Chapter 20
Tax Inefficiencies and Their Implications for Optimal Taxation

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Introduction

- Markets do not take taxes lying down.
- If there is some action that market participants can undertake to minimize the burden of a tax, they will do so.
- This is true both for consumers and producers.
- This lesson will illustrate how attempts to minimize tax burdens have efficiency costs for society.
- Since social efficiency is maximized at the competitive equilibrium (in the absence of market failures), taxing market participants entails deadweight loss.

TAXATION AND ECONOMIC EFFICIENCY
Graphical approach

- We now move from discussing the effects of taxation on equity to a discussion of its effect on efficiency.
- The focus therefore turns from prices to quantities.
- Consider the impact of a 50¢ per gallon tax on the suppliers of gasoline, illustrated in Figure 1.

![Figure 1](image.png)

**Figure 1**
The tax on gasoline shifts the supply curve.

- Before the tax was imposed, 100 billion gallons were sold. Afterwards, only 90 billion gallons are sold.
- Recall that the demand curve represents the social marginal benefit of gasoline consumption, while the supply curve represents the social marginal cost.
- SMB=SMC at 100 billion gallons
- Production less than that amount results in deadweight loss. Beneficial trades are not made because of the 50¢ per gallon tax.

Taxation and economic efficiency
Graphical approach

- The efficiency consequences would be identical regardless of which side of the market the tax is imposed on.
- Just as price elasticities of supply and demand determine the distribution of the tax burden, they also determine the inefficiency of taxation.
- Higher elasticities imply bigger changes in quantities, and larger deadweight loss.
- **Figure 2** illustrates that deadweight loss rises with elasticities.
Taxation and economic efficiency

Elasticities determine tax inefficiency

- With inelastic demand, there is a large change in market prices with consumers bearing most of the tax, but little change in quantity.
- With more elastic demand, market prices change more modestly and the supplier bears more of the tax. The reduction in quantity is greater, as is the deadweight loss triangle.

**Application**

Tax avoidance in practice

- In reality, there are many inefficient, tax-avoiding activities.
- For example, the Thai government levies a tax on signs in front of businesses, where the tax rate depends on whether the sign is completely in Thai (low tax), in Thai and English (medium tax), or completely in English (high tax).
- Many signs are in English, with a small amount of Thai writing!

**Application**

Deadweight loss in Thailand

- This formula for deadweight loss has many important implications:
  \[ DWL = -\frac{1}{2} \times \eta_p \times r^2 \times \frac{Q}{P} \]
- Deadweight loss rises with the elasticity of demand.
  - The appropriate elasticity is the Hicksian compensated elasticity, not the Marshallian uncompensated elasticity.
- Deadweight loss also rises with the square of the tax rate.
  - That is, larger taxes have much more DWL than smaller ones.
Taxation and economic efficiency
Determinants of deadweight loss

- This point about DWL rising with the square of the tax rate can be illustrated graphically.
- Marginal deadweight loss is the increase in deadweight loss per unit increase in the tax.
- See Figure 3.

![Figure 3](image)

Figure 3
The first $0.10 tax creates little DWL, ABC.
The next $0.10 tax creates a larger marginal DWL, BCDE.
The first $0.10 tax creates little DWL, ABC.

Taxation and economic efficiency
Determinants of deadweight loss

- As the tax rate doubles, from 10¢ to 20¢, the deadweight loss triangle quadruples.
- The area DBCE is three times larger than BAC.
The total deadweight loss from the 20¢ tax is DAE.
- As the market moves farther and farther from the competitive equilibrium, there is a widening gap between demand and supply. The loss of these higher surplus trades means marginal DWL gets larger.

![Figure 4](image)

Figure 4
In a market with a preexisting distortion, taxes can create larger (or smaller) DWL.

Taxation and economic efficiency
Deadweight loss and the design of efficient tax systems

- The insight that deadweight loss rises with the square of the tax rate has implications for tax policy with respect to:
  - Preexisting distortions
  - Progressivity
  - Tax smoothing

- Preexisting distortions are market failures that are in place before any government intervention.
- Externalities or imperfect competition are examples.
- Figure 4 contrasts the use of a tax in a market without any distortions and in one with positive externalities.
Taxation and economic efficiency
Deadweight loss and the design of efficient tax systems

- Imposing the tax in the first market, without externalities, results in a modest deadweight loss triangle equal to \( BAC \).
- When an existing distortion already exists where the firm is producing below the socially efficient level, the deadweight loss is much higher. The marginal deadweight loss from the same tax is now \( GEFH \).
- Of course, if there were negative externalities, such a tax would actually improve efficiency.

This insight about deadweight loss also demonstrates that a progressive tax system can be less efficient.

Consider two tax systems – one a proportional 20% payroll tax, and the other a progressive tax that imposes a 60% rate on the rich, and a 0% rate on the poor.

Figure 5 shows these cases.

Figure 5 increases with the square of the tax rate. Smaller taxes in many markets are better.

Low Wage Workers

High Wage Workers

Table 1 puts actual numbers to the picture.

In this case, a proportional tax is more efficient.

The large increase in deadweight loss arises because the progressive tax is levied on a smaller tax base. In order to raise the same amount of revenues on a smaller base, the tax rate must be higher meaning a higher marginal DWL.

This illustrates the larger point that the more one loads taxes onto one source, the faster DWL rises. The most efficient tax systems spread the burden most broadly. Thus, a guiding principle for efficient taxation is to create a broad and level playing field.
Taxation and economic efficiency

Deadweight loss and the design of efficient tax systems

- The fact that DWL rises with the square of the tax rate also implies that government should not raise and lower taxes, but rather set a long-run tax rate that will meet its budget needs on average.
- For example, to finance a war, it is more efficient to raise the rate by a small amount for many years, rather than a large amount for one year (and run deficits in the short-run).
- This notion can be thought of as “tax smoothing,” similar to the notion of individual consumption smoothing.

Application: The deadweight loss of taxing wireless communications

- An interesting applied example computing DWL is Hausman’s (2000) study of wireless communications. He found that:
  - The federal/state tax on wireless phones was as high as 25%.
  - There was 53¢ of DWL per $1 raised in revenue.

Fairly priced elastic commodity.

Imperfectly competitive market with high mark-ups.

Preexisting tax distortions.

Marginal DWL much higher – as high as 90¢ of DWL per $1 raised.

Optimal commodity taxation

- **Optimal commodity taxation** is choosing tax rates across goods to minimize the deadweight loss for a given government revenue requirement.
- The Ramsey Rule is:
  \[
  \frac{\text{MDWL}}{\text{MR}} = \lambda \Rightarrow t = \frac{\lambda}{\eta_0}
  \]
  - It sets taxes across commodities so that the ratio of the marginal deadweight loss to marginal revenue raised is equal across commodities.

Optimal commodity taxation

- **Ramsey rule**
  - The goal of the Ramsey Rule is to minimize deadweight loss of a tax system while raising a fixed amount of revenue.
  - The value of additional government revenues is the value of having another dollar in the government’s hands relative to its next best use in the private sector.

Optimal commodity taxation

- The inverse elasticity rule, which expresses the Ramsey result in a simplified form, allows us to relate tax policy to the elasticity of demand.
- The government should set taxes on each commodity inversely to the demand elasticity.
- Less elastic items are taxed at a higher rate.
Optimal commodity taxation
Equity implications of the Ramsey rule

- Two factors must be balanced when setting optimal commodity taxes:
  - The elasticity rule: Tax commodities with low elasticities.
  - The broad base rule: It is better to tax a wide variety of goods at a lower rate, because deadweight loss increases with the square of the tax rate.

- Thus, the government should tax all of the commodities that it is able to, but at different rates.

Price reform in Pakistan

- An interesting application of these rules is price reform in Pakistan.
- Deaton (1997) found that the Pakastani government was paying subsidies for wheat and rice, and was collecting taxes on oils and fats.
- The market conditions are summarized in Table 2.

<table>
<thead>
<tr>
<th>Good</th>
<th>Subsidy</th>
<th>Price</th>
<th>Elasticity</th>
<th>Policy Change</th>
<th>Welfare Gain</th>
<th>Include Distributional Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>40%</td>
<td>-0.64</td>
<td>Reduce subsidy</td>
<td>Small</td>
<td>Don’t reduce subsidy</td>
<td></td>
</tr>
<tr>
<td>Rice</td>
<td>40%</td>
<td>-2.08</td>
<td>Reduce subsidy</td>
<td>Large</td>
<td>Reduce subsidy</td>
<td></td>
</tr>
<tr>
<td>Oil/Fat</td>
<td>-5%</td>
<td>-2.33</td>
<td>Reduce tax</td>
<td>Large</td>
<td>Reduce tax further</td>
<td></td>
</tr>
</tbody>
</table>

Price reform in Pakistan

- The subsidies generate overconsumption of wheat and rice, and lead to particularly large efficiency losses for rice.
- The tax on oils/fats also generates deadweight loss.
- Using a framework similar to Ramsey’s, Deaton suggested a tax reform that would increase efficiency and be revenue neutral: reduce the tax on oils and fats, and make up for the lost tax revenues by reducing the subsidies to rice (especially) and wheat.

Deaton also found that distributional considerations might offset some of these conclusions.

- Wheat and fats/oils were consumed quite heavily by the poor, but rice was consumed fairly evenly throughout the income distribution. This suggests not to decrease the wheat subsidy on equity grounds.

OPTIMAL INCOME TAXES

- Optimal income taxation is choosing the tax rates across income groups to maximize social welfare subject to a government revenue requirement.
- A key concern in the analysis is vertical equity.
Optimal income taxes
A simple example
- Imagine we make the following assumptions:
  - Identical utility functions
  - Diminishing marginal utility of income
  - Total income is fixed
  - Utilitarian social welfare function
  - The optimal income tax system in such a case gives everyone the same level of post-tax income.
  - Implies marginal tax rate of 100% for those with above-average income.
  - The unrealistic assumption is that total income (labor supply) is fixed with respect to taxes.

Optimal income taxes
General model with behavioral effects
- More generally, there are equity-efficiency tradeoffs.
- Raising tax rates will likely affect the size of the tax base. Thus, increasing the tax rate on labor income has two effects:
  - Tax revenues rise for a given level of labor income.
  - Workers reduce their earnings, shrinking the tax base.
  - At high tax rates, this second effect becomes important.

Optimal income taxes
General model with behavioral effects
- The Laffer curve, which motivated the supply-side economic policies of the Reagan presidency is shown in Figure 7.
- If tax rates are too high and we are on the wrong side of the Laffer curve, lowering tax rates increases revenue.

Optimal income taxes
General model with behavioral effects
- The goal of optimal income tax analysis is to identify a tax schedule that maximizes social welfare, while recognizing that raising taxes has conflicting effects on revenue.
- The optimal tax system meet the condition that tax rates are set across groups such that:
  \[
  \frac{MU_i}{MR_i} = \lambda
  \]
- Where \(MU_i\) is the marginal utility of individual \(i\), and \(MR\) is the marginal revenue from that individual.

Optimal income taxes
An example
- As with optimal commodity taxation, this outcome represents a compromise between two considerations:
  - Vertical equity
  - Behavior responses
- Figure 8 shows that optimal income taxation equates this ratio across individuals, leading to a higher tax rate for the rich.
Optimal income taxes

The structure of optimal tax rates: Simulation exercise

- Simulation exercises are the numerical simulation of economic agents' behavior based on measured economic parameters.
- These are used to determine the optimal tax rates or other parameters of interest.
- Gruber and Saez (2000) considered a tax rate with:
  - Guaranteed income level (as with welfare)
  - Utilitarian SWF
  - Revenue neutral
  - Four income categories
- They weighed the equity-efficiency implications here; their results are presented in Figure 9.

Optimal income taxes

The structure of optimal tax rates: Simulation exercise

- Gruber and Saez (2000) found that marginal tax rates were highest on the poor and lowest on the rich, while average tax rates rose with income (because of the loss of the grant).
- Results of these sorts of exercises can be sensitive to the formulation of the SWF.

TAX-BENEFITS LINKAGES AND THE FINANCING OF SOCIAL INSURANCE PROGRAMS

- Tax-benefit linkages are direct ties between taxes paid and benefits received.
- Summers (1989) shows that such linkages can affect the equity and efficiency of a tax. The link between payroll taxes and social insurance benefits can lead the incidence to fall more fully on workers than might be presumed.
The key point of Summers’ analysis is that with taxes alone, only the labor demand curve shifts, but with tax-benefit linkages, the labor supply curve shifts as well.

That is, workers are willing to work the same amount of hours at a lower wage, because they get some other benefit as well, such as workers’ compensation or health insurance.

This is illustrated in Figure 10.

Wages adjust by more with the tax-benefit linkage, and employment falls by less.

Because of the smaller reduction in employment, deadweight loss is smaller than with a pure tax. The true “tax” is the difference between the statutory tax and the employee’s valuation of the benefit.

Figure 11 shows the case of full valuation of the benefit.

With full valuation, the cost of the program is fully shifted onto workers in the form of lower wages, and there is no deadweight loss or employment reduction.

This raises some issues with tax-benefit linkages, especially with respect to employer mandates.

If there is no inefficiency, why doesn’t the employer simply provide the benefit without government intervention?

Market failures, such as adverse selection, may be present. The employer that provides a benefit such as workers’ compensation or health insurance may end up with high risks.
### Tax-benefits linkages and the financing of social insurance programs: Issues raised

- When are there tax-benefit linkages?
  - They are strongest when taxes paid are linked directly to a benefit for workers.
  - This generates the rise in labor supply.
- There are a number of empirical studies that have examined the incidence of social insurance contributions on wages and employment.
- Gruber (1994) examines a quasi-experiment involving mandated maternity benefits, and finds full wage shifting and little effect on labor supply.