

I. The Burden of Taxation

A. Taxation is the primary method by which governments finance themselves.

- i. Essentially all taxes transfer resources from the private to public sector, where government decision makers (both elected and unelected) will choose how those resources will be allocated between services and redistribution.
- ii. Essentially all taxes shift resources to the government by threatening current resource holders (property owners, labor, international trading firms, etc.) with punishments of various sorts if they do not "give" their resources to the government's tax collectors.
 - a In this sense, **all taxes are coercive at the point of collection.**
 - b This contrasts with government bonds and ordinary fees for services, because such transactions are voluntary at the point of collection. Bond buyers and public service purchasers feel better off after the purchase, whereas tax payers normally feel worse off after paying the tax (although better off than had they not paid and been placed in jail).
 - c (On the other hand, insofar as taxes are used to fund desired public services, taxation as a method of government finance can be regarded as voluntary in much the same sense that the amounts paid stores for their products can be regarded as voluntary. In such cases, voters prefer to "tax themselves" to pay for desired governmental services, rather than go without those services.)

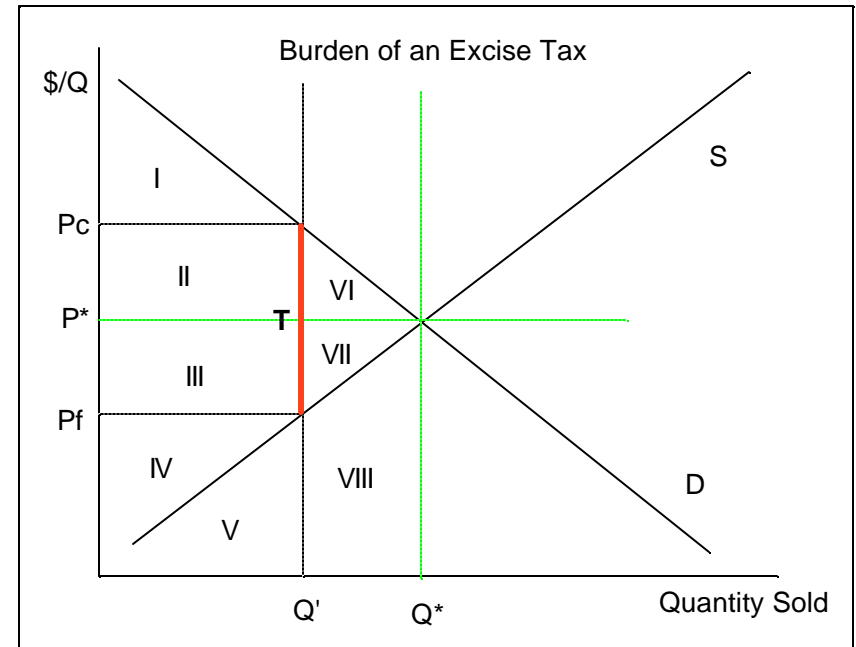
B. The burden of taxation can be measured in two ways:

- i. First, it can be calculated as a cash payment--in much the same way that payments for ordinary goods are calculated.
 - a (This is the most widely used measure by macro-economists, accountants, and newspaper reporters.)
- ii. Second, it can be calculated by determining the **losses** imposed on tax payers as a consequence of the tax--that is to say the *opportunity cost of the tax*.
 - a This representation of the burden of an excise or income tax can be measured as the **reduction of consumer surplus and profits** induced by the tax.
 - { (This measure of burden is the most widely used among microeconomists and public economists.)
 - b This differs a bit from the money paid to the government, because the existence of a tax often reduces the extent of market transactions.
 - { Most taxes have a **deadweight loss**, which can be measured as the extent to which "social surplus" is reduced by the existence of a particular tax, which as we will see depends partly on how the taxes are spent.

iii. The advantage of calculating the total burden of a tax as the change in surplus generated by that tax rather than tax payments is that tax payments are often made by persons or firms who are not directly mentioned in the tax code.

- a For example, sales taxes are "paid" by firms in the sense that firms (or firm owners) actually write the checks deposited in the government's treasury. Thus, calculated as cash payments, one could say that the burden of a sales tax falls entirely on firms.
- b On the other hand, if firms simply increase their prices to pay for the tax, which is what they appear to do at the cash register, then the tax burden has really been "shifted" forward onto their customers, even though consumers never actually write checks for sales taxes and send them into the treasury.
- c In many cases, the persons most affected by a tax are **not** the persons who "directly" pays the taxes by writing out a check to the treasury or IRS!

C. Illustration of the burden of an excise tax:

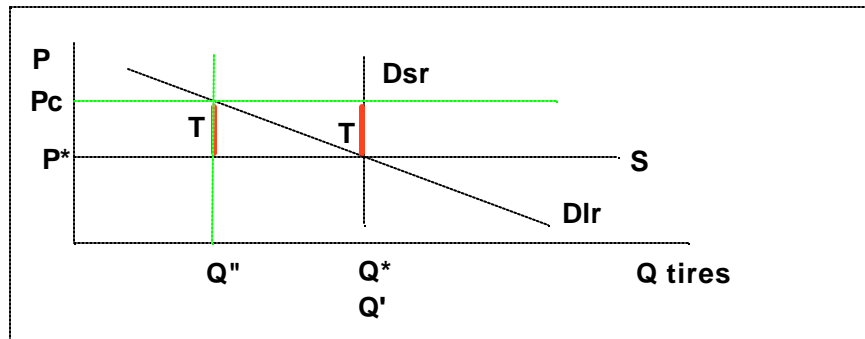
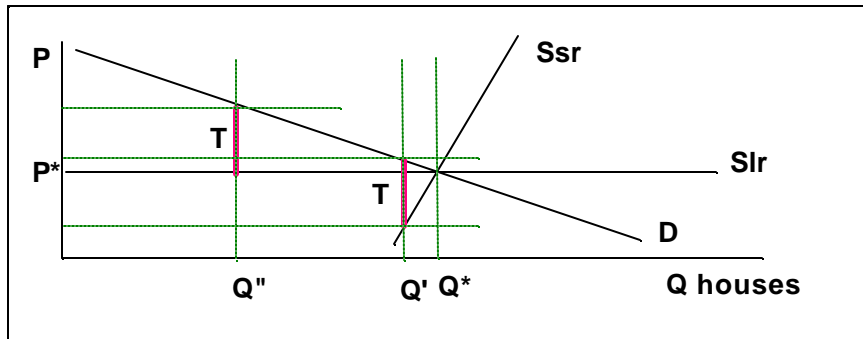


- i. Suppose that a market is initially in an equilibrium without taxes, so that demand equal supply at P^* . In this case, there is no "tax wedge" between the price paid by consumers, P_c , is the same as that received by firms, P_f ; so $P_f = P_c = P^*$.
 - a Now, suppose that an excise tax of T is imposed on each unit of the good sold in this market, as for example is done with tire sales in the US.

- b** After the tax is imposed, P^* is no longer a market clearing price:
- c** If T is simply added to P^* by firms, consumers will purchase too little at their new price ($P_c = P^* + T$) to match supply, which would remain at Q^* .
- d** On the other hand, if firms simply "ate" the tax, they would provide too little of the good (at their after tax price of $P_f = P^* - T$) to meet demand, which would remain at Q^* if $P_c = Q^*$.
- e** To clear the market, thus, firms have to receive less than P^* per item sold, and consumers have to pay more.
- f** At the new equilibrium output, the demand curve will be exactly T dollars above the supply curve, $Q_d(P_f + T) = Q_s(P_f)$.
- ii.** At the new equilibrium output depicted, supply equals demand, and the price paid by consumers is exactly T dollars higher than the amount firms receive ($P_f = P_c - T$). Note that Q' units of the good are sold, with $Q' < Q^*$.
 - a** At this equilibrium, there is a sense in which the tax has simply been passed onto consumers, because $P_c = P_f + T$.
 - b** However, there is another sense in which the **burden of taxation is shared** by firms and consumers, because both consumer surplus and profits have been diminished by the tax!
 - c** Consumer Surplus falls from area $I + II + VI$ (before the tax at Q^*) to just area I after the tax is imposed and output falls to Q' .
 - d** Similarly, Profit falls from $III + IV + VII$ (before the tax at Q^*) to area IV (after the tax at Q').
 - e** Thus, the burden on consumers is $II + VI$, and that on firms is $III + VII$.
 - f** Note that **this distribution of the loss of consumer and firm net benefits occurs regardless of who actually writes the check to the state or federal treasury.**
 - { Price movements ultimately determine the actual division of burden between firms and consumers.
 - { If firms send in the check, their effective "payment" is reduced by the increase in price paid by consumers.
 - { If consumers write out the checks, their effective "payment" is reduced by the price decrease absorbed by firms.
- iii.** The amount of revenue raised by the tax is T^*Q' .
 - a** Recall that Q' units are sold and each pays a tax of T dollars.
 - b** Consequently, the total tax revenue, TQ' , can be measured with area $II + III$ in the diagram.
 - { (Note that $II + III$ is the area of a rectangle T tall and Q' wide.)

- iv.** Note that this "cash" measure of the tax burden is smaller than the "surplus" measure of the tax burden.
 - a** The reduced profit plus the reduced consumer surplus equals $\{II + VI\} + \{III + VII\}$.
 - b** The total burden of this tax is $VI + VII$ larger than the tax revenue.
 - c** This area of "excess burden" is sometimes referred to as the **deadweight loss of an excise tax.**
- D.** Both the extent of the deadweight loss and the distribution of the tax burden vary with the slopes of the supply and demand curves.
 - i.** Generally, more of the burden falls on the side of the market with the least price sensitive curves.
 - a** If the demand curve is less elastic than the supply curve, more of the burden falls on consumers than on firms.
 - { In the extreme case in which market demand is completely inelastic or the industry supply curve is completely elastic, all of the burden falls on consumers!
 - b** On the other hand if the demand curve is very elastic, because good substitutes exist, or the supply curve is relatively inelastic then more of the burden tends to fall on the firm.
 - { In the extreme case in which the market supply of the product of interest is completely inelastic or consumer demand is perfectly elastic, all of the burden falls on suppliers.
 - ii.** The excess burden of a tax tends to increase with the price sensitivity (slope or elasticity) of the demand and supply curves.
- E.** Both supply and demand tend to be **more elastic in the long run than in the short run**, consequently, the excess burden of taxation tends to be larger in the long run than in the short run.
 - i.** In cases in which long run and short run demand are the same, the fact that long run supply is relatively more price sensitive (elastic) than short run supply implies that the burden of a new tax or increase in tax tends to be gradually shifted from firms to consumer in the long run.
 - { Many competitive markets have perfectly elastic supply curves in the long run, which implies that narrow taxes on such products are shifted entirely to consumers in the long run.
 - ii.** There are, however, also cases in which consumer demand is more price elastic in the long run than in the short run (as when demand for a good is determined in part by consumer capital goods, like automobiles).
 - { In such cases, a tax such as a gasoline tax may be gradually shifted from consumers to firms (owners of capital and natural resources) in the long run.

- iii. In cases where both sides of the market (firms and consumers) are more price elastic in the long run than in the short run, the shift of burden will reflect their relative ability to adjust.
- iv. However, all such long run adjustments imply that **deadweight losses** to narrow taxes, such as an excise tax, are **larger in the long run than in the short run**.
- v. Illustrations: effects of an excise tax in the short run and long run for different kinds of markets



- vi.
 - a Note that in the first case, supply is more elastic in the long run than in the short run, so the initial effect of the tax is largely on firms, but in the long run the burden is shifted to consumers.
 - { The after tax price falls at first for firms, but rises back to P^* .
 - { The price to consumers rises just a bit at first, but rises to $P^* + P_c$ in the long run.
 - b The second case is an unusual case where demand is more price sensitive (elastic) in the long run than in the short run, but because supply is completely elastic in both the long and short run, the burden falls entirely on consumers in both the short and long run.
 - c As an exercise, construct a case in which the burden falls entirely on firms in both the long and short run.

II. The Importance of Marginal Tax Rates

- A. These supply and demand diagrams are very useful ways to illustrate the burden of an excise tax, tariff, or other tax that can be represented in more or less “flat” per unit terms.
 - i. However, they are less useful for examining the impact of more complex taxes such as a progressive income tax.
 - v The taxes examined in the diagrams all had a constant tax rate, which implied that their average and marginal tax rates were essentially the same.
 - v In many cases, however, the marginal and average tax rates will differ, in which case it is the marginal tax rate rather than the average tax rate that is most important for predicting the impact of the tax on persons and markets.
 - ii. In such cases, one gains more insight into the effects of a tax by using indifference curve analysis or a bit of mathematics.
 - iii. Consider the following decision setting in which Al can work to earn money for goods available only in markets or engage in leisure.
 - a To simplify, assume that their H hours a day that can be worked and that Al is free to work as much or as little as he or she wants to.
 - v Also assume that work produces neither pleasure nor pain, but is simply a means of obtaining the desired market basket of consumption goods, C.
 - v Leisure, L, is assumed to be a good subject to diminishing marginal returns as usual..
 - b Hours worked are denoted W and the wage rate is w.
 - v So, income is $Y = wW$.
 - c The income tax schedule is $T = t(wW)$ or $T = t(w(H-L))$ with $T_Y > 0$.
 - v (Assume for convenience, that the entire burden of the tax is borne by Al.)
 - d Given all this, we can write down the optimization problem that characterizes Al’s labor-leisure choice:
 - v $U = u(L, C)$
 - v with $C = wW - T$ or $C = w(H-L) - t(w(H-L))$
 - e Both leisure and consumption are ordinary goods subject to diminishing marginal utility and have positive or zero cross-partials.
 - v $U_L > 0, U_C > 0, U_{LL} < 0$ and $U_{CC} < 0$ with $U_{CL} > 0$
 - f To simplify the math a bit, note that one can substitute the budget constraint for C into the utility function.
 - v This allows Al’s utility can be written either entirely in terms of leisure (L)
 - v or entirely in terms of hours worked W, if we also substitute for $L = H - W$.
 - g In the latter case: $U = u(H-W, wW - t(wW))$

h Differentiating with respect to W (the only control variable available to Al in this representation), we obtain the first order condition that characterizes Al 's optimal work day:

i W^* satisfies: $U_L(-1) + U_C(w - T_Y w) = 0$

v

v or $w(1 - T_Y)U_C = U_L +$

v

v $w(1 - T_Y)U_C$ is the marginal benefit of an hour worked (in utility terms) net of taxes

v U_L is the marginal opportunity cost of working (also in utility terms)

v

v A utility maximizing person will work at the point where his marginal increase in income [$w(1 - T_Y)$] times the marginal utility of income equals the marginal utility of leisure.

v

iv. It is important to note that it is the **marginal tax rate**, T_Y , rather than the average or total tax rate that affects Al 's decision.

v (In cases in which Al bears less than the full burden of the tax, it will be his or her effective marginal tax rate that affects behavior.)

v

III. Normative Principles of Taxation

A. Because there are a wide variety of ways to collect revenue for government purposes, and because economists like to be able to give advice on such matters, several normative principles have been developed by economists to allow them to rank alternative tax instruments.

i. Most of these normative theories assume that a given amount (T) is to be raised in revenue.

v Examples include: neutral taxes and Ramsay taxes.

ii. Others evaluate alternative tax rates by assessing their effects on income or economic growth rates.

v Such "minimal growth reducing" taxes might encourage work and capital accumulation relative to other taxes.

iii. Several other normative theories attempt to evaluate the overall fiscal package from the vantage point of the average or median taxpayer, or simply in terms of Pareto efficiency.

v Examples include: the Samuelsonian, Lindalsh, and Pigovian taxes.

v

iv. Note that in many cases these normative principles yield similar rankings of taxes and tax rates.

B. For example, it has long been argued that a tax system should not directly affect *relative prices* across markets.

i. That is to say, a tax system should be **NEUTRAL**.

a A perfectly neutral tax system would not affect private sector decisions across markets for private goods and services, because it would not affect relative prices faced by firms or consumers (although it does, of course, produce revenues for the government).

b In this case, a government that tried to finance itself via a system of excise taxes would impose excise taxes so that prices increased by the same proportion in every market taxed.

c Alternatively, the government could look for somewhat narrower tax sources that do not have relative price effects, such as a **lump sum** or **head tax**.

d (The logic of lump sum taxes and other neutral taxes can be illustrated a bit more easily using indifference curves and budget constraints, as is done in the Appendix below. However, the types of taxes that can generate a proportionate increase in all prices faced by consumers can clearly be illustrated with the tools developed above using demand and supply curves for several markets.)

C. Another normative theory of taxation was proposed by Frank **Ramsay** in 1927. He argued that a system of excise taxes should attempt to **minimize the excess burden** of the tax system.

i. A **Ramsay tax** system imposes higher taxes on markets with relatively inelastic supply and demand curves, and relatively lower taxes on markets with relatively large price sensitivities.

ii. The Ramsay tax can thus be examined using the diagrams worked out above that show excess tax burdens.

iii. Note that if markets with perfectly inelastic demand or supply curves exist, government services can be financed without any deadweight loss at all, if taxes on such goods can generate sufficient revenues.

a (Remember that taxes on products with inelastic supply or demand curves generate no deadweight losses.)

b A special case of such a tax is a tax on land--which is sometimes called a Georgist tax after Henry George who proposed financing government entirely with land taxes.

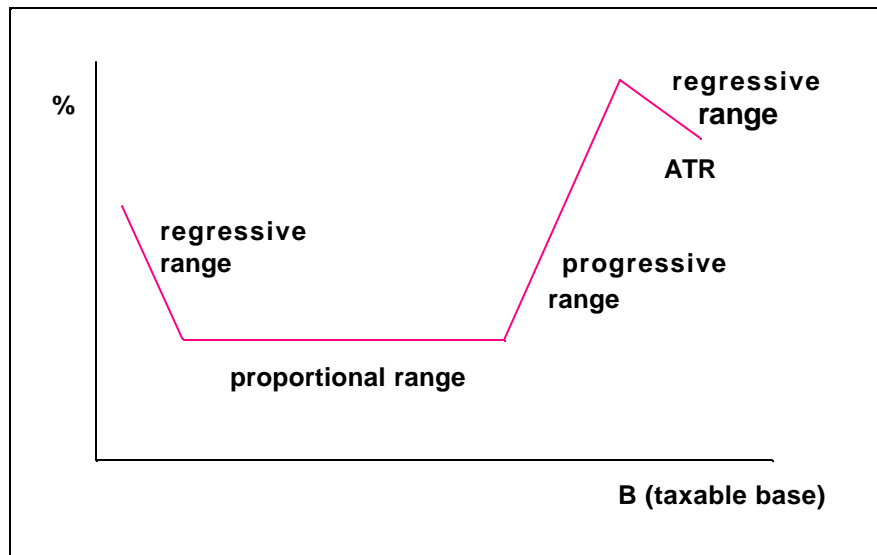
c The supply of land, after all, is perfectly inelastic (ignoring dikes and dumps).

d (Analyze the limitations, if any, of a Georgist land tax. Where does the value of a piece of land come from? Would there be allocative effects across different types of land?)

- e Would a Georgist land tax be neutral even if it is a Ramsay tax?)
 - f (Given the possibility of international emigration, can their actually be a tax that has no dead weight loss? Discuss.)
- D.** Other normative principles of taxation imply that one cannot determine the proper division of the tax burden without thinking about the services that will be provided.
- i. For example, Lindahl argues in favor of a **benefit tax**, that is a tax that imposes the greatest burden on those who receive the most valued services should pay the highest taxes.
 - ii. Under an ideal Lindahl tax system, each person's *marginal tax rate is set equal to the marginal benefits* she or he receives from government services.
 - v Notice that such a tax system assures that the result is both Pareto efficient and political stable in the sense that given the tax system, there is unanimous agreement about the optimal service level.
 - v (Illustration)
 - iii. James Buchanan (who won a Nobel Prize in economics while a professor at GMU, partly for his contributions to public finance) tends to agree with Lindahl.
 - a Buchanan argues that proper accounts of tax burden--should focus on net tax burden--that is, they should take account of the services financed by taxes as well as the taxes paid.
 - b For example, if a person receives an especially valuable service from the government, it is possible that his or her "true" net tax burden is negative. Others who receive no services of value, might have positive net tax burdens.
 - v Ideally, all citizens would bear "negative" tax burdens in the sense that each person should receive services that are considered to be more valuable than the taxes paid.
 - v Buchanan points out that most Western governments are very productive in the sense that a good deal of the wealth produced in a given nation state is affected by property rights, civil law, and public services--as well the taxes used to finance them.
 - v (We will take up the demand and supply of government services later in the course, when we develop a few public choice models of government policy making..)
- E.** Other normative principles of taxation come are rooted in social norms or political philosophies of various kinds--often dealing with **fairness** (or equity).
- i. John Rawls in this *Theory of Justice* argues that fiscal packages should be designed so that the welfare of the least well off person in society is maximized.

- ii. Others argue that taxation of persons should be based on their "ability to pay."
 - a This notion of fairness tends to imply progressive income taxes.
 - b For example, a "fair tax" might be one that caused all taxpayers should all sacrifice approximately the same "utility" (rather than net benefits) when they pay their taxes.
 - { Since the marginal utility of money tends to be smaller for rich persons than poor persons, more money would be collected from rich persons than from poor persons.
 - { This notion of fairness often plays an important role in policy debates over taxation in the US.
 - { "Progressivity" if often argued to be desirable, while "regressivity" is often argued to be undesirable--although these ideas are not universally accepted among normative tax theorists.
- iii. Others suggest that fairness requires all persons to pay be treated the same way under a tax system.
 - { (This notion of fairness tends to imply a flat tax--a proportional tax on income, or a heat tax. See Buchanan and Congleton (1998).)
- iv. **Definitions:**
 - a A **progressive tax** is a tax whose average burden increases as the taxable base owned by an individual increases. [Such taxes often have marginal tax rates that increase with the base (increase with income), although not all progressive taxes have this property. Most income tax systems in industrialized countries are somewhat progressive.]
 - b A **proportional tax** is a tax whose average tax burden does not change with income. (Such taxes normally have a constant marginal tax rate, as true of most sales taxes and some income taxes. A flat (proportional) tax on income has the form: $T = tY$.)
 - c A **regressive tax** is a tax whose average tax burden falls with income. Such taxes often have declining marginal tax rates with ownership of the taxable base, however, not all regressive taxes have this property. An example of a regressive tax in the US is the social security tax--which has a cap on taxable income.
- v. **Definitions and Relationships:**
 - a The **tax base**, B , is that which is taxed. (taxable income, sales of final goods and services, profits, property, gasoline, etc.)
 - b The **average tax rate** of a particular tax often varies with an individual's holding of the taxable base. If an individual pays tax T_i on a holding of B_i , his average tax rate is B_i/T_i . (If $T_i = \$50$ and $B_i = 200$, the average tax rate for this tax is $50/200 = 0.25$ or 25%.)

- c The **marginal tax rate** of a particular tax is the change in taxes owed for a one unit increase in holdings of the taxable base, $\Delta T/\Delta B$. (So, if a tax payer earning 50,000/year pays a tax of 10,000 and a taxpayer earning 50001 pays a tax of 10,000.50, his or marginal tax rate is $0.50/1 = 50\%$. Fifty percent of each additional dollar earned is taken from the "last" dollar of income earned by a taxpayer earning 50,000/year.)
- d In a **diagram of tax** schedules. If MTR is above ATR, then that ATR curve will be rising (the marginal tax rate will be pulling the average up). If MTR is below ATR, then the ATR curve will be falling (the marginal tax rate will be pulling the average down). If the $MTR = ATR$, the ATR will be neither rising nor falling.
- e Since individual decisions are determined by marginal cost and marginal benefits at various quantities, **it is the marginal tax rate rather than the average tax that affects tax payer behavior.**
- f (Thus, one argument in favor of proportional, or indeed, regressive taxes, is that they may have smaller effects on economic activities than a revenue equivalent progressive tax.)



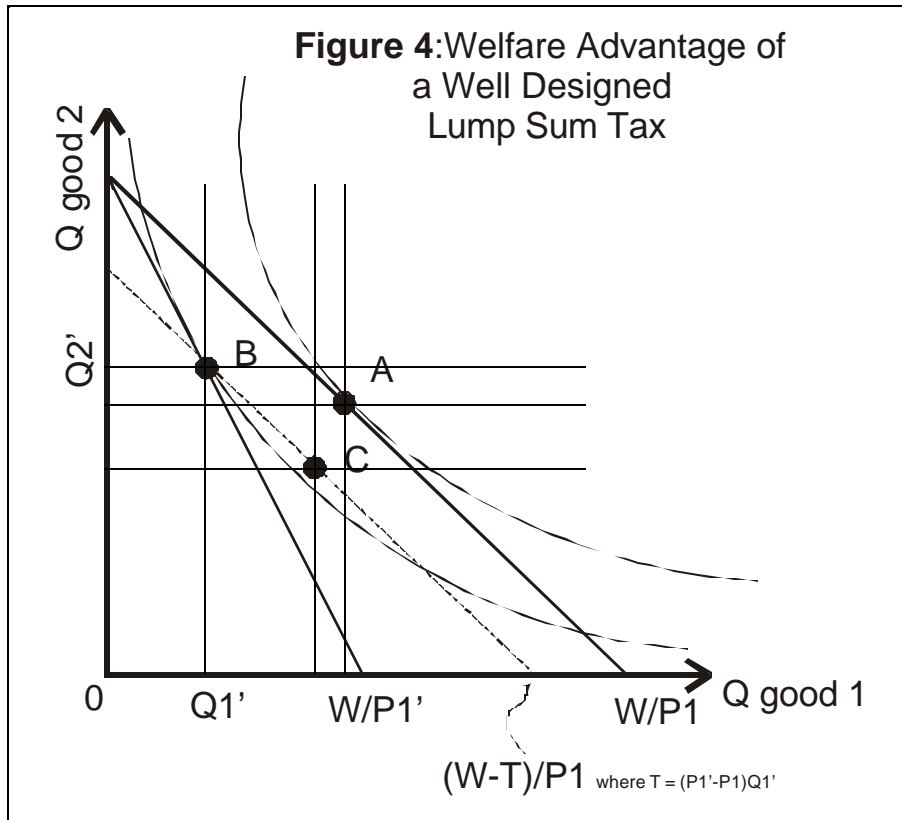
- F. (Peckman's estimates of the effective average and marginal tax rates faced by a typical American taxpayer, often look a bit like this odd tax schedule.)
- i. (As an exercise try to determine what the marginal tax schedule that corresponds to this average tax schedule looks like.)

- ii. (Explain briefly why Peckman finds regressive ranges of taxation at both the highest and lowest ranges of income.)
- G. Other normative tax theories are unconcerned with the fairness of the tax system and argue that a tax system should attempt to promote economic growth--or at least minimize the reduction in growth associated with raising a given amount of revenue.
- i. Such persons often favor consumption taxes in order to encourage saving and investment.
- ii. (The effects of a consumption tax on investment is easiest to illustrate with indifference curves and budget constraints, but the intuition behind the effect is simply based on supply and demand. If the price of saving falls relative to consumption, individuals will consume less and save more. And if savings increase, capital will be more rapidly accumulated, which leads to higher income levels and growth rates.)

IV. APPENDIX: Analysis of Tax Effects Using Indifference Curves

- A. The behavior affects of an excise tax can also be analyzed with indifference curves and budget constraints. Suppose that there are two goods, Q and X, both of which the consumer normally uses.
- i. Our previous analysis implies that the effect of an excise tax on a typical consumer is to raise the price of the taxed good from P^* to P_c .
- ii. This increase in price affects the location of each consumer's budget set.
- iii. It rotates the budget constraint from the untaxed end of the budget constraint and generates a new budget constraint that lies inside the original one at all points where the consumer purchases positive quantities of the taxed good.

iv. Illustration.



- v. Suppose that "A" is the original bundle consumed by this consumer.
- a In this drawing the tax has increased price of good 1 from P_1 to P_1' (this price effect is taken from a supply and demand diagram)
 - { In the case drawn, the new higher price causes the consumer to purchase bundle B instead of A. (Indeed, A is no longer feasible.)
 - { Note that had the same revenue been generated from a lump sum tax equal to $Q_1'P_1'$
 - b Such a tax, would have allowed the individual to purchase a bundle like C which is on a higher indifference curve (not drawn) than bundle B.
 - { This loss in utility (from being on a lower indifference curve) is another measure of the excess burden of a non-neutral tax on consumers.
 - c Again, much of the deadweight loss is a consequence of reduction in purchases of the taxed good, particularly that part which was generated by the "relative price" effect of the excise tax.

d You learned in micro economics that every price increase has both a (relative price) substitution effect and a wealth effect on purchases of the good whose price has increased.

{ Similarly every excise tax that affects consumer prices has both a (relative price) substitution effect and an income effect on purchases of the good whose price has increased because of a tax.

- B. The behavioral effect of a general tax and a lump sum tax tends to be smaller than that of an excise tax, because these taxes have only a wealth effect.
- i. A revenue neutral lump sum tax, a (neutral) general sales tax, and an income tax all shift each consumer's budget constraint towards the origin, but **these taxes do not affect the slope** of the consumer's budget constraint.
 - v Consequently, general taxes and lump sum taxes tend to have a smaller effect on behavior than excise taxes that raise the same amount of revenue. (There is no "substitution effect.")
 - ii. To see this, *calculate the slope of the budget lines for lump sum, sales and income taxes.*
 - a Recall that slope is "rise over run."
 - b In the case without taxes, the slope of the budget line is $-(W/P_1) / (W/P_2)$, which simplifies to $-P_2/P_1$.
 - c In the case of a lump sum tax, the endpoints of the new budget line are $(W-T)/P_2$ and $(W-T)/P_1$. The slope of the new budget constraint is $-[(W-T)/P_1] / [(W-T)/P_2]$ which equals $-P_2/P_1$. (Show this algebraically.)
 - d In the case of a an income tax, where W is treated as income, the after tax income is $(1-t)W$, so the endpoints of the new budget line are $((1-t)W)/P_2$ and $((1-t)W)/P_1$.
 - v The slope of the new budget line is: $-[(1-t)W]/P_1 / [((1-t)W)/P_2] = -P_2/P_1$.
 - e In the case of a general sales tax the new after tax prices will be approximately $(1+t)P_1$ and $(1+t)P_2$.
 - v (What assumptions about supply and demand are sufficient for this to be exactly true?)
 - v The slope of the new budget line will be $-[(W)/(1+t)P_1] / [((1-t)W)/(1+t)P_2]$, which again can be shown to equal $-P_2/P_1$.
 - f All three of these taxes are "neutral" with respect to the choice illustrated in our diagram.
 - v None of these taxes change the relative prices of goods 1 and 2. It remains $-P_2/P_1$ in each case..
- C. However, it bears noting that in some cases, the purposes of some taxes it to **change behavior**, as with Pigovian taxation.
- v In such cases, excise taxes and other "marginal" taxes will be more effective at altering behavior than lump sum or general taxes.