Public Economics

Lecture: 08 Taxation II

Taxation of Goods and Services

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Outline of Lecture

1. The Three Rules of Tax Incidence

2. Welfare losses of Consumption Taxes

3. Substitution Effects

Taxation of Goods and Services

Indirect Consumption Taxes:

- **Sales tax:** Charged on the final price paid by the consumer at the point of sale.
- **VAT:** Levied at each stage of production and distribution on the value added at that stage.
- **Excise tax:** A specific type of tax targeting particular goods or services (fuel, alcohol, tobacco, etc.).

$\longrightarrow$ VAT and sales tax are calculated as a percentage of the *monetary value* of goods or services.

$\longrightarrow$ Excise taxes are often per-unit quantity taxes.

Per-unit Taxes as a Simplification

As a simplification, we focus on a per-unit **quantity tax:**

- A fixed amount levied per unit of a good, regardless of its price.
- Example: \$0.50 per liter of gasoline or \$2 per pack of cigarettes.
- Tax is based solely on the *quantity* of goods sold.

$\rightarrow$ Captures the important features of indirect consumption taxes.

$\rightarrow$ Abstracts from features, which do not change the overall direction of the causal effect.

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The Three Rules of Tax Incidence

1. The statutory burden of a tax does not describe who really bears the tax.
2. The side of the market on which the tax is imposed is irrelevant to the distribution of the tax burdens.
3. Parties with inelastic supply or demand bear taxes; parties with elastic supply or demand avoid them.

Tax Incidence

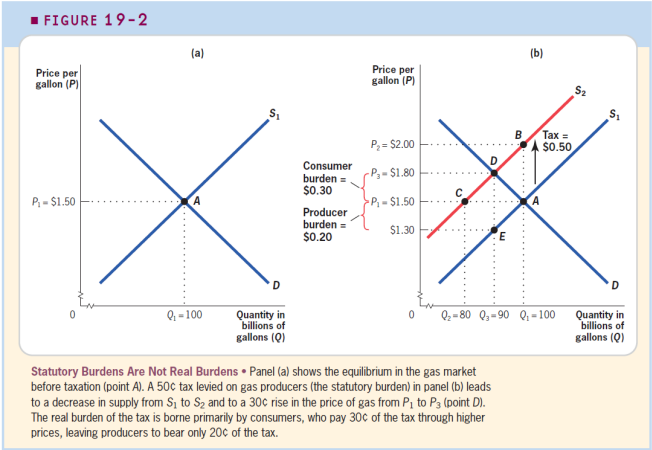
- **Statutory Incidence:** Refers to who legally pays the tax (e.g., producers of gasoline, redistributors, sellers).
- **Economic Incidence:** Reflects the true burden of the tax, considering market reactions and changes in available resources.
- **Market Reaction:** Taxes affect supply, demand, and prices, leading to a shift in who actually bears how much of the tax burden.

$$\underline{\textit{Consumer tax burden}}$$
$$= (\text{post-tax price} - \text{pre-tax price}) + \text{per-unit tax payments by consumers.}$$

$$\underline{\textit{Producer tax burden}}$$
$$= (\text{pre-tax price} - \text{post-tax price}) + \text{per-unit tax payments by producers.}$$

Statutory Burdens Are Not Real Burdens

Example: 50¢ per gallon tax on gasoline, to be paid by the producers.



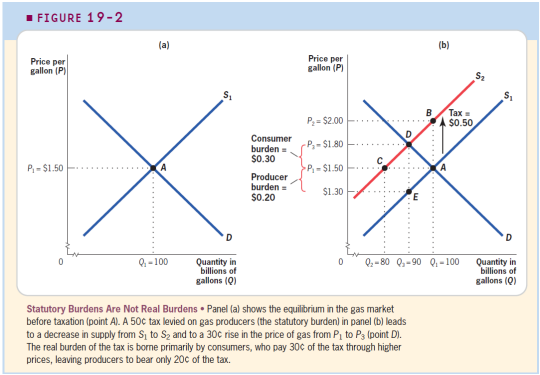
Source: Gruber (2005)

Will gas producers receive 50¢ less on each gallon they produce as a result of this tax?

- No, because of **market reactions** (from A to D).

Statutory Burdens Are Not Real Burdens

Example: 50¢ per gallon tax on gasoline, to be paid by the producers.



Source: Gruber (2005)

1. **Tax effect:** Producer have to pay the tax per unit, hence production becomes more 'costly'. (S_1 shifts to S_2).
2. **Market reaction:** New equilibrium in D.

$\rightarrow$ Less quantity produced (from Q_1 to Q_3).

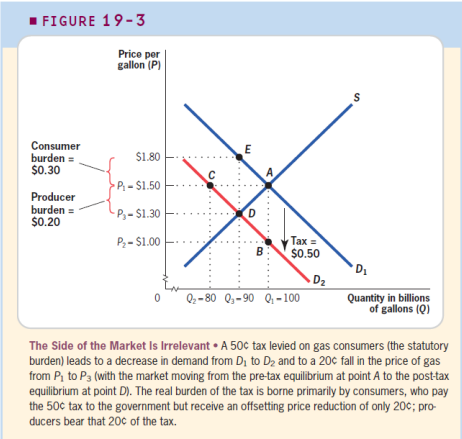
$\rightarrow$ Market price rises (from P_1 to P_3).

$\rightarrow$ Consumers pay 30¢ more ($P_3 - P_1$).

$\rightarrow$ Producers bear 20¢ of the tax ($\$1.8 - \$1.30 - \$0.5$ tax).

The Side of the Market is Irrelevant

Example: 50¢ per gallon tax on gasoline, to be paid by the consumers.



Source: Gruber (2005)

1. **Tax effect:** Product becomes more expensive, consumers demand less for the same ex-ante price (without tax). (D_1 shifts to D_2)
2. **Market reaction:** New equilibrium in D.

$\rightarrow$ Less quantity demanded (from Q_1 to Q_3)

$\rightarrow$ The market price (without tax) falls (from P_1 to P_3)

$\rightarrow$ However, consumers pay 30¢ more because they have to pay the tax ($\$1.50 - \$1.30 + \$0.50$ tax).

$\rightarrow$ Producers bear 20¢ of the tax ($P_1 - P_3$) .

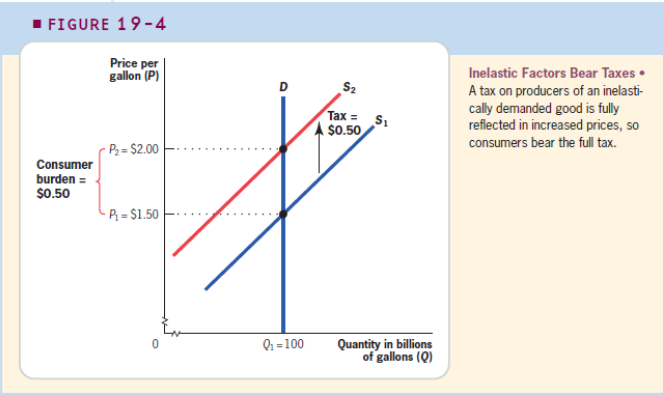
Elasticity of Demand

- Elasticity measures how sensitive the quantity demanded of a good is to changes in its price.
- It reflects the responsiveness of consumers: do they buy much less, or only slightly less, when prices rise?

Types of Elasticity:

- *Elastic Demand:* Large changes in demand due to small price changes.
  $\longrightarrow$ *e.g., easily substitutable products: soft drinks, airline tickets, luxury goods, etc.*
- *Inelastic Demand:* Small or negligible changes in demand despite larger price changes.
  $\longrightarrow$ *e.g., essential medicines, water, or electricity.*
- *Perfectly Elastic Demand:* Demand drops to zero with any price increase.
  $\longrightarrow$ *e.g., homogeneous products in a perfectly competitive market, e.g., gas at one specific gas station.*
- *Perfectly Inelastic Demand:* Demand remains unchanged regardless of price changes.
  $\longrightarrow$ *e.g., life-saving drugs like insulin for diabetics.*

Elasticity Determines who Pays for the Tax



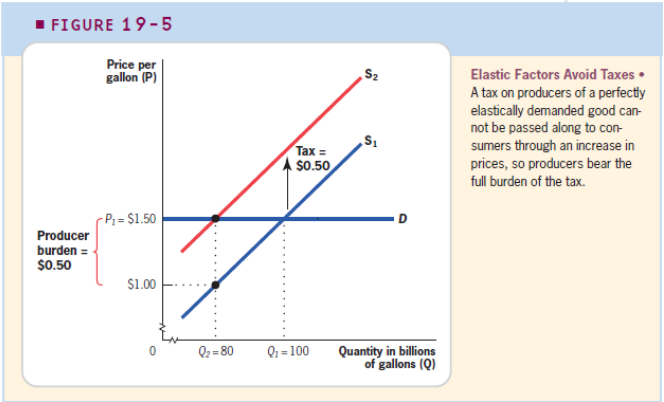
Source: Gruber (2005)

Perfectly inelastic demand:

$\longrightarrow$ No change in demanded quantity after price increase.

$\longrightarrow$ **Consumers bear** all the burden of the tax.

Elasticity Determines who Pays for the Tax



Source: Gruber (2005)

Perfectly elastic demand:

$\longrightarrow$ No change in price after tax, as consumers only buy for P_1.

$\longrightarrow$ **Producers bear** all the burden of the tax.

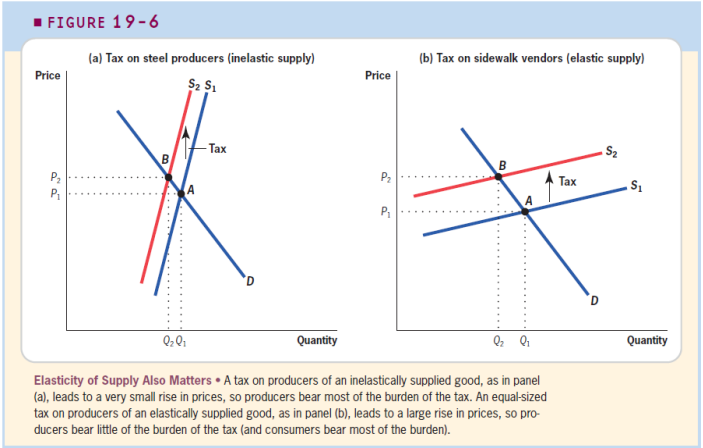
Elasticity of Supply

- Measures how responsive the quantity supplied of a good is to a change in its price.
- It shows the flexibility of producers in adjusting production levels.

Types of Elasticity:

- *Elastic supply:* Producers can quickly increase supply in response to price changes.
  $\longrightarrow$ *e.g., taxi rides (Uber/ Bolt), easily manufactured goods like pencils, plastic/ paper bags, etc.*
- *Inelastic supply:* Quantity supplied is less responsive to price changes due to constraints.
  $\longrightarrow$ *e.g., agricultural products (it needs time and land to grow something), electricity from nuclear reactors, etc.*

Elasticity of Supply also Matters



Source: Gruber (2005)

Inelastic supply (a):

$\longrightarrow$ small price changes, producers bear most of the tax burden.

Elastic supply (b):

$\longrightarrow$ larger price changes, consumers bear most of the tax burden.

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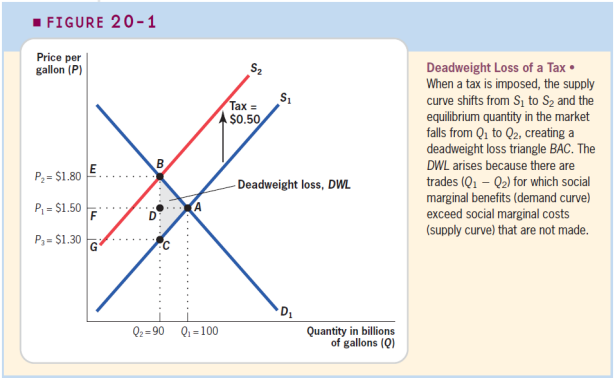
Deadweight Loss of Taxation



Source: Gruber (2005)

A tax leads to a welfare loss (**deadweight loss**):

1. The price is higher than the (efficient) market price.
2. Produced quantity decreases compared to the (efficient) market quantity.

Tax Revenue

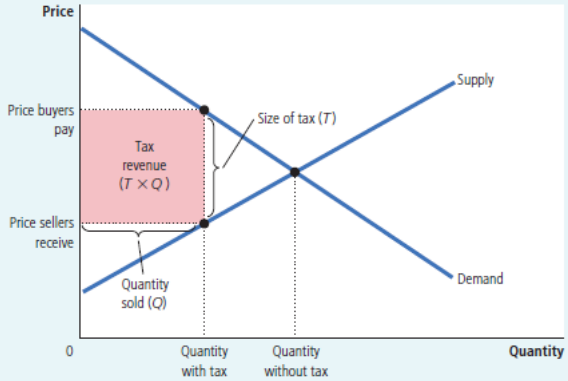


FIGURE 2

Tax Revenue

The tax revenue that the government collects equals $T \times Q$, the size of the tax T times the quantity sold Q. Thus, tax revenue equals the area of the rectangle between the supply and demand curves.

Source: Mankiw (2021)

Deadweight Loss

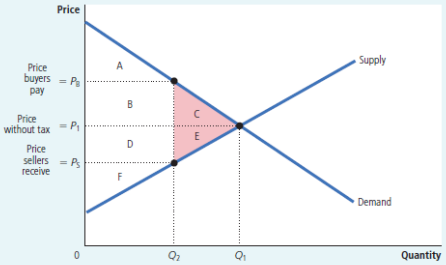
FIGURE 3

How a Tax Affects Welfare

A tax on a good reduces consumer surplus (by the area B + C) and producer surplus (by the area D + E). Because the fall in producer and consumer surplus exceeds tax revenue (area B + D), the tax is said to impose a deadweight loss (area C + E).

	Without Tax	With Tax	Change
Consumer Surplus	A + B + C	A	− (B + C)
Producer Surplus	D + E + F	F	− (D + E)
Tax Revenue	None	B + D	+ (B + D)
Total Surplus	A + B + C + D + E + F	A + B + D + F	− (C + E)

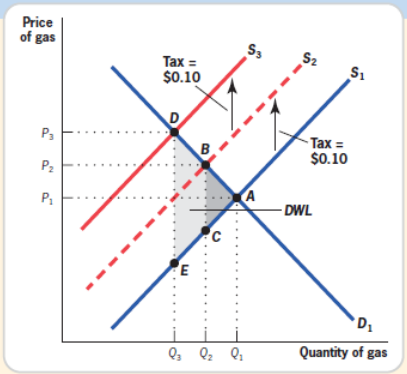
The area C + E shows the fall in total surplus and is the deadweight loss of the tax.



Source: Mankiw (2021)

Deadweight loss growth of Taxation

■ FIGURE 20-3

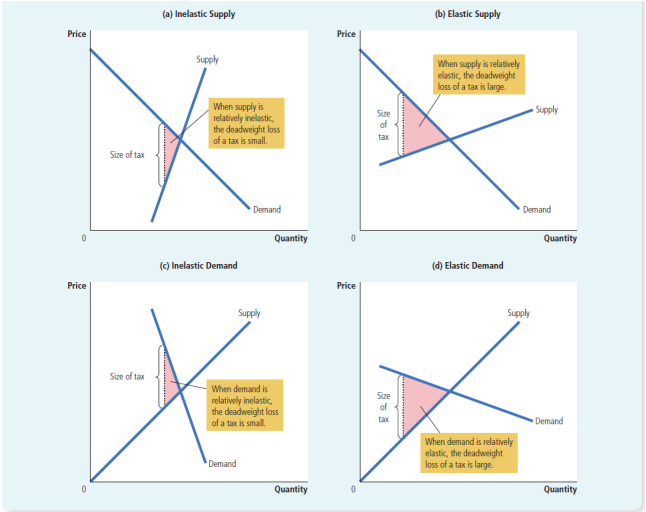


Marginal Deadweight Loss Rises with Tax Rate • An initial $0.10 tax on suppliers causes a deadweight loss triangle *BAC*. An additional $0.10 tax causes a much larger deadweight loss, *DAE*. The trapezoid *DBCE* is the marginal deadweight that is added to the initial deadweight loss of triangle *BAC*.

There is an overproportional increase in the deadweight loss with the tax rate.

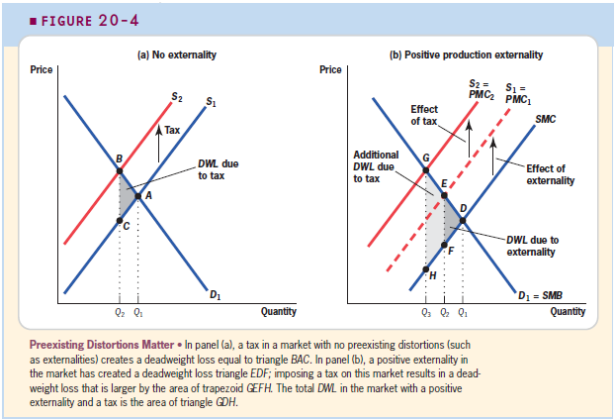
- Small tax rates lead to lower distortions.
- High tax rates lead to larger distortions.

Tax Distortions and Elasticities



Source: figure 5 Mankiw (2021)

Pre-existing Distortions Matter – Positive Externalities



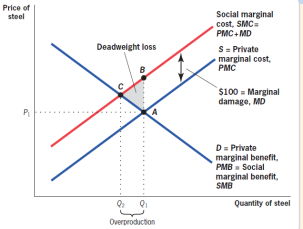
Source: Gruber (2005)

Taxes are particularly harmful if there are positive externalities.

- There is already an underproduction and deadweight loss with positive externalities.
- A tax increases the market distortion and leads to even more underproduction.

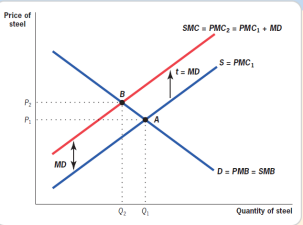
Pre-existing Distortions Matter – Negative Externalities

■ FIGURE 5-2



Market Failure Due to Negative Production Externalities in the Steel Market • A negative production externality of $100 per unit of steel produced (marginal damage, *MD*) leads to a social marginal cost that is above the private marginal cost, and a social optimum quantity (Q_2) that is lower than the competitive market equilibrium quantity (Q_1). There is overproduction of $Q_1 - Q_2$, with an associated dead-weight loss of area *BCA*.

■ FIGURE 5-6



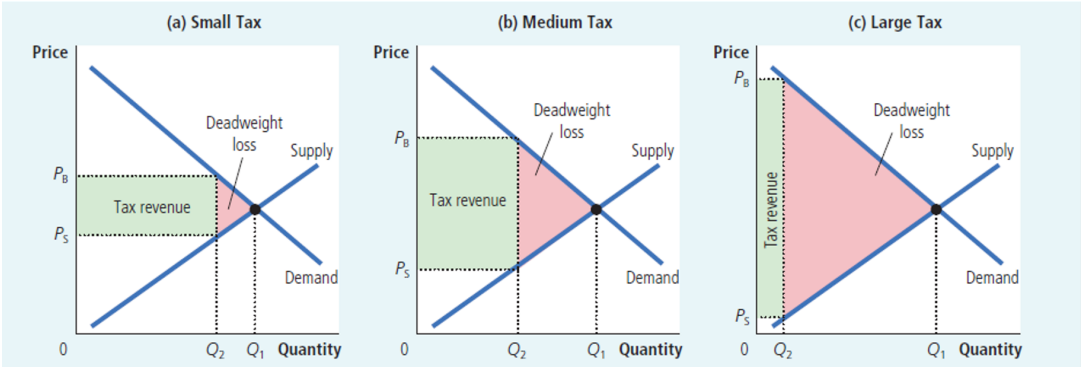
Taxation as a Solution to Negative Production Externalities in the Steel Market • A tax of $100 per unit (equal to the marginal damage of pollution) increases the firm's private marginal cost curve from PMC_1 to PMC_2, which coincides with the *SMC* curve. The quantity produced falls from Q_1 to Q_2, the socially optimal level of production. Just as with the Coasian payment, this tax internalizes the externality and removes the ineffi-ciency of the negative externality.

Exception: Pigouvian Tax

There is an efficiency increase, when there are negative externalities in the market.

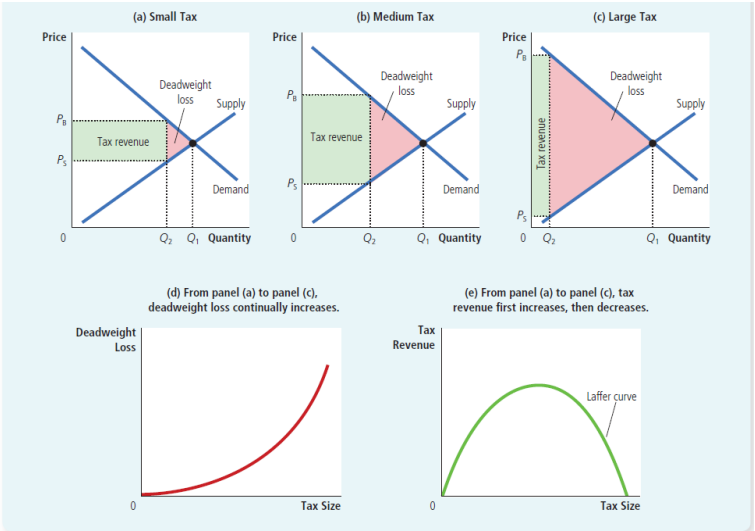
- Pre-existing distortion gets corrected.
- The deadweightloss from the negative externality dissapears after the tax.
- (Corrective) taxation can lead to a welfare gain.

Deadweight Loss and Tax Revenue



Source: figure 6 Mankiw (2021)

Deadweight Loss and Tax Revenue



Source: figure 6 Mankiw (2021)

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1. The Three Rules of Tax Incidence

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Excise Taxes and Substitution Effects

Example: An additional excise tax on beer, no additional tax on soda.

- Relative price of beer to soda increases.
- Individuals budget constraint shifts downwards: they can buy less beer with the income that they have.

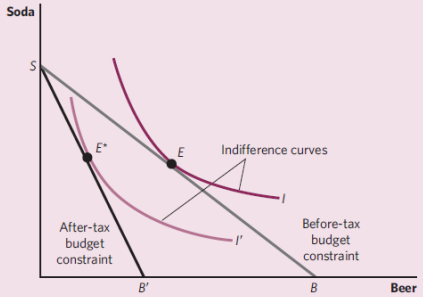

FIGURE 19.1

EQUILIBRIUM AFTER THE IMPOSITION OF A TAX ON BEER

The effect of the tax is to shift the budget constraint down and, thus, the equilibrium changes from E to E^*.

Source: Stiglitz and Rosengard (2015)

Substitution Versus Income Effect

- **Income Effect:** How would consumption of beer have been reduced if we had taken away income from the individual – to put him or her on the new, lower indifference curve – but, at the same time, had not changed relative prices? (E to $\hat{E}$)
- **Substitution Effect:** Beer becomes relatively more expensive, leading to substitution toward other goods. ($\hat{E}$ to E^*)

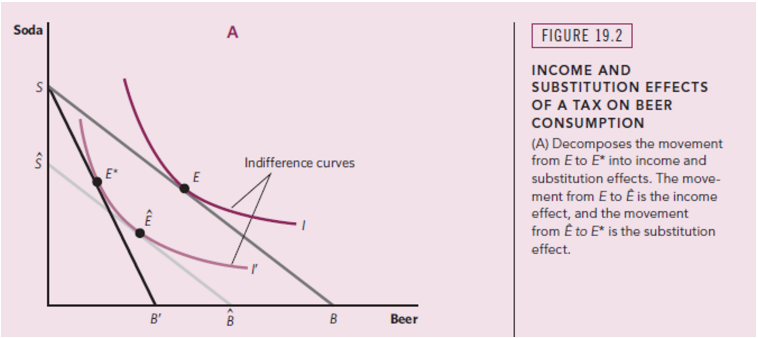

FIGURE 19.2

INCOME AND SUBSTITUTION EFFECTS OF A TAX ON BEER CONSUMPTION

(A) Decomposes the movement from E to E^* into income and substitution effects. The movement from E to $\hat{E}$ is the income effect, and the movement from $\hat{E}$ to E^* is the substitution effect.

Source: Stiglitz and Rosengard (2015)

Readings for Next Lecture

Lecture 9: Taxation III

Stiglitz and Rosengard (2015)

- Chapter 19: Taxation of Savings (pp. 588-591)
- Chapter 19: Taxation of Labor Income (pp. 591-597)

References I

Gruber, J. (2005). *Public Finance and Public Policy*, Worth Publishers.

Mankiw, N. G. (2021). *Principles of economics*, Cengage Learning.

Stiglitz, J. E. and Rosengard, J. K. (2015). Economics of the public sector (4th edition).