

commodity (e.g., clean air). This type of commodity is not traded in an organized market but it does have a value to society. The levels of this environmental commodity are assumed to be outside the control of the individual. Hence, the overall level of consumer welfare depends not only upon prices of market commodities and money income, but also upon the level of environmental commodities he consumes.

Where there are no markets and hence no prices, it is difficult to derive a demand curve. Demand is derived through other means as discussed in Sections 2 and 3. Again, the measure of consumer's surplus is the area under the demand curve. In this case, consumer's surplus is the total area since the price is zero. The change in consumer surplus would be measured by the change in quantity if, for example, visibility increases due to reduced LRTAP (Figure 7-7).

While willingness-to-pay is used to determine demand curves, this is not the real test of the value of visibility. However, it is an easier measure. The change in quantity has affected consumer utility, and the consumer effectively enjoys an increase in income.

We can therefore obtain a monetary measure of the welfare change, by considering the change in income which will have the same impact as the change in environmental quality. Here there are two measures -- compensating and equivalent surplus (denoted as CS and ES), depending upon which welfare position is used for the initial starting point for comparison.

Compensating surplus is the change in income which results in the same level of utility, given the change in quantity (Figure 7-8). Equivalent surplus is a change in income which produces a change in utility equal to the change in quantity, at the original quantity level.

## A.2 Producer's Surplus

The discussion thus far has been concerned with consumer's surplus as one measure of economic welfare. It is possible to define an analogous concept for producers in the economy. This is called producer's surplus. The concept of consumer's surplus is defined with respect to the consumer's demand curve. Producer's surplus is defined with respect to the producer's supply curve of the relevant commodity. Figure 7-9 presents a supply curve, which presumes that more of the output will be produced as price rises. Higher prices are required to cover increased production costs at higher output levels.

In Figure 7-9 a point  $(X_1, P_1)$  on the supply curve can be given two interpretations. For a given price  $P_1$ , the output  $X_1$  is the largest that the firm is prepared to supply at that price. For a given output  $X_1$ , the price  $P_1$  is the minimum price that the firm will accept for supplying  $X_1$ . In the market all units sell for the