Optimal taxation is the term used to describe the design of tax systems to achieve a socially desirable redistribution of income while minimizing economic distortions caused by taxes. Optimal tax theory addresses such questions as, should the government use income or commodity taxes? within commodity taxes, how should tax rates vary across commodities? How progressive should the tax system be? The chief problem under the optimal taxation is to strike a correct balance between equity and efficiency.
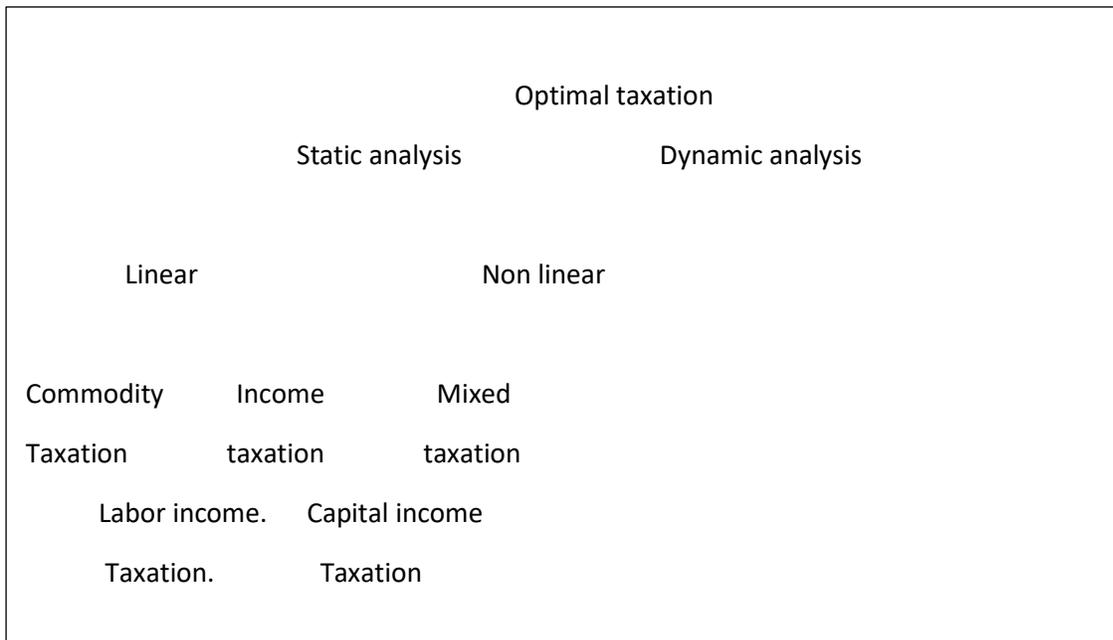
Optimal tax theory encompasses a range of models that focus on particular aspects of the tax system. Some of the Important considerations for determination of optimal taxation can be listed as follows.

1) Heterogeneity of taste and preferences among consumers
2) Differences in productivity and income earning ability of agents in economy
3) Market imperfections and Externalities

These different models of optimal taxation share three features.

1) Each model specifies a set of feasible taxes for the government, such as commodity taxes or capital income taxes or labour income taxes etc. or a mix of taxes of uniform or progressive character.
2) Each model specifies how individual and firms respond to Taxes. that is, individual have preferences about goods and Leisure, firms have a given technology for producing goods and, individuals and firms interact in a given market structure (often perfect competition).
3) The government has an objective function for evaluating different configurations of taxes. In the simplest models the government's objective function is to minimise the "excess burden" generated by the tax system while raising a set amount of revenue. The more complicated models, balance efficiency considerations with equity concerns.

Literature on optimal taxation can be categorised as mentioned below.

Optimal taxation

Static analysis   Dynamic analysis

Linear   Non linear

Commodity   Income   Mixed

Taxation   taxation   taxation

Labor income.   Capital income

Taxation.   Taxation

Frank Ramsey 1927 developed a theory for optimal commodity taxes in his article "A contribution to the theory of taxation" He was concerned with how commodities should be taxed to achieve are given revenue from a representative consumer

Ramsey problem

1) For a given amount of revenue to be extracted from consumer what tax system makes the consumer happiest
2) For a given level of happiness how can we extract how can we extract the the most revenue from a consumer.

The simplest version of Ramsey problem is a static model with a representative consumer (alternatively, the model could have many consumers with the with the same demand function or or preferences). The government's objective is to raise a given amount of revenue while minimizing the distortions (excess burden) created by the tax system.

Ramsey Model

Government impose taxes on uses of income in order to accomplish two objectives

1) Raise a set amount of total revenue
2) Minimise utility loss for agents in economy

Key assumptions

1) Linear demand
2) Lump sum taxation prohibited
3) Can not tax all commodities (leisure untaxed)
4) Production prices are fixed
5) Supply curves are perfectly elastic so that consumer bears the entire burden of taxes.

Derivation of Ramsey solution " Ramsey optimal tax rate formula"

The goal of the Ramsey rule is to minimize "dead weight loss" of a tax system while raising a fixed amount of revenue. So the problem is to minimize DWL (dead weight loss) subject to the revenue constraint.

Dead weight loss

Triangular area (DWL_i) under the demand curve corresponds to dead weight loss due to tax.

With demand curve of form $P = a - b*X$ and perfectly elastic supply at price C_i
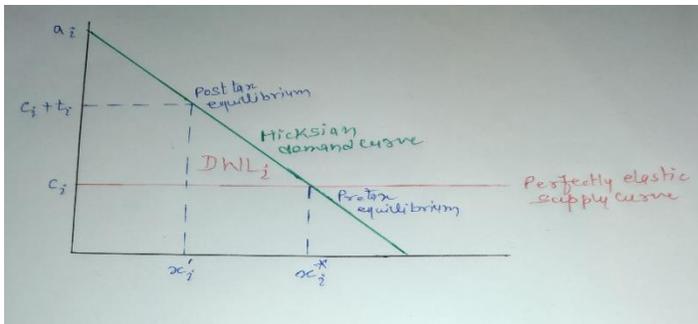
The pretax equilibrium price = Ci at which the equilibrium quantity is X*

Imposition of tax(ti) raises the post tax equilibrium price to Ci+ti which reduces equilibrium quantity demanded to x'i. Dead weight loss given by the area of triangle,

DWL = ½ * base * h

= ½ * (Ti*Ti/bi) * CiCi

Objective function

objective function

$$\min_{T_1, T_2, T_N} \sum_{i=1}^{N} DWL_i \quad s.t. \quad \sum_{i=1}^{N} T_i \geq [b]$$

The Lagrangian for Ramsey's problem is:

$$\mathcal{L} = \sum_{i=1}^{N} \frac{1}{2} b_i T_i^2 c_i^2 + \lambda \left[[b] - \sum_{i=1}^{N} T_i c_i \frac{a_i - c_i - T_i c_i}{b_i} \right]$$

$\underbrace{\quad}$ Sum of deadweight loss from each good

$\underbrace{\quad}$ Lagrangian multiplier from the govt. budget constraint

$\underbrace{\quad}$ sum of tax revenue of each good

Taking the first order condition w.r.t. T_i and solving for T_i

$$\frac{T_i c_i^2}{b_i} = \lambda e_i \frac{a_i - c_i}{b_i} - 2\lambda \frac{T_i c_i^2}{b_i}$$

Multiplying by $b_i/(a_i - c_i)$

$$T_i c_i \frac{c_i}{a_i - c_i} = \lambda c_i - 2\lambda T_i c_i \frac{c_i}{a_i - c_i}$$

$$T_i = \frac{\lambda}{1+2\lambda} \frac{a_i - c_i}{c_i}$$

$$\boxed{T_i = \frac{\lambda}{1+2\lambda} \frac{1}{E_i}} \quad \begin{array}{l} \text{Ramsey's} \\ \text{optimal tax} \\ \text{formula.} \end{array}$$

Inverse elasticity rule

By dividing Ramsey formula for any two goods i and j

$T_i / T_j = E_j / E_i$

It states that elastically demand goods should be taxed less and goods with inelastic demand be taxed more.

Arguments against Ramsey rule

The major criticism of the Ramsey rule is based on the observation that the demand for necessity goods is more inelastic than the demand for luxury goods. As a result a tax system that strictly follows the Ramsey rule might be somewhat regressive in nature, because necessity goods are likely to represent a higher percentage of household income for poorer households.

Corlett and Hague(1953) generalized Ramsey's model for more general preferences. They consider a representative household that consumes two goods and Leisure. The government can tax the two goods but not the leisure. The Corbett – Hague rule states that a good which is more complimentary with leisure should be taxed at a higher rate. The intuition is that, because leisure is untaxed goods, taxing goods that are complimentary to leisure, implicitly taxes leisure.

In Diamonds model (1971) the governments social welfare function is a weighted average of the utilities of individual consumers. The social welfare weights for the household could depend on the wellbeing of the household, with higher weights for Les advantaged households. Incorporating fairness into the Ramsey problem modifies the basic result so that the percentage reduction in goods consumed heavily by the households favoured by the government (often assumed to be poor households) is smaller than the percentage reduction in the goods consumed by households with lower weights in the social welfare function. Thus equity can be introduced in the optimal commodity tax system by having higher taxes on the goods consumed predominantly by the rich. This result accords with the the intuition behind many governments exempting necessities from their sales tax base. Because poor people spend a higher fraction of their income on necessities than rich people, the exclusion of necessities from the sales tax base adds fairness to the tax system. This exemption is counter to basic Ramsey rule because necessity goods demand is relatively price inelastic.

Diamond and Mirrlees (1971) generalized Ramsey's (1927) optimal tax analysis to heterogeneous individuals that differed in their wage rates but had same preferences. An important result from diamond and Mirrlees, is the "production efficiency theorem" which states that if the optimal commodity tax system is in place and if pure profits are all taxed away production efficiency should apply for the economy as a whole. This result is at odds with the Lancaster lipsey (1956) second best theorem which says that in the second best situation we cannot just say a anything on the nature of the optimum diamond and may release result intern says that when there is a a pre-existing distortion, introducing another distortion to the economy may improve welfare. Its implications are that taxes on producer inputs are eliminated. Thus promoting production efficiency. this means no taxes on (for example, investment goods, office space, fuel etc). The value added tax (VAT) used in most countries ensure that taxes on the the producer inputs are eliminated.

Naito (1999) shows that if profits cannot be fully taxed and or not all goods are taxed optimally then the theoretical case for production efficiency no longer applies. Naito in his model with nonlinear income taxation and public production shows that if the public good is produced using two types of labour, skilled and unskilled, then it is optimal to deviate from production efficiency in public production and use more unskilled labour relative to market equilibrium in public production the reason is that this increases the demand for unskilled labour. It increases their wage rate and reduces the burden to redistributive income by the distortive income tax.

It is difficult to observe the amount of purchases by individual consumers which would be needed to implement Nonlinear commodity taxation. General Nonlinear income tax systems allow marginal income tax to change continuously with the level of income. The problem facing the government is that people has different innate ability levels that the tax authorities can not observe. If the government could observe these ability levels, then it could levy Non distortionary individual specific taxes on ability. As a proxy for taxing ability, the government taxes income.

The mixed Taxation framework has attractive feature that it corresponds to the type of tax system actually used. When the government can use both direct and indirect taxes, what is the optimal mix of taxes. In most of the developed countries labor income is taxed on a nonlinear scale, whereas indirect taxation is linear. Deaton (1979) has shown that if preferences are weakly separable in goods and Leisure and exhibit linear Engels curves with the same slope for all individuals, then the optimal tax is a linear progressive income tax, commodity taxes are not needed.

Atkinson and Stiglitz (1980) show that commodity taxes are a relatively inefficient way of increasing the equity of a tax system that includes an optimally designed income tax. However there maybe administrative reasons for using indirect taxes.

One major consideration in designing an optimal tax system is how how taxes interact with market imperfections externalities surcharge pollution are are one of the the example of market imperfection that can affect optimal tax policy taxes on activities that create external can be E1 mechanism to reduce the economic inefficiency caused by externalities for example a tax on polluting may have the social benefit of reducing the level of pollution. Optimal tax model aimed at correcting externalities suggest that the optimal tax balances the marginal social damage from the externalities with the marginal benefit of the activity that generates the externalities. The optimal tax not necessarily eliminates the activity that generates the externalities, for example, even with an optimal tax there may still be some pollution.