I. INTRODUCTION

This paper introduces the basic concept of deadweight loss and its relevance in the taxation. The term deadweight loss also known as the Harberger triangle is an economic concept that shows the excess burden to taxpayers resulting from the imposition of taxes. It is used to calculate the efficiency cost of taxes, government regulations and other market distortions. In addition, other basic economic concepts necessary to understand the basic concept of deadweight loss such as markets, supply and demand, elasticity and tax incidence are also discussed.

II. REVIEW OF BASIC ECONOMIC CONCEPTS

A. Supply and Demand

1. According to Gans, et al (2005), supply and demand is the first and most useful tool of analysis when studying government policies. The simple model of supply and demand is at once a reminder of how resources are guided by prices and a device for the analysis of public policy. Meanwhile, the terms supply and demand refer to the behavior of people as they interact with one another in the market and are the forces that make the market economies work. Market, on the other hand, is a group of buyers and sellers of a particular good or service. The buyers as a group determine the demand for the product, and the sellers as a group determine the supply of the product. With regard to this, price and quantity are determined by all buyers and sellers as they interact in the market place.

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B. The Law of Demand

The quantity demanded of any good or service is the amount of the good that buyers are willing and able to purchase. There are many things that determine the quantity demanded of any good, but when analyzing how the markets work, one determinant plays a central role – the price of the good. In addition, quantity demanded is negatively related to the price because the quantity demanded falls as the price rises and rises as the price falls. This relationship between price and quantity demanded is true for most goods in the economy and, in fact, is so pervasive that economists call it the law of demand. Other things being equal, when the price of a good rises, the quantity demanded of said good falls.⁴

Meanwhile, the market demand is the sum of all the individual demands and a change in price is represented by a movement along the demand curve. The downward sloping line relating price and quantity demanded is called the demand curve.

C. The Law of Supply

The quantity supplied of any good or service is the amount that sellers are willing and able to sell. There are many determinants of quantity supplied, but once again price plays a special role in the analysis. Quantity supplied is positively related to the price of the good. Thus, the law of supply means that when the price of a good rises, the quantity supplied of said good also rises, and when the price falls, the quantity supplied falls as well.⁵

Market supply is the sum of the supplies of all the sellers and price also represents a movement along the supply curve. The upward sloping line relating price and quantity supplied is called the supply curve.

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D. Supply and Demand Together

Supply and demand together determine the prices of the economy's many different goods and services; prices in turn are the signals that guide the allocation of resources\(^6\) where the **equilibrium** is the point where the demand and supply curves intersect. The **equilibrium price** is the price where the two curves cross and the **equilibrium quantity** is the quantity where the two curves cross.

At the **equilibrium price**, the quantity of the goods that buyers are willing and able to buy exactly balances the quantity that sellers are willing and able to sell.\(^7\) The equilibrium price is sometimes called the **market-clearing price** because at this price, everyone in the market is deemed satisfied - buyers have bought all they want to buy, and sellers have sold all they want to sell.

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\(^6\) Gans, et al, p.78.

\(^7\) Gans, et al, p.72.
A movement along a fixed supply curve is called a change in the quantity supplied, and a movement along a fixed demand curve is called a change in the quantity demanded.

E. Elasticity

To measure how much supply and demand responds to changes in its determinants, economists use the concept of elasticity. Thus, elasticity is a measure of how much buyers and sellers respond to changes in the market conditions. It provides greater precision in analyzing supply and demand.

F. The Elasticity of Demand

The price elasticity of demand measures how much the quantity demanded responds to a change in price. It can be determined by using the formula below:

\[ \text{Price elasticity of demand} = \frac{\% \Delta \text{ in Quantity Demanded}}{\% \Delta \text{ in Price}} \]

Variety of Demand Curve

- Demand for a good is said to be elastic if the quantity demanded responds substantially to changes in the price. \(( >1 \) )

- Demand is said to be inelastic if the quantity demanded responds only slightly to changes in the price. \(( <1 \) )

- If the elasticity is exactly equal to 1, the quantity moves in the same amount proportionately as price, demand is said to have unit elasticity. \(( =1 \) )

Larger price elasticity implies a greater responsiveness of quantity demanded to price. The flatter the demand curve that passes through a given point, the greater the price elasticity of demand \((\text{elastic})\) while the steeper the demand curve that passes through a given point, the smaller the price elasticity of demand \((\text{inelastic})\).

G. The Elasticity of Supply

The price elasticity of supply measures how much the quantity supplied responds to changes in the price structure. It can be determined by using the formula below:

\[ \text{Price elasticity of supply} = \frac{\% \Delta \text{ in Quantity Supplied}}{\% \Delta \text{ in Price}} \]
Variety of Supply Curve

- Supply for a good is said to be **elastic** if the quantity supplied responds substantially to changes in the price. ($>1$)

- Supply is said to be **inelastic** if the quantity supplied responds only slightly to changes in the price. ($<1$)

- If the elasticity is exactly 1, the quantity moves in the same amount proportionately as price, supply is said to have **unit elasticity**. ($=1$)

The elasticity of supply depends on the flexibility of sellers to make changes in the amount of the goods they produce. Hence, larger price elasticity implies a greater responsiveness of quantity supplied to price. With regard to this, the flatter the supply curve that passes through a given point, the greater the price elasticity of supply (**elastic**), while the steeper the supply curve that passes through a given point, the smaller the price elasticity of supply (**inelastic**).

### III. TAXES AND TAX INCIDENCE

**Tax incidence** is the study of who bears the burden of a tax\(^8\) or the manner in which the burden of a tax is distributed among various economic units – consumers, producers, employers, employees and so on.\(^9\)

Taxation or the imposition of taxes on the other hand, is a system of coercively collecting revenues from individuals who will tend to resist\(^10\) and will result to a change in market equilibrium because it increases the price that buyers pay but decreases the price sellers receive. However, the actual tax burden does not always fall on those who are statutorily liable to pay the tax (the legal assignment is called statutory incidence) and it depends on who is best able to change his/her behavior in response to the tax. Economic analysis indicates that the actual burden of a tax is independent of whether it is statutorily placed on the buyer or seller.

The incidence of a tax depends on the responsiveness of buyers and sellers to a change in price. The burden of a tax (incidence) tends to fall more heavily on whichever side of the market has the least attractive options elsewhere; or less sensitive to price changes.

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Simply put, the burden tends to fall on the side of the market that is less elastic because that side of the market can respond easily to the tax by changing the quantity bought or sold.\footnote{EconPort, “Elasticity and Taxes, Tax Incidence.”}

A tax imposed on buyers will shift the demand curve to the left because it increases the price to the buyers and reduces the quantity demanded while the supply curve is not affected. The effect of this tax can be seen by comparing the equilibrium without the tax and the equilibrium with the tax. Notice in Figure 4 that the demand curve shifts downward by exactly the size of the tax. Thus, the tax imposed on buyers discourage market activities because the quantity of the good sold is smaller in the equilibrium with tax. In addition, buyers and sellers share the burden of tax because the equilibrium with tax shows that buyers pay more for the good or service, and sellers receive less.

**Figure 4. TAX ON BUYERS**

On the other hand, a tax imposed on sellers will also not affect the demand curve but will shift the supply curve upward because the tax on sellers raises the cost of producing and selling the good and making it less profitable at any given price; thus, reducing the quantity supplied at every price. In addition, the quantity supplied in the equilibrium with a tax is smaller as compared to the quantity supplied in the equilibrium without tax as shown in Figure 5.

**Figure 5. TAX ON SELLERS**
Notice that the tax imposed on buyers and sellers is equivalent because in both cases, the tax places a wedge between the price that buyers pay and the price that sellers receive. The wedge between the buyers' price and the sellers' price is the same, regardless of whether the tax is levied on buyers or sellers. In either case, the wedge shifts the relative position of the supply and demand curves. In the equilibrium with tax, buyers and sellers share the burden of the tax.

Moreover, a tax in a market with more elastic supply and relatively inelastic demand - that is, sellers are very responsive to the price of the good, whereas buyers are not very responsive, the price received by sellers does not fall much, so sellers bear only a small burden of the tax. In contrast, the price paid by buyers rises substantially, indicating that buyers bear most of the burden of the tax.

**Figure 6. TAX INCIDENCE: WHEN SUPPLY IS MORE ELASTIC THAN DEMAND**

![Graph showing tax incidence when supply is more elastic than demand]

On the other hand, a tax in a market with relatively inelastic supply and more elastic demand as presented in Figure 7 will show that when a tax is imposed on the market with these elasticities, the price paid by buyers does not rise much, and the price received by sellers falls substantially. Thus, sellers bear most of the burden of the tax. In this case, sellers are not very responsive to the price, whereas buyers are very responsive.

**Figure 7. TAX INCIDENCE: WHEN DEMAND IS MORE ELASTIC THAN SUPPLY**

![Graph showing tax incidence when demand is more elastic than supply]
In this regard, the tax burden falls more heavily on the side of the market that is less elastic. A small elasticity of demand means that buyers do not have good alternatives to consuming this particular good while a small elasticity of supply means that sellers do not have alternatives to producing this particular good. When the good is taxed, the side of the market with fewer alternatives cannot easily leave the market and must, therefore, bear more of the burden of the tax.

The formula to compute the fraction of the tax that is borne by demander and supplier\(^\text{12}\) is as follows:

\[
\text{Fraction borne by demander} = \frac{Es}{(Ed + Es)}
\]

\[
\text{Fraction borne by supplier} = \frac{Ed}{(Ed + Es)}
\]

Where: \(Es\) = Price Elasticity of Supply  
\(Ed\) = Price Elasticity of Demand

### IV. WELFARE ECONOMICS

**Welfare economics** is the study of how the allocation of resources affects economic well-being.

- Buyers and sellers receive benefits from taking part in the market.
- The equilibrium in a market maximizes the total welfare of buyers and sellers.

Central to the concept of welfare economics is consumer surplus - the amount that buyers are willing to pay for a good minus the amount they actually pay for it.\(^\text{13}\) It measures the benefit that buyers receive from a good as the buyers themselves perceived it and the benefit to buyers in participating in the market. Thus, consumer surplus is a good measure of economic well-being if policy makers want to respect the preferences of buyers.

The consumer surplus is the area below the demand curve and above the price. The reason is that the height of the demand curve measures the value buyers place on the good, as measured by their willingness to pay – measures how much that buyers value the good - for it. The difference between their willingness to pay and the market price is each buyer’s consumer surplus. Thus, the total area below the demand curve and above the price is the sum of the consumer surplus of all buyers in the market for a good or service.

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\(^{13}\) Gans, et al, p.128.
Figure 8. CONSUMER SURPLUS

On the other hand, a **producer surplus** is the amount a seller is paid minus the cost of production. It measures the benefits to sellers for participating in the market. Moreover, surplus is the benefit of having access to a commodity over and above the cost of producing it. The area below the price and above the supply curve is the producer surplus. The height of the supply curve measures sellers' costs, and the difference between the price and the cost of production is each seller's producer surplus. Thus, the total area is the sum of the producer surplus of all sellers.

Figure 9. PRODUCER SURPLUS

Consumer surplus and producer surplus are the basic tools that economists use to study the welfare of buyers and sellers in a market. To measure the economic wellbeing of a society, economists use the concept of total surplus which is the total value to buyers of the goods, as measured by their willingness to pay, minus the costs to sellers of providing those goods. There is efficiency when an allocation of resources maximizes total surplus.

On the other hand, the allocation of resources is not efficient when some of the gains from trade are not being realized. It is noted that the consumer surplus equals the area above
the price and under the demand curve and the producer surplus equals the area below the price and above the supply curve. Thus, the total area between the supply and demand curves up to the point of equilibrium represents the total surplus in the market.

Figure 10. TOTAL SURPLUS

In this regard, free markets allocate the supply of goods to the buyers who value them most highly, as measured by their willingness to pay and allocates the demand for goods to the sellers who can produce them at the least cost possible.

However, governments levy taxes to raise revenues to finance public activities. It is noted that a tax raises the price buyers pay and lowers the price sellers receive. In addition, a tax results in a change in market equilibrium because it places a wedge between the price that buyers pay and the price that sellers receive and because of this tax wedge, the quantity sold falls below the level that would be sold without tax. Hence, the size of the market for that good shrinks.

Figure 11. THE EFFECTS OF TAXES
Using Figure 12, the government’s tax revenue is represented by the rectangle between the supply and demand curves. The height of this rectangle is the size of the tax, $T$, and the width represents the quantity of the goods sold, $Q$. Thus, the tax revenue can be determined by computing the area of rectangle which is $T \times Q$.

**Figure 12. TAX REVENUE**

It is observed that the effect of a tax on economic behavior is important for three distinct reasons:

a. The behavioral response of taxpayers affects the revenue consequences of changes in tax rates and tax rules;

b. The effects on economic efficiency or deadweight loss depend on taxpayers compensated behavioral responses; and

c. Behavior is important in understanding the short-run macroeconomic consequences of tax changes on aggregate demand and employment.

In addition, for most forms of taxation, the amount paid is influenced by the actions people take because taxpayers respond to government policies.\(^{15}\) Taxes cause people to adopt less preferred action and, thereby, impose additional costs on them over and above the amounts they remit to the taxman.\(^{16}\) This is supported by one of the lessons of economics.

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\(^{16}\) Diewert, et al, p.7.
that people respond to incentives because people’s behavior may change when the costs or benefits change.\textsuperscript{17} That is the inefficiency that a tax creates as people allocate resources according to the tax incentives rather than according to the true costs and benefits of the goods and services that they buy and sell.

Moreover, there are two criteria by which economists measure the outcomes of tax policy:\textsuperscript{18}

a. Efficiency, which is traditionally the purview of economics, and does not involve ethical and normative judgments. Efficiency considers only how resources are allocated; and

b. Equity, which considers the distribution of resources. There is a need to refer to social norms and value judgments to get conclusions based on this measure.

Furthermore, one tax system is more efficient than another if it raises the same amount of revenue at a smaller cost to taxpayers. Meanwhile, taxes also impose two other costs, which well-designed tax policy tries to avoid or, at least, minimize:

a. The deadweight losses that result when taxes distort decisions that people make; and

b. The administrative burdens that taxpayers bear as they comply with tax laws.

Hence, the behavioral response of taxpayers affects the revenue consequences of changes in tax rates and tax rules while the effects of economic inefficiency or deadweight loss depend on taxpayers behavioral responses. With a tax, the quantity sold declines; therefore the loss in welfare represents a loss for consumers and producers who would have traded without the tax.\textsuperscript{19}

To illustrate the effects of the tax, there is a need to compare the welfare between before and after the tax was introduced in the market.

\textsuperscript{17} Gans, et al, p.6.


\textsuperscript{19} EconPort, “Elasticity and Taxes, Elasticity and Deadweight Loss”, http://www.econport.org/content/handbook/Elasticity/elasticitydeadweightloss.html, (9 November 2009).
Figure 13. CONSUMER SURPLUS, PRODUCER SURPLUS, TAX REVENUE AND DEADWEIGHT LOSS

Using Figure 13, the “without tax” scenario will show zero tax revenue for the government while the consumer surplus covers \(A+B+C\); and producer surplus includes \(D+E+F\). The total surplus for “without tax” scenario is \(A+B+C+D+E+F\). On the other hand, under the “with tax” scenario, tax revenue shows area \(B+D\) while consumer surplus and producer surplus are reduced to \(A\) and \(F\). The total surplus for “without tax” scenario is \(A+B+D+F\).

Consumer and producer surplus falls for two reasons. First, for units still purchased, the consumer pays a higher price. In addition, the tax raises the price higher than the willingness to pay for some units that were previously consumed, so these units are not purchased. On one hand, the producer gets a lower price for the units still produced and no longer produces some units because the surplus would be negative.

Table 1. EFFECTS OF A TAX ON WELFARE

<table>
<thead>
<tr>
<th></th>
<th>Without Tax</th>
<th>With Tax</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer Surplus</td>
<td>(A+B+C)</td>
<td>(A)</td>
<td>(-(B+C))</td>
</tr>
<tr>
<td>Producer Surplus</td>
<td>(D+E+F)</td>
<td>(F)</td>
<td>(-(D+E))</td>
</tr>
<tr>
<td>Tax Revenue</td>
<td>NONE</td>
<td>(B+D)</td>
<td>(+B+D)</td>
</tr>
<tr>
<td>Total Surplus</td>
<td>(A+B+C+D+E+F)</td>
<td>(A+B+D+F)</td>
<td>(-(C+E))</td>
</tr>
</tbody>
</table>

Deadweight loss reflects changes in economic behavior induced by the structure of the tax system. While collection and compliance costs may be substantial, they do not increase significantly with an increase in tax rates, as the size of the deadweight loss does.
In addition, the comparison between “with and without tax” scenarios would show that total surplus was reduced from A+B+C+D+E+F to A+B+D+F. The loss area of C+E is the deadweight loss due to tax. Furthermore, the cost of tax to taxpayers is not limited to the amount of tax but also includes the lost surplus. Thus, the total cost of tax to taxpayers is area B+C+D+E. It is worthy to note that B+D goes to the government coffers while C+E goes to no one.

Central Results in the Theory of Taxes\(^{20}\)

a. Except for limiting special cases, a tax has a non-zero deadweight loss;

b. The incidence (on buyers and sellers) of a tax is independent of whether the liability to pay the tax is on buyers or sellers; and

c. The relative incidence (on buyers and sellers) of a tax is determined by relative price elasticities of demand and supply.

As shown in Figure 13, the deadweight loss of a tax reduces the economic well-being of taxpayers in excess of the amount of revenue raised by the government.\(^{21}\) It is the inefficiency that a tax creates as people allocate resources according to the tax incentive rather than according to the true costs and benefits of the goods and services that they buy and sell.\(^{22}\) In addition, it harms the society because of taxpayer’s diversion of consumption from more taxed to less taxed goods.\(^{23}\)

V. DEADWEIGHT LOSS (DWL)

Deadweight loss is a loss to the economy with no offsetting gain because the overall deadweight loss reduces production, investment, and economic growth.\(^{24}\) It generates neither revenue nor gains for any other party. Simply put, it is composed of both welfare losses to buyers and sellers.\(^{25}\) Thus, it is often referred to as the excess burden of taxation. Also, the

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\(^{22}\) Ibid.

\(^{23}\) Chapter 4, “Putting Demand and Supply Curve Works”, p.1.


\(^{25}\) EconPort, “Elasticity and Taxes, Elasticity and Deadweight Loss”.

[Deadweight Loss and Taxation]
deadweight cost measures the value of the opportunities that are lost when taxes or regulations divert labor, land and capital from their best uses.\footnote{26}

Furthermore, deadweight loss is an efficiency term. It is the total cost to society of raising a certain amount of revenue. It is the additional cost imposed by the tax’s distortion of behavior.\footnote{27} However, some economists differentiate the terms deadweight loss and excess burden, the former being a general term that can be used to refer to trade restrictions, market failures, etc., while excess burden is used specifically when discussing taxes.\footnote{28}

How does deadweight loss arise?

a. Taxes often impose costs on the economy by reallocating resources from more productive uses to less productive ones.

b. In the absence of taxes, people would have done things differently. Taxes have made them worse off, not only by the amount of the taxes they must pay, but also causing them to shift away from their preferred patterns.

The size of deadweight losses is influenced by a range of factors but deadweight losses are likely to be greatest where the actions of producers and consumers are highly responsive to after-tax prices.\footnote{29} Hence, the size of deadweight loss depends on the price elasticities of supply and demand. It is noted that elasticities of supply and demand measure how much sellers and buyers respond to the changes in the price and therefore, determine how much a tax distorts the market outcome. Thus, the greater the elasticities of supply and demand, the greater the deadweight loss from a tax while the smaller the elasticities of supply and demand, the smaller the deadweight loss from a tax.

\begin{figure}
\centering
\includegraphics[width=0.5\textwidth]{deadweight_loss}
\caption{DEADWEIGHT LOSS WITH INELASTIC SUPPLY}
\end{figure}

\footnote{26} Dievert, et al, p.7.

\footnote{27} “Basic Welfare Economics and Optimal Tax Theory”, p.11.

\footnote{28} Ibid.

\footnote{29} Dievert, loc. cit.
Figure 15. DEADWEIGHT LOSS WITH ELASTIC SUPPLY

Figure 16. DEADWEIGHT LOSS WITH INELASTIC DEMAND

Figure 17. DEADWEIGHT LOSS WITH ELASTIC DEMAND
The deadweight loss equals the area of the triangle between the supply and demand curves. Figures 14, 15, 16 and 17 show the size of tax and deadweight loss. Notice that for a small tax, the deadweight loss is quite small. But as the size of the tax rises in Figures 18, 19 and 20, the deadweight loss grows larger and larger. Indeed, the deadweight loss of a tax rises even more rapidly than the size of the tax. The reason is that the deadweight loss is an area of a triangle, and an area of a triangle depends on the square of the size of the tax.\footnote{Gans, et al., p.154.}
To calculate the deadweight loss, the following steps can be followed:

a. Draw the supply and demand curves.

b. Calculate price and quantity demanded at market efficiency

c. Keeping supply constant, calculate the new quantity demanded and price after the tax has been applied or the inefficiency has been introduced.

d. Calculate deadweight loss using the equation:

\[ \text{DWL} = (0.5) \times (\text{Change in Price} \times \text{Change in Quantity Demanded}) \]

Calculation of deadweight loss is central to a number of policy questions including:

a. Which tax measures impose the least burden or costs?

b. How valuable do public projects have to be to cover the full costs of the revenue needed to finance them?

c. How much redistribution from rich to poor can society afford?

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Why is measuring deadweight loss important?

a. The deadweight loss measures the value of the opportunities that are lost when taxes divert resources from their best uses;

b. Taxes cause people to adopt less preferred actions and, thereby, impose additional costs on them over and above the amounts they remit to the taxman;

c. The failure to estimate the efficiency effects of alternative tax changes also leaves the policy process without the information that it needs. Thus, when policymakers fail to consider behavior, their policies may not generate the effects that they intend.

d. The central role of incentives in determining behavior is important for those designing public policy because it often alters the costs or benefits of private actions.

e. Understanding the magnitude and nature of the deadweight loss is important in assessing the true cost of increased government spending and for shaping the appropriate structure of taxes.\(^{33}\)

f. Efficiency calculations are central to the analysis that public finance economists bring to tax policy and to quantify the adverse effects of policy or translate them into reductions in economic inefficiency.

g. The full cost to the taxpayer per additional peso of tax revenue is central in determining whether public expenditure is warranted.\(^ {34}\)

h. Any sensible policy analysis of alternative tax structures should involve comparing the revenue, deadweight loss and distributional consequences of the alternative tax options\(^ {35}\).

Moreover, the concept that ideally a tax base should be as broad as possible has its origin in the observation that the deadweight loss increases with higher tax rates, at an increasing rate. Thus, the broader the tax base, the lower the tax rate and also the deadweight loss in the aggregate.\(^ {36}\)

Another important role of deadweight loss in tax studies is to determine the total costs of tax policy to taxpayers and its effects on the behavior of people that will be useful in revenue estimation of proposed tax bills. At present, the most common method of estimating


\(^ {34}\) Chapter 4, “Putting Demand and Supply Curve Works”.


tax revenue or loss is the static revenue estimate\textsuperscript{37} that refers to revenue estimates that assume no behavioral response.

In contrast, dynamic revenue estimates involve revenue estimates that recognize the impact of tax rates on taxpayers’ behavior even when they do not take into account long term effects as implied by the term “dynamic”. This reflects the changes in behavior of people due to tax induced distortions that will provide a better estimate of revenue or loss from a change in tax policy.

It is noted that tax on goods affects supply of and demand for a good because it reduces the quantity sold in a market. It causes deadweight loss, as the reduction in consumer and producer surplus resulting from a tax exceeds the revenue raised by the government. Thus, the measurement of economic efficiency and deadweight losses should be considered factors in tax policy analysis and part of revenue estimation that will consider the effects of taxes on revenue.\textsuperscript{38}

VI. SAMPLE COMPUTATION OF DEADWEIGHT LOSS FROM A TAX PROPOSAL

Assume that Congress is looking for a new source of additional government revenue and deemed it wise to impose a tax on Good X. The proposals are 10% of sales or PhP100 per unit specific tax. The following are the data on Good X for 2011.

<table>
<thead>
<tr>
<th>Market</th>
<th>Sales Revenues (in million pesos)</th>
<th>Units Sold (in millions)</th>
<th>Sales Revenues/Unit (in pesos)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good X</td>
<td>5,000</td>
<td>5</td>
<td>1,000</td>
</tr>
</tbody>
</table>

As shown in Figure 23, the equilibrium price and quantity of Good X is PhP1,000 per unit at 5 million units. It is noted that at equilibrium price, the quantity of the goods that buyers are willing and able to buy exactly balances the quantity that the sellers are willing and able to sell. Hence, the equilibrium price and quantity is the price and quantity where the curves cross.

\textsuperscript{37} Feldstein, “The Effect of Taxes on Efficiency and Growth”, p.12.

\textsuperscript{38} Ibid.
Figure 20. DEADWEIGHT LOSS WITH LARGE TAX

Below is the deadweight loss curve that shows the relationship between the size of the tax and the size of deadweight loss. Notice that as the size of the tax grows larger, the deadweight loss grows even larger.

Figure 21. RELATIONSHIP OF DEADWEIGHT LOSS AND TAX SIZE

The revenue curve also known as the Laffer’s curve shows the relationship between the size of the tax and tax revenue. It shows that tax revenue first rises, then falls as the size of the tax becomes larger.
Figure 23. MARKET FOR GOOD X WITHOUT THE TAX

Based on the given data, the new price and quantity demanded will be computed and compared to the price and quantity demanded before the imposition of tax to determine the deadweight loss arising from the envisioned tax policy. Moreover, traditional revenue estimate or the so-called "static estimate" will be computed and compared against the revenue estimates that consider changes in behavior because of the tax. Meanwhile, the rationale of computing the deadweight loss is to show the additional burden of taxation that is a gain to no one.

The "static estimate" is computed by just getting 10% of total sales revenue for ad valorem or by multiplying the P100 specific tax rate by total units sold. Thus, it assumes that taxes have no effect on consumer behavior. Simply put, the analysis of tax rate increases overstates the resulting revenue gains or revenue losses from tax rate reductions. Moreover, the same computation does not consider the additional tax burden due to the imposition of the tax. Thus, under the most common method of computing revenue estimates, the figures may be overstated for failure to consider changes in the decision that people make.

Using static estimates, the estimated revenue from the proposed 10% ad valorem and PhP100 per unit specific tax is PhP500 million. Notice that the sales revenue and units sold for Good X are the same before the imposition of the tax.

Table 3. ESTIMATED REVENUE UNDER THE 10% AD VALOREM AND P100 SPECIFIC TAX USING STATIC ESTIMATION*

<table>
<thead>
<tr>
<th>Particulars</th>
<th>10% Ad Valorem Tax</th>
<th>PhP100 Specific Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales Revenue (in million pesos)</td>
<td>5,000</td>
<td></td>
</tr>
<tr>
<td>Units Sold (in million)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Tax Rate</td>
<td>10%</td>
<td>100</td>
</tr>
<tr>
<td>Estimated Tax Revenue (in million pesos)</td>
<td>500</td>
<td>500</td>
</tr>
</tbody>
</table>

*(without considering the change in behavior due to an increase in price because of the tax).


Deadweight Loss and Taxation
On the other hand, considering the changes in the behavior of consumer because of the increase in price due to taxes will provide a more realistic revenue impact. To compute the revenue estimates that consider the change in behavior, the supply or the sales revenue will be held constant. The price after the tax will be computed by adding the rate of tax to the price before the tax. This is then used to compute the new quantity demanded after the tax or the estimated number of units sold after the tax. In this regard, the new quantity demanded and estimated tax revenue will be 4.55 million units and PhP455 million for both ad valorem and specific tax.

Table 4. REVENUE ESTIMATES UNDER A 10% AD VALOREM TAX AND PHP100 SPECIFIC TAX

<table>
<thead>
<tr>
<th>Particulars</th>
<th>10% Ad Valorem Tax</th>
<th>PhP100 Specific Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales revenue (in million pesos)</td>
<td>5,000</td>
<td>5,000</td>
</tr>
<tr>
<td>Volume of sales (in million Q1</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Sales revenue/unit (P1)</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>Add: Tax rate</td>
<td>10%</td>
<td>100</td>
</tr>
<tr>
<td>Cost to consumers (P2)</td>
<td>1,100</td>
<td>1,100</td>
</tr>
<tr>
<td>New quantity demanded</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Sales revenue/cost to consumer) (in million) Q2</td>
<td>4.55</td>
<td>4.55</td>
</tr>
<tr>
<td>Sales revenue/unit (P1)</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>New sales revenue (in million pesos)</td>
<td>4,550</td>
<td></td>
</tr>
<tr>
<td>Tax rate</td>
<td>10%</td>
<td>100</td>
</tr>
<tr>
<td>Estimated Tax Revenue (in million pesos)</td>
<td>455</td>
<td>455</td>
</tr>
</tbody>
</table>

Meanwhile, the deadweight loss from the proposal amounted to PhP22.50 million. It is observed that under both proposals, the quantity demanded, estimated revenue and deadweight loss are the same. This is because the amount of the tax are the same under both proposals.

Table 5. DEADWEIGHT LOSS UNDER A 10% AD VALOREM TAX AND PHP100 SPECIFIC TAX

<table>
<thead>
<tr>
<th>Particulars</th>
<th>10% Ad Valorem Tax</th>
<th>PhP100 Specific Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price 1</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>Price 2</td>
<td>1,100</td>
<td>1,100</td>
</tr>
<tr>
<td>Changes in Price</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Quantity Demanded 1 (in millions)</td>
<td>5.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Quantity Demanded 2 (in millions)</td>
<td>4.55</td>
<td>4.55</td>
</tr>
<tr>
<td>Changes in Quantity Demanded (In millions)</td>
<td>0.45</td>
<td>0.45</td>
</tr>
<tr>
<td>DWL (in million pesos)</td>
<td>22.50</td>
<td>22.50</td>
</tr>
</tbody>
</table>
On the other hand, it is worth pointing out that the revenue estimate after considering the changes in behavior of consumer due to the imposition of tax on Good X is lower at PhP455 million as compared to PhP500 million revenue using static estimate. The reason is that static revenue estimate did not consider the changes in the behavior of consumer due to the tax as compared to revenue estimate which considers the deadweight loss.

**Figure 24. MARKET FOR GOOD X WITH A 10% AD VALOREM TAX AND PHP100 SPECIFIC TAX AND ITS CONSEQUENT DEADWEIGHT LOSS**

![Diagram showing market for Good X with a 10% ad valorem tax and PHP100 specific tax and its consequent deadweight loss.]

Suppose the proposed specific tax is PhP150 per unit, the new quantity demanded under this tax level will be 4.35 million units and the estimated revenue is PhP652.5 million while the deadweight loss is PhP48.75 million. Notice that as the tax increases, the deadweight loss from a tax also increases.

**Table 6. ESTIMATED REVENUE UNDER A PhP150 SPECIFIC TAX**

<table>
<thead>
<tr>
<th>Particulars</th>
<th>PhP150 Specific Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sale revenue (in million pesos)</td>
<td>5,000</td>
</tr>
<tr>
<td>Units sold (in million) Q1</td>
<td>5</td>
</tr>
<tr>
<td>Sales revenue/unit (P1)</td>
<td>1,000</td>
</tr>
<tr>
<td>Add: Tax rate</td>
<td>150</td>
</tr>
<tr>
<td>Cost to consumer (P2)</td>
<td>1,150</td>
</tr>
<tr>
<td>New quantity demanded (Sales revenue/cost to consumer) (in million) (Q2)</td>
<td>4.35</td>
</tr>
<tr>
<td>Tax rate</td>
<td>150</td>
</tr>
<tr>
<td>Estimated Tax Revenue (in million pesos)</td>
<td>652.5</td>
</tr>
</tbody>
</table>
Table 7. DEADWEIGHT LOSS UNDER A PhP150 SPECIFIC TAX

<table>
<thead>
<tr>
<th>Particulars</th>
<th>PhP150 Specific Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price 1</td>
<td>1,000</td>
</tr>
<tr>
<td>Price 2</td>
<td>1,150</td>
</tr>
<tr>
<td>Changes in price</td>
<td>150</td>
</tr>
<tr>
<td>Quantity demanded 1 (in million)</td>
<td>5.00</td>
</tr>
<tr>
<td>Quantity demanded 2 (in million)</td>
<td>4.35</td>
</tr>
<tr>
<td>Changes in quantity demanded (in million)</td>
<td>0.65</td>
</tr>
<tr>
<td><strong>DWL (in million)</strong></td>
<td><strong>48.75</strong></td>
</tr>
</tbody>
</table>

Figure 25. MARKET FOR GOOD X WITH A P150 SPECIFIC TAX AND DEADWEIGHT LOSS

By comparing the estimated revenues and deadweight loss, policymakers can have a broader picture of the impact of imposing a tax on Good X. Imposing a 10% ad valorem tax or a PhP100 specific tax creates a smaller deadweight loss while imposing a PhP150 specific tax imposes a slightly larger deadweight loss. Revenue wise, the PhP150 specific tax is more appealing but it creates a 7.5% deadweight loss as a percent of revenue generated. This means that imposing a PhP150 tax on Good X will result to a PhP48.75 million in loss efficiency that could have a more favorable impact than the expected benefits of the government from the tax. Alternatively, the economy losses PhP0.05 for every PhP1.00 revenue under the 10% ad valorem tax or PhP100 specific tax and PhP0.075 for every PhP1.00 revenue under the PhP150 specific tax.
Table 8. SUMMARY OF ESTIMATED REVENUE, DEADWEIGHT LOSS AND RATIO OF DEADWEIGHT LOSS TO ESTIMATED REVENUE UNDER THE AD VALOREM AND SPECIFIC TAX REGIMES

(Amounts in million pesos)

<table>
<thead>
<tr>
<th>Particulars</th>
<th>10% Ad Valorem Tax</th>
<th>PhP 100 Specific Tax</th>
<th>PhP150 Specific Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Revenue</td>
<td>455</td>
<td>455</td>
<td>652.50</td>
</tr>
<tr>
<td>Deadweight Loss</td>
<td>22.50</td>
<td>22.50</td>
<td>48.75</td>
</tr>
<tr>
<td>Ratio of DWL to Revenue</td>
<td>5.00%</td>
<td>5.00%</td>
<td>7.50%</td>
</tr>
</tbody>
</table>

To sum up, the deadweight loss concept provides a measurement of the economic inefficiency due to the imposition of taxes and making it a part of the revenue estimation process will increase the accuracy of revenues estimates as compared to the use of static revenue estimate. In this regard, the revenue estimates of any proposed tax measure should include as much as possible the computation of deadweight loss to provide more accurate revenue estimates that consider the effect of taxes on the behavior of people and to enlighten fiscal policymakers about the real cost to taxpayers of any proposed tax and how to respond to such changes in behavior.