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Marketing Concepts Applied to Recyclable Materials

by

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INTRODUCTION

Waste management is an increasingly important issue in the Twin Cities area. Over the past few years, landfill space has become scarcer resulting in higher tipping fees for waste handlers. One way to reduce the waste stream is through recycling. As more waste is recycled, landfill space is conserved, and fewer resources are needlessly wasted. Unfortunately, a very small amount of the waste stream is currently being recycled.

The present solid waste and recycling situation in the Twin Cities will not change unless vigorous actions are taken. Several options are available to increase recycling and landfill abatement. These policies fall into two broad categories: coercive, and market oriented. Coercive policies force individuals to abide by the use of punitive threats. These types of policies seem effective, but are often difficult to enforce and may be politically unpopular. Market oriented policies stimulate recycling by increasing the economic incentive to do so.

Some examples of coercive policies are listed below.

- Mandatory Source Separation. A law requiring individuals to separate waste in their homes for later retrieval. Violators of this law would assumably pay a fine or be denied disposal services.

- Container Deposit Program. A law forcing individuals to pay a deposit for beverage containers that is refunded when the container is returned.

- Recycling Tax. A tax paid by firms which is refundable if the firm abides by prescribed recycling regulations.

All of these policies have the common theme of forcing waste generators to curtail their waste output using the threat of monetary retribution. Advocacy propaganda and misinformation also play an important role with coercive policies. Unlike coercive policies, market oriented policies attempt to stimulate the demand for recycling, the supply of recyclable materials, and public awareness. Increased education about cost effective recycling and the environmental tradeoffs of alternatives to landfills will increase the supply of recyclable materials. Examples of these policies are listed below.

- Changing the Pricing System. Presently, individuals can dispose of an almost unlimited amount of waste for a set fee. The disposal cost of an additional bag of garbage is zero. If instead, individuals were charged on the basis of weight or volume, they would become more aware of disposal costs. This would lead to an increased demand for recycling services.

- Surtax on Tipping. An increase in "tipping fees"(the cost of emptying a garbage truck at a land fill). Obviously, the increase cost would be passed directly from the waste collector to the waste generator providing an incentive to reduce the amount of waste generated.

- Subsidizing Recycling Firms and Collection Efforts. Subsidizing the collection costs of currently existing recycling firms will enable them to collect material more frequently, thus increasing the convenience to individuals. Providing containers for individuals to separate materials would also increase convenience.

- Subsidizing the Creation of Output Markets. Recycling will not occur unless a market exists for the waste. By subsidizing transportation costs to existing markets, creation of new markets, and the technology to process waste, demand for recyclable materials will increase.

To wisely assess these policies, an understanding of economics is necessary. In this setting, the three main functions of economics described by Knutson et al.[1] are relevant.

1. It provides insight into the origin of economic problems. This insight can be traced from the aggregate or macro level. An understanding of the origin of problems is crucial to developing solutions.

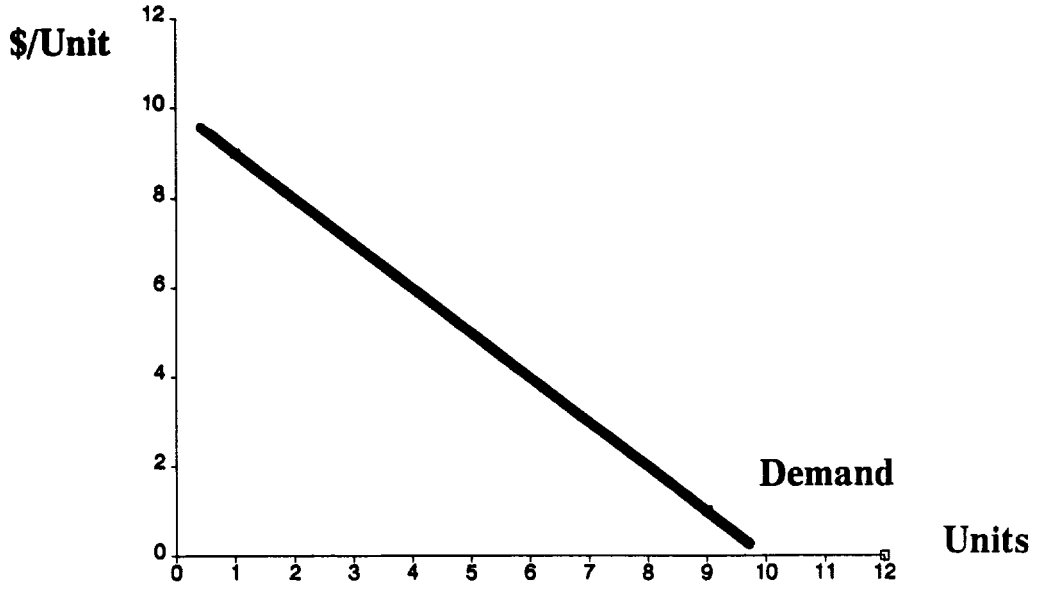
2. Economics assists in developing policy and program alternatives for solving problems.

3. Economics can be used to analyze the economic consequences of policies. It is an understanding of the consequences, more than anything else, that is crucial to wise public policy decision making.

This paper provides a concise overview of basic economic principles and their application to issues of waste recycling and disposal. The paper begins by outlining the principles of supply and demand. Next, a model explaining the economic behavior of a recycling firm is presented. Finally, the model is used to analyze selected recycling programs. This paper is not meant to be an exhaustive treatment of economics, or the issues of waste management and recycling. However, the paper does provide an explanation of the economic workings of recycling firms and programs.

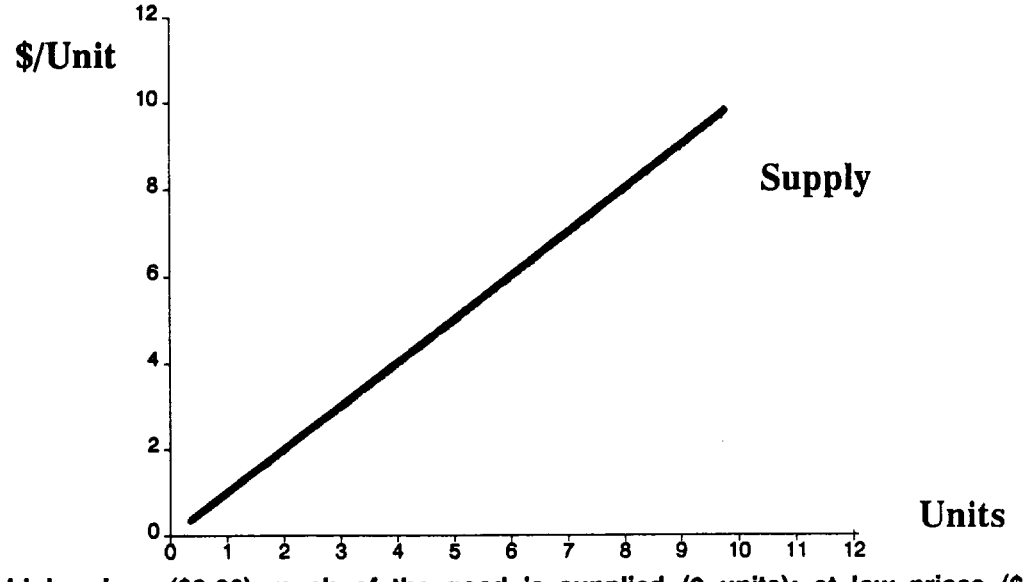
SUPPLY, DEMAND, AND PRICE DETERMINATION

One of the concepts central to understanding economics is supply and demand. Economists typically talk about the supply and demand of an "economic good". An economic good is anything that has value to a member of society. Solid wastes such as paper and aluminium cans are economic goods since they are potentially valuable. The law of demand states that consumers will buy more of a good at low prices than at high prices. From the consumers point of view, the price of a good and the quantity demanded are inversely related. The law of demand is portrayed in the graph that follows.



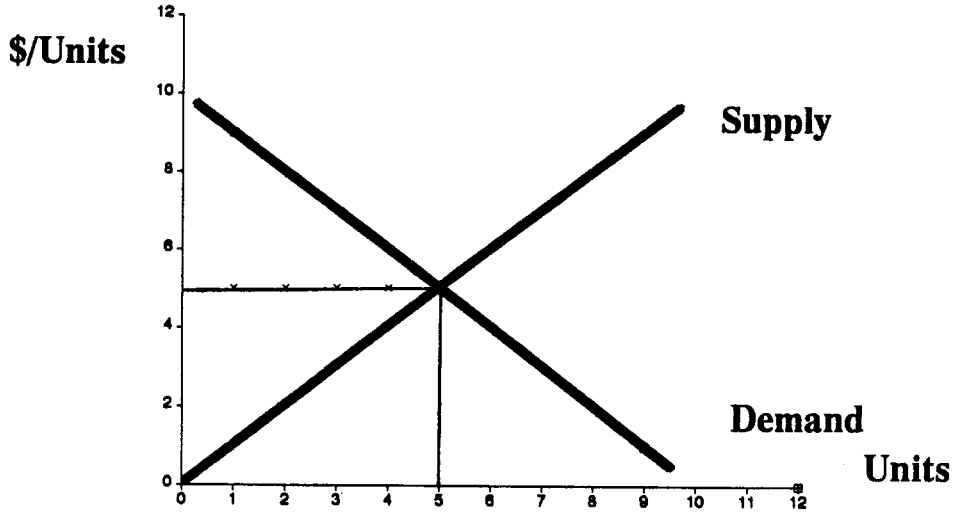
At high prices ($9.00) little of the good is demanded (1 unit); at low prices ($1.00) more of the good is demanded (9 units). For example, consider the good to be recyclable material (e.g. aluminium cans, newspaper, cardboard). The recycling firm's demand for this material depends on its net receipts for the material. Net receipts depend on the firms selling price less the cost of collection. For a given sales price, when collection costs are high, less of the good is demanded than when collection costs are low.

The law of supply states that producers are willing to supply more of a good at high prices than at low prices. From a producers point of view, the quantity of a good supplied and the price of that good are directly related. The law of supply is graphically expressed below.

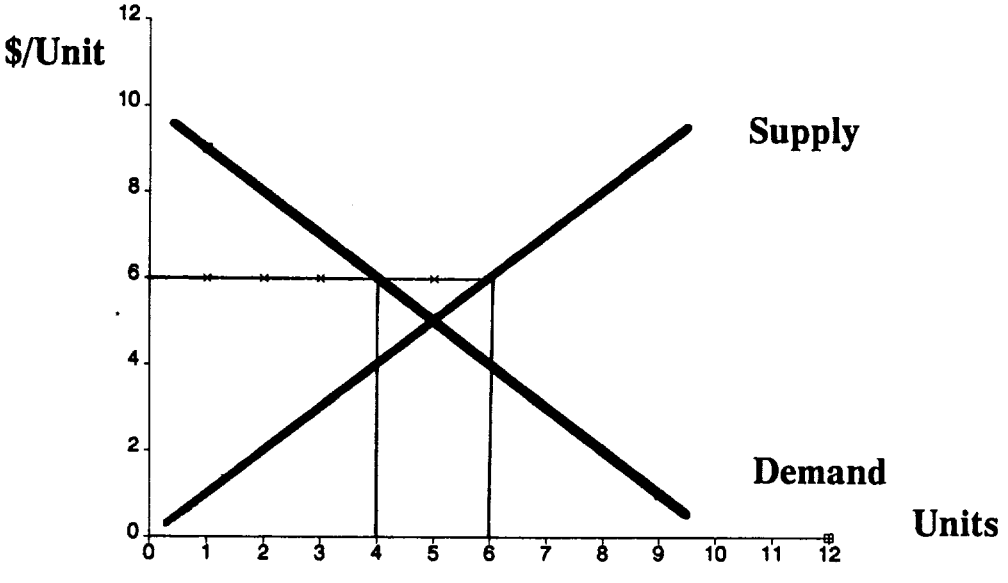


At high prices ($9.00) much of the good is supplied (9 units); at low prices ($1.00) less of the good is supplied (1 unit). Returning to the example, suppliers of recyclable material are the individual waste generators. From their point of view, the amount of recyclable material depends on garbage disposal costs, the alternative to recycling. If disposal costs are high, more material is supplied than if they are low.

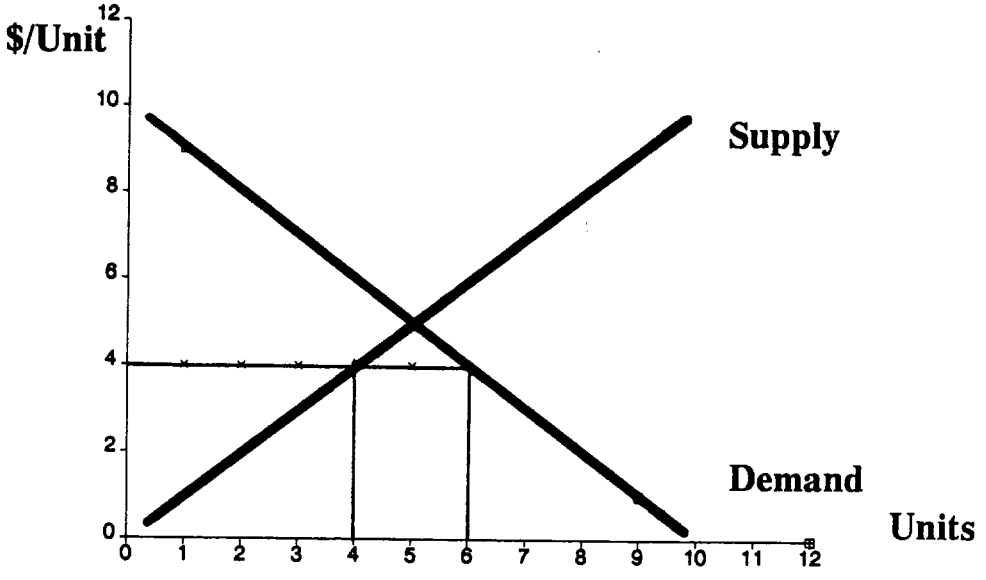
To determine the market price of the good, the amount demanded by consumers must equal the amount supplied by producers. This "equilibrium" price and quantity is determined by the intersection of the supply and demand curves discussed above. Placing the curves of the two graphs above onto the graph below reveals that the equilibrium price is $5.00, and the equilibrium quantity is 5 units. Notice that this price and quantity satisfies both the law of demand faced by consumers, and the law of supply faced by producers.



At times, markets are said to be "out of equilibrium". This means that the quantity demanded does not equal the quantity supplied. Two types of nonequilibruim situations can occur: surplus and shortage. The graph below reflects the surplus situation. At a price of $6.00, 4 units are demanded, but 6 units are supplied. The difference between the amount supplied and the amount demanded (2 units) is the surplus. During a surplus, suppliers will lower the price to attract more customers. Eventually, the price falls to a point where the market regains equilibrium.



The second nonequilibruim situation, shortage, is shown below. At a price of $4.00, the amount demanded is 6 units and the amount supplied is 4 units. The difference between the amount demanded and the amount supplied (2 units) is the shortage.During a shortage, consumers of the good bid the price up causing more to be supplied. Eventually, the price rises to a point where the market regains equilibrium.



CHARACTERISTICS AND FUNCTIONS OF A MARKET

A market is an institution through which price making forces operate. Market determined prices serve as a link between buyers and sellers of a particular good. On the buyers (demand) side, the price determines who will buy a particular good and how much will be purchased. On the sellers (supply) side, the price determines who will supply the good and how much will be supplied.

Markets are commonly classified by their structure. Market structure describes the number of buyers and sellers in the market, the similarity of the product, and the ease with which firms can enter and exit the market. Three broad classifications of market structure are: perfect competition, oligopoly, and monopoly. Each of these types of market structure are briefly described below.

The perfectly competitive market contains many sellers who sell an identical product. Since each firm produces a small fraction of the total amount supplied in the market, it cannot influence the output price. Agriculture serves as an example of this market structure. Many farms exist that produce a homogeneous product. Since the individual farmer produces only a tiny fraction of the total amount sold, he cannot influence price. As another example, consider a generator of recyclable waste. The waste generator can sell recyclable waste to a recycling firm, but he cannot influence the price he receives.

Oligopolistic markets have a few large "dominant" firms producing similar, but slightly different products. These firms tend to react to changes in the pricing policies of their competitors. As a result, oligopolists often compete with one another on non-

price terms. Prices in these markets are usually stable over long periods of time. For example, American auto makers exhibit oligopolistic behavior. A few large firms exist producing slightly different products. These firms compete with one another using non-price incentives such as extended warranties and low financing rates. A mirror image of the oligopolistic market is the oligopsonistic market. This type of market contains many sellers, but few buyers of a certain good. Like the oligopolistic market, the oligopsonistic market tends to be characterized by prices that are fixed for long periods of time. Purchasers of recyclables act as oligopsonists.

A monopoly is a market containing a single producer of a good. An example of a monopoly is a utility company which is the sole supplier of electricity or natural gas. Conversely, a monopsony is a single buyer of a particular good. As an example, the U.S. government is a monopsonistic buyer of nuclear missiles.

A MODEL OF THE MARKET STRUCTURE OF RECYCLING FIRMS

This section ties together the concepts discussed above to describe the type of environment in which a recycling firm operates. The term recycling firm is used loosely to describe any firm that purchases or collects waste from individual waste generators and then cleans or processes it for sale in another market. To discuss market structure, two important sides of the firm need to be considered: the input side and the output side. The output side describes the type of market the firm faces when selling the cleaned or processed waste (the output). The input side describes how the recycling firm obtains materials to be cleaned or processed (the input).

Recycling firms face a competitive market on the output side. Even though there may be few recycling firms in a given area, many exist nationwide. Aside from competing with other recycling firms, these firms also compete with producers of virgin material. For example, the market for scrap paper is closely tied to the market for virgin paper. Therefore, the price that recycling firms receive for their output is given. Recycling firms are price takers in the output market; they are unable to influence the prices they receive. Output prices are determined by the intersection of the supply and demand for the material at the national or regional level.

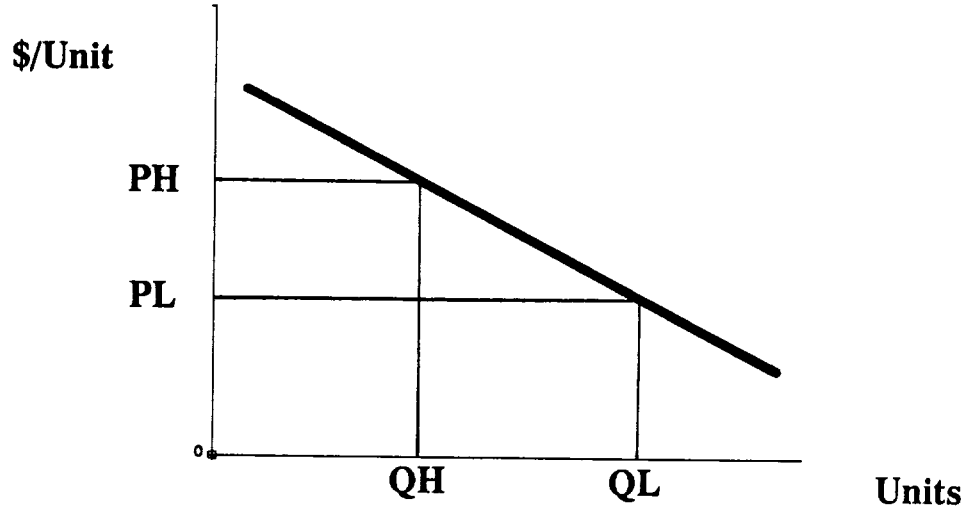
The input side of recycling firms is much different. Few recycling firms, and an almost unlimited number of waste generators (suppliers) exist at the local level. Therefore, the market that recycling firms face when purchasing solid waste is imperfectly competitive (oligopsonistic). Firms that buy solid waste have some ability to set price. This ability is termed market power. The price will normally be set so that the buyer acquires an adequate supply, and makes a profit. The input pricing policy of a firm that is imperfectly competitive in the input market, but perfectly competitive in the output market is slightly more complicated than simply equating supply and demand. The next few paragraphs discuss how recycling firms theoretically operate.

Three concepts determine how a recycling operates:

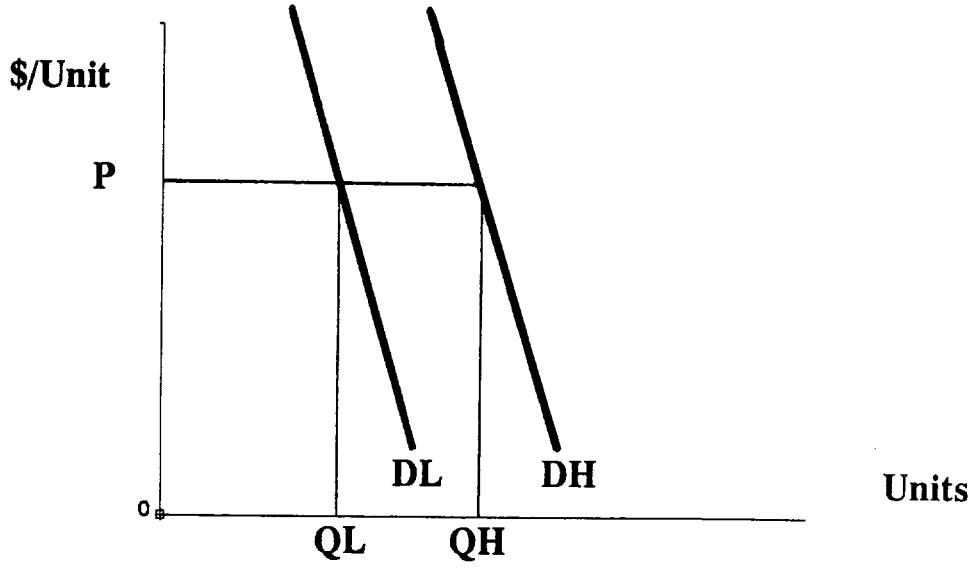
- Input Demand;
- Input Supply;
- Marginal Factor Cost.

These concepts are described below.

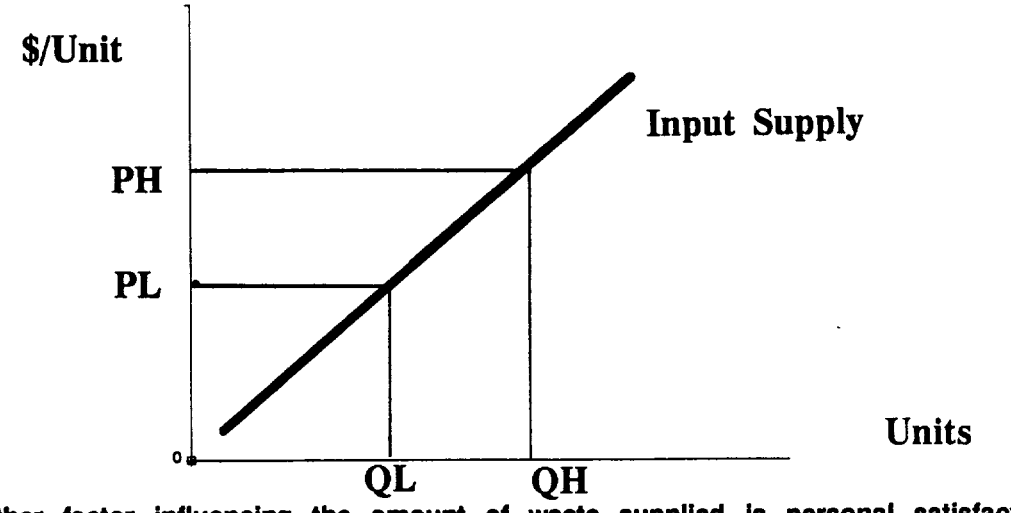
Like a consumer, the firm operates under the law of demand when purchasing inputs (waste). The firm will demand more of the recyclable material when the price paid to suppliers (waste generators) is low, and less when the price is high. Recycling firms don't actually pay for waste. Instead, they rely on individuals to leave it by the curb to be collected. The actual "price" paid for waste is the cost of collection. If collection costs are low, more waste will be demanded than if collection costs are high. This is shown in the graph below. At high collection costs (PH), less waste is demanded (QH). Low collection costs (PL) result in more waste demanded (QL).



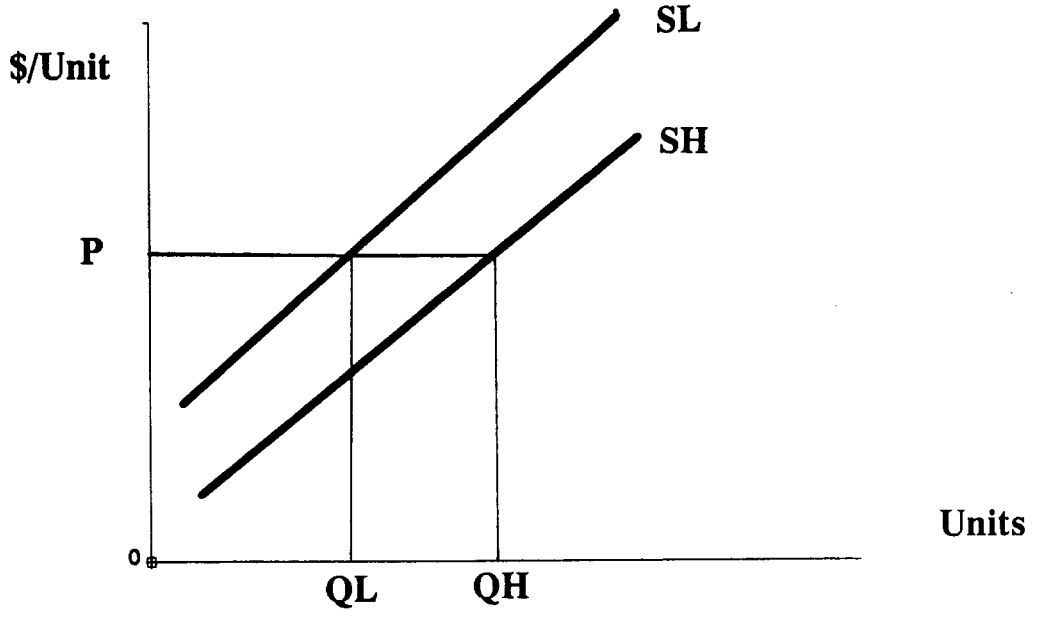
The amount of waste demanded also depends upon the price that the firm receives in the output market. For example, a recycler of aluminium will demand more aluminium cans (input) if the price of aluminium scrap (output price) is high than if it is low. This is shown in the diagram below. The demand curve DL is the demand schedule for the input if the output price is low; demand curve DH is the demand schedule for the input if output price is higher. Notice that at any given price (P), more is demanded when the output price is high (QH) than when it is low (QL).



Conversely, input supply is the waste generator's (supplier's) viewpoint. The supplier will supply more of the input at high prices than at low prices. The actual price that waste generators receive for recycling is the foregone cost of waste disposal -- the alternative to recycling. Specifically, the price received for supplying waste is the amount saved in waste disposal costs. This situation is summarized in the graph below. If the cost of waste disposal is small (PL), most suppliers will not take the trouble to provide waste, so only a small amount of waste will be supplied (QL). However, if the cost of disposal is high (PH), the supplier will supply more waste (QH) to avoid paying the high cost of disposal.



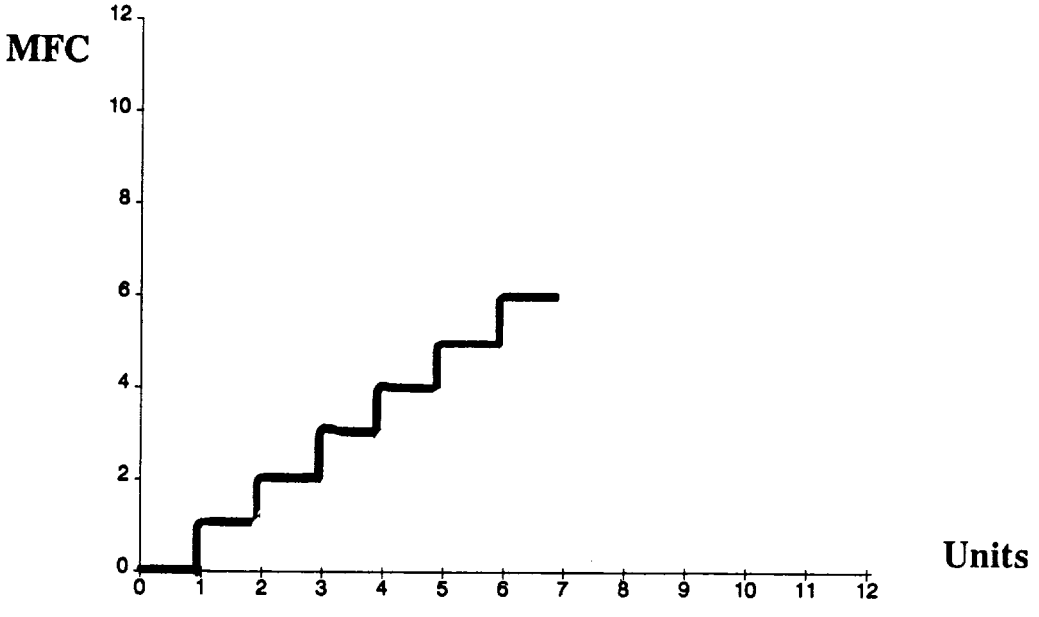
Another factor influencing the amount of waste supplied is personal satisfaction. Suppliers of waste may gain satisfaction from recycling because they believe they are doing "the right thing". The level of satisfaction influences the input supply curve. The diagram below illustrates this. Input supply curve SL is the supply schedule for individuals who gain little satisfaction from participating in recycling programs. Input supply curve SH is the supply schedule for individuals that gain high personal satisfaction from recycling participation. At any given price (P), less is supplied when satisfaction is low (QL) than if it is high (QH).



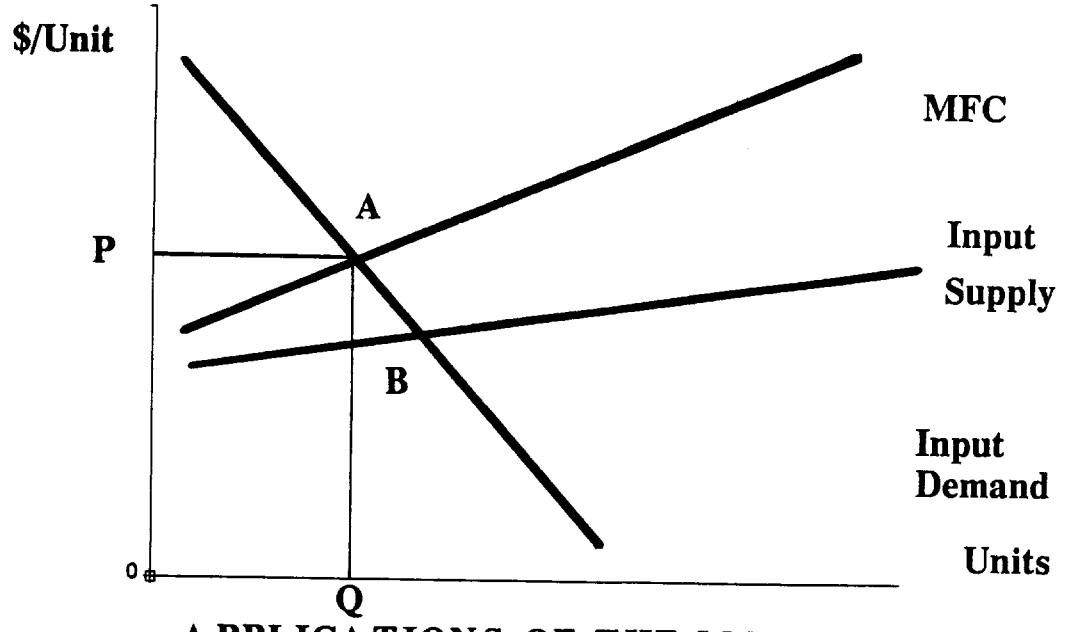
The final concept is marginal factor cost (MFC), a topic related to supply. MFC describes how the cost of purchasing an input changes as the input quantity purchased changes. The table below describes how MFC is calculated in a hypothetical example. The first column is the quantity of the input. The second column is the price per unit. Notice that as the units purchased increases, the cost per unit increases. These two columns reflect the law of supply – suppliers of the input will supply more at high prices/disposal costs than at low prices/disposal costs. The third column is the total factor cost (TFC). This is simply the units purchased (supplied) multiplied by the price per unit. For example, the total factor cost of 6 units is $21.00 (6 x $3.50). The last column is the MFC. This is the change in total factor cost divided by the change in units purchased (supplied). For example, the MFC of 6 units is $6.00 [($21.00 - $15.00) / (6 - 5)].

Quantity	Price per Unit ($)	TFC ($)	MFC ($)
0	0.00	0.00	0.00
1	1.00	1.00	1.00
2	1.50	3.00	2.00
3	2.00	6.00	3.00
4	2.50	10.00	4.00
5	3.00	15.00	5.00
6	3.50	21.00	6.00

The table data is presented graphically below. Each point on the diagram is the quantity and corresponding marginal factor cost (MFC). The MFC curve in this diagram is not "smooth" like the other curves above because only one unit changes in quantity are considered in the example.



Putting all of these curves onto the graph below reveals the quantity and price for the input. Notice that in this graph, the MFC curve is drawn "smoothly".This graph reveals how the recycling firm uses market power to influence the price paid for the input. Instead of equating supply and demand (as the competitive input buyer would do), the recycling firm equates demand and MFC (point A). The quantity of input (recyclable material) purchased is the quantity directly below point A (Q). The price paid for the input is found by moving horizontally from point B to the Price/Unit axis. The resulting price paid is P. Understanding this model allows issues of recycling and waste disposal to be analyzed from an economic viewpoint.



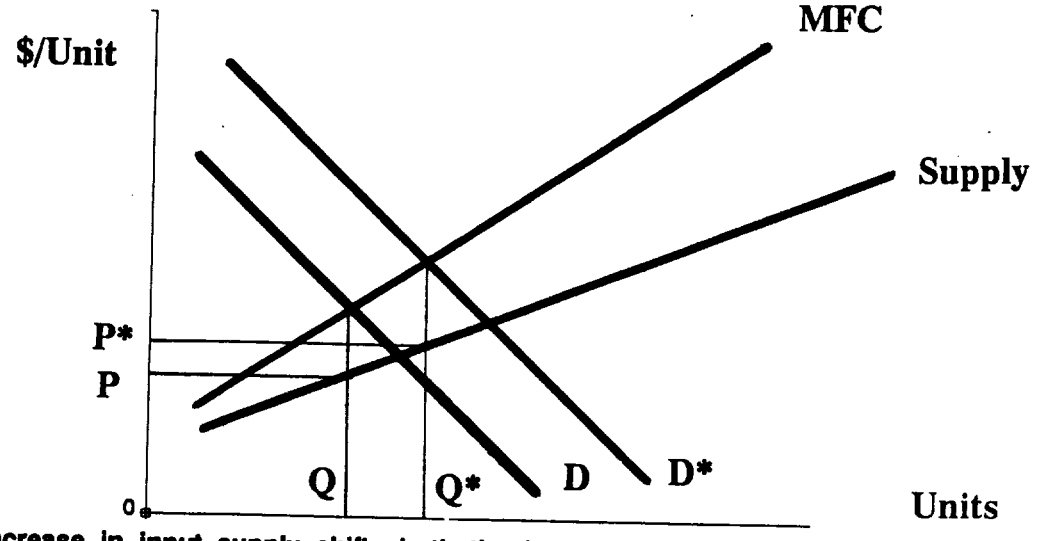
APPLICATIONS OF THE MODEL

In this section, issues of recycling and waste disposal are discussed using the theoretical model outlined above. Programs that encourage more recycling are those which increase the quantity of the recyclable input. In the proceeding diagram, this amounts to increasing Q (the amount of waste processed or collected by the recycling firm). This goal can be accomplished by either:

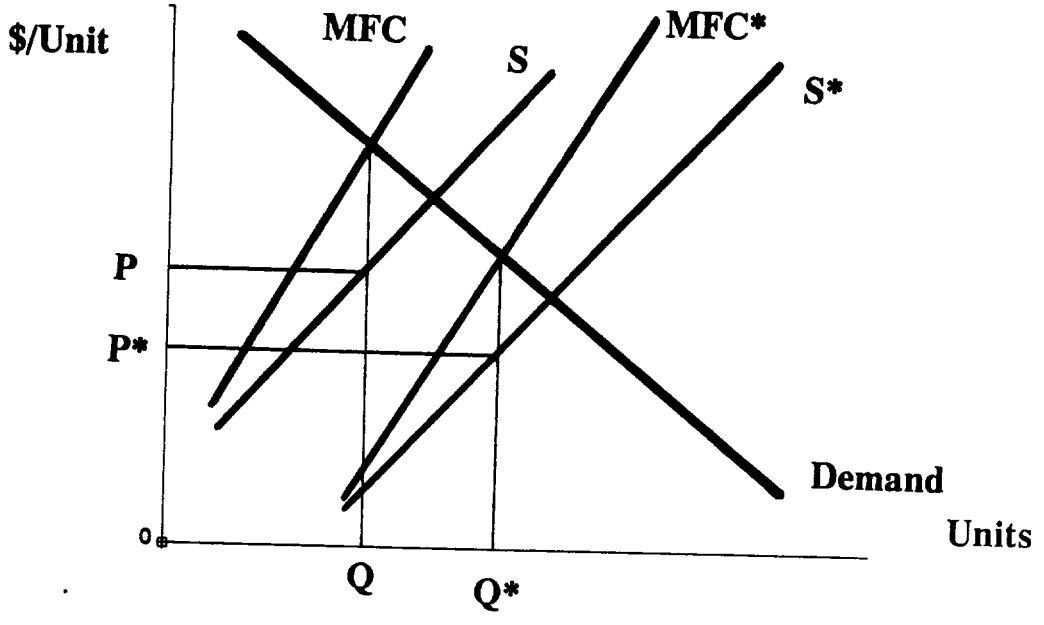
- An increase in input demand;
-
- An increase in input supply (which lowers MFC).

Increasing Input Demand and Supply

An increase in input demand shifts the input demand curve outward. This is shown in the diagram below. The demand curve (D) is the curve before the outward shift. When the recycling firm faces this demand schedule, price and quantity are P and Q respectively. Now suppose that input demand increases to D*.The new price and quantity are P* and Q* respectively. An increase in input demand increases both price and quantity.



An increase in input supply shifts both the input supply curve, and the MFC curve outward. This is shown below. The supply curve (S) and the marginal factor cost curve (MFC) are the curves before the outward shift. When the recycling firm faces these input supply and marginal factor cost curves, price and quantity are P and Q respectively. Now suppose that input supply and marginal factor cost increase to S* and MFC* respectively. The new price and quantity are P* and Q* respectively. An increase in input supply decreases the input price and increases the input quantity.



Analysis of Recycling Programs

From the discussion above, it should be clear that an increase in recycling can be accomplished by increasing input demand and/or input supply. However, it is most desirable if both are accomplished simultaneously. If the supply of recyclable material increases, but there is no demand for the material, the amount of recycling will not increase. Conversely, if demand increases, but supply remains constant, increased recycling is not possible. Increasing recycling is desirable from two standpoints. First, more recycling will lessen the volume of waste put into the dwindling landfill space.

Second, natural resources are conserved when recycling occurs. Currently, 95% of the waste generated in the Twin Cities is placed into landfills, while only 3% is recycled[2]. An estimated 44% of the waste placed into landfills could be recycled[3]. The potential for recycling is vast.

In order for recycling to occur, it must be economically feasible. Three conditions determine economic feasibility for the recycling firm.

- First, the firm must be able to obtain a consistent supply of waste.
- Second, the firm must have a reliable market to sell the processed or cleaned waste to.
- Third, the firm must receive an output price which will enable it to be profitable.

As previously noted, policies aimed at increasing recycling fall into two broad categories: coercive and market oriented. Coercive policies rely on taxes and/or laws to force individuals to participate in recycling programs. Market oriented policies are created to stimulate the demand for recycling services and the supply of recyclable material. Examples of these two types of policies are described below. The theoretical model described earlier is used to analyze their effects.

Several possible coercive policies exist. Although these policies may seem to be quick and easy solutions, they are often difficult to enforce. Enforcement costs may be high, and the policies themselves may be politically unpopular.

- Mandatory Source Separation. This policy requires individuals to separate waste in their homes for later retrieval. Violators of the program would assumably pay a fine or be denied waste collection. The net effect of the program would be an increase in input supply to recycling firms.
- A Container Deposit Program. A container deposit program would require a deposit on all beverage containers that would be redeemed when the container is returned. Enactment of this law would lead to a predicted 95% redemption rate resulting in a 6-8% reduction in the waste stream. However, the law would take aluminium away from recyclers. Since aluminium is one of the most valuable commodities recycled, the loss of revenue to recyclers has been estimated at approximately 25-42%[4]. In the model, this is analogous to a reduction in output price which would shift the input demand curve inward and result in less recycling. However, it is unclear whether the decrease in recycling by firms would exceed the increase in the collection of beverage containers.
- Recycling Tax. This program would require firms to pay a tax that is refunded if prescribed recycling regulations are followed. The goal of the policy is to increase the supply of recyclable material. The program would only be effective if the tax were large enough to force the firm to comply. This program is a costly one for two reasons. First, the costs required to monitor each firm will be high. Second, administrative costs involved in collecting the tax and refunding it to compliant firms will be large.

All of these policies have the common property of forcing individuals to participate in recycling programs. Also, these policies are all supply oriented. None of the policies addresses the problem of increasing the demand for recyclable materials. If these coercive policies were implemented on their own, it is likely that the supply of recycl-

able materials would increase. Unfortunately, the demand for recyclable materials may not. The end result could be a modest increase in recycling. Unlike coercive policies, market oriented policies attempt to either stimulate the supply of recyclable materials or the demand for those materials. Some examples of these policies are listed below.

- Changing the Pricing System. The waste disposal pricing system in the Twin Cities leaves no monetary incentive for the individual waste generator to participate in recycling programs. The waste disposal fee paid by individuals is the same regardless of volume or weight. Few individuals are willing to take the time to separate waste and transfer it to a recycler because no monetary benefit exists. The perceived price of recycling is negative to most waste generators. Volume or weight sensitive disposal costs would make the trouble of participating in recycling programs worthwhile.

Several communities have successfully implemented pricing systems where waste disposal fees are volume sensitive (e.g. Seattle, WA; Grand Rapids, MI; Eau Claire, WI). Volume sensitive fees gives individuals an incentive to recycle (to avoid higher disposal fees). Using the model, this program has the effect of shifting the input supply and MFC curves outward resulting in more recycling.

- Education. Elaine Maas claims that "one of the key elements of an effective municipal recycling program is public education"[5]. A recent survey[6] of waste haulers, recycling processors, and consumers on the subject of increasing recycling found that "... nearly everyone feels that more promotion and education is needed." The idea behind education is to convince the public that participation in recycling programs is the right or moral thing to do. Convincing the public of this will lead them to perceive psychological (moral) benefits. Advertising campaigns targeted toward this goal may be effective, but the results are hard to predict. The effect of a successful campaign of this type would be to shift the input supply and MFC curves outward causing more recycling to occur.

- Subsidizing Recycling Firms and Collection Efforts. The price that recycling firms pay for waste is the collection cost. If the operating costs of recycling firms are subsidized, more waste would be demanded. Lowering collection costs through a subsidy would cause both the input demand and supply to increase. Increases in input demand would occur because the recycling firm could collect more waste at less cost. Increases in input supply would occur because recycling would be more convenient to waste generators. Lower collection costs would allow recyclers to collect waste more frequently (e.g. the same day as trash collection). Lower collection costs would also allow recycling firms to collect waste from firms (e.g. construction sites). A survey conducted by MPIRG[7] found that "of the firms that recycling applies to, an overwhelming majority ... claimed that on site pick up would make them recycle more." Other programs such as furnishing containers to waste generators would also make participation more convenient. A survey conducted by Pope Reid associates[8] concluded that "a preferred residential waste recycling system would include a storage container provided by local government or the recycling collector." Providing containers is currently being experimented with in portions of Minneapolis with great success. The community newspaper Southeast[9] reports that providing containers "doubled the usual (recycling) participation rate". Reportedly, the recycling office hopes to provide containers to all Minneapolis residents in the near future.

- Subsidizing the Creation of Output Markets. As mentioned above, the success of a recycling program depends on the existence of an output market. New technology to process waste and new uses for the processed waste will lead to a strong

output market. Strong output markets stimulate the output demand and result in higher prices paid to recycling firms. In turn, higher output prices stimulate more recycling to occur. Subsidizing research to meet these goals will foster more recycling.

Some recyclable waste has no market in the local area, but may have a market in other regions. However, transportation costs to these other regions may be prohibitive. Subsidizing transportation cost would overcome this problem. Another solution would be to subsidize a market in the local area. In order for this solution to be effective, the market must receive a consistent supply so that a profit can be obtained.

FOOTNOTES

1 Agricultural and Food Policy. Ronald Knutson, J.B. Penn, William Boehm. Prentice-Hall Inc. Englewood Cliffs, New Jersey 07632. 1983, p.13.

2 "The New Weigh to Recycle." Citizens League Report. Public Affairs Research and Education in the Minneapolis-Saint Paul Metropolitan Area. p.5

3 "B.A.R.T.E.R. Commercial Reuse and Recycling Research and Development Project. M. E. Lee. Feb 26, 1988 p.4.

4 "The New Weigh to Recycle." Citizens League Report. Public Affairs Research and Education in the Minneapolis-Saint Paul Metropolitan Area. p.22-23.

5 Elaine D. Maas. "Recycling Education in the Schools" Resource Recycling March-April 1988, p.36.

6 "Intermediate Processing System Demonstration Project." Resource Conservation Consultants with Pope-Reid Associates. Feb. 1988, p.3.

7 "B.A.R.T.E.R. Commercial Reuse and Recycling Research and Development Project." M. E. Lee. Feb 26, 1988 p.A43.

8 "Intermediate Processing System Demonstration Project." Resource Conservation Consultants with Pope-Reid Associates. Feb. 1988, p.C-3.

9 Southeast. August 1988, Vol. 14 (5), p.4.