Taxation-Inefficiency and Optimal Taxation (Chapter 20)
Taxation-Inefficiencies

• Indonesia: cars are more heavily taxed than motorcycles.
  – Consumers’ solution: turn motorcycles into cars and even buses by ‘artful additions’
  – Issue: obviously not desirable in terms of public safety, leading to inefficiencies

• As a result of the tax, consumers will change their behavior to avoid the tax, causing inefficiencies.
Taxation-Inefficiencies

• Consider a 50 cent per gallon tax levied on producers of gasoline:
  – Increase in the marginal cost of producers shifting the supply curve upwards by the tax amount
  – Reduces the quantity of gasoline demanded
  – The trades with social marginal benefit higher than social marginal cost will not take place
Taxation-Inefficiencies

• Consider a 50 cent per gallon tax levied on producers of gasoline:
Taxation-Inefficiencies

• Consider a 50 cent per gallon tax levied on producers of gasoline:
  – Reduction in consumer surplus: trapezoid EBAF
  – Reduction in producer surplus: trapezoid FACG
  – Tax revenue: EBCG
  – **Tax inefficiency = (Reduction in CS + Reduction in PS) – Tax Revenue**
  – Tax inefficiency would be the same if the tax was levied on the consumers.
Taxation-Inefficiencies

• Elasticities determine tax inefficiency
  – The more elastic the demand/supply is, the higher the deadweight loss will be
    • Higher elasticity of demand (supply) ⇒ more ways for consumers (producers) to avoid taxation ⇒ higher inefficiencies
    • The inefficiency of any tax is determined by the extent to which consumers and producers change their behavior to avoid the tax; deadweight loss is caused by individuals and firms making inefficient consumption and production choices in order to avoid taxation.
Taxation-Inefficiencies

- Elasticities determine tax inefficiency
  - The more elastic the demand/supply is, the higher the deadweight loss will be
Taxation-Inefficiencies

• Math behind the figures
  – Consider the case where consumers pay the tax

\[
\text{DWL} = -0.5 * \Delta Q * \tau
\]

• Change in price for consumers:
  \[
  \text{Total price change} = \Delta P + \tau
  \]

• Elasticity of demand:
  \[
  \eta_d = \frac{\Delta Q}{\Delta P + \tau} \times \left(\frac{P}{Q}\right)
  \]

\[
\eta_s = \frac{\Delta Q}{\Delta P} \times \left(\frac{P}{Q}\right)
\]

• Solve for \(\Delta Q / Q\)
Taxation-Inefficiencies

• Math behind the figures
  – Consider the case where consumers pay the tax

$$\eta_d = \frac{\Delta Q}{Q} = \eta_d \times \frac{(\Delta P + \tau)}{P}$$

$$= \eta_s \times \frac{\Delta P}{P}$$

$$\Rightarrow \eta_d \times \frac{(\Delta P + \tau)}{P} = \eta_s \times \frac{\Delta P}{P}$$

$$\Rightarrow \Delta P = [\eta_d / (\eta_s - \eta_d)] \times \tau$$

• Substitute $\Delta P$ into $\Delta Q / Q$
Taxation-Inefficiencies

• Math behind the figures
  – Consider the case where consumers pay the tax

\[ \Delta Q / Q = \eta_s \times (\Delta P / P) \]

\[ \Delta Q / Q = \eta_s \times [\eta_d / (\eta_s - \eta_d)] \times \tau / P \]

\[ \Delta Q = (Q / P) \times [\eta_s \eta_d / (\eta_s - \eta_d)] \times \tau \]

\[ DWL = -0.5 \times (Q / P) \times [\eta_s \eta_d / (\eta_s - \eta_d)] \times \tau^2 \]
Taxation-Inefficiencies

- **Math behind the figures**
  - Consider the case where consumers pay the tax
  - **Marginal deadweight loss**: the increase in deadweight loss per unit increase in the tax

\[
MDWL = \frac{\partial DWL}{\partial \tau} = - \frac{Q}{P} \times \left[ \frac{\eta_s \eta_d}{(\eta_s - \eta_d)} \right] \times \tau
\]

- Marginal deadweight loss increases with the tax rate
Taxation-Inefficiencies

• Marginal deadweight loss increases with the tax rate
Taxation-Inefficiencies

- Deadweight loss and efficient tax systems
  - The government should tax the markets with no preexisting distortions such as externalities, monopolies etc.
Taxation-Inefficiencies

• Deadweight loss and efficient tax systems
  – Governments should ‘smooth’ tax rates over time due to increasing marginal deadweight loss
    • Instead of raising the taxes from 20% to 40% in one year and reverting back the following year, the government should raise tax rate by 1% for the next 20 years.
Taxation-Optimal Taxation

• **Optimal Commodity Taxation**
  – In order to raise a certain level of tax revenue, how should we tax the goods?
    • Ramsey’s rule of optimal commodity taxation
    • Set commodity taxes such that, for any $i$

\[
\frac{\text{MDWL}_i}{\text{MR}_i} = \lambda
\]
Taxation-Optimal Taxation

• Optimal Commodity Taxation
  – Ramsey’s rule of optimal commodity taxation
    • $\text{MDWL}_i$: the change in the deadweight loss with a unit increase in the tax rate of good $i$
    • $\text{MR}_i$: the change in the tax revenue raised with a unit increase in the tax rate of good $i$
    • $\lambda$: the social value of additional government revenues
    • $(\text{MDWL}_i / \text{MR}_i)$: marginal cost of taxation
    • $\lambda$: marginal benefit of taxation
Taxation-Optimal Taxation

• **Optimal Commodity Taxation**
  – Ramsey’s rule of optimal commodity taxation
    • For two goods $i$ and $k$, if

    $\frac{MDWL_i}{MR_i} > \frac{MDWL_k}{MR_k} = \lambda$

    • Lower the tax rate on good $i$ ⇒ marginal deadweight loss will decline
    • Lower the tax rate until the first quantity equals $\lambda$. 
Taxation-Optimal Taxation

• **Optimal Commodity Taxation**
  – Ramsey’s rule of optimal commodity taxation
    • If $\lambda$ is high $\Rightarrow$ the marginal benefit of an additional dollar of tax revenue raised is high
    • Increase the tax rates on all goods.
Taxation-Optimal Taxation

• **Optimal Commodity Taxation**
  – Ramsey’s rule of optimal commodity taxation
    • When we write it in terms of elasticities of demand

\[ T_i^* = - \left( \frac{1}{\eta_i} \right) \times \lambda \]

where \( T_i^* \) is the optimal tax for good \( i \) and \( \eta_i \) is the elasticity of demand for good \( i \).
Taxation-Optimal Taxation

• **Optimal Commodity Taxation**
  – Ramsey’s rule of optimal commodity taxation

\[ T_i^* = - \left( \frac{1}{\eta_i} \right) \times \lambda \]

– **Implications**
  • When elasticity of demand for a good is high, it should be taxed at a lower rate, since the cost of taxation will be high.
  • It is better to tax a wide variety of goods at a moderate rate than to tax very few goods at a high rate (tax-smoothing).
Taxation-Optimal Taxation

• **Optimal Commodity Taxation**
  – Ramsey’s rule of optimal commodity taxation
  – **Equity Implications**
    • Consider two goods: cereal (low elasticity) and caviar (high elasticity)
    • Ramsey’s rule implies that the government should tax cereal harsher than caviar.
    • Even though the outcome will be efficient, it will violate vertical equity.
    • Government should also take into account the redistributive effects of the taxation in addition to efficiency concerns.
Taxation-Optimal Taxation

• Optimal Income Taxation
  – In order to raise a certain level of tax revenue, how should we tax the individual incomes?
  – Basic model
    • Everyone in the society has the same utility function with diminishing marginal utility.
    • The total amount of income in the society is fixed.
    • Society has a utilitarian social welfare function.
  – Under these assumptions, the optimal tax system is on that leaves everyone with the same level of post-tax income ⇒ 100% marginal tax rate
Taxation-Optimal Taxation

• Optimal Income Taxation
  – General model
    • It is unrealistic to expect that individuals will not change their labor supply when faced with a higher income tax.
    • Higher income tax ⇒ lower labor supply ⇒ lower tax base (Laffer curve)
Taxation-Optimal Taxation

- Optimal Income Taxation
  - General model
    - Similar to optimal commodity taxation, we set the marginal benefit of taxation equal to the marginal cost.
    \[
    \frac{MU_i}{MR_i} = \lambda
    \]
    For two individuals \( i \) and \( k \), if
    \[
    \frac{MU_i}{MR_i} > \frac{MU_k}{MR_k} = \lambda
    \]
    increase the tax rate for individual \( i \) \( \Rightarrow \) decrease MU and increase MR (if on the ‘correct’ side).
Taxation-Optimal Taxation

- Optimal Income Taxation
  - General model
    - **Vertical equity:** Social welfare is maximized when those with high level of consumption are taxed more heavily and those with low level of consumption are taxed less heavily.
    - **Behavioral responses:** A tax rise on any group will reduce their labor supply and reduce the tax revenues.
Taxation-Optimal Taxation

• **Optimal Income Taxation**
  – *Example*

\[
\lambda = \frac{MU}{MR_{\text{Poor}}} = \frac{MU}{MR_{\text{Rich}}}
\]
Taxation-Optimal Taxation

• Tax-benefit linkages
  – Consider a workers’ compensation program (which provides reimbursement to the injured workers) financed by a payroll tax on employers.
    • Decrease the labor demand of employers at each wage level shifting the labor demand curve downwards.
    • The compensation, on the other hand, increases the labor supply since workers with ‘risky’ jobs will not ask their employers for compensation.
Taxation-Optimal Taxation

- **Tax-benefit linkages**
  - Consider a workers’ compensation program
Taxation-Optimal Taxation

• Tax-benefit linkages
  – Why doesn’t the employer provide the compensation?
    • Market failures: If the employer provides compensation, might attract accident-prone workers (adverse selection), increasing compensation costs.

  – The tax-benefit linkage is strongest when taxes paid are directly linked to a benefit for the workers.