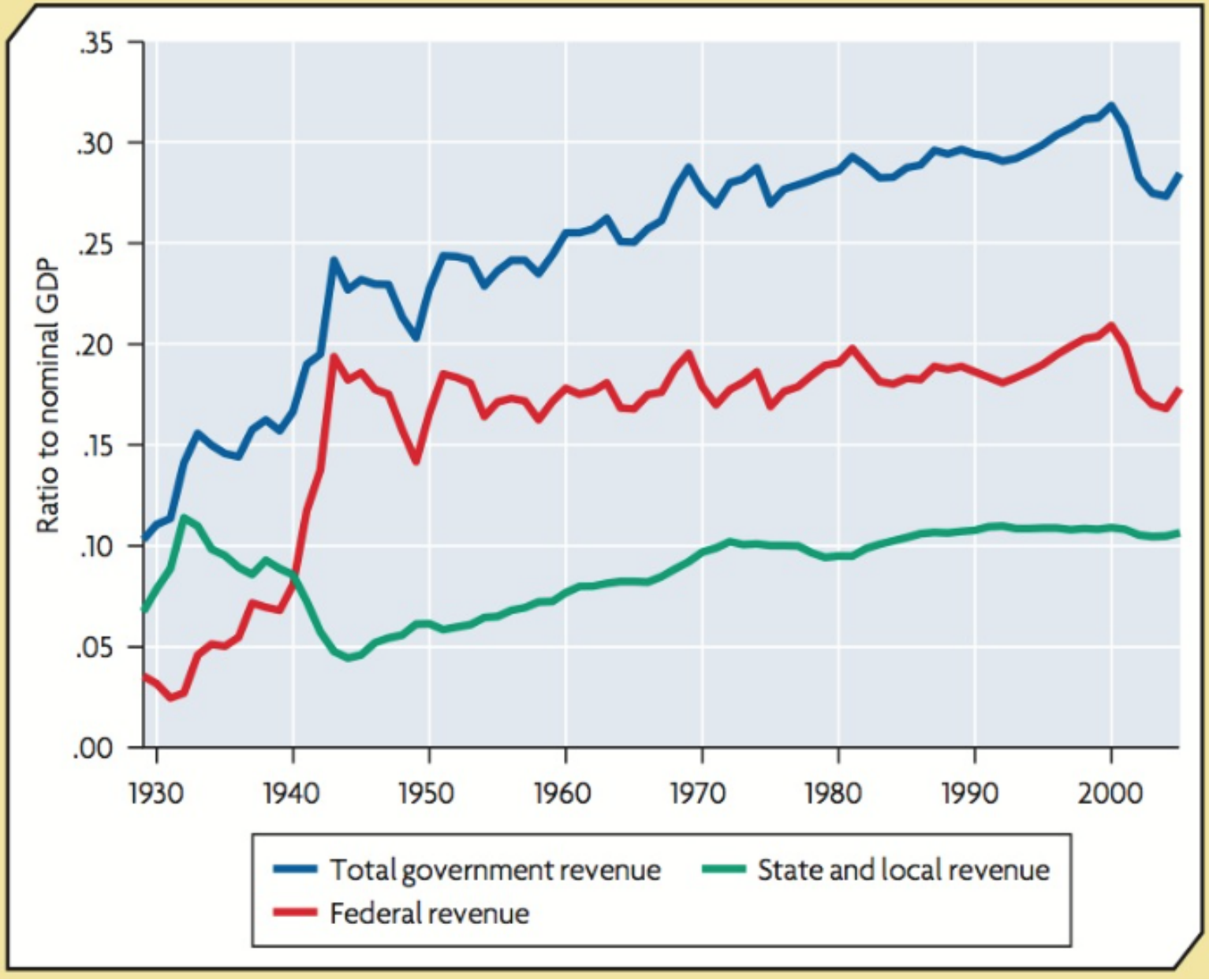
Spring, 2016

Where are we? Taking stock

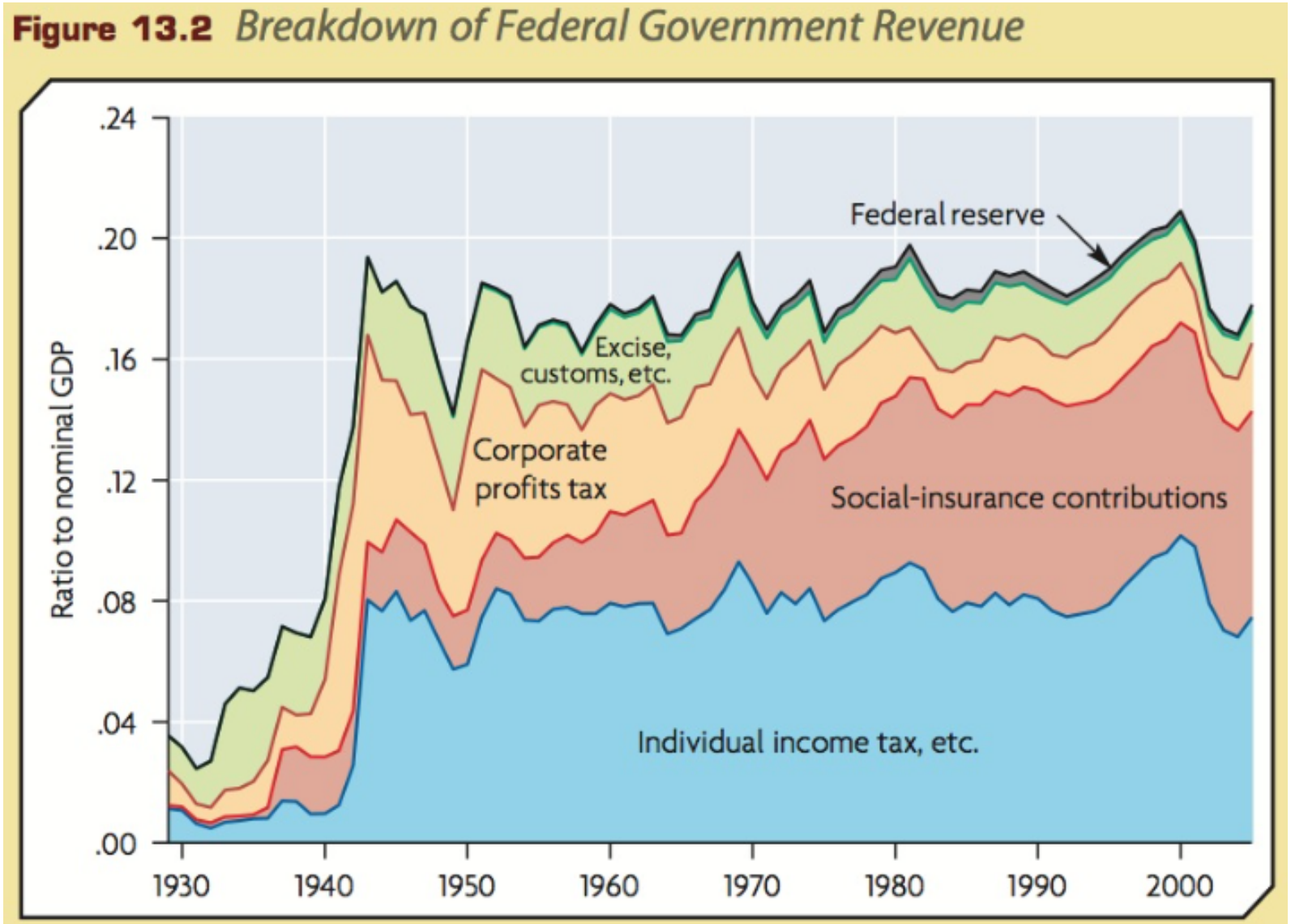
- We have an equilibrium business cycle model
- We've started adding government in, but we did so in a crazy way: lump-sum taxes
- This isn't how we actually raise revenue!
- We'll try to add more realistic taxes and discuss the distortions they create

Government Revenue

Figure 13.1 *Government Revenue*

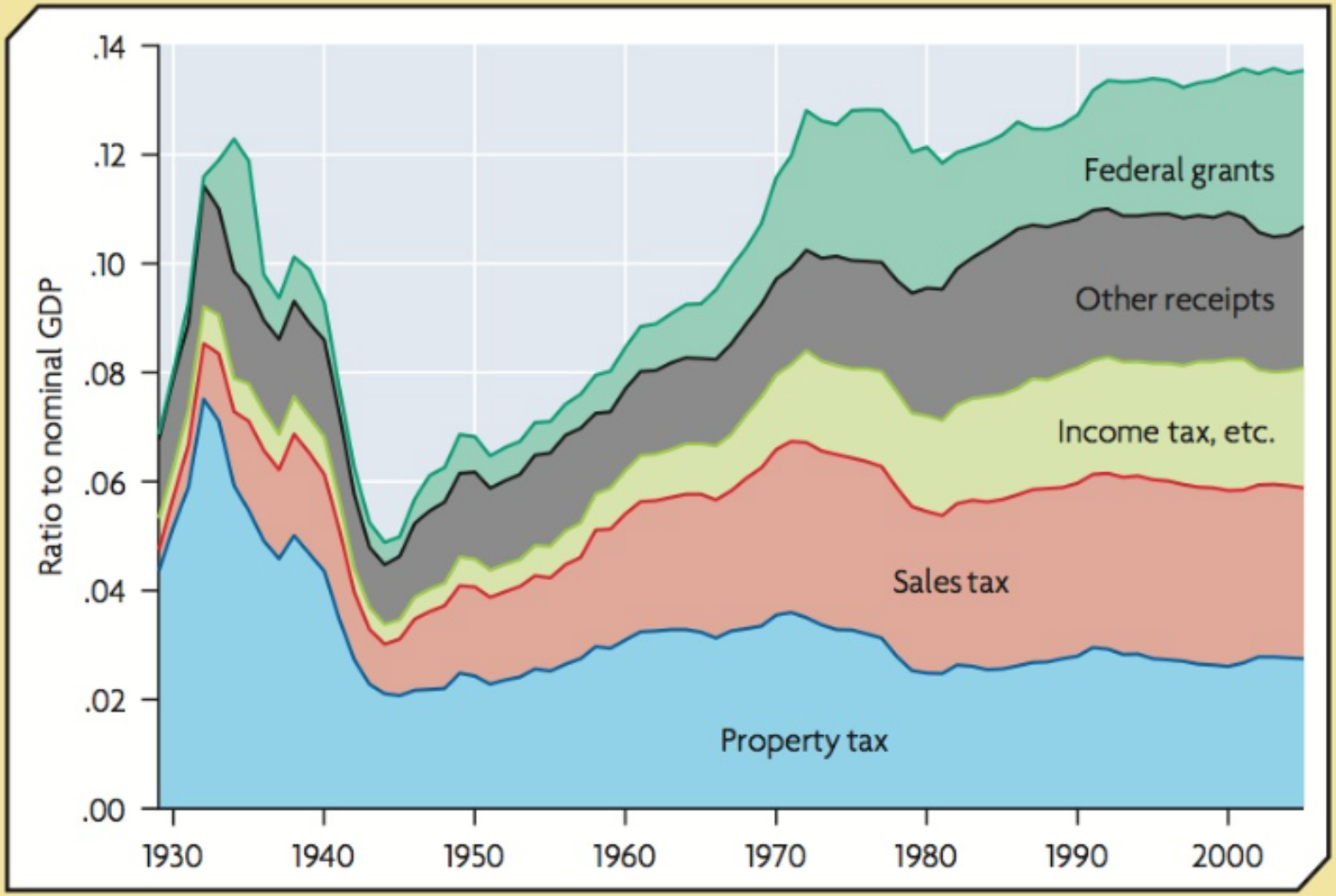


Federal Revenue



State Revenue

Figure 13.3 *Breakdown of State and Local Government Revenue*



Federal and State Revenue Takeaways

- Customs/import taxes used to be a huge deal
- Now they are not
- For Feds, individual income tax and social-insurance taxes are a big deal
- Seniorage is tiny (why we ignored it last chapter)
- For states, property taxes, sales taxes are a big deal
- None of these taxes look remotely like a lump-sum tax

How do income taxes work?

- The basic idea:

$$\begin{aligned}\text{Gross income} = &\text{Income - Personal Exemption} \\ &\text{- Standard Deduction}\end{aligned}$$

How do income taxes work?

- The basic idea:

$$\begin{aligned}\text{Gross income} = &\text{Income - Personal Exemption} \\ &\text{- Standard Deduction}\end{aligned}$$

- Personal exemption in 2015 is \$4000

How do income taxes work?

- The basic idea:

$$\begin{aligned}\text{Gross income} = &\text{Income - Personal Exemption} \\ &\text{- Standard Deduction}\end{aligned}$$

- Personal exemption in 2015 is \$4000
- Standard deduction (single) in 2015 is \$6300

How do income taxes work?

- The basic idea:

$$\begin{aligned}\text{Gross income} = &\text{Income - Personal Exemption} \\ &\text{- Standard Deduction}\end{aligned}$$

- Personal exemption in 2015 is \$4000
- Standard deduction (single) in 2015 is \$6300
- So if you made \$15,000, you are taxed on the last \$4,700

How do income taxes work?

- The basic idea:

$$\begin{aligned}\text{Gross income} = &\text{Income - Personal Exemption} \\ &\text{- Standard Deduction}\end{aligned}$$

- Personal exemption in 2015 is \$4000
- Standard deduction (single) in 2015 is \$6300
- So if you made \$15,000, you are taxed on the last \$4,700
- So why are you guys taxed?

How do income taxes work?

- The basic idea:

$$\begin{aligned}\text{Gross income} = &\text{Income - Personal Exemption} \\ &\text{- Standard Deduction}\end{aligned}$$

- Personal exemption in 2015 is \$4000
- Standard deduction (single) in 2015 is \$6300
- So if you made \$15,000, you are taxed on the last \$4,700
- So why are you guys taxed?
- Payroll taxes!

    - For poorer households, payroll is a bigger deal!

How do income taxes work?

- The basic idea:

$$\begin{aligned}\text{Gross income} = &\text{Income - Personal Exemption} \\ &\text{- Standard Deduction}\end{aligned}$$

- Personal exemption in 2015 is \$4000
- Standard deduction (single) in 2015 is \$6300
- So if you made \$15,000, you are taxed on the last \$4,700
- So why are you guys taxed?
- Payroll taxes!
  - 6.2% to social security + 6.2% from employer
  - For poorer households, payroll is a bigger deal!

How do income taxes work?

- The basic idea:

$$\text{Gross income} = \text{Income} - \text{Personal Exemption} - \text{Standard Deduction}$$

- Personal exemption in 2015 is \$4000
- Standard deduction (single) in 2015 is \$6300
- So if you made \$15,000, you are taxed on the last \$4,700
- So why are you guys taxed?
- Payroll taxes!
  - 6.2% to social security + 6.2% from employer
  - 1.45% to Medicare + 1.45% from employer
  - For poorer households, payroll is a bigger deal!

Average and Marginal

- Both average and marginal tax rates matter
- Average tax rate answers the question "how much do I take home if I earn \$100 total?"
- Marginal tax rate answers the question "if I work one more hour, how much do I get to keep?"
- Imagine you're working 2000 hours at \$10/hour and thinking about adding another hour. Think about two scenarios:
  1. Your average tax rate is 20% but your marginal tax rate is 0%.
  2. Your average tax rate is 20% but your marginal tax rate is 50%
- In both your current income is $(1 - 0.2) \cdot \$20,000 = \$16,000$.
- But in one you give up an hour of leisure for \$10, in the other you give up an hour of leisure for \$5

What are the tax brackets for the individual income tax?

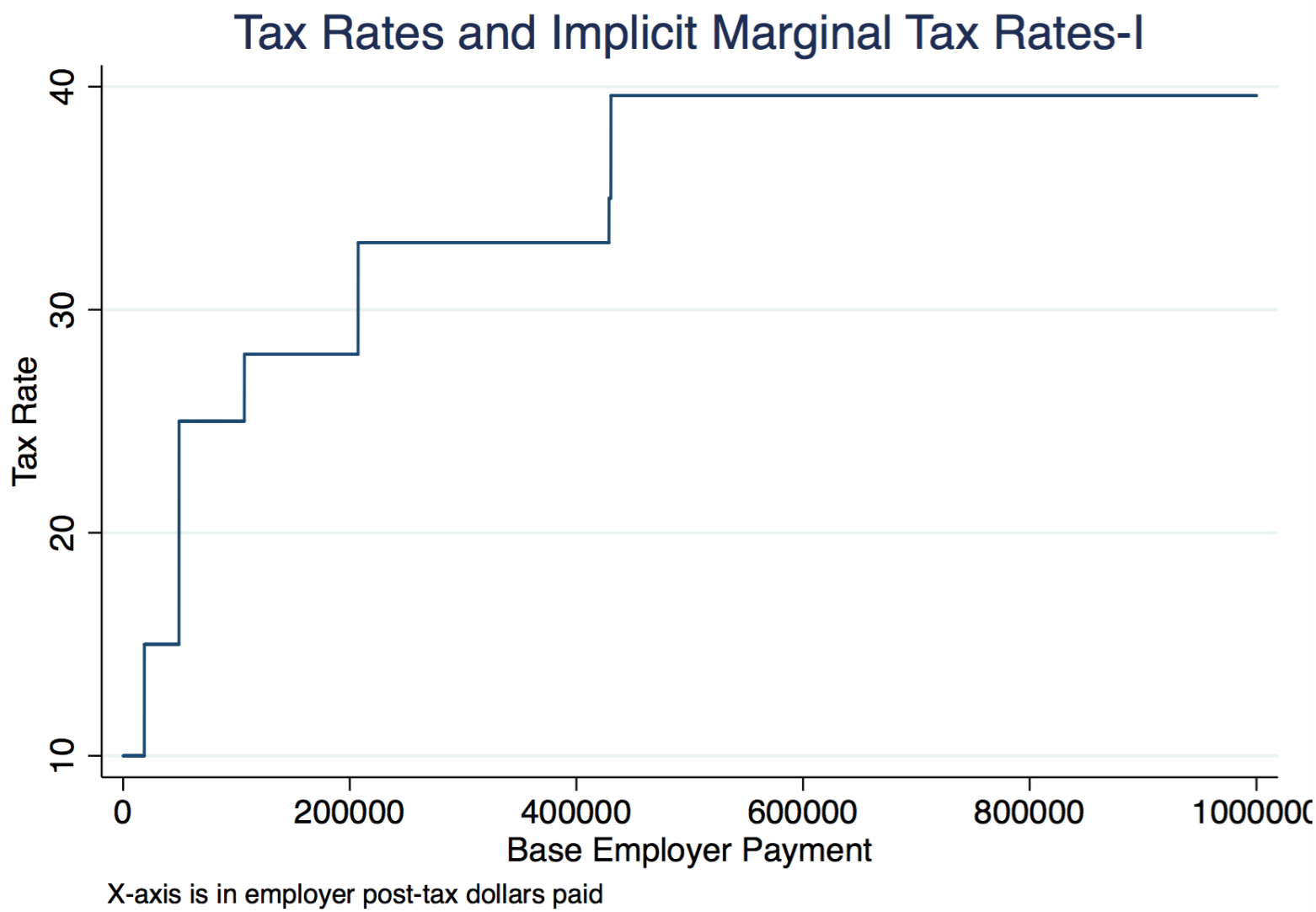
For singles:

Taxes as a function of income

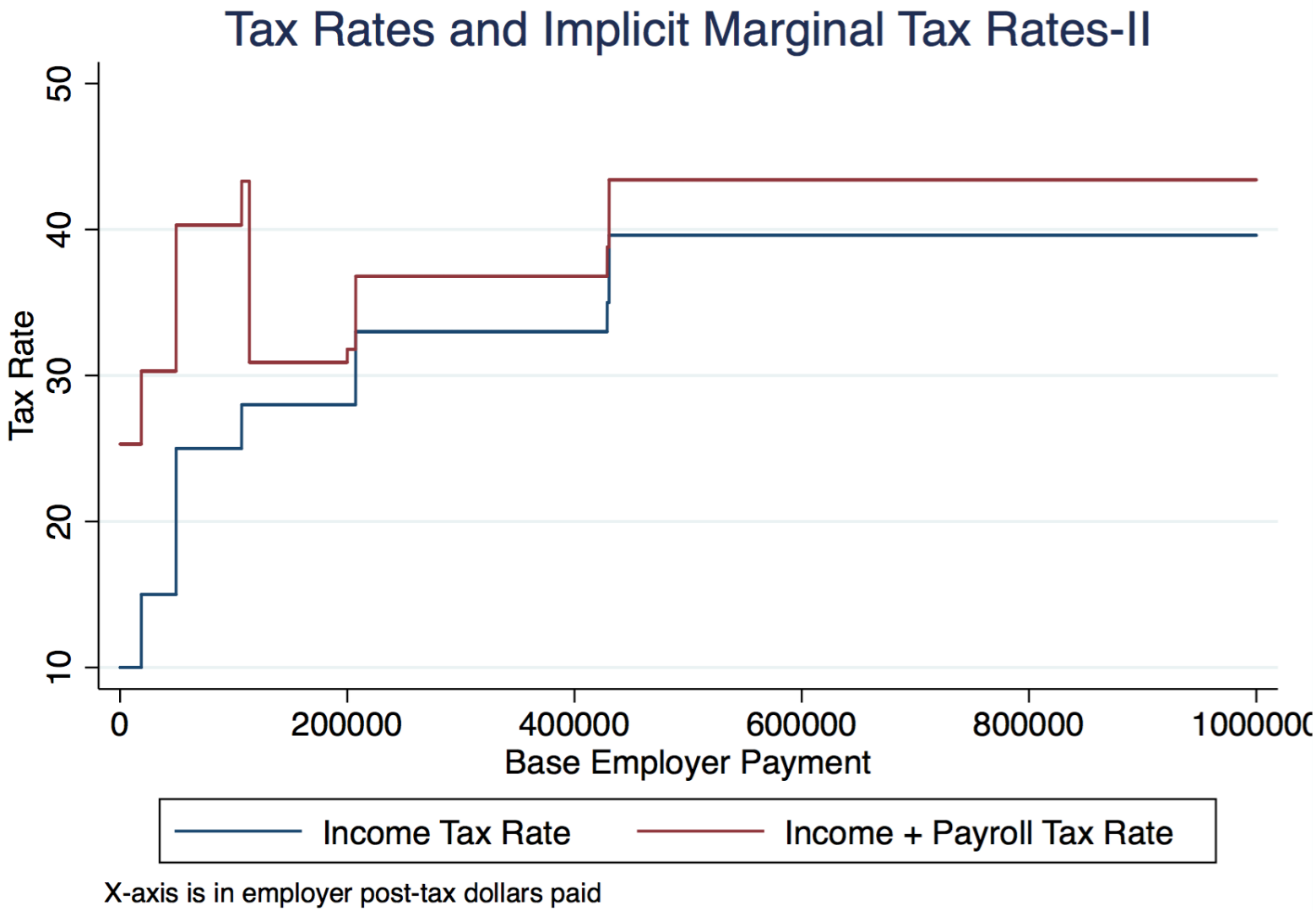
Initial Income	AGI	Income Tax	Payroll Tax	Marginal Income Tax Rate	Average Income Tax Rate
10,300	0	0	1,575	0%	0%
19,525	9,225	922	2,987	10%	10%
47,750	37,450	5,156	7,306	15%	14%
101,050	90,750	18,481	15,460	25%	20%
199,600	189,300	46,075	17,595	28%	24%
421,800	411,500	119,401	27,945	33%	29%
423,500	413,200	119,996	27,945	35%	29%
1,010,300	1,000,000	352,369	27,945	39.60%	35%

Note: this table is a sketch, I didn't include some nitty-gritty rules like personal exemption phase-out.

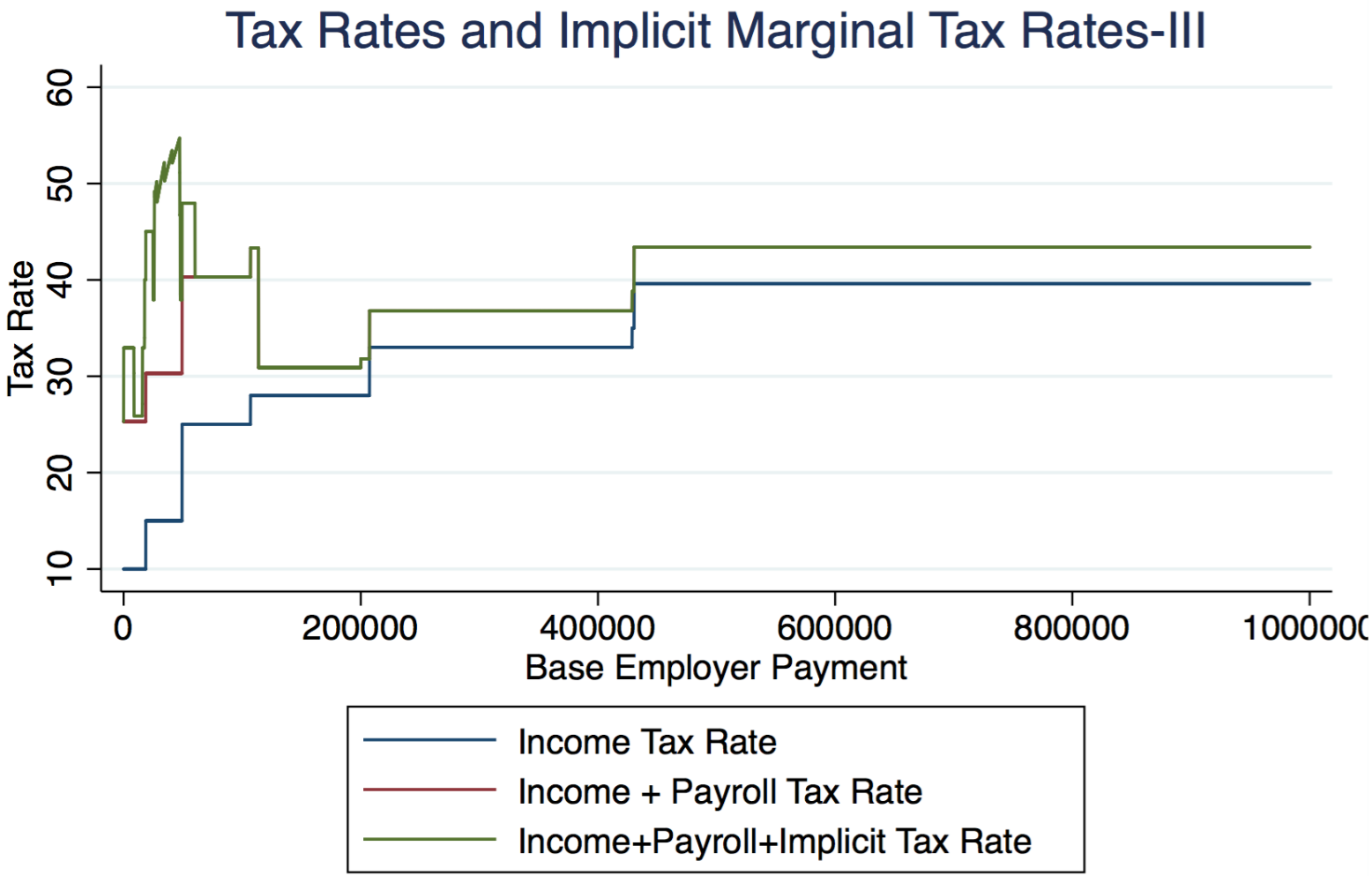
Marginal Income Tax Rates



Marginal Income + Payroll Tax Rates



Implicit Marginal Tax Rates



X-axis is in employer post-tax dollars paid
Includes EITC, Medicaid, and ACA Exchange Subsidies valued dollar for dollar

Income tax returns are very skewed!

Percent of Taxes Paid by Top X% Income Households

Year	Top 1%	Top 5%	Top 10%	Top 25%	Top 50%
1970	16.7%	31.4%	41.8%	62.2%	83.0%
1980	17.4%	33.7%	45.0%	66.6%	87.0%
1990	25.1%	43.6%	55.4%	77.0%	94.2%
2000	37.4%	56.5%	67.3%	84.0%	96.1%

- Numbers in black are percent of total income taxes paid

Income tax returns are very skewed!

Percent of Taxes Paid by Top X% Income Households

Year	Top 1%	Top 5%	Top 10%	Top 25%	Top 50%
1970	16.7%	31.4%	41.8%	62.2%	83.0%
	7.4	18.3	28.0	49.4	74.7
1980	17.4%	33.7%	45.0%	66.6%	87.0%
	7.8	19.2	29.1	51.4	76.7
1990	25.1%	43.6%	55.4%	77.0%	94.2%
	14.0	27.6	38.8	62.1	85.0
2000	37.4%	56.5%	67.3%	84.0%	96.1%
	20.8	35.3	46.0	67.2	87.0

- Numbers in black are percent of total income taxes paid
- Numbers in red are percent of income earned

Takeaways

- Taxes aren't lump-sum: they change based on income

Takeaways

- Taxes aren't lump-sum: they change based on income
- Taxes are graduated, meaning they increase with income: marginal tax rates rise with income

Takeaways

- Taxes aren't lump-sum: they change based on income
- Taxes are graduated, meaning they increase with income: marginal tax rates rise with income
- Average tax rates "follow" marginal tax rates slowly

Takeaways

- Taxes aren't lump-sum: they change based on income
- Taxes are graduated, meaning they increase with income: marginal tax rates rise with income
- Average tax rates "follow" marginal tax rates slowly
- Marginal tax rates are what matter for most labor market decisions

Takeaways

- Taxes aren't lump-sum: they change based on income
- Taxes are graduated, meaning they increase with income: marginal tax rates rise with income
- Average tax rates "follow" marginal tax rates slowly
- Marginal tax rates are what matter for most labor market decisions
- In order to understand government revenues we need to recognize big skew in income and taxes (can't just use the "average" agent)

Takeaways

- Taxes aren't lump-sum: they change based on income
- Taxes are graduated, meaning they increase with income: marginal tax rates rise with income
- Average tax rates "follow" marginal tax rates slowly
- Marginal tax rates are what matter for most labor market decisions
- In order to understand government revenues we need to recognize big skew in income and taxes (can't just use the "average" agent)
- Average tax rates matter for government revenues (holding constant labor market behavior)

Putting more realistic taxes in the model

- Let's look at labor income taxes
- Before we had, in a one-period budget constraint:

$$C + \frac{\Delta B}{P} + \Delta K = \frac{w}{P} L + r \left(\frac{B}{P} + K \right) + V - T$$

Putting more realistic taxes in the model

- Let's look at labor income taxes
- Before we had, in a one-period budget constraint:

$$C + \frac{\Delta B}{P} + \Delta K = \frac{w}{P}L + r\left(\frac{B}{P} + K\right) + V - T$$

- Now we have taxes that are a function of your labor income:

$$C + \frac{\Delta B}{P} + \Delta K = \frac{w}{P}L + r\left(\frac{B}{P} + K\right) + V - T\left(\frac{w}{P}L\right)$$

- Where we could have something like: $T\left(\frac{w}{P}L\right) = \tau_w \frac{w}{P}L$, taking τ_w dollars for every extra dollar of labor income you earn

Putting more realistic taxes in the model

- Let's look at labor income taxes
- Before we had, in a one-period budget constraint:

$$C + \frac{\Delta B}{P} + \Delta K = \frac{w}{P}L + r\left(\frac{B}{P} + K\right) + V - T$$

- Now we have taxes that are a function of your labor income:

$$C + \frac{\Delta B}{P} + \Delta K = \frac{w}{P}L + r\left(\frac{B}{P} + K\right) + V - T\left(\frac{w}{P}L\right)$$

- Where we could have something like: $T\left(\frac{w}{P}L\right) = \tau_w \frac{w}{P}L$, taking τ_w dollars for every extra dollar of labor income you earn
- Plugging this in, we would get:

$$C + \frac{\Delta B}{P} + \Delta K = (1 - \tau_w)\frac{w}{P}L + r\left(\frac{B}{P} + K\right) + V$$

Putting more realistic taxes in the model

- Let's look at labor income taxes
- Before we had, in a one-period budget constraint:

$$C + \frac{\Delta B}{P} + \Delta K = \frac{w}{P}L + r\left(\frac{B}{P} + K\right) + V - T$$

- Now we have taxes that are a function of your labor income:

$$C + \frac{\Delta B}{P} + \Delta K = \frac{w}{P}L + r\left(\frac{B}{P} + K\right) + V - T\left(\frac{w}{P}L\right)$$

- Where we could have something like: $T\left(\frac{w}{P}L\right) = \tau_w \frac{w}{P}L$, taking τ_w dollars for every extra dollar of labor income you earn
- Plugging this in, we would get:

$$C + \frac{\Delta B}{P} + \Delta K = (1 - \tau_w)\frac{w}{P}L + r\left(\frac{B}{P} + K\right) + V$$

- In other words, as far as you're concerned, higher taxes just look like a lower wage

Two important questions

1. How does an increase in government expenditures impact labor market behavior?

2. How does an increase in government transfers impact labor market behavior?

An increase in government expenditures

- What happens to behavior when G (government expenditures) increases?

$$C + \frac{\Delta B}{P} + \Delta K = (1 - \tau_w)\frac{w}{P}L + r\left(\frac{B}{P} + K\right) + V$$

An increase in government expenditures

- What happens to behavior when G (government expenditures) increases?

$$C + \frac{\Delta B}{P} + \Delta K = (1 - \tau_w)\frac{w}{P}L + r\left(\frac{B}{P} + K\right) + V$$

- τ_w must go up to finance more expenditures

An increase in government expenditures

- What happens to behavior when G (government expenditures) increases?

$$C + \frac{\Delta B}{P} + \Delta K = (1 - \tau_w)\frac{w}{P}L + r\left(\frac{B}{P} + K\right) + V$$

- τ_w must go up to finance more expenditures
- So households have a lower wage: how does their labor change?

An increase in government expenditures

- What happens to behavior when G (government expenditures) increases?

$$C + \frac{\Delta B}{P} + \Delta K = (1 - \tau_w)\frac{w}{P}L + r\left(\frac{B}{P} + K\right) + V$$

- τ_w must go up to finance more expenditures
- So households have a lower wage: how does their labor change?
  - Income effect says work more, substitution effect says work less: ambiguous in sign

An increase in government expenditures

- What happens to behavior when G (government expenditures) increases?

$$C + \frac{\Delta B}{P} + \Delta K = (1 - \tau_w)\frac{w}{P}L + r\left(\frac{B}{P} + K\right) + V$$

- τ_w must go up to finance more expenditures
- So households have a lower wage: how does their labor change?
  - Income effect says work more, substitution effect says work less: ambiguous in sign
- From what we've seen in the time series, we think this is around zero

An increase in government expenditures

- What happens to behavior when G (government expenditures) increases?

$$C + \frac{\Delta B}{P} + \Delta K = (1 - \tau_w)\frac{w}{P}L + r\left(\frac{B}{P} + K\right) + V$$

- τ_w must go up to finance more expenditures
- So households have a lower wage: how does their labor change?
  - Income effect says work more, substitution effect says work less: ambiguous in sign
- From what we've seen in the time series, we think this is around zero
- But that's for the *whole* wage! A marginal change is mostly substitution!

An increase in government expenditures

- What happens to behavior when G (government expenditures) increases?

$$C + \frac{\Delta B}{P} + \Delta K = (1 - \tau_w)\frac{w}{P}L + r\left(\frac{B}{P} + K\right) + V$$

- τ_w must go up to finance more expenditures
- So households have a lower wage: how does their labor change?
  - Income effect says work more, substitution effect says work less: ambiguous in sign
- From what we've seen in the time series, we think this is around zero
- But that's for the *whole* wage! A marginal change is mostly substitution!
- An average rise in taxes spent on government expenditures small effect, a marginal rise has a bigger (negative) effect

An increase in government transfers

- What happens to behavior when V (government transfers) increases?

$$C + \frac{\Delta B}{P} + \Delta K = (1 - \tau_w)\frac{w}{P}L + r\left(\frac{B}{P} + K\right) + V$$

An increase in government transfers

- What happens to behavior when V (government transfers) increases?

$$C + \frac{\Delta B}{P} + \Delta K = (1 - \tau_w)\frac{w}{P}L + r\left(\frac{B}{P} + K\right) + V$$

- τ_w must go up to finance more expenditures

An increase in government transfers

- What happens to behavior when V (government transfers) increases?

$$C + \frac{\Delta B}{P} + \Delta K = (1 - \tau_w)\frac{w}{P}L + r\left(\frac{B}{P} + K\right) + V$$

- τ_w must go up to finance more expenditures
- But transfers also increases!
- So households have a lower wage and higher property income: how does their labor change?

An increase in government transfers

- What happens to behavior when V (government transfers) increases?

$$C + \frac{\Delta B}{P} + \Delta K = (1 - \tau_w)\frac{w}{P}L + r\left(\frac{B}{P} + K\right) + V$$

- τ_w must go up to finance more expenditures
- But transfers also increases!
- So households have a lower wage and higher property income: how does their labor change?
  - Income effect says work more, substitution effect says work less: ambiguous in sign (call it zero, from before)

An increase in government transfers

- What happens to behavior when V (government transfers) increases?

$$C + \frac{\Delta B}{P} + \Delta K = (1 - \tau_w)\frac{w}{P}L + r\left(\frac{B}{P} + K\right) + V$$

- τ_w must go up to finance more expenditures
- But transfers also increases!
- So households have a lower wage and higher property income: how does their labor change?
  - Income effect says work more, substitution effect says work less: ambiguous in sign (call it zero, from before)
  - Income effect of more transfers says work less

An increase in government transfers

- What happens to behavior when V (government transfers) increases?

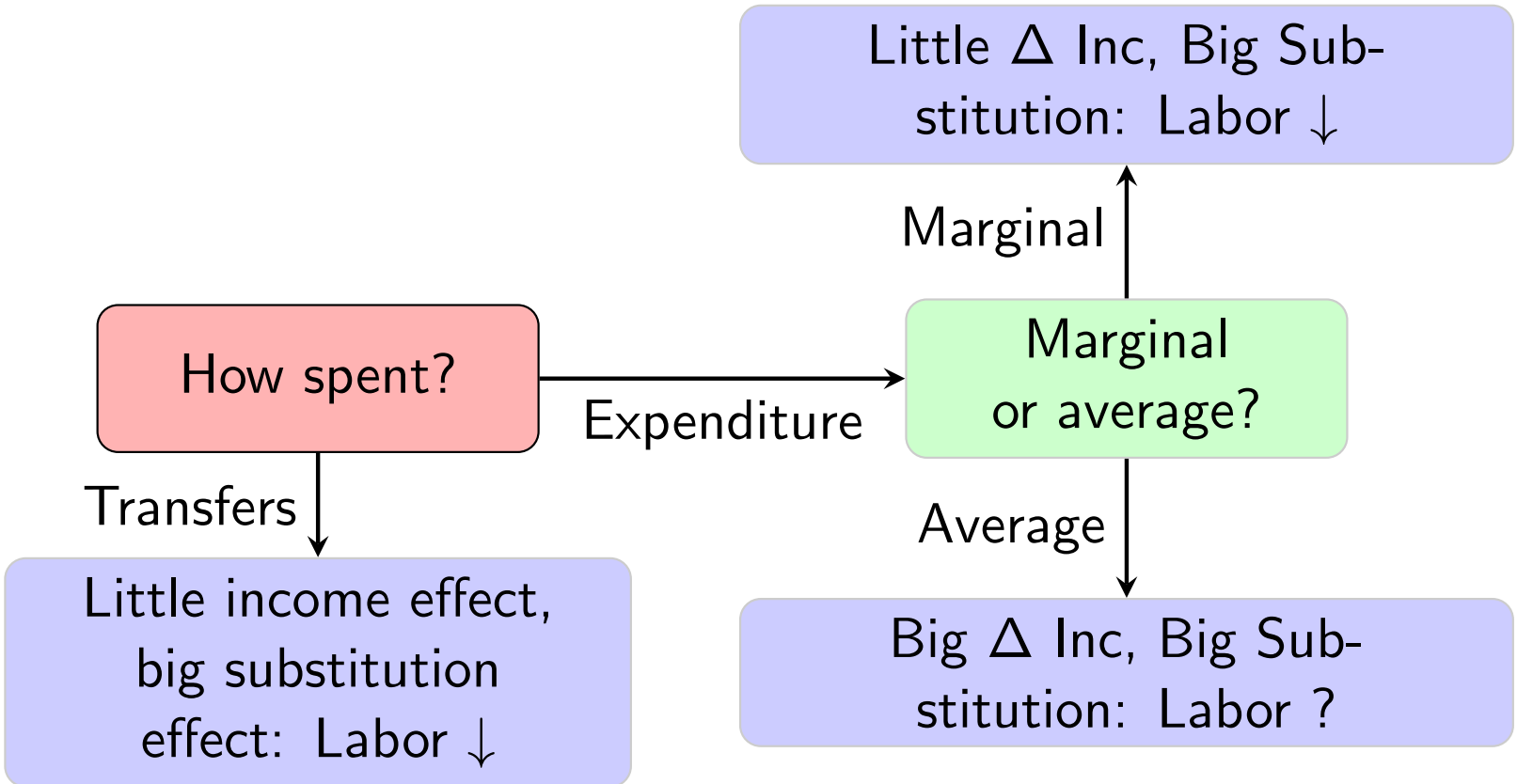
$$C + \frac{\Delta B}{P} + \Delta K = (1 - \tau_w)\frac{w}{P}L + r\left(\frac{B}{P} + K\right) + V$$

- τ_w must go up to finance more expenditures
- But transfers also increases!
- So households have a lower wage and higher property income: how does their labor change?
  - Income effect says work more, substitution effect says work less: ambiguous in sign (call it zero, from before)
  - Income effect of more transfers says work less
- So the total effect is to work less!

Summing up

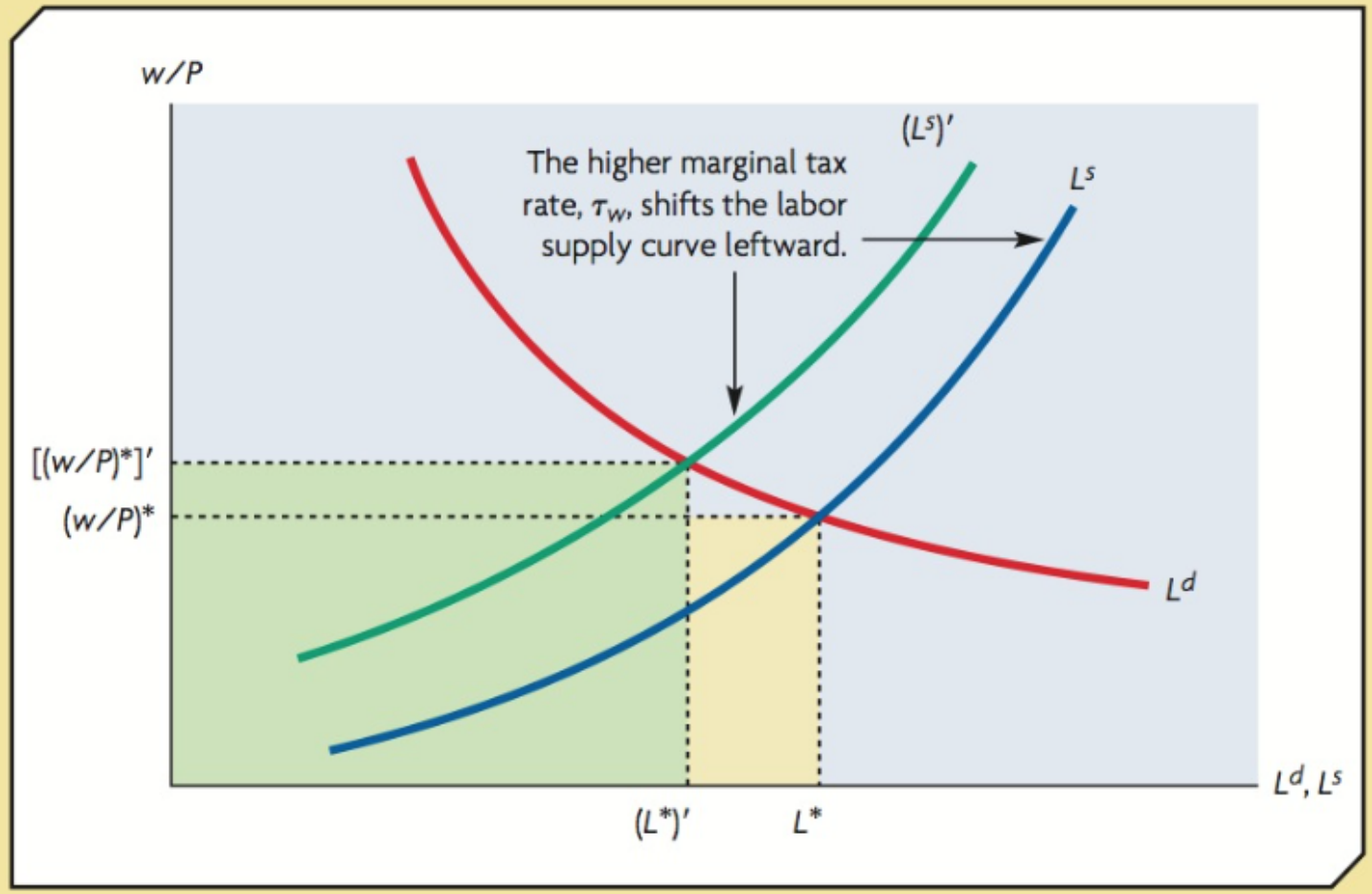
- The effect of taxes has an unambiguously negative substitution effect on labor
- If the taxes are used to increase transfers then there is no (or only a small) income effect, and the negative substitution effect dominates
- If the taxes are used to finance government transfers, then there is also a income effect that increases labor supply, partially offsetting the substitution effect
- The substitution effect is bigger when it's a marginal tax rate change rather than an average tax rate change, because income changes less when it's a marginal tax rate change
- When thinking about increasing labor income taxes, we'll typically think about the substitution effect dominating
- This yields a decline in the *effective* wage rate, so a decline in labor supply

For distortionary taxation



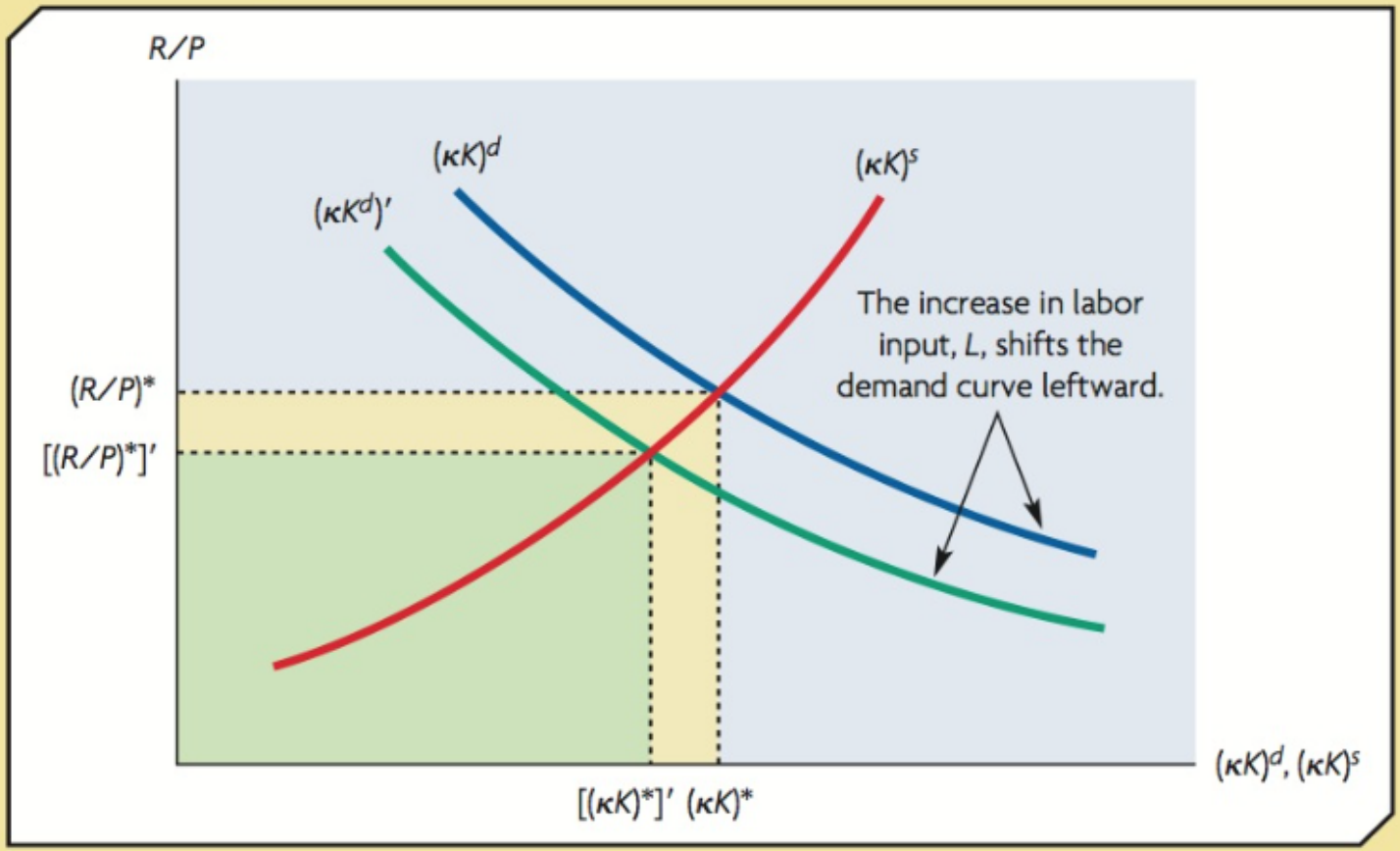
Increase in the Labor-Income Tax Rate: Labor Supply

Figure 13.5 *Effect of an Increase in the Labor-Income Tax Rate on the Labor Market*



Increase in the Labor-Income Tax Rate: Capital Services

Figure 13.6 *Effect of an Increase in the Labor-Income Tax Rate on the Market for Capital Services*



What about a tax on asset income?

- So far we've only looked at labor income taxation
- Depending on what distortionary tax we use and how we spend it, we think it either decreases or keeps labor the same
- What about taxes on asset income? Capital gains taxes, for instance, property taxes, estate tax?

$$C + \frac{\Delta B}{P} + \Delta K = \frac{w}{P} L + r \left(\frac{B}{P} + K \right) + V - T$$

What about a tax on asset income?

- So far we've only looked at labor income taxation
- Depending on what distortionary tax we use and how we spend it, we think it either decreases or keeps labor the same
- What about taxes on asset income? Capital gains taxes, for instance, property taxes, estate tax?

$$C + \frac{\Delta B}{P} + \Delta K = \frac{w}{P} L + r\left(\frac{B}{P} + K\right) + V - T$$

- Labor income taxes hit wages

What about a tax on asset income?

- So far we've only looked at labor income taxation
- Depending on what distortionary tax we use and how we spend it, we think it either decreases or keeps labor the same
- What about taxes on asset income? Capital gains taxes, for instance, property taxes, estate tax?

$$C + \frac{\Delta B}{P} + \Delta K = \frac{w}{P} L + r \left(\frac{B}{P} + K \right) + V - T$$

- Labor income taxes hit wages
- Capital income taxes hit returns

Taxing asset income-I

- Before, I gave up \$1 and get back \$$(1 + r)$ back tomorrow

Taxing asset income-I

- Before, I gave up \$1 and get back $\$(1 + r)$ back tomorrow
- Now, I'll give up \$1 and get back $\$(1 + r - \tau r)$

Taxing asset income-I

- Before, I gave up \$1 and get back $\$(1 + r)$ back tomorrow
- Now, I'll give up \$1 and get back $\$(1 + r - \tau r)$
- What? What are we taxing here? Shouldn't it be $(1 + r)(1 - \tau_k)$?

Taxing asset income-I

- Before, I gave up \$1 and get back $\$(1+r)$ back tomorrow
- Now, I'll give up \$1 and get back $\$(1+r-\tau r)$
- What? What are we taxing here? Shouldn't it be $(1+r)(1-\tau_k)$?
  - It depends. The first taxes *gross* capital income, while the second taxes *net*. Most countries do the latter.

Taxing asset income-I

- Before, I gave up \$1 and get back $\$(1+r)$ back tomorrow
- Now, I'll give up \$1 and get back $\$(1+r-\tau r)$
- What? What are we taxing here? Shouldn't it be $(1+r)(1-\tau_k)$?
  - It depends. The first taxes *gross* capital income, while the second taxes *net*. Most countries do the latter.
- So we're just hitting r with our tax. How does this effect behavior? What do interest rates control?
  - Interest rates cause us to defer consumption
  - Interest rates tell us how much capital to utilize

Asset income tax on consumption

- Effect of a tax (holding the interest rate constant!) are pretty clear
- Save less today
- Consume more today
- Consume less in the future

Asset income tax on capital utilization

- Before, we chose to maximize:

$$\text{Net rate of return} = \frac{R}{P}\kappa - \delta(\kappa)$$

- Now, we have to maximize:

$$(1-\tau_k)\text{Net rate of return} = (1-\tau_k)\left(\frac{R}{P}\kappa - \delta(\kappa)\right)$$

Asset income tax on capital utilization

- Before, we chose to maximize:

$$\text{Net rate of return} = \frac{R}{P}\kappa - \delta(\kappa)$$

- Now, we have to maximize:

$$(1-\tau_k)\text{Net rate of return} = (1-\tau_k)\left(\frac{R}{P}\kappa - \delta(\kappa)\right)$$

- How does our choice change? How to we maximize this object?

Asset income tax on capital utilization

- Before, we chose to maximize:

$$\text{Net rate of return} = \frac{R}{P}\kappa - \delta(\kappa)$$

- Now, we have to maximize:

$$(1-\tau_k)\text{Net rate of return} = (1-\tau_k)\left(\frac{R}{P}\kappa - \delta(\kappa)\right)$$

- How does our choice change? How to we maximize this object?

- You can't change anything by choosing κ differently! The maximum is exactly the same

Asset income tax on capital utilization

- Before, we chose to maximize:

$$\text{Net rate of return} = \frac{R}{P}\kappa - \delta(\kappa)$$

- Now, we have to maximize:

$$(1-\tau_k)\text{Net rate of return} = (1-\tau_k)\left(\frac{R}{P}\kappa - \delta(\kappa)\right)$$

- How does our choice change? How to we maximize this object?

- You can't change anything by choosing κ differently! The maximum is exactly the same

- Statutorially, the capital income tax doesn't fall on demand, so if supply isn't changing neither is demand

Asset income tax on capital utilization

- Before, we chose to maximize:

$$\text{Net rate of return} = \frac{R}{P}\kappa - \delta(\kappa)$$

- Now, we have to maximize:

$$(1-\tau_k)\text{Net rate of return} = (1-\tau_k)\left(\frac{R}{P}\kappa - \delta(\kappa)\right)$$

- How does our choice change? How to we maximize this object?
- You can't change anything by choosing κ differently! The maximum is exactly the same
- Statutorially, the capital income tax doesn't fall on demand, so if supply isn't changing neither is demand
- Nothing changes in capital markets!

Summarizing asset taxes

- Capital utilization doesn't change
- But households face lower interest rates
- They save less, consume more
- In macroeconomy, $C \uparrow$ or $C(?)$, $I \downarrow$ (save less)

Taxes

- Chapters 12 and 13 looked at different forms of taxation and spending
- When you're thinking about how taxes change behavior, you should think about:
  - Is the government spending it on expenditures or transfers?
  - Is it a permanent tax hike or a temporary one?
  - Am I talking about labor, savings/investment, or consumption behavior?
  - Is it lump-sum, an average/across-the-board tax hike, or a marginal tax hike?
  - Is the tax on consumption, labor, or capital?