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The Old Newspapers Problem: Benefit-Cost Analysis of a Marketable Permit Policy

Prepared for

Economic Analysis Branch
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U.S. Environmental Protection Agency
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DISCLAIMER

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CHAPTER 1
INTRODUCTION

Clay, bamboo, wooden tablets coated with wax, sheets of soft metal, tree bark, animal skins, cloth, and papyrus have all been used to store and transmit information. Chinese inventor Tsai Lun's development in 105 A.D. of a sheet of material from wet silk rags, bark, hemp, and old fish nets is today regarded as the discovery of paper. By the end of the ninth century the art of paper making was known throughout the Orient. The rise of the Arab hegemony and the Moors' conquest of Spain carried the art into the Mediterranean area by the end of the first millennium. By about 1700, paper making reached northern Europe, the same time the first mill was built in America. Technical changes, especially substituting wood fiber for rags, improved quality and reduced the cost of paper making, while the discovery of movable type and the printing press increased demand. Today, paper is a ubiquitous and integral feature of modem society. Unfortunately, paper places a large burden on our municipal solid waste stream and must be disposed of through incineration or landfilling.

Paper and paperboard represent about 41 percent of the 1.3 tons of post-consumer waste each household generates annually. Newspapers are an important fraction of this total. They represent about 8 percent of all municipal solid waste (MSW). After recovery for recycling, newspapers account for 6 percent of net discards (Franklin Associates Ltd., 1988).

Concern about the environmental damages caused by waste disposal, coupled with public resistance to siting new solid waste landfills and incinerators, has created increasing interest in recycling. In the Environmental Protection Agency's (EPA) recently published report, The *Solid Waste Dilemma: An Agenda for Action* (U.S. EPA, 1988a), source reduction (generating less waste) and recycling are cited as preferred methods of waste management. EPA has set a national goal of managing 25 percent of MSW through source reduction and recycling by 1992.

This report examines the potential economic effects of encouraging recycling of old newspapers with a marketable permit policy. The idea for marketable permits was proposed by Dales (1972). He suggested limiting the aggregate quantity of residuals that can be discharged to the environment by developing a system of tradable property rights to access the environment for residuals disposal. The rights would be transferrable in a market. Initially, they would be offered for sale to the highest bidder. Auctions, however, are only one distribution scheme. The rights can also be given freely to selected recipients.

The marketable permit policy examined here limits the aggregate quantity of virgin pulp available for use in newsprint production, thereby inducing producers to substitute old newspapers for wood in pulp production. The policy would, however, let market forces decide where and to what extent individual newsprint producers substitute secondary fiber pulp for virgin pulp. These substitutions will reduce the municipal solid waste management burden created by newspapers. As shown in subsequent chapters, this policy will reduce the newspaper component of solid waste at the minimum possible social cost and will address an important market failure that results from an excess quantity of solid waste generation and disposal.

1.1 BACKGROUND

Americans generate more MSW per capita than any other nation (U.S. EPA, 1988a). The total amount of MSW generated in 1986 is estimated at 158 million tons. Of this amount, about 11 percent was recovered for materials and 6 percent was used for energy recovery (Franklin Associates Ltd., 1988). The remaining 131 million tons (83 percent) were managed through landfilling, ocean disposal, or incineration. However, the amounts of waste disposed through incineration without energy recovery and through ocean dumping were small. The 13 1 million tons, therefore, can be viewed as a near estimate of MSW disposed of in landfills in 1986 (U.S. EPA, 1988b).

On an absolute basis, the U.S. is the world's largest recoverer and consumer of wastepaper-see Tables 1-1 and 1-2. On a relative basis, however, many of the countries shown in Table 1-1 lead in recovering and using wastepaper (the difference in recovery and use is foreign trade in waste paper). This is undoubtedly due to economic factors including the cost of pulpwood and energy, since virgin paper is more energy-intensive than recycled paper, and perhaps also cultural factors that influence the recovery of waste paper from the solid waste stream.

As indicated in Figure 1-1, in the U.S. about 10 percent of old newspapers find their way back into new newsprint. The remainder are used to manufacture paperboard and other products, or are exported. The policy considered in this report would expand the flow of old newspapers into newsprint production. The opportunity to expand the flow of old newspapers into other paper and paperboard products is limited by an ample supply of other grades of wastepaper (Iannazzi, 1989).

TABLE 1-1. WORLD WASTEPAPER RECOVERY BY COUNTRY, 1986

Country	Paper and Paperboard Consumption (10^6 tons)	Wastepaper Recovery (10^6 tons)	Wastepaper Recovery Rate (%)
United States	71.6	19.6	27.4
Japan	21.0	10.5	50.0
Fed. Rep. Germany	10.5	4.5	42.9
People's Rep. China	10.9	2.1	19.3
U.S.S.R.	9.8	1.9	19.4
United Kingdom	8.4	2.4	28.6
France	7.2	2.1	29.2
Canada	5.6	1.1	19.6
Italy	5.2	1.1	26.9
Brazil	4.1	1.3	31.7
Others	49.3	16.0	32.5
World total	203.6	62.9	30.9

Source: Olkinuora, 1989, pp. 130-132.

TABLE 1-2. WORLD WASTEPAPER UTILIZATION BY COUNTRY, 1986

Country	Paper and Paperboard Production (10^6 tons)	Wastepaper Utilization (10^6 tons)	Wastepaper Utilization Rate (%)
United States	65.0	16.3	25.1
Japan	21.1	10.7	50.7
Canada	15.1	1.5	9.9
U.S.S.R.	10.4	1.7	16.3
People's Rep. China	10.0	2.1	21.0
Fed. Rep. Germany	9.4	4.1	43.6
Finland	7.5	0.3	4.0
Sweden	7.4	0.8	10.8
France	6.5	2.0	35.7
Italy	4.6	2.0	43.5
Others	4.6	2.0	43.5
World total	203.8	63.7	31.3

Source: Olkinuora, 1989, pp. 130-132.

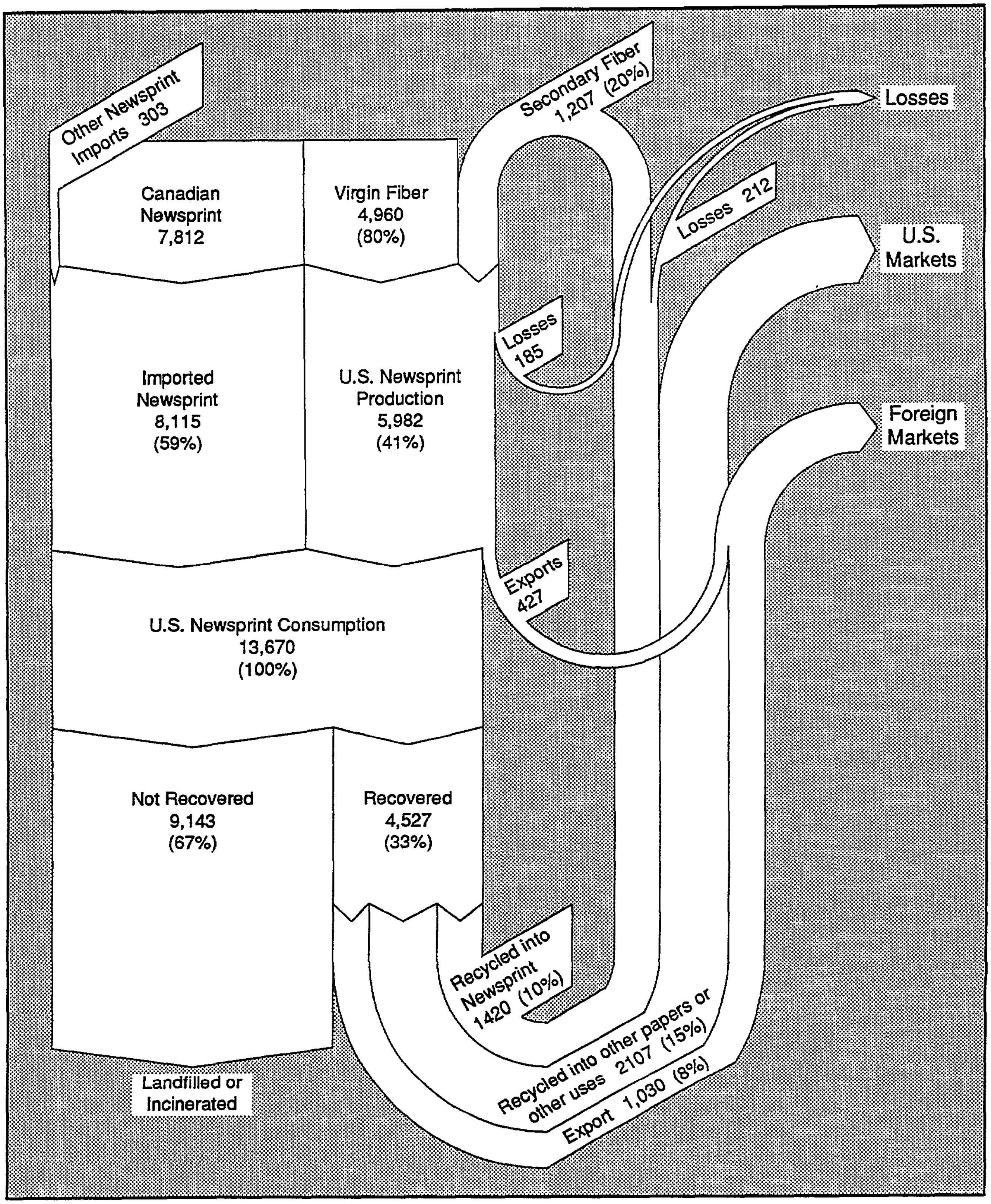


Figure 1-1. North American Fiber Flows for Newsprint, Newspaper, and Old Newspapers, 1988

All values are thousand tons.

Source: Based on a diagram developed by Andover International Associates; data compiled by Franklin Associates, Ltd.

There are two reasons to consider newspapers as a target for increased recycling. First, as explained earlier, paper products account for the largest and fastest growing share of the MSW stream, representing 41 percent of all MSW in 1986. Newspapers account for a significant amount of waste paper generated-18 percent of the the 50 tons of paper and paperboard discarded in 1986. The only single item composing a larger share of total paper and paperboard discards is corrugated containers at 22 percent (Franklin Associates Ltd., 1988).

A second reason for considering newspapers as a target for increased recycling is that they are easily separated from the other components of household waste, do not require additional rinsing or washing (as is the case for recycled used food containers), and do not attract pests or their resulting health problems. Thus the implicit cost to households of old newspaper recovery should not be substantial. Indeed, many households today separate out and recycle newspaper totally out of an environmental ethic and not for monetary gain.

Although newspapers are a significant share of the solid waste stream and are easy for households to separate, their increased recovery may not necessarily lead to increased recycling. Successful recycling of recovered newspapers requires that a market exist for them The market's ability to absorb old newspapers has been questioned, particularly in the northeast United States where recent mandatory source separation laws have glutted the market with old newsprint. The marketable permit policy considered here would provide an incentive for newsprint producers to utilize old newspapers, thereby strengthening the demand for them.

1.2 ECONOMIC INCENTIVES FOR ENVIRONMENTAL, QUALITY MANAGEMENT

In the 1970's several studies examined the potential use of economic incentives for improving air quality (e.g., Bingham et al., 1973; Griffin, 1974; Watson, 1974; Bingham et al., 1974a) and water quality (e.g., Kneese et al., 1971) and for reducing noise (e.g., Barde, 1974; Pearce, 1976) and the quantity of municipal solid waste (e.g., Bingham et al., 1974b; Miedema et al., 1976). While these types of approaches have been advocated by economists, those responsible for designing, implementing, and enforcing environmental regulations have generally used command-and-control approaches rather than market-type policies. Under the command-and-control approach, government attempts to dictate the residuals management behaviors of polluters. Over the last several years, however, the government has had renewed interest in using incentive-type policies for environmental quality management. Much of this attention came from recognizing the potential effectiveness of incentive-based policies in cases where environmental improvement requires behavioral changes by many firms having varying costs of making these changes. There has been significant interest in applying market-type policies to the MSW area in particular, because of the concern about landfill capacity shortages and the potential for recycling to reduce municipal solid waste management burdens.

State-level concerns about reducing solid waste disposal through increased recycling are reflected by the large number of legislative initiatives. In 1989 state legislatures passed 140 bills relating to municipal solid waste management (personal communication, Series, 1989). Three states have recently passed legislation that specifically promotes the use of recycled newsprint.

In 1988, Florida passed legislation requiring newspaper publishers to pay a tax based on the virgin content of the newsprint they consume. This policy went into effect on January 1, 1989. The tax is 10 cents per ton.[1] Although the size of the tax is small, it provides a message to publishers indicating public preference for increased recycling. The recovery rate for newspapers in Florida is currently estimated at 30 percent. If this recovery rate rises to 50 percent by 1992, the law will be rescinded; if the recovery rate does not reach 50 percent by 1992, then the tax will increase to 50 cents per ton.

In June 1989, Connecticut passed legislation mandating publishers to increase the use of recycled content of newsprint within their states. Publishers that distribute newsprint within Connecticut will be required to use 20 percent recycled newsprint by 1993. As defined by this legislation, recycled newsprint is paper. Publishers are then required to increase their use of recycled newsprint by 10 percentage points each year until a level of 90 percent recycled newsprint is achieved by 1998. A task force has been formed to make recommendations on the implementation of the policy. The existing legislation does not include any penalties for non-compliance.

Most recently, California has passed legislation in September 1989 that is similar to Connecticut's law. California's law requires publishers to use recycled newsprint for 10 percent of their newsprint needs in 1991. The amount used must increase by 10 percentage points per year until a rate of 50 percent is achieved in 1995. Violation of the law is classified as a misdemeanor and civil penalties of up to $1,000 per violation may be applied. Revenue generated by penalties will be used to defray the expenses of implementing the law.

In addition to these laws, three other states (New York, Illinois and Wisconsin) have legislation pending that would encourage the use of recycled newsprint For example, Wisconsin

[1]Since the average price of newsprint is approximately $600/ton, this tax is equal to approximately 0.16% of the price of newsprint.

In addition to these laws, three other states (New York, Illinois and Wisconsin) have legislation pending that would encourage the use of recycled newsprint. For example, Wisconsin is considering legislation similar to California's law. The scheduled requirements for the use of recycled newsprint are the same as in California. The penalties under the proposed Wisconsin law are a function of the violator's total annual expenditures on newsprint and the difference between actual recycled newsprint purchases and required purchases. Revenue generated by penalties will be used to encourage recycling efforts by loans and grants.

One of the problems with state legislation is that newsprint mills are found in just 15 states, and only 7 of these currently have facilities for reprocessing old newspapers into newsprint. To meet a given state's requirement for recycling, newspaper publishers will purchase newsprint from the least-cost supplier who meets the state's minimum of recycled fiber. However, the mills from which consumers buy newsprint may not be in the same state as the newspaper publishers. Therefore, any particular state's initiative may not significantly affect the quantity of newspapers discarded to its solid waste stream. Another problem is the possible proliferation of a patchwork of unique state laws affecting a commodity typically traded across state lines.

At the federal level, Senator Boschwitz has introduced a bill (S 1764) requiring certain newsprint consumers to use a minimum percentage of recycled newsprint. The requirement increases over time. Senators Heinz and Wirth have introduced a bill (S1763) that has the basic features of the marketable permit policy examined in this report. Whether any of the legislation proposed will become law is, of course, uncertain. Nonetheless, the intense interest in this issue indicates that some additional laws will likely be passed to address the solid waste problems posed by newspapers.

1.3 REPORT ORGANIZATION

Chapter 2 considers the case for government intervention in this market and describes the features of several market-type policies. Chapter 3 provides an overview of the newsprint-newspaper-old newspapers system The production processes are outlined to identify the important considerations for the policy model. Chapter 4, which non-economists may wish to read only briefly, summarizes the operational model. Chapter 5 presents the economic effects of a marketable permit policy for virgin pulp in newsprint production. The report concludes with an evaluation of the economic welfare effects of the policy in Chapter 6. Several appendices provide additional information on the policy and the model developed to evaluate the marketable permit policy.

CHAPTER 2
ALTERNATIVE POLICIES

The quantity of solid waste disposed, including old newspapers, may be larger than socially optimum. Virgin materials-biased tax policies, virgin materials-biased regulations, indirect subsidies of virgin materials, and flat assessment pricing of solid waste collection and disposal services all contribute to excessive consumption of virgin materials and generation of solid wastes (Miedema et al., 1983; Anderson, 1977; Fiekowsky, 1975; Goddard, 1975; Page, 1977; and the Resource Conservation Committee, 1979). Society's economic welfare may be improved by correcting the market failures that lead to this misallocation of resources. The important issue, however, is whether we can identify and implement policies that can potentially reallocate resources such that society is better off than with the status quo.

The economic rationale for considering market intervention is summarized below. Three market-type policies are identified and their features discussed. Finally, the section concludes by identifying the marketable permit policy as an especially attractive policy for addressing the old newspapers (ONP) disposal problem.

2.1 EXAMINATION OF THE NEED FOR INCREASED RECYCLING

As discussed earlier, the Environmental Protection Agency (EPA) has set a goal of significantly increasing the level of recycling by 1992. This goal implies that our society is currently disposing of more solid waste (through landfilling and incineration) than is optimal. This section evaluates the set of market conditions necessary for the consumption and production of a "correct," or socially optimal, level of solid waste management services.

The activities that generate solid waste also benefit society. For example, newspapers provide readers information and entertainment. The convenience of being able to easily dispose of old newspapers is also a valued benefit-throwing ONP in the trash is obviously quicker and easier than recycling. However, management of solid waste also imposes costs on society. There are the obvious costs of picking up the garbage and hauling it to a landfill, and of purchasing the land for the landfill, operating it, and closing it when full, as well as the less obvious costs such as the noise made by garbage trucks, the odors from the garbage, and the potential air and water pollution associated with landfills and incinerators.

Traditional economic reasoning implies that the "optimal" or efficient level of waste disposal occurs where the marginal social benefits associated with the disposal of each unit of waste are equal to the marginal social cost of disposal. For this optimal level of solid waste disposal .to occur, the prices charged for solid waste services should reflect the marginal social cost associated with providing those services. This ensures that the individuals demanding solid waste disposal services consider the full costs of those services in their production and consumption decisions. Failure to reflect the marginal social cost of a good or service in its price leads to over-consumption. This is illustrated for solid waste disposal services in Figure 2-1.

The demand for solid waste management services, D, indicates the quantities of waste disposal services households would consume under alternative prices. As the price of these services decreases, the quantity of those services demanded increases. This demand curve represents the marginal social benefits of disposal services. The marginal social cost of waste disposal, MSC, increases as the quantities of waste disposal services provided increase. The optimal quantity of waste disposal services is Q* where the marginal benefit and cost of these services are equal. This quantity is, optimal in the sense that any increase or decrease from this amount diminishes society's economic welfare. If the price charged for waste disposal services is set at P*, then this amount is automatically induced.

Failure to charge for waste disposal services results in consumption rate Q^1. This consumption of waste disposal services in excess of Q* results in a net loss to society because its additional cost in providing those services (represented as the area below the MSC curve) is greater than the additional value society places on them (represented as the area below the demand curve). The net loss to society from not charging for waste disposal is indicated by the shaded area in Figure 2-1. The distance from Q^1 to Q* may be thought of as the amount of over-consumption of waste disposal services that results from failing to reflect the full resource cost of production in the prices charged for waste disposal.

A fundamental pricing failure in the waste disposal area is that the ultimate consumers of waste disposal services-households-are usually not charged according to the volume of waste that they generate. Households are typically charged either through their local property taxes or by a fixed fee paid to a private collector. Under this system, the household pays a zero price for each additional unit of waste it generates and has no incentive to reduce the amount of trash generated by changing its consumption behavior or by increasing recycling efforts.

Several policy options have the potential to address this overproduction of solid waste management services. Three policies that use market-type incentives are particularly attractive.

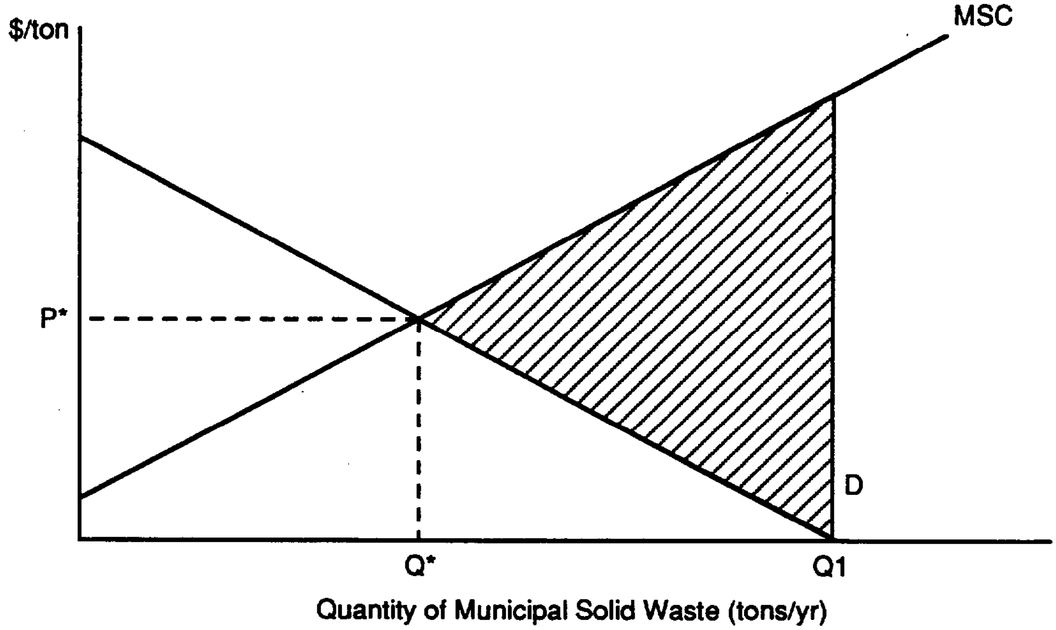


Figure 2-1. Social Costs of Market Failure in Solid Waste Services Pricing

2.2 HOUSEHOLD DISPOSAL CHARGES

Since the fundamental pricing failure in solid waste management is that households are not charged according to the volume of waste they generate, one obvious policy is to impose user charges for these services. Charging households the marginal social cost associated with disposing of each unit of waste produced would cause them to consider the waste management costs of their consumption decisions (Morris and Byrd, 1990). They may elect to shift consumption away from waste-intensive products and recycle rather than dispose of their wastes through conventional means. The household disposal charge would reflect the local economics of waste management. A result of the household disposal charge would be to shift the supply function of secondary materials outward, lowering their prices and encouraging their substitution for virgin inputs in materials manufacture.

However, the administrative costs of household user charges may outweigh the gains associated with providing households with the correct price incentives. Charging each household according to the volume or weight of the solid waste it discards requires some means of measuring the solid waste quantity and enforcing the policy. Perhaps more importantly, setting the household disposal charge equal to the true opportunity costs of solid waste management is likely to result in a fairly high household disposal charge value raising important questions of the impact of the charge on littering and other illegal disposal methods (Miedema, 1983). However, as discussed more fully in Section 5, household disposal charges of some level and a marketable permit policy may be complements if the municipality provides a way for households to readily recycle selected components of their solid waste streams.

2.3 PRODUCER DISPOSAL CHARGE

Another method of internalizing the costs of waste disposal is to charge manufacturers the marginal social costs generated by disposal of their products (Miedema, 1983). Such a disposal charge is a variant of the emission tax first proposed by the British economist Pigou. The producer disposal charge level could vary with the factors that affect the social costs of disposal, including the characteristics of the product (volume and toxicity) and the characteristics of the landfill in which it is disposed (e.g., remaining capacity, likelihood of groundwater contamination). In reality, the administrative burden of setting different fees for products based on the region of the country where they are consumed would be overwhelming. For this reason, only a uniform fee is sensible. The problem with a uniform fee, of course, is that the fee will be less than the social cost of disposal in some areas and greater than that cost in other parts of the country.

The producer disposal charge should be levied only on the virgin content of products. The rationale for exempting recycled materials is that the charge is a *disposal* charge. Products made with recycled materials have already been charged for disposal when originally produced. Since secondary materials are exempt from the charge producers have an incentive to utilize them when manufacturing their products. The disposal charge will shift the demand outward for secondary materials, raising their price and inducing increases in the quantity supplied by households and municipalities. producers will substitute secondary materials in their products up to the point where the additional costs of the secondary material are equal to the charge.

Another design issue associated with a producer disposal charge is the question of what to do with the revenue it generates. Imposition of the charge is a sufficient condition for internalizing the externalities associated with disposal (provided the level of the charge is set correctly), and using the revenue generated by the charge for cleaning up environmental problems associated with solid waste disposal is not necessary for internalization of the externalities. In addition, previous research has demonstrated that the revenue from the tax should not be utilized to compensate the victims of the externality, since this may create incentives for individuals to expose themselves to such externalities (Freeman, 1984, Baumol and Oats, 1988). However, if the revenues were distributed to municipalities on a population basis, such behavior would probably not be induced.

The producer disposal charge provides an incentive for producers to find new approaches to the substitution of secondary for virgin inputs thereby further reducing their consumption of virgin materials. In contrast, the payments required by a disposal charge may be substantial, thus raising political obstacles to implementing it. But, for the disposal charge to be effective, it need only be applied to producers' marginal unit of virgin materials consumption. To reduce the size of the policy's financial burden, the charge can be set to apply only to quantities of the product produced from virgin materials above a threshold level. As long as this quantity is set by the authorities to be no larger than the minimum amount of virgin inputs a producer would use, the efficiency aspects of the policy are not eroded. The policy would not, however, motivate reductions in virgin materials consumption beyond the threshold level.

2.4 MARKETABLE DISPOSAL PERMITS

Transferrable disposal rights, or permits, are a third market-type policy for internalizing the disposal costs of products. Transferrable rights to use the environment for residuals disposal were first proposed by the Canadian political scientist Dales (1972) to apply to water pollution problems. With this policy, government establishes an aggregate limit for residuals discards to the environment. It then sells or gives away permits for fractions of the total. Holders of the permits may use or exchange them, presumably for money or other considerations. The rights are denominated in mass per unit of time-for example, tons per year, and their life can be finite or perpetual.

A permit would only be required for virgin inputs because, as argued above, using secondary materials avoids solid waste management costs. Since permits are not needed for secondary materials, producers will have an incentive to substitute recycled materials for virgin materials in their products.

Under a producer disposal charge system, an important design issue is the level of the charge. Under a marketable petit system, the equivalent issue is the number of permits to be issued. Ideally, the government would determine the amount of recycling that would occur if households were charged for the marginal social costs of disposing of their solid wastes. It would then issue the number of permits that would result in this level of recycling. As was the case for choosing an “optimal” level of a producer disposal charge, determining an “optimal” quantity of permits is likely to be an unrealistic goal. Following Baumol(1972), the pragmatic approach is to set a goal using the best benefit and cost information available, then use an appropriate economic incentive to achieve that end.

With sufficient information about the market for newsprint, one might design a producer disposal charge or a permit system to bring about identical changes in the quantities of virgin and secondary pulp used in newsprint production (i.e., the same increase in the recycled content) and identical changes in market prices. However, information about the underlying supply and demand conditions of the markets is imperfect; thus, predicting *ex ante* the exact magnitude of the adjustments either policy will induce is impossible. Under a marketable permit system, the maximum quantity of virgin pulp consumed in the production of newsprint is set, the price (the value of the permit) is allowed to adjust, and the total costs are unknown. With the disposal charge, this price is set, the resulting quantity of virgin pulp is allowed to adjust, but its total quantity of virgin pulp is unknown. Of course, a purpose of this report is to reduce uncertainty inherent in the introduction of any new policy, but some will always remain. Appendix A provides a graphic illustration of the effects of uncertainty about market conditions under a producer disposal charge and a permit system.

A second important difference between the producer disposal charge and marketable permit approach lies in their distributional effects. Under a producer disposal charge system, the revenue generated by the charge transfers funds from stockholders, resource suppliers, and consumers to the taxpayers' agent-the federal government. Under a marketable permit approach, the revenue generated by selling permits transfers funds from permit buyers to permit sellers. Thus, an important issue in designing permit systems is how the permits are initially allocated.

Three approaches traditionally considered for distributing permits are: revenue auctions, grandfathering, and zero-revenue auctions (Tietenberg, 1985). Under a revenue auction approach, the federal government would auction off the number of permits necessary to meet the established goal for reducing the use of virgin pulp. Under this approach, the funds generated by the auction are a transfer from private firms to the federal government.

Under a grandfathering approach, existing firms are given the rights to use virgin pulp (permits) according to some predetermined distribution rule. These permits may then be bought and sold amongst firms in the industry. Under the grandfathering approach, the revenue generated by the sale of permits is a transfer of funds between firms within the industry. Grandfathering approaches benefit existing firms over potential entrants to the industry, since new entrants would need to buy permits from existing firms.

A zero-revenue approach is a combination of the revenue auction and grandfathering approaches. Under this approach, existing firms are grandfathered "credits" for permits and then must purchase permits through an auction. The amount of permits each firm must pay for is the difference between the amount that they received credits for and the amount that they purchased through the auction. Like the grandfathering approach, this approach benefits existing firms over new entrants since existing firms receive credits, whereas future entrants would not.

The approach used for distributing permits in this study is a variation of the grandfathering approach described above. A predetermined distribution rule is used for distributing permits; however, *all* potential producers in the industry are entitled to permits, not just existing firms. Under this approach, an industry-wide standard for the maximum allowable percent of virgin pulp is established (e.g., 80 percent). Each firm is able to use up to that percent of virgin pulp without purchasing any permits (they are, essentially, given permits for 80 percent of their production under the 80 percent virgin pulp limit example). Firms that produce paper having less than 80 percent pulp would be able to sell their surplus permits to firms producing newsprint with greater than 80 percent virgin pulp content. Like the grandfathering approach described above, this policy results in a redistribution of revenue within the industry (from firms making virgin newsprint to firms making recycled newsprint). Unlike the grandfathering approach, however, this policy does not disadvantage new entrants to the industry. As new firms enter the industry, they are automatically entitled to permits for 80 percent of their production and need to buy permits from existing firms only if they are using more than 80 percent virgin pulp. (For a discussion of the implementation issues associated with this policy, see Appendix B.)

A potentially important difference between the producer disposal charge and permit system is the opportunity for individuals and groups outside the newsprint industry to effect the amount of virgin pulp available for use in newsprint. Under the producer disposal charge system, each firm chooses the amounts of virgin and old newspaper pulp to produce based on the the relative prices of each pulp type (including the charge) and production costs. Under a permit system, however, individuals or groups outside the industry may purchase permits. For example, an environmental group may decide to buy up a share of the permits. This would reduce the total quantity of virgin pulp the industry may use.

Because of their distributional implications and the certainty they offer for meeting environmental goals, marketable permits are the market-type policy most often proposed and implemented in the environmental arena. For example, the bubble policy for air pollutants is a marketable permit-type policy, as was the leaded gasoline phase-down rule. In the next section of this report, we describe the basic features of the newsprint-newspapers-old newspapers system that will be affected by the policy.

CHAPTER 3
INDUSTRY DESCRIPTION

Old newspapers are the end product of a complex production system that begins with pulp wood or recycled fiber, moves to newsprint manufacture, and then to the publishing and distribution of newspapers. Once read, the old newspapers (ONP) become a waste management problem for the household. Depending on local institutional and market conditions, the household may simply dispose of the ONP with other trash and garbage, or may keep them separate from other household trash and recycle them through the municipal solid waste system or though private waste paper dealers.

The effects of the marketable permit policy on the quantities of newsprint and newspapers produced, and on the ONP disposed or recycled, as well as the impacts on the welfare of the market participants depends on the production choices available at each step in the newsprint-newspapers-old newspapers system. The key components of this system are shown in Figure 3-1. The opportunities for substitution in the production and consumption processes of each component are reviewed below.

3.1 NEWSPRINT PRODUCTION

Newsprint is a relatively strong, opaque paper. Its key characteristics are “runability,” the ability to run on large, fast presses without breaking, and “‘printability,” the ability to absorb ink quickly (Canadian Pulp and Paper Industry, 1988). Brightness and smoothness are also important characteristics of newsprint because they affect the quality of the advertising and news materials.

Figure 3-2 summarizes the newsprint manufacture process. Newsprint manufacture begins with preparing raw materials for processing. In the virgin fiber process, pulpwood is delivered to the mill as logs that are first debarked, or as chips from lumber mills. The prepared wood is reduced to its fibrous state through mechanical or chemical means. With mechanical pulp, which is the predominate pulp type used for newsprint, the wood is pressed against a grindstone or refined into wood pulp; with chemical pulp, the wood is chipped and cooked under pressure and at high temperature in a chemical liquor to separate the fibers (Canadian Pulp and Paper Industry, 1988). Each ton of paper produced using virgin fibers requires about two tons of wood.

When ONP are used to produce pulp, they must be deinked. Deinking is a laundering process similar to washing clothes or dishes. There are three basic phases of removing ink:

- ink removal from the fiber,
- ink removal from the pulp, and
- ink removal from the effluent (Horacek, 1979).

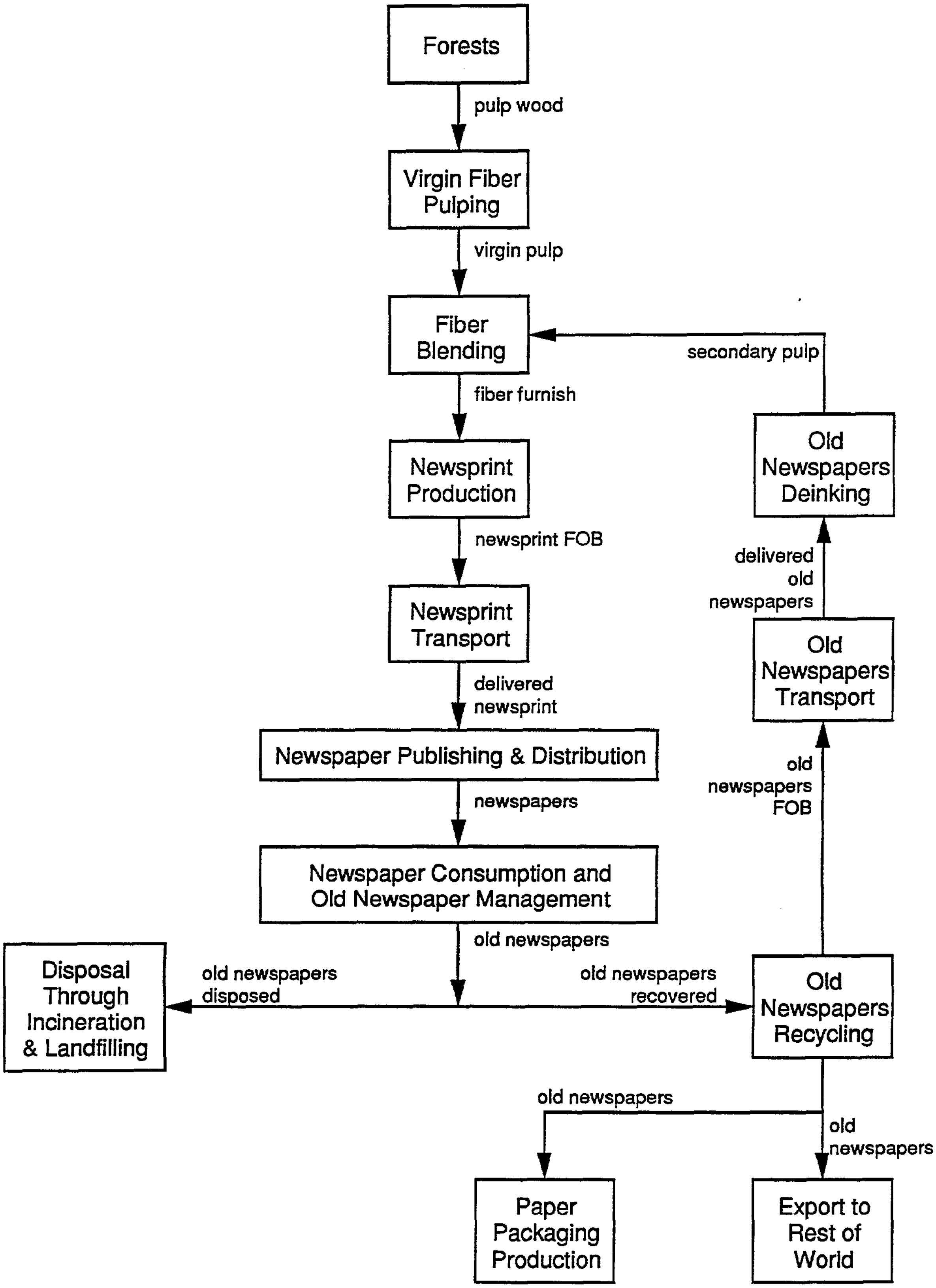


Figure 3-1. Newsprint, Newspapers, and Old Newspaper System

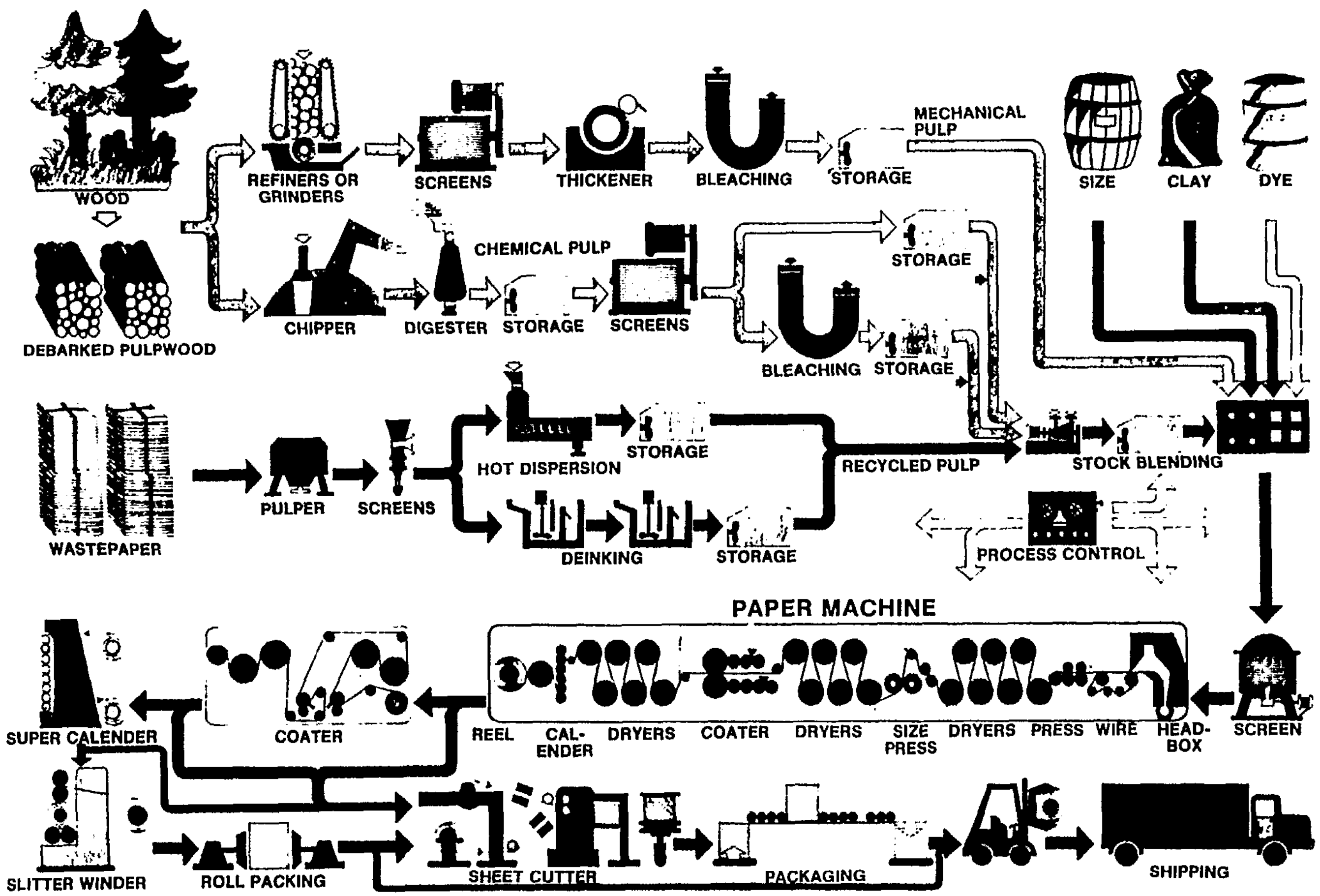


Figure 3-2. Modern Papermaking Process from Forest to Finished Product

Source: Weidenmuller, 1984

Newsprint ink is a carbon black pigment typically dispersed in a petroleum or mineral oil vehicle. Inks are specifically formulated for either letterpress or offset newspaper printing processes. Inks for offset printing have a higher carbon content than inks for letterpress applications and a hydrocarbon resin binder to promote adhesion to the paper fibers. While some ink is removed through mechanical forces, chemical methods are necessary to disperse it from ONP fiber. Dispersion chemicals remove ink from the fibers and suspend the individual ink particles in a chemical bath. Color inks are more difficult to disperse than black (Horacek, 1979). Chemical formulations that disperse ink typically include a surfactant (detergent), sodium silicate, and hydrogen peroxide. The formulations are based on the types of inks, paperstock (mechanical, chemical, and secondary fiber content), and degree of paper brightness desired.

After the ink is chemically separated from the fiber, it is removed from the pulp slurry through either dilution washing or froth flotation. With dilution washing, several-stage washers are used in a counter-current system-the pulp moves in one direction, the wash water in the opposite. The wash water starts at the downstream side and moves upstream, collecting impurities, until it is discharged or cleaned through clarification. Fresh water is used to make up for water losses and at the final washing stage. With froth flotation, the pulp slurry is chemically treated and air is blown through it to create bubbles. The bubbles have a greater affinity for the ink particles than for the fiber. The bubbles with ink particles attached are floated into a froth that is continuously skimmed off. Froth flotation produces lesser quality but higher yields than dilution washing. The key characteristics of paper-freeness, tensile strength, tear, burst, bulk, and brightness are all better with washing, but yields are lower. Froth flotation is more costly because of the chemicals involved. U.S. manufacturers primarily use the washing system (Jeyasingam, 1982).

The inky effluent from washing or froth flotation contains suspended solids and toxic substances. Discharging of this effluent is regulated under the Clean Water Act. Clarifying the water is typically done to meet discharge limits. Each ton of newsprint produced from secondary fibers requires about 1.2 tons of ONP (Jeyasingam, 1982).

Fiber furnish is produced by using or blending mechanical pulp, chemically produced pulp, and secondary fiber pulp. Mechanical pulp produces a low-grade paper; chemical pulp, a higher-grade paper because it is more printable (Murarka, 1987). Longevity is not important to newspapers, so mechanical pulp and secondary fiber pulp are used chiefly in newsprint, with small amounts of chemical pulp added for strength. A key issue in examining the potential of policies to induce more newsprint recycling is the degree to which pulp produced from ONP is substitutable for virgin pulp.

As explained by McKee (197l), each time fiber is repulped it is subject to mechanical attrition and swelling followed by deswelling as the fiber dries. The theory of fibrous networks shows that the quality of paper changes with repulping. In a laboratory experiment, McKee found that repulping reduces fiber strength and bonding. In a more recent paper, Bobalek and Chaturvedi (1989) examined the effects of repulping over three cycles for various fiber species (e.g., southern pine, northern pine) on the physical, surface, and strength properties of paper. The paper was not printed on between cycles. They found that the physical and surface properties are unchanged with repulping, but that there were substantial differences in these properties across fiber species. The strength properties of paper, however, are reduced as repulping cycles arc increased. The reduction may be severe depending on the strength measure and fiber species used. Decreased paper strength increases the probability of breaking during manufacture or printing. Paper making machines may run at the rate of 40 miles per hour (Canadian Pulp and Paper Association, 1987). One estimate implies that in paper making, a break results in about 20 minutes down time. Garden State Paper Company, a producer of 100 percent recycled paper, suggests 50 percent as the technical limit for secondary content before quality and runability is affected (Jeyasingam, 1982).

Newsprint is produced by combining the fiber furnish with paper-making additives and forming the materials into sheets using a fourdrinier paper or a cyclinder machine. The sheets are formed through pressing and drying the slurry to remove the water. After dewatering, coatings are mechanically applied to the sheets to improve the paper surface for printing. Newsprint is typically produced to a customer's specifications (Murarka, 1987).

Newsprint consumed by U.S. newspaper publishers comes from 21 U.S. mills and 41 Canadian mills located as shown in Figure 3-3. The U.S. has eight mills with deinking capacity, Canada, one. U.S. and Canadian newsprint producers each have plans to introduce additional deinking capacity in 1990. The U.S. facility will be in Georgia, the Canadian facility in Ontario Province (Franklin Associates Ltd., 1989a).

Newsprint mills using virgin fiber tend to be located near forest and water resources; those using recycled newsprint near areas of high population densities. For Canadian mills, recycled fiber represents less than 2 percent of newsprint production. In the U.S., it represents almost 25 percent. Newsprint mills located in the western states are especially large users of recycled fiber. Using recycled fiber reduces the cost of energy but raises the cost of furnish chemicals (Price Waterhouse, 1988). In 1981, Garden State Paper Company, which uses all recycled fiber, estimated their maximurn economic transport distance for waste paper to be 250 miles for their New Jersey mill if they must deadhead to the collection point South East Paper Manufacturing Company in Dublin, Georgia, estimates their maximum economic distance is at least 700 miles (Jeyasingam, 1982).

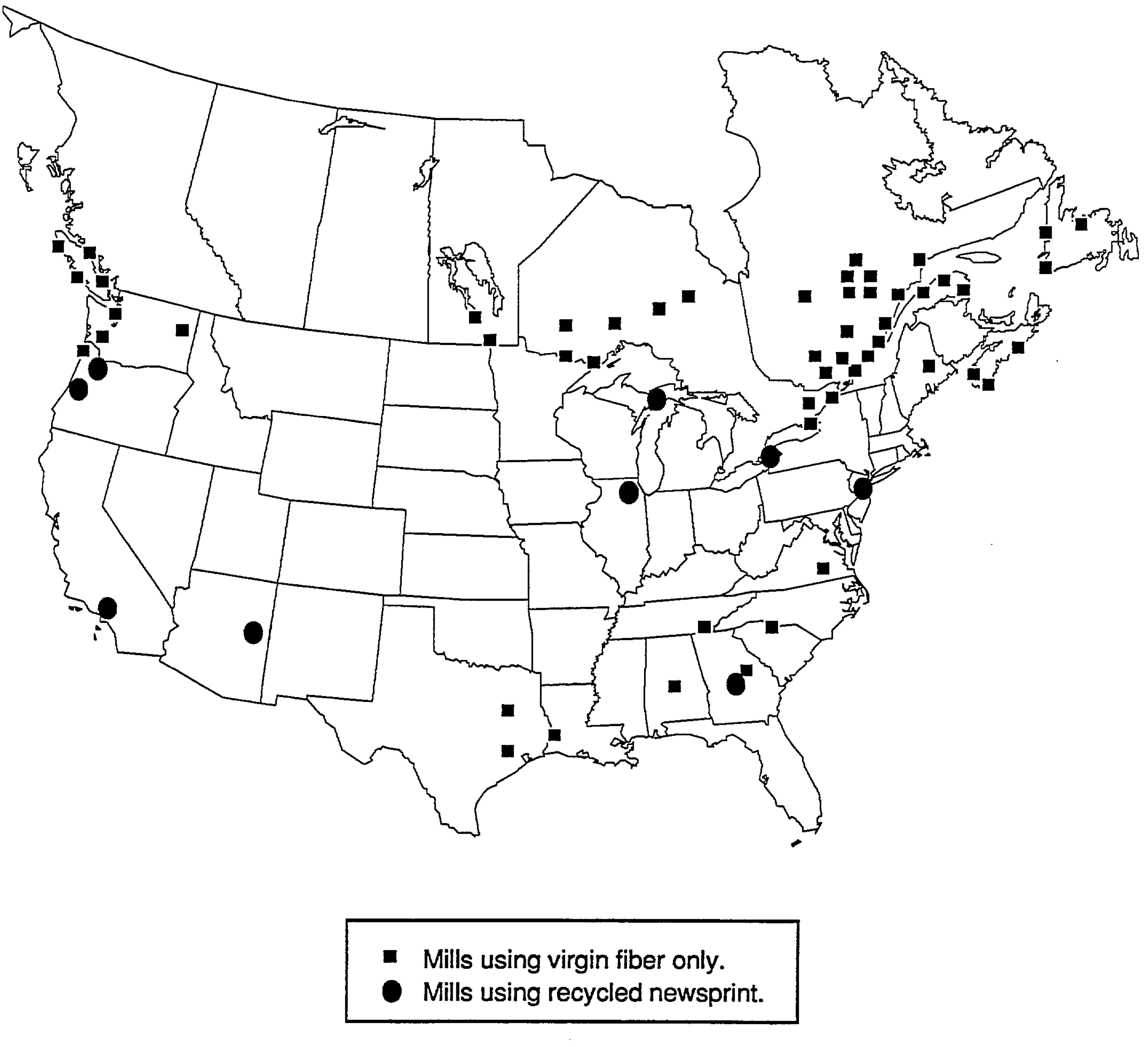


Figure 3-3. Location of Paper Mills Producing Newsprint

Substantial forest resources, large rivers for electric power and fresh water, and proximity to leading international markets combine to make Canada the world's largest newsprint producer and exporter (Canadian Pulp and Paper Association, 1987). Almost three-quarters of Canadian production is consumed in the U.S. where it accounts for about 57 percent of U.S. newsprint (Canadian Pulp and Paper Industry, 1988). Canadian producers' competitive advantage is having lower energy costs than their U.S. counterparts. However, U.S. newsprint producers have lower costs for furnish material and delivery (Price Waterhouse, 1988).

3.2 NEWSPAPER PUBLISHING AND DISTRIBUTION

Newspapers provide news and entertainment and commercial messages-about two-thirds of their content is advertising (Jeyasingam, 1982). Newspapers compete with other media for consumer and advertisers dollars. About three-fifths of newspaper revenues are derived from advertising (Lofano, 1989).

In 1988, U.S. newspaper publishers consumed a record quantity of newsprint-12.3 million tons (American Paper Institute, 1989a). Preprint tonnage is apparently not included in newsprint consumption data. There are perhaps an additional 2 million tons of this insert material, about one-third of which is printed on newsprint (Udell, 1988). The U.S. is the world's largest consumer of newsprint and accounts for about 41 percent of world consumption (Iannazzi, 1989).

Newsprint consumption depends on newspaper circulation. Newspaper circulation figures are shown in Table 3-1. Daily newspapers account for about three-quarters of U.S. newsprint consumption (Canadian Pulp and Paper Industry, 1988). Adding insert materials raises the proportion to 83 to 88 percent of total newsprint consumption (Franklin Associates, Ltd., 1989a). Circulation of dailies has been relatively flat over the last decade at 62 to 63 million copies annually. Weeklies have declined in number while Sunday circulation has grown (U.S. Dept. of Commerce, 1988). Newspapers account for about one-quarter of all advertising expenditures (American Paper Institute, 1989b).

TABLE 3-1. U.S. NEWSPAPERS, 1987

	Editions	Circulation (10^6)	Copies (10^6)
Dailies[1]	1,645	62.8	16,328
Weeklies[2]	7,600	47.7	2,480
Sundays	820	60.1	3,125
Total			21,933

[1] Assumes 5 editions week per week.
[2] Assumes 1 edition per week.
Source: U.S. Dept. of Commerce/International Trade Administration, 1988.

The opportunity to reduce the amount of newsprint in newspaper publishing is fairly limited. The major options are using lighter weight paper and changing the paper format to reduce the amount of white space. An additional option is to reduce fringe area and newsstand distribution to reduce returns. Some publishers have responded to increases in newsprint prices by making these reductions. Between 1969 and 1975, the *New York Times* reduced its newsprint use 3 1 percent through conservation and declining circulation. However, reducing newsprint use per newspaper by only a few percent is possible, as publishers have exhausted most newsprint conservation options (Cornpaine, 1980).

Several large newspaper companies have acquired whole or part interest in newsprint companies as a hedge against price increases, and to help ensure their supply during shortages. These companies include the Washington Post Co., Times Mirror Co., The New York Times Co., Dow Jones, Media General Co., and Knight-Ridder and Cox (Compaine, 1980).

3.3 OLD NEWSPAPERS MANAGEMENT

Once read, newspapers become an immediate solid waste management problem for the consumer. There is substantial regional variation in newsprint consumption, and, presumably, in ONP generation. In the northeast states, newsprint consumption averaged 136 pounds per capita in 1987 compared to 94 pounds in the Midwest. The size of the local newspaper(s) and local economic activity play an important part in accounting for these differences. A single subscriber to the Los Angeles Times or the New York Times generates 650 to 700 pounds of newspaper waste annually. A typical local newspaper is about one-third of this quantity (Franklin Associates, Ltd., 1989a). Consumers have two choices available for managing ONP: disposal through incineration and landfilling, or recycling.

Traditionally, recycling has been a voluntary activity. Households separated newspapers, as well as other recyclables, for collection by the municipality, private haulers, or non-profit organizations, or by taking them to drop-off or buy-back centers. More recently, municipalities are changing the conditions of waste collection and disposal services and are requiring households to separate and recycle selected components of their solid wastes. About three cubic yards of landfill space is saved for each ton of ONP recycled (Energy Systems Research Group, 1989).

The quantity of ONP generated has increased along with the quantity recovered over the last decade and a half as shown in Figure 3-4. In 1988, the quantity of ONP diverted from the solid waste stream reached a record of 4.7 million tons (American Paper Institute, 1989b). The recovery rate has tended slightly upward as shown in Figure 3-5. In 1988, this value was 34 percent. In Canada, the recovery rate is about 17 percent. The upper limit to the recovery rate is thought by observers to be in the 50 to 55 percent range, although a few have even suggested that 75 percent recovery is possible (Franklin Associates, Ltd., 1989a).

3.4 OLD NEWSPAPERS RECYCLING

Waste paper dealers receive the ONP, remove nonpulpable materials such as plastic inserts, and sort them into grades developed by the Paper Stock Institute of America. The dealers may be independent or captive dealers owned by a paper company. Generally, grades 8 (special news deink quality) and 9 (over issue news) are deinked into newsprint. About three percent of recycled newspapers are from pressroom scrap, five percent from overissue news-newspapers returned by distributors from newsstands. The great majority comes from households (Franklin Associates, Ltd., 1989a).

About one-third of ONP recovered in the U.S. are recycled back into newsprint. Almost one-quarter is exported to other countries. Major foreign buyers of U.S. wastepaper include South Korea, Taiwan, Japan, and Mexico. The remaining 50 per cent or so are used in folding cartons, sanitary tissue, construction paper and paperboard, cellulosic insulation, molded egg cartons, cushioning materials for packaging, and animal bedding (American Paper Institute, 1989b).

In the U.S., old newspapers recycled into newsprint represents almost one-quarter of the weight of newsprint produced-see Figure 3-6. In Canada, only one mill uses ONP in newsprint production. Old newsprint for this mill comes from Ontario Province, not from sources in the U.S. In the aggregate, Canadian mills use less than two percent of recycled newspapers in newsprint (Franklin Associates, Ltd., 1989a).

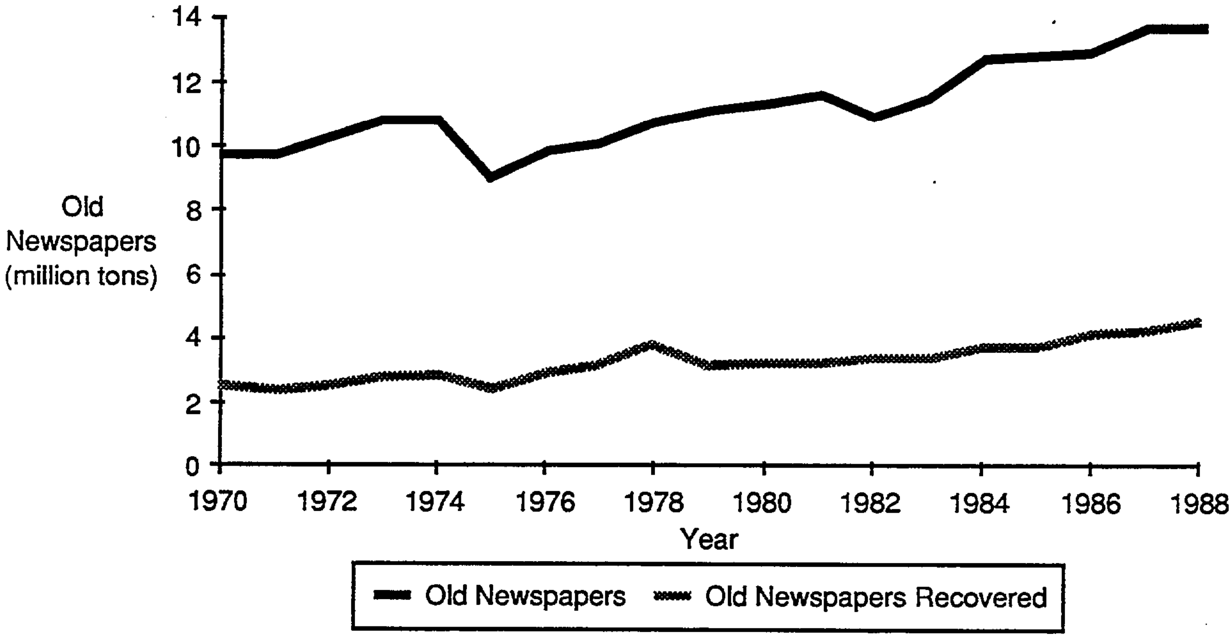


Figure 3-4. Old Newspaper Generation and Recovery

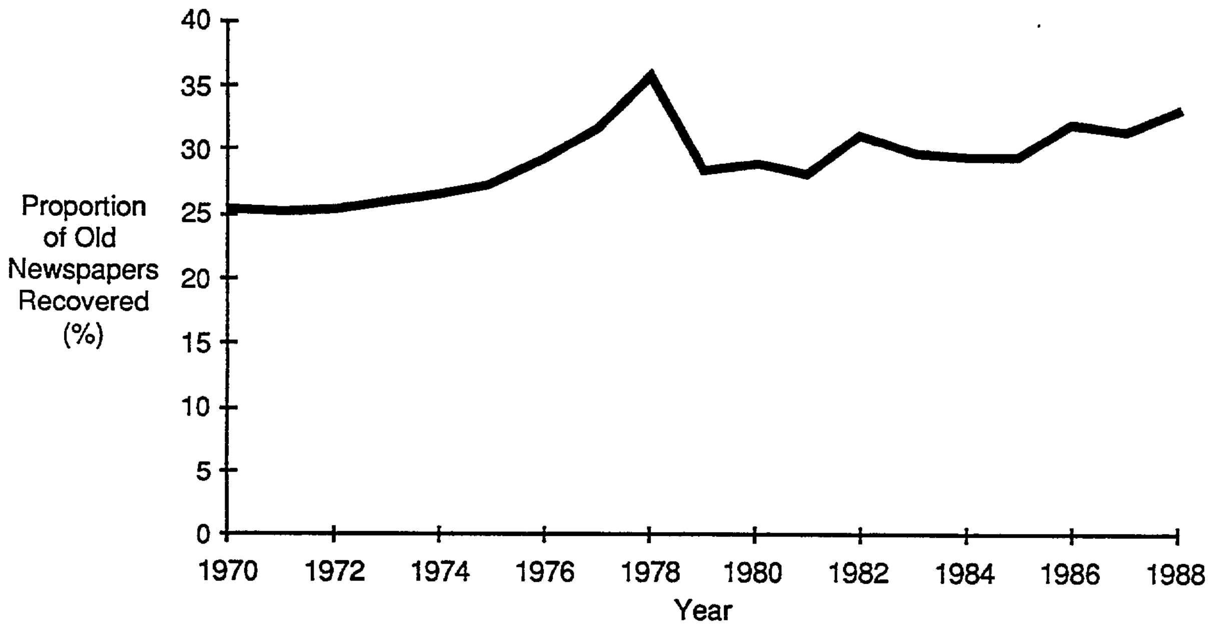


Figure 3-5. Old Newspaper Recovery Rate

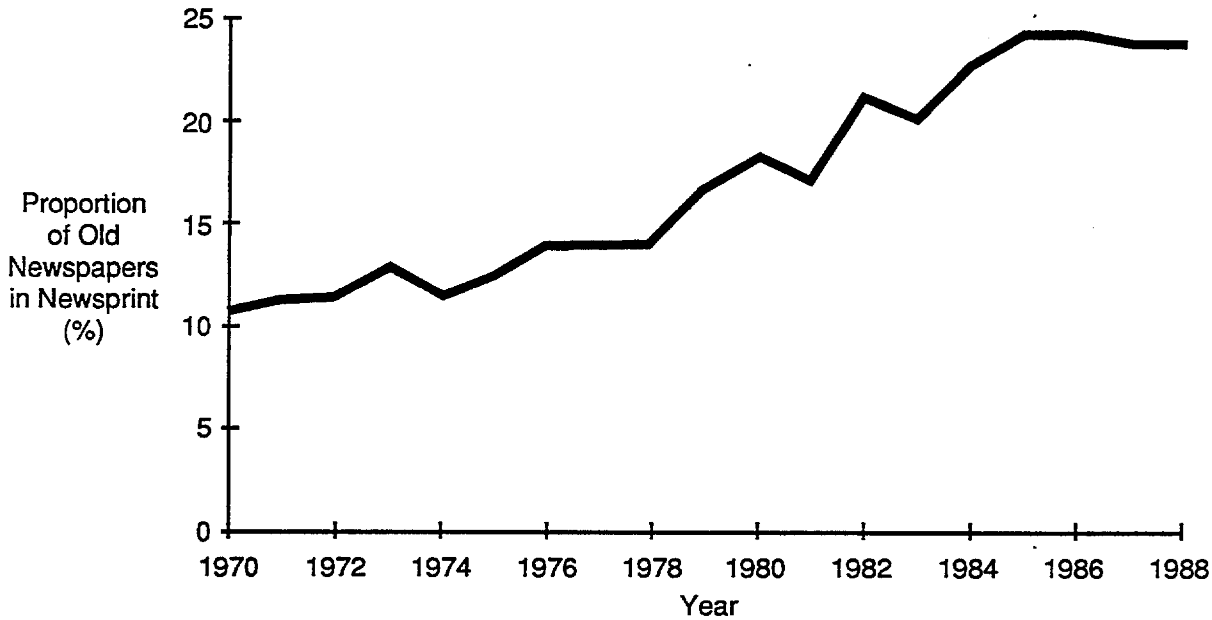


Figure 3-6. Old Newspaper Utilization in U.S. Newsprint Manufacture

Mills frequently warehouse wastepaper to provide a sure source of supply and a buffer against excessive secondary paper price movements. Inside storage protects the paper from sunlight and moisture that hinder the deinking process. Storage time depends on climatic conditions. In the northern areas, waste paper can be stored two to three years without adversely affecting quality; in the south, that time is halved (Jeyasingam, 1982).

CHAPTER 4
POLICY MODEL

Introducing the marketable permit policy will limit the consumption of virgin fiber inputs in newsprint production and will require using secondary fiber produced from old newspapers (ONP). The prices and quantities of all commodities in the newsprint-newspapers-old newspapers system described in Section 3 will also change. Estimating the economic effects of the marketable permit policy requires developing an analytic framework and an operational model that incorporates the above framework or structure. Below, we present the basic structure of an operational ONP policy model. (See Appendix C for a complete description of it.) The model is a comparative statics model of the markets comprising the newsprint-newspapers-old newspapers system. All of these markets are assumed to be perfectly competitive. We first summarize essential characteristics of the model, then discuss the model parameters and the data sources used.

4.1 MODEL OVERVIEW

Figure 4-1 provides an overview of the system of markets and activities likely to be affected by the marketable permit policy and the relationships between them. Because of the importance of Canadian newsprint producers in the U.S. market, a separate Canadian sector is shown. A total of 26 commodities are shown in Figure 4-1-11 Canadian and 15. U.S. Other inputs to each productive activity are also implied. For example, producing newspapers requires newsprint as well as labor and capital services, ink, energy, and other materials. To demonstrate the interaction between markets that may take place, we provide a simplified example of the effects of the policy in six interrelated markets in Figure 4-2 and discuss them below.

The marketable permit policy will have a direct effect on the market for virgin newsprint by limiting the quantity of virgin pulp that may be used in producing newsprint for sale in the U.S. This limit derives from the recycling content standard-the proportion of newsprint that must be composed of secondary fiber under the marketable permit policy. producers of newsprint containing less secondary pulp than the standard must obtain permits from producers whose newsprint exceeds the secondary content standard. Ignoring fiber losses in newsprint manufacture, the standard newsprint proportion, RCS, is defined as

$$RCS = S/(S + V) \tag{4.1}$$

where S is the quantity of secondary pulp made from ONP and V is the quantity of virgin pulp made from wood.

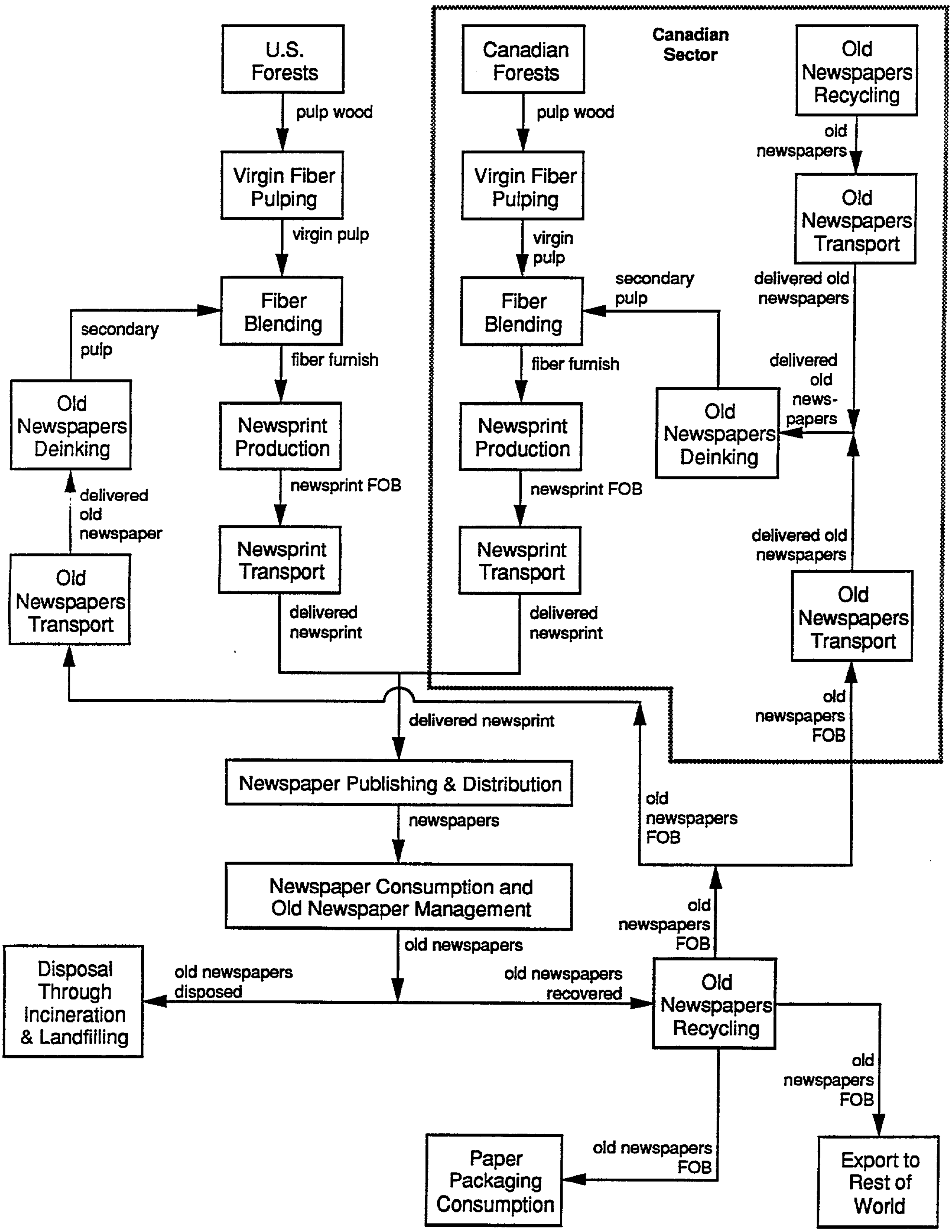


Figure 4-1.
North American Newsprint-Newspaper-Old Newspaper System

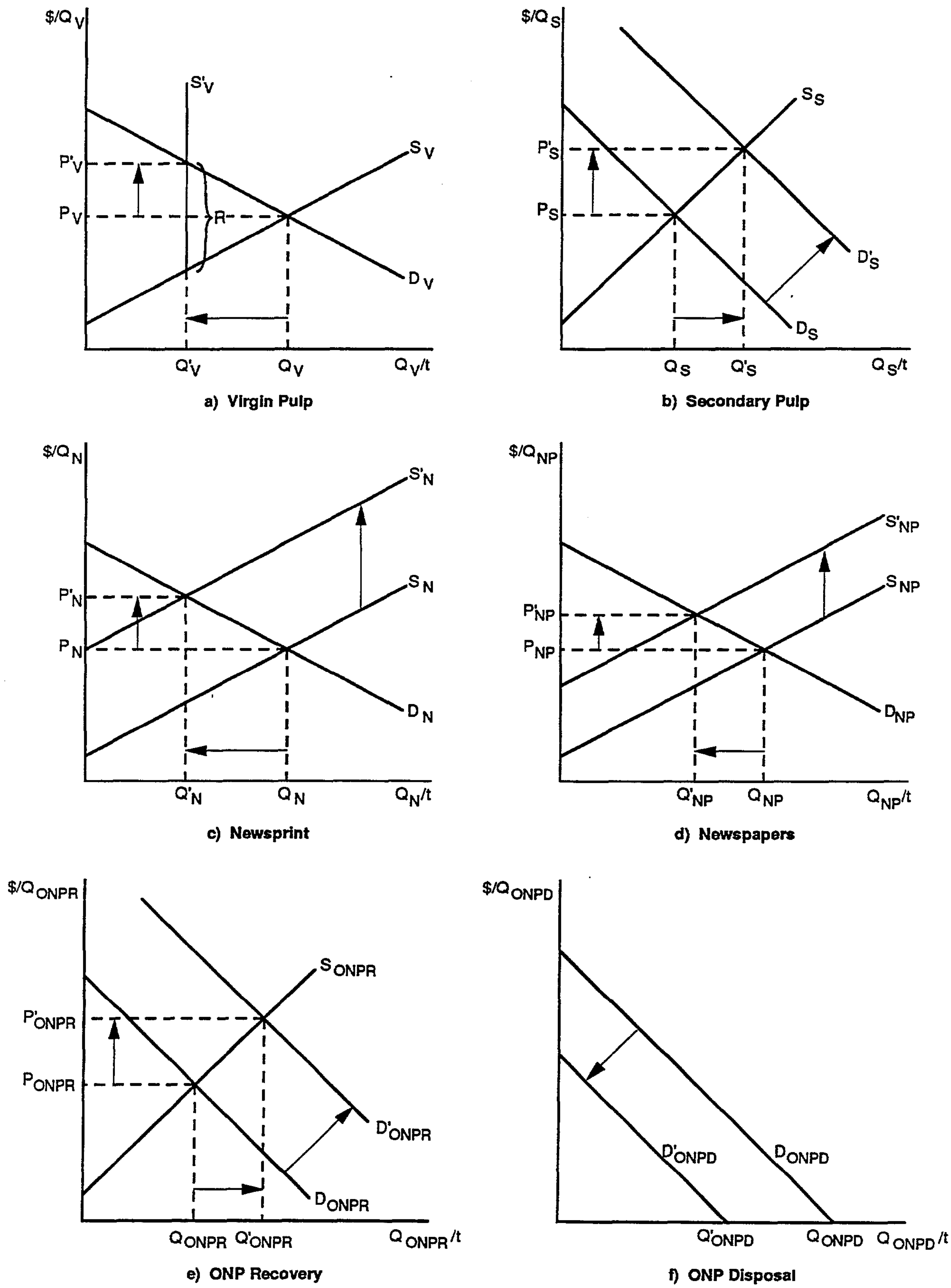


Figure 4-2. Selected Market Effects of a Marketable Permit Policy for Virgin Pulp

Limiting the total quantity of virgin pulp will affect all other related markets in the newsprint-newspaper-old newspapers system, six of which are shown in Figure 4-2. The demand for virgin pulp for newsprint is shown by D_V and the supply, S_V, in Figure 4-2a. The demand curve slopes downward because the demand from which it is derived (newsprint and ultimately, newspapers) is negatively sloped and because secondary pulp may be substituted for virgin pulp in newsprint manufacture. The supply curve slopes upward for two reasons. First, production at each mill occurs under diminishing marginal returns. That is, as existing virgin pulp producers push against their capacity limits, marginal costs increase. Second, production costs differ across mills due to differences in technology, plant vintages, and input prices. Thus, there is a hierarchy of mills from low to high cost. The low-cost mills occupy the lower portion of the supply curve, while the high-cost mills comprise the higher part of the curve. Suppose introducing the marketable permit policy restricts the allowable quantity of virgin pulp to Q'_V. The new market clearing price of virgin pulp is P'_V, and the average cost of permits per unit of virgin pulp is R.

The increase in the price of virgin pulp shifts the demand curve outward for secondary pulp, which is a substitute in newsprint production, as shown in Figure 4-lb. Due to the outward shift in the demand curve, the quantity of secondary pulp supplied increases to Q'_S with the price of secondary pulp increasing to P'_S. Higher pulp costs increase the cost of producing newsprint, represented by an upward shift in the supply curve to S'_N as shown in Figure 4-2c. The upward shift in the supply curve causes the price of newsprint to increase to P'_N and the quantity of newsprint demanded to decline to Q'_N.

In turn, higher newsprint prices raise the cost of newspaper production, represented in Figure 4-2d as an upward shift in the supply curve to S'_{NP}. The price of newspapers increases to P'_{NP} and the quantity demanded declines to Q'_{NP}. Higher secondary pulp prices shifts the demand curve outward for ONP as shown in Figure 4-2e. This increases the price of ONP to P'_{ONPR}, increasing the quantity supplied to Q'_{ONPR}. Increases in the price of ONP and decreases in newspaper consumption shift households' demand curve down for ONP disposal services (Figure 4-2f), reducing the quantity of ONP disposed to Q'_{ONPD}.

By introducing the marketable permit policy, ONP waste generation declines by Q_{NP} Q'_{NP}, the *waste generation effect* of the policy; and the quantity of ONP recovered increases by $Q'_{ONPR} - Q_{ONPR}$, the *waste recovery effect.* The quantity of ONP disposal declines by $Q_{ONPD} - Q'_{ONPD}$, the *waste disposal effect* of the policy, which is the sum of the waste generation and waste recovery effects.

Our simplified six-market example is limited in two ways. First, it only illustrates a subset of the many markets affected by the policy (see Figure 4-1 for the key markets affected). Second, it does not illustrate the feedback or dynamic effects of the policy. For example, decreases in newspaper consumption will shift the demand curve downward for newsprint, which in turn will shift the demand curves down for pulp of both types.

A number of approaches can potentially model introducing a marketable permit policy in this system and address the feedback effects. Most require extensive econometric estimation or process engineering modeling. However, the neoclassical theory of derived demand allows us to model the policy and reduce the data requirements without sacrificing the richness of detail needed to evaluate the policy. Our model incorporates the market structure of Figure 4-1 in the competitive model of price formation and quantity determination. The model is a 52-simultaneous-equations linear system. It incorporates Hicks-Allen derived demand relationships, uses readily available data on the initial prices and quantities for each market, and incorporates estimates of the elasticity of supply, demand, and substitution for selected commodities and each production process. The dynamic effects between markets are fully accounted for by solving for the equilibrium conditions for each market simultaneously. This solution to the model reflects the new long-run equilibrium after all markets have fully adjusted to the initial limit on virgin pulp production. The model is formally set out in Appendix C.

While reducing the data and estimation requirements of other modeling approaches, this approach to economic modeling also has limitations. Because it is formulated in proportional changes rather than actual levels, the model cannot address problems characterized by corner solutions. That is, the prices and quantities of all commodities modeled must be greater than zero. It accounts for spatial differences by having separate U.S. and Canadian sectors, modeling each sector as a representative firm. Regional differences within each country are not addressed. As a result, the model does not account for differences in transportation costs experienced by newsprint mills in other locations throughout each country.

Our model also does not account for changes in other external factors that may also affect these markets. For example, the quantity of newsprint consumed is likely to be a function of multiple factors including GNP and the price of advertising in newspapers and other media. Over the time period needed to implement the policy, these and other factors are likely to change as well. The demand for newspapers is expected to shift outward with increased population and income. The supply of ONP is also likely to change with states' initiatives and municipalities' responses to their mounting solid waste problems.

But this model does not forecast those effects. Since this model nor any other model can account for all factors influencing the commodities in the newprint-newspapers-old newspapers system, the changes projected are based on the assumption that these other factors are constant. For a policy that will be implemented over a period of years, this assumption obviously does not hold. Therefore, the price and quantity changes our model predicts will represent only the changes resulting from the policy itself, not the true set of prices and quantities likely to exist at the end of the implementation period.

We assume that the policy is implemented in one step rather than phased in over time. If the policy is phased in, a target date for achieving the recycled content goal would be defined and the recycled content standard increased gradually over time until the goal is met. Phasing in the policy will reduce the present value of its benefits, since its full benefits will not be achieved until some future date. However, phasing in the policy will also reduce the present value of its costs in two ways. First, some of the costs will be deferred until a future time, thus decreasing the present value of those costs. Second, additional secondary pulp may come from the expected industry expansion and not from displaced existing virgin pulp capacity.

While the model does not account for the full set of outside factors affecting each of these interrelated markets and the phase-in alternative is not addressed, it does capture the simultaneous character of the included markets (the feedback effects in the example at the beginning of this chapter), and it includes most of the key sectors affected by the policy. The model design also reflects standard microeconomic theory and provides the basis for consistent economic and welfare effect estimates.

4.2 MODEL PARAMETERS

We must assume the parameter values necessary to make the model operational, take them from the literature, or estimate them. The approach to developing the parameters is summarized below.

4.2.1 Baseline Values

Table 4-1 provides baseline price and quantity estimates for 1988 for each commodity in the newsprint-newspaper-old newspapers system and the data source for each estimate. These values are used in two applications. First, they are the basis for transforming the proportional changes in prices and quantities produced by the ONP policy model into actual values. Second, they provide input into the development of the cost and quantity shares as described below.

TABLE 4-1. BASELINE VALUES FOR THE NEWSPRINT-NEWSPAPERS, OLD NEWSPAPER SYSTEM

Commodity	Serial No.	Quantity[1]	Price[2]	Sources for Quantities	Sources for Prices
Canadian Newsprint Sector					
Virgin pulp	1	7,926	200	fiber furnish—secondary pulp	equal to secondary pulp
Secondary newspaper pulp	2	120	200	ONP x 0.85 (per FAL)	cost engineering estimate
Fiber furnish	3	8,046	200	newsprint x 1.03 (per FAL)	equal to pulp price
Newsprint, FOB	4	7,812	563	FAL with RTI adjustment	assumed same as U.S. price
Delivered newsprint	5	7,812	600	equal to produced newsprint	*Pulp and Paper Week*, Jan. 11, 1988
ONP from U.S., FOB	6	18	35	FAL with RTI adjustment	assumed same as U.S. price
Delivered ONP from U.S.	7	18	75	FAL with RTI adjustment	assumed $40/ton for delivery
ONP from Canada, FOB	8	123	35	FAL with RTI adjustment	assumed same as U.S. price
Delivered ONP from Canada	9	123	75	FAL with RTI adjustment	assumed $40/ton for delivery
Delivered ONP for deinking	10	141	75	18 + 123	equal to Canadian ONP
Non-ONP inputs to secondary pulp	11	120	112	index = secondary pulp	price of residual input
U.S. Newsprint Sector					
Virgin pulp	12	4,601	200	fiber furnish—secondary pulp	equal to secondary pulp
Secondary pulp	13	1,121	200	ONP x 0.85 (per FAL)	cost engineering estimate
Fiber furnish	14	5,722	200	newsprint x 1.03 (per FAL)	equal to pulp price
Newsprint, FOB	15	5,555	563	FAL	delivered price – $37/ton for delivery, per FSAC
Delivered newsprint from U.S.	16	5,555	600	equal to produced newsprint	*Pulp and Paper Week*, Jan. 11, 1989
Delivered newsprint (U.S. plus Canada)	17	13,367	600	Canadian + U.S. newsprint	equal to U.S. newsprint
Newspapers	18	22,372	38	RTI estimate	RTI estimate (excludes revenue from advertising)
ONP	19	13,367	0	equal to delivered newsprint	assumed average household unit price
ONP disposed	20	8,940	0	FAL with RTI adjustment	assumed average household unit price
ONP recovered	21	4,427	25	FAL with RTI adjustment	Energy Systems Research
ONP for deinking, FOB	22	1,319	35	FAL with RTI adjustment	assumes $10/ton for handling, sorting, bailing
ONP for packaging, etc.	23	2,101	35	FAL with RTI adjustment	assumes $10/ton for handling, sorting, bailing
ONP exported except to Canadian newsprint producers	24	989	35	FAL with RTI adjustment	assumes $10/ton for handling, sorting, bailing
Delivered ONP	25	1,319	75	FAL with RTI adjustment	assumes $40/ton for delivery
Non-ONP inputs to secondary pulp	26	1,121	112	index equal to secondary pulp	price of residual input

[1]All values in 10^3 tons except newspapers which are in 10^6 copies.
[2]All values in $/ton except newspapers which are in ¢/copy.

4.2.2 Demand and Supply Elasticities

Demand and supply elasticities are used in the ONF policy model to represent the exogenous demand and supply functions. The three demand and seven supply elasticities used in the model are identified in Table 4-2. These elasticities are estimates of the responsiveness of consumers and producers respectively to changes in the price of the commodity.

The sign of demand elasticities is negative. The elasticity of demand is a measure of consumers' responsiveness to commodity price changes, which in turn, is determined by their opportunities for substitution in commodity consumption. The elasticity of demand, η, is in the range $-\infty < \eta < 0$. When commodities have limited substitutes, demand is inelastic (close to zero); when many substitutes are available, demand is elastic (approaches negative infinity).

We estimate the elasticity of demand for newspapers following the approach used by Houthakker and Taylor (1970). They estimated an expenditure function for the newspaper and all other components of personal consumption expenditures in the national income accounts. Then they transform the expenditure elasticity into a price elasticity. Following their approach, our estimate of the elasticity of demand for newspapers is -2.99.

The elasticities of demand for ONP in packaging and other applications and for ONP exports are both assumed values. We assume that the demand for ONP in these markets is fairly unresponsive to price changes and have used - 0.25 as the demand elasticity for both commodities in this analysis. This implies that doubling the price of ONP would reduce the quantity demanded by 25 percent. As discussed in Section 5, these demand elasticities have a significant effect on the projected resource recovery effects of the policy. If the demand were rather inelastic as assumed here, then increases in ONP consumption for newsprint production would come primarily from greater ONP recovery from households. On the other hand, if the demand for ONP in these uses were elastic, then the policy would divert ONP from packaging and export markets to secondary pulp for newsprint production. The resource recovery effects, accordingly, would be reduced from the inelastic case.

The normal sign of supply elasticities is positive. Supply elasticity is a measure of producers' responsiveness to commodity price changes. Supplier response to price changes is determined by the usage alternatives of the inputs used to produce the product. The elasticity of supply, ε, is in the range $\infty > \varepsilon > 0$. When inputs have limited alternative uses, supply is inelastic (close to zero); when many alternatives are available, supply is elastic (approaches infinity).

TABLE 4-2. ONP POLICY MODEL PARAMETER VALUES

Parameter Description	Parameter Symbol	Parameter Value
Demand Elasticities		
Newspapers	η_{18}	-2.99
ONP disposal	η_{20}	-1.00
ONP for packaging	η_{23}	-.25
ONP for export	η_{24}	-.25
Supply Elasticities		
Virgin pulp (Canada)	ε_1	15.20
ONP from Canada	ε_8	1.60
Specialized inputs for secondary pulp (Canada)	ε_{11}	4.28
Virgin pulp (U.S.)	ε_{12}	10.76
ONP recovered	ε_{21}	1.60
Specialized inputs for secondary pulp	ε_{26}	3.40
Elasticities of Substitution		
Canadian Newsprint Sector		
Delivered ONP and non-ONP inputs	σ_2	0
Virgin and secondary pulp	σ_3	infinity
Fiber furnish and all other inputs	σ_4	0
Newsprint and all other inputs	σ_5	0
ONP from U.S. and all other inputs	σ_7	0
ONP from Canada and all other inputs	σ_9	0
Delivered ONP from U.S. and Canada and all other inputs	σ_{10}	infinity
U.S. Newsprint Sector		
Delivered ONP and non-ONP inputs	σ_{13}	0
Virgin and secondary pulp	σ_{14}	infinity
Fiber furnish and all other inputs	σ_{15}	0
Newsprint and all other inputs	σ_{16}	0
Delivered newsprint from U.S. and all other inputs	σ_{17}	infinity
Delivered newsprint and all other inputs	σ_{18}	0
ONP and all other inputs	σ_{25}	0

CONTINUED

TABLE 4-2. ONP POLICY MODEL PARAMETER VALUES (CONTINUED)

Parameter Description	Parameter Symbol	Parameter Value
Cost Shares (%)		
Canadian Newsprint Sector		
Delivered ONP in secondary fiber	k_2	44.06
Virgin pulp fiber furnish	k_3	98.51
Fiber furnish in newsprint	k_4	37.94
Newsprint in delivered newsprint	k_5	90.50
ONP from U.S. in delivered ONP	k_7	46.67
ONP from Canada in delivered ONP	k_9	46.67
Canadian ONP in delivered ONP for secondary pulp	k_{10}	12.77
U.S. Newsprint Sector		
Delivered ONP in secondary pulp	k_{13}	44.12
Virgin pulp in fiber furnish	k_{14}	80.41
Fiber furnish in newsprint	k_{15}	36.59
Newsprint in delivered newsprint	k_{16}	93.83
Delivered newsprint from U.S. in delivered newsprint	k_{17}	41.56
Delivered newsprint in newspapers	k_{18}	20.19
ONP in delivered ONP	k_{25}	46.67
Quantity Shares (%)		
ONP for secondary pulp	g_{22}	**29.79**
ONP for Canada secondary pulp	g_6	0.41
ONP for packaging, etc.	g_{23}	47.46
ONP exported	g_{24}	22.34
ONP disposed of ONP generated	g_{20}	66.88

We use an engineering-cost approach to estimate the supply elasticities for virgin pulp, non-ONP inputs to secondary pulp production, and ONP recovery. For virgin pulp and non-ONP inputs, we estimate supply separately for U.S. and Canadian producers. A simple linear unit-cost function provided by Franklin Associates, Ltd., (1989b) reflecting the presence of economies of scale is used to compute mill-specific unit cost estimates based on the production capacity of each mill in the U.S. and Canada. The result is a J-shaped supply curve for each mill where marginal costs are constant to capacity output and then become infinite. The curves are horizontally summed to develop the market supply curve. The supply elasticity is econometrically estimated from the data for each curve.

The supply curves for virgin pulp are shown in Figure 4-3. They reflect only the operating costs of virgin pulp production, including the cost of pulp wood. Capital costs are not included because these costs are sunk and do not influence producers' operating decisions for existing mills that without the phase-in option, will experience a reduction in output. The estimated supply elasticity for Canadian mills is 15.20; for U.S. mills it is 10.76, reflecting the smaller U.S. mills.

For deinking facilities, we include a capital recovery factor because these would all be new mills as the policy will increase secondary pulp consumption. The supply curves are shown in Figure 4-4. The new deinking facilities are sized to the capacity of each newsprint mill in the U.S. and Canada. The estimated supply function only includes the costs of non-ONP inputs as the price of ONP will change with the policy and this change is accounted for within the model. The estimated supply elasticity for Canadian deinking facilities is 4.28; for U.S. producers the value is 3.40.

We estimate the elasticity of supply for recovered ONP from data provided by Energy Systems Research Croup (1989). They used their model of municipal waste management decision-making to estimate the minimum ONP price necessary for ONP recovery to be economically attractive for 12 paradigm communities. The paradigm communities are counties that vary by their population and tipping fees, which are assumed to reflect the marginal cost of landfilling ONP. For each county in the nation we then identified the paradigm community it was most similar to in terms of population and tipping fees, thereby obtaining the minimum ONP price at which each county would recover ONP. Each county is assumed to have an J-shaped ONP supply curve beginning at the identified price and going horizontally to the assumed maximum recoverable ONP of the county. Next, we again horizontally summed the supply curves across all suppliers (counties) to obtain the national supply curve for recovered ONP. The result is a supply function with seven steps shown in Figure 4-5, as many of the smaller counties are represented by the same paradigm community. An exact curve represents the three positive price values. The function has a positive quantity intercept-implying that many communities currently find recycling old newspapers attractive, even at a zero price, as their savings in landfill costs more than offset the recovery costs.

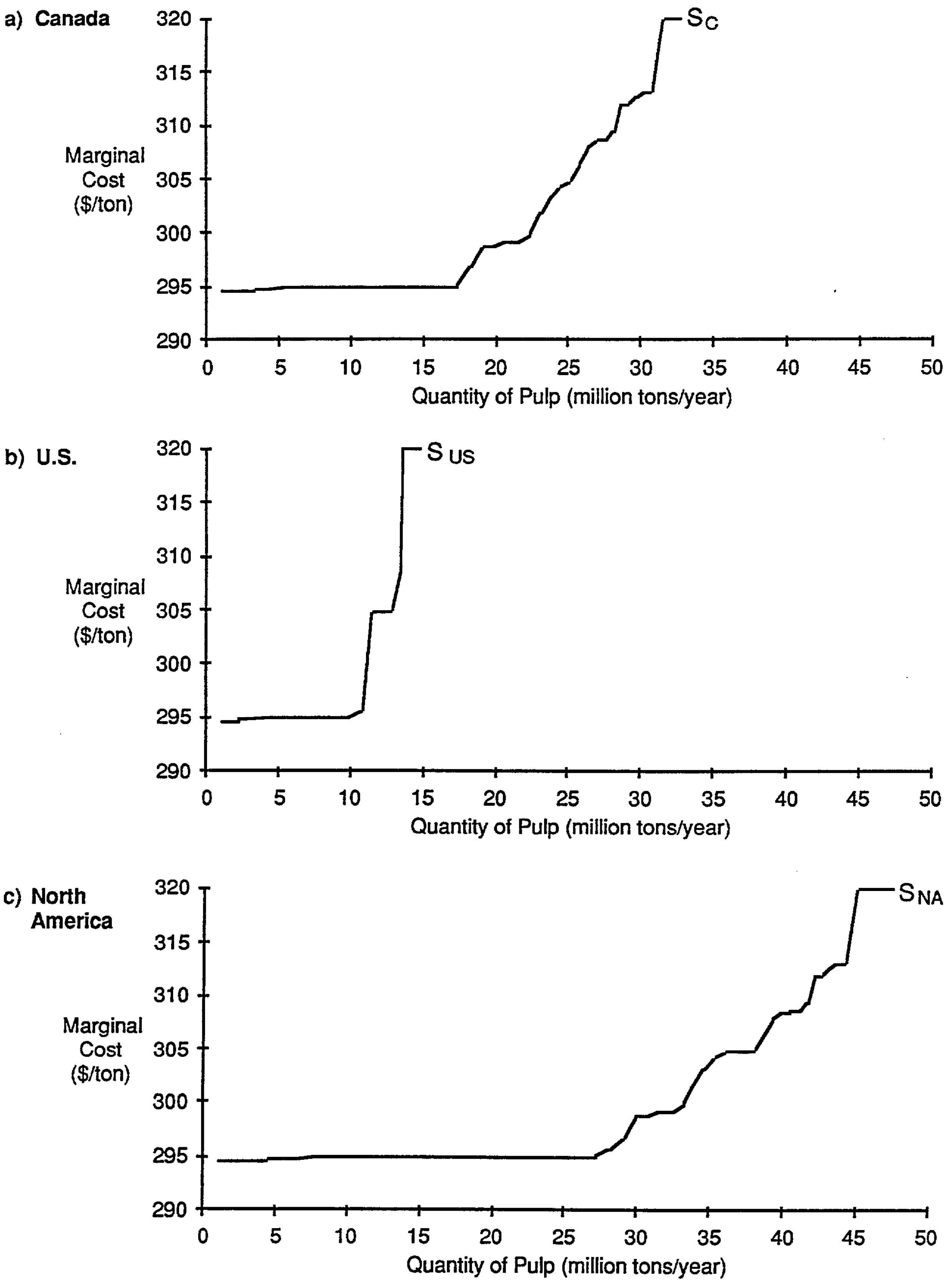


Figure 4-3. Virgin Pulp Supply Function

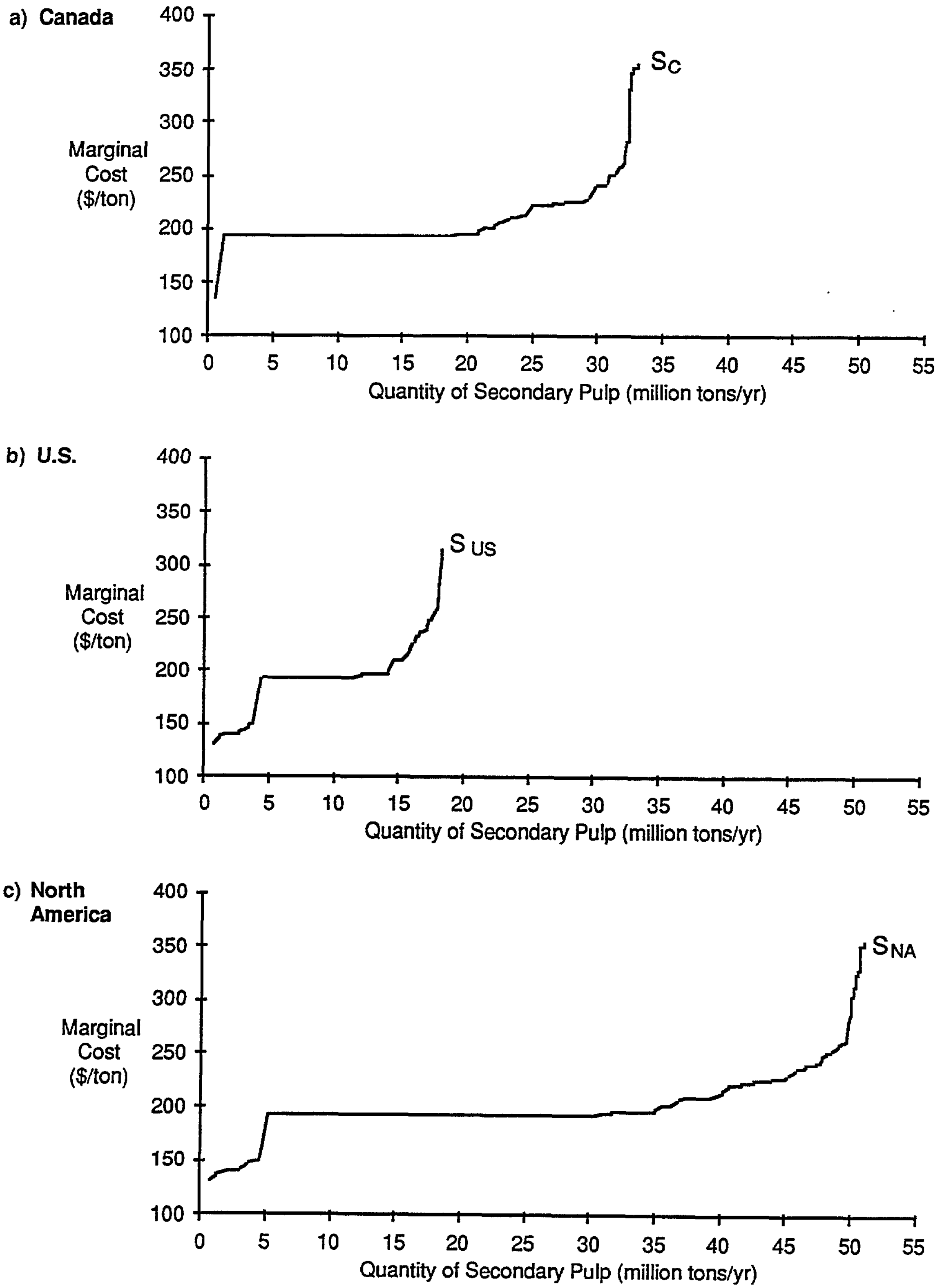


Figure 4-4. Long-Term Supply of Secondary Pulp

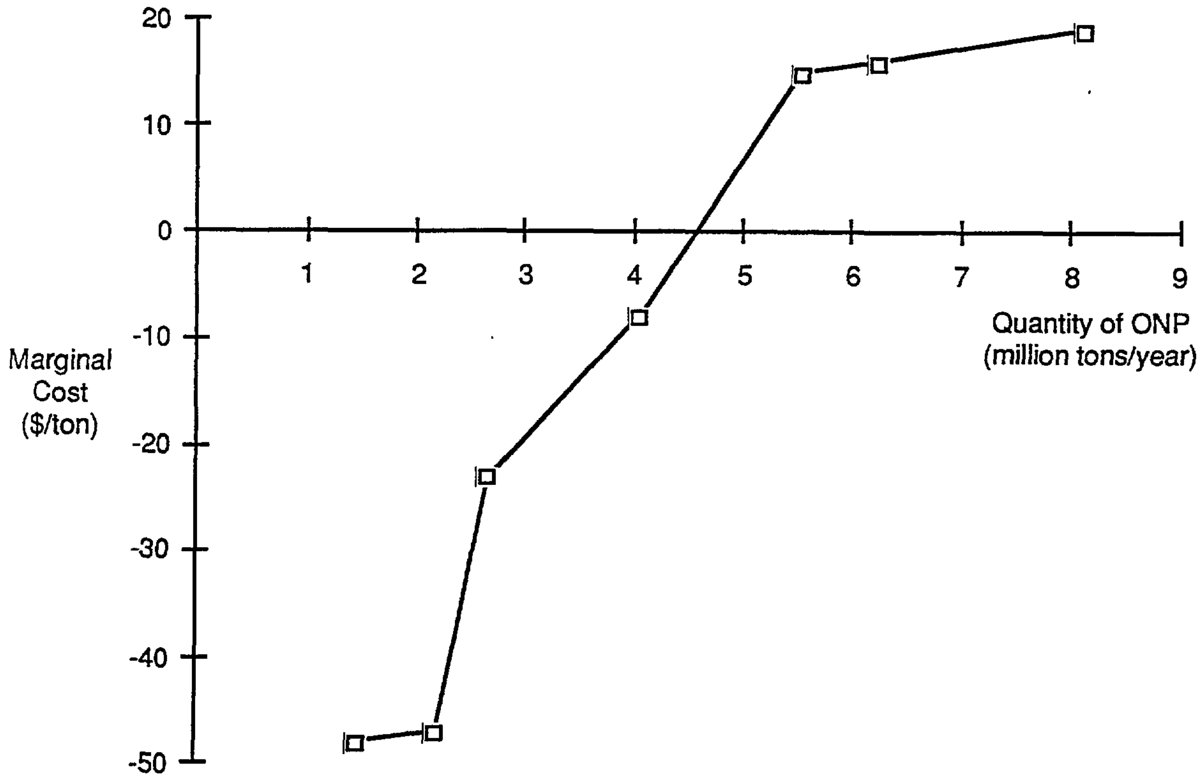


Figure 4-5. U.S. Supply of Old Newspapers

4.2.3 Elasticities of Substitution

The derived demand functions in the ONP policy model incorporate elasticities of substitution between the two productive inputs. The elasticity of substitution reflects the ease of substitution between two inputs in production. The elasticity of substitution, σ, is in the range $\infty > \sigma > 0$. Production processes characterized by $\sigma = 0$ arc fixed proportions; substitution between the two inputs is not technically possible. The two inputs are complements that are always used in a fixed ratio (e.g., one unit of labor and three units of capital). In this case of fixed proportions or Leontief production functions, the elasticity of derived demand for an input has the same value as the elasticity of demand for the produced commodity. When $\sigma > 0$, substitution between the two inputs is possible and the elasticity of derived demand for a production input is more elastic than in the case of the fixed proportions. When $\sigma = \infty$, the two inputs are perfect technical substitutes in the production process.

Every production function in the ONP policy model is modeled as having fixed proportions, and we provide for introducing a non-zero (neoclassical) elasticity of substitution. Table 4-2 shows the sectors where production functions with variable proportions are incorporated and shows the elasticities of substitution used in the model. The values selected for this analysis are either zero or infinity. We have assumed that virgin and secondary pulp are virtually perfect substitutes in'newsprint production at least to an aggregate North American recycling rate of 50 per cent. Our understanding is that at least to that rate, and perhaps beyond, newsprint printability and runnability are not affected by the use of secondary fiber (New York State Newspaper Recycling Task Force report, 1989).

4.2.4 Cost and Quantity Shares

Changes in the production cost of a commodity computed in the ONP policy model depend on the prices of the production inputs and their cost or quantity shares. Table 4-2 shows the values developed from the baseline price and quantity values.

CHAPTER 5
POLICY SIMULATIONS

The model described above simulates the price and quantity effects of the marketable permit policy for virgin newsprint. The model is a 52-simultaneous-equation comparative statics representation of the newsprint-newspaper-old newspapers system. It provides snapshots of the 26 commodity prices and quantities throughout the system with and without a marketable permit policy based on 1988 conditions. We assume competitive pricing behavior. The U.S. and Canadian newsprint sectors are separately modeled. All producers in each country are treated as if they are located at a single place in their respective countries, with a representative firm for each country. This approach precludes examining intracountry effects.

The model parameters and baseline values are identified in Section 4. Initial prices and quantities are based on market observations. Some of the values for the response parameters (elasticities) are estimated; however, many are assumed based on our understanding of the technical choices available to producers and consumers. Given the data limitations and the assumptions necessary, our results only suggest the magnitude of the policy's effects on the prices and quantities of the commodities modeled. Further work is needed to examine the results' sensitivity to key parameter values, and to develop more of the necessary elasticities.

5.1 PERMIT QUANTITIES

The marketable permit policy requires that newsprint contain a certain proportion of secondary fiber. Firms producing newsprint with less than the required content must have a permit for the excess virgin pulp component. They would obtain these permits from firms producing newsprint with a secondary fiber content exceeding the required amount.

Each producer receives an annual entitlement of permits, PE_i, equal to

$$Q_i\,(1\text{-RCS})$$

where Q_i is the fiber content in tons of the newsprint produced by the ith producer annually, and RCS is the recycling content standard expressed as a proportion. Each producer's permit requirement, PR_i, is $Q_i\,(1 - RC_i)$ where RC_i is the actual proportion of secondary fiber in the ith firm's newsprint.

Therefore, the net permit requirement, NPR_i, for the producer is

$$Q_i\,(RCS - RC_i).$$

In cases where NPR_i is positive, the producer is required to purchase permits; when NPR_i is negative the producer may sell excess permits. For example, if the recycling content standard is 20 percent, a firm producing 100 tons of newsprint with 30 percent secondary fiber would generate 10 permits (NPR_i = -10). A firm producing 100 tons of newsprint with no secondary fiber would be required to purchase 20 permits (NPR_i = 20). Under this permit system, some newsprint will have less than the required content and some will have more. But on average, all newsprint marketed in the U.S. will have the required recycled fiber content.

After adjusting for the foreign trade in newsprint between North America and the rest of the world, the recycled content of newsprint produced in North America for U.S. consumption in 1988 averaged 9.3 percent. The U.S. value was 20.2 percent, and the Canadian value, 1.5 percent. Laboratory research on repulping and actual experiences of newsprint mills using secondary fiber suggest that recycling rates of at least 50 percent are technically possible without significant reductions in newsprint runability or printability. Furthermore, old newspaper (ONP) recovery rates of 50 percent arc generally regarded as quite feasible. Thus, we conduct policy simulations for recycling content standards up to 50 percent. However, it is important to note that recovery rates and recycling rates are not necessarily equal. They are only equal when there is no recovery of ONP for non-newsprint uses. Currently about two-thirds of all ONP recovered in the U.S. is not used in newsprint production in North America. Thus, for the recycling and recovery rate to become equal, the policy would have to displace all alternative uses for ONP.

We examine the policy as if it were introduced in the 1988 economy and as if all adjustments in production are instantaneously made. However, phasing in the recycling content standard over time would reduce the adverse effects of the policy. Indeed, the Heinz/Wertz bill (S1763) starts with a low requirement that increases annually. A phase-in period bill gives newsprint producers time to gradually purchase and install new deinking capacity and reduces the negative impacts on current owners of virgin pulp facilities. With the phase-in option, other factors such as newsprint consumption and waste generation would be different than in 1988. The results presented here isolate the effects of the policy from these other factors. It is as if we instantly have the new equilibria with the policy in place and keep other aspects of the 1988 situation constant. Please keep these points in mind while reviewing the findings presented below.

An important assumption of this policy as envisioned here is that Canadian producers may meet the recycled content standard by using old newsprint from any origin-it need not come from the U.S. but may come from their own domestic sources. This assumption is made because requiring Canadian producers to use old U.S. newspapers would apparently violate U.S.-Canadian trade agreements (personal communication, Roe, 1989).

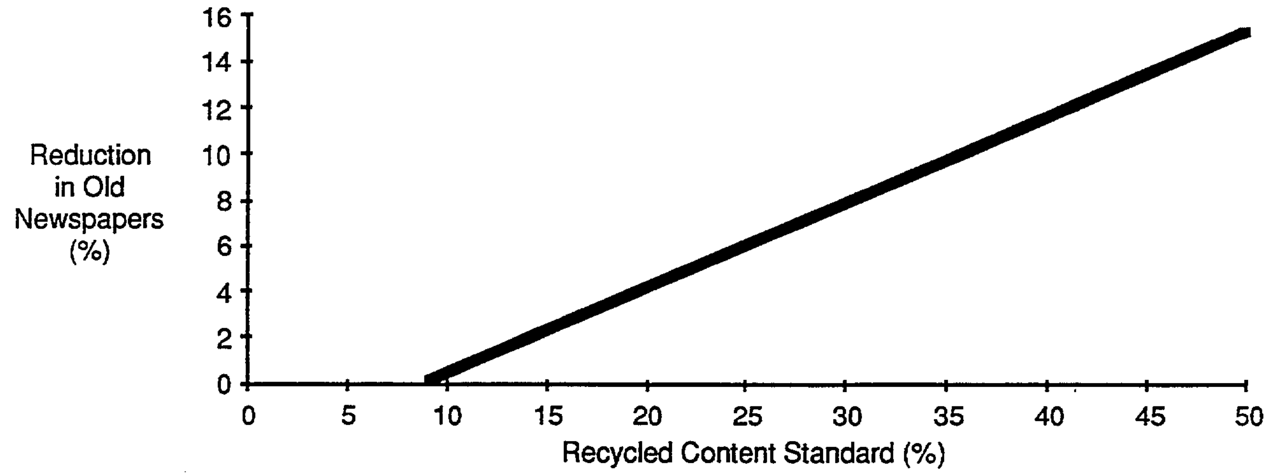
Most permits will be retained by producers because they must have permits for their virgin newsprint production. Only a fraction of the permits will be available for exchange with each standard. Currently, U.S. producers have over five times the secondary pulp capacity of Canada. The economics of adding additional secondary pulp capacity may slightly favor U.S. producers because of their proximity to the source of raw materials-ONP. On the other hand, the relatively larger Canadian newsprint mills can take advantage of the economies of scale in deinking. An important assumption of the model is that newsprint producers respond in proportional rather than absolute amounts when adding secondary pulping capacity. The responsiveness of Canadian producers on a proportional basis is projected to be slightly greater than that of U.S. newsprint producers. However, because the Canadian base is small in comparison to U.S. producers, the absolute additions to secondary pulping capacity of U.S. producers is projected to be substantially larger than their Canadian counterparts.

5.2 QUANTITY EFFECTS

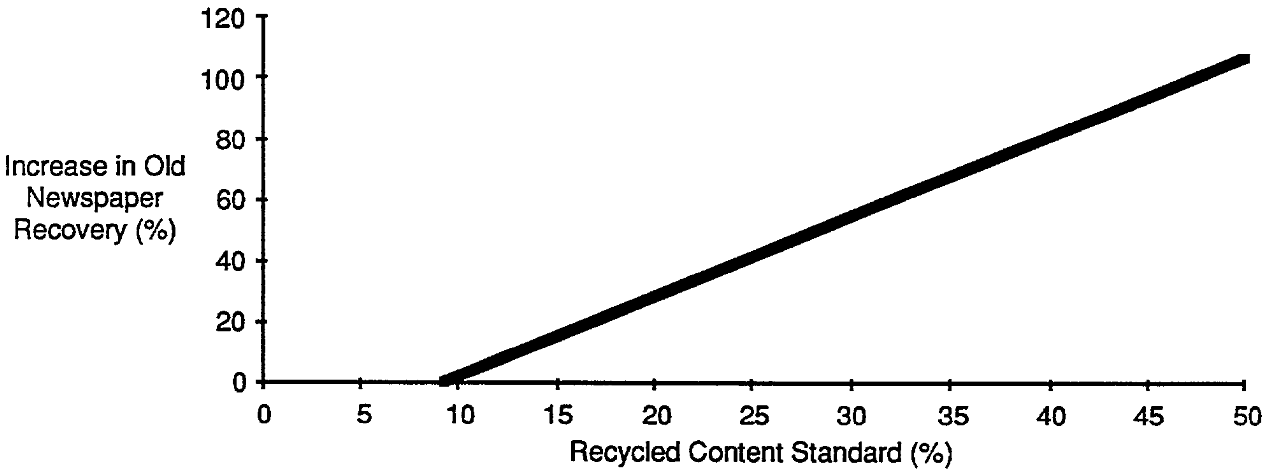
Although the marketable petit system for virgin pulp will alter the quantity of all 26 commodities in the newsprint-newspaper-old newspapers system, three significant quantity effects are in the areas of

- waste generation,
- waste recovery, and
- waste disposal.

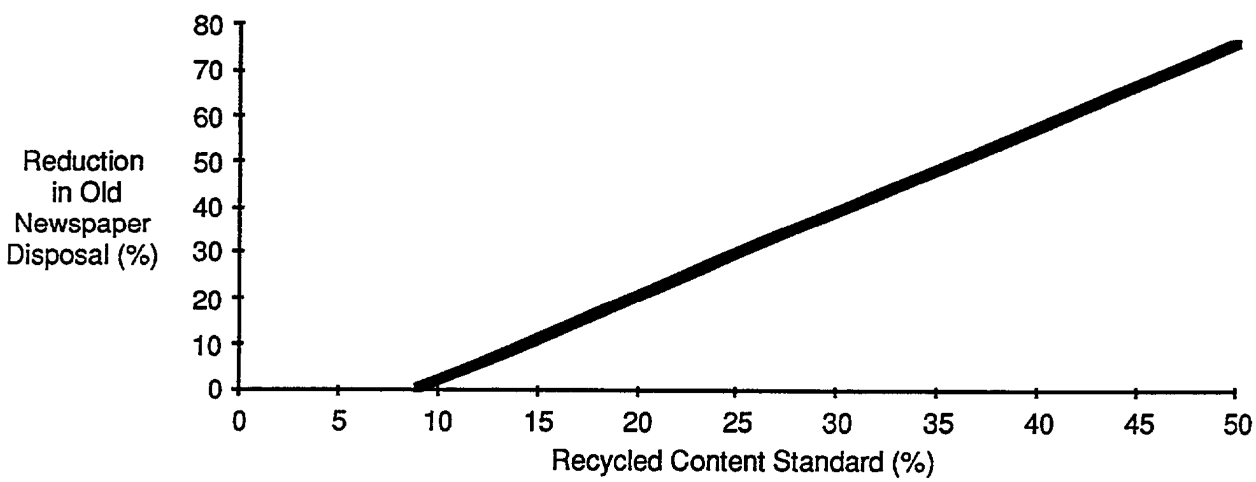
The policy's ***waste generation effect*** is the effect of the policy on the quantity of old newspapers generated. In 1988, U.S. consumers generated about 13.7 million tons of old newspapers, 13.4 million tons of which came from newsprint mills in North America. Increases in the recycling content standard causes the substitution of higher cost secondary pulp for virgin pulp in newsprint manufacture. We assume that these increases will raise the price of newsprint and newspapers, and hence, reduce newspaper consumption. The reductions in waste generation are proportional to the reductions in newspaper purchases by households. The projected waste generation effects of the policy are shown in Figure 5-1a. They are small, generally only a few percent because even though the estimated price elasticity of demand for newspapers is fairly responsive (-2.99), the projected newspaper price effects are small. For example, a recycled content standard of 25 percent is projected to increase the price of newspapers by 2.2 percent.



a) Waste generation effect



b) Waste recovery effect



c) Waste disposal effect

Figure 5-1. Quantity Effects of a Permit Policy, 1988

The policy's ***waste recovery effect*** is its effect on the quantity of old newsprint recycled in the U.S. In 1988, about 4.4 million tons of the newspapers originally produced in North America were recovered from the U.S. solid waste stream. The marketable permit policy will shift outward the demand for ONP by U.S. and Canadian newsprint producers, increasing the price and recovery of old newspapers from the solid waste streams of both countries. However, the resource recovery effect is the net effect of the increased use of ONP from U.S. sources by North American newsprint producers and the reduced use of old U.S. newspapers in other applications;

In 1988, about two-thirds of all ONP recovered were used in non-newsprint applications. However, the increase in ONP price will gradually eliminate some of these non-newsprint applications because using ONP will no longer be cost-effective. (See Appendix A for a graphical description of this effect.). These applications include purchases by other countries (principally Asian) and uses in the manufacture of paper products and other items such as insulation and animal bedding. While these diversions are accounted for in the model, the value of the elasticity of demand for ONP in these applications is assumed. We have assumed a fairly unresponsive elasticity: -0.25. With this elasticity, a doubling of the price of ONP reduces by 25 percent ONP consumption in non-newsprint applications. For example, under a 25 percent recycled content standard, the price of ONP will increase by 29 percent, reducing by 7 percent ONP use in non-newsprint applications.

The waste recovery effect is shown in Figure 5-lb. These are substantial increases in ONP recovery, even after allowing for its diversion from other non-newsprint uses. Figure 5-2 shows the actual values projected in ONP recovery and the distribution in ONP consumption between newsprint and non-newsprint uses. The projected decreases in ONP for non-newsprint uses thus attenuates the resource recovery effects of the marketable permit policy.

Not shown in Figure 5-lb is Canada's increased ONP recovery. These newspapers are assumed to be equally treated with ONP from the U.S. for the marketable permit policy. Thus, the policy will reduce the municipal solid waste burden of Canadian municipalities. Since the prices of newsprint marketed in the U.S. will increase due to this policy, and since Canadian ONP may provide secondary fiber to meet the recycled content standard, U.S. consumers will subsidize the recovery of Canadian ONP. Figure 5-3 shows the projected total recovery of ONP from both U.S. and Canadian households. The U.S. function is the same function as shown in Figure 5-2. The Canadian function shows the projected recovery of ONP for use in Canadian newsprint mills.

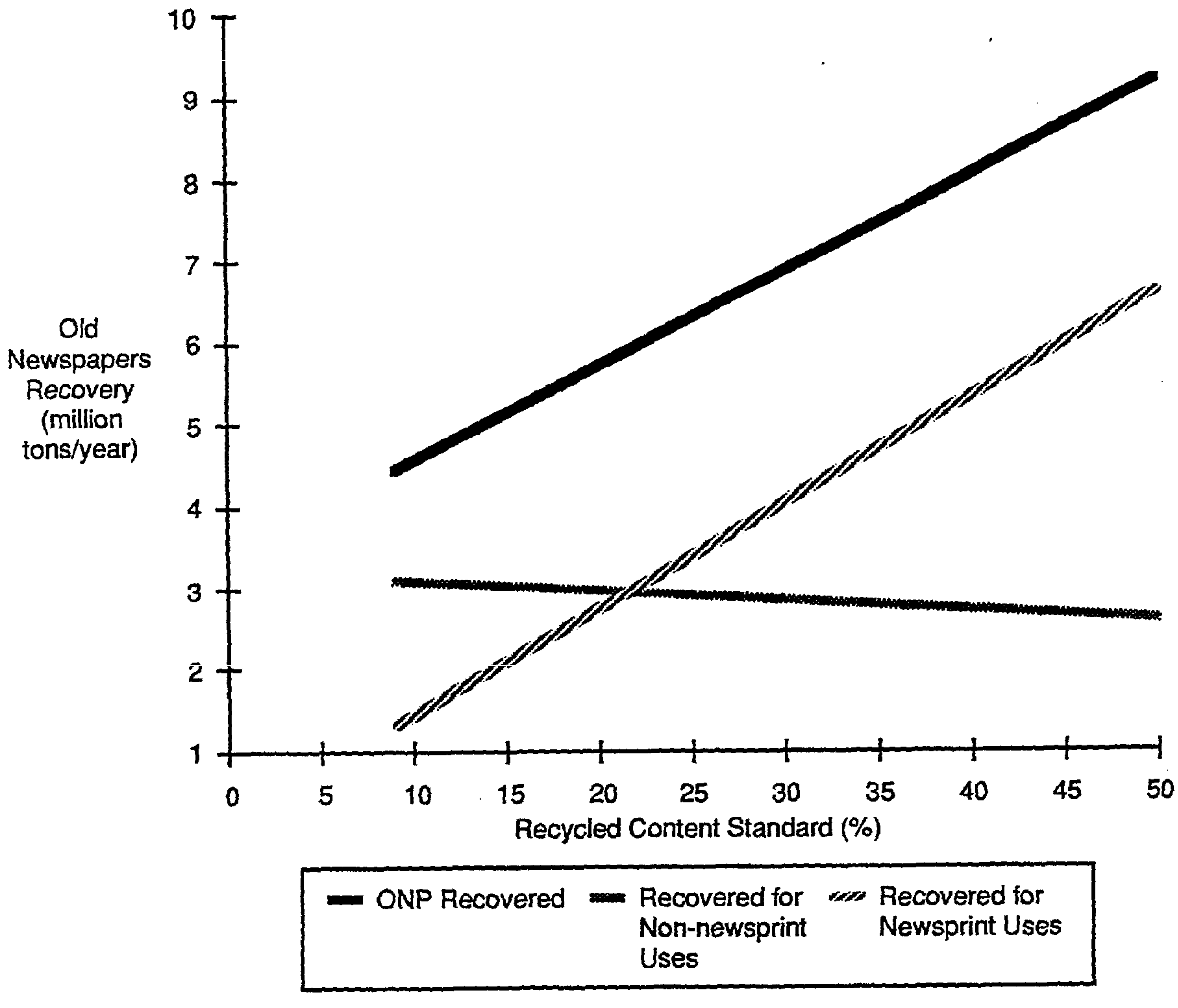


Figure 5-2. Waste Recovery Effects with a Permit Policy, 1988

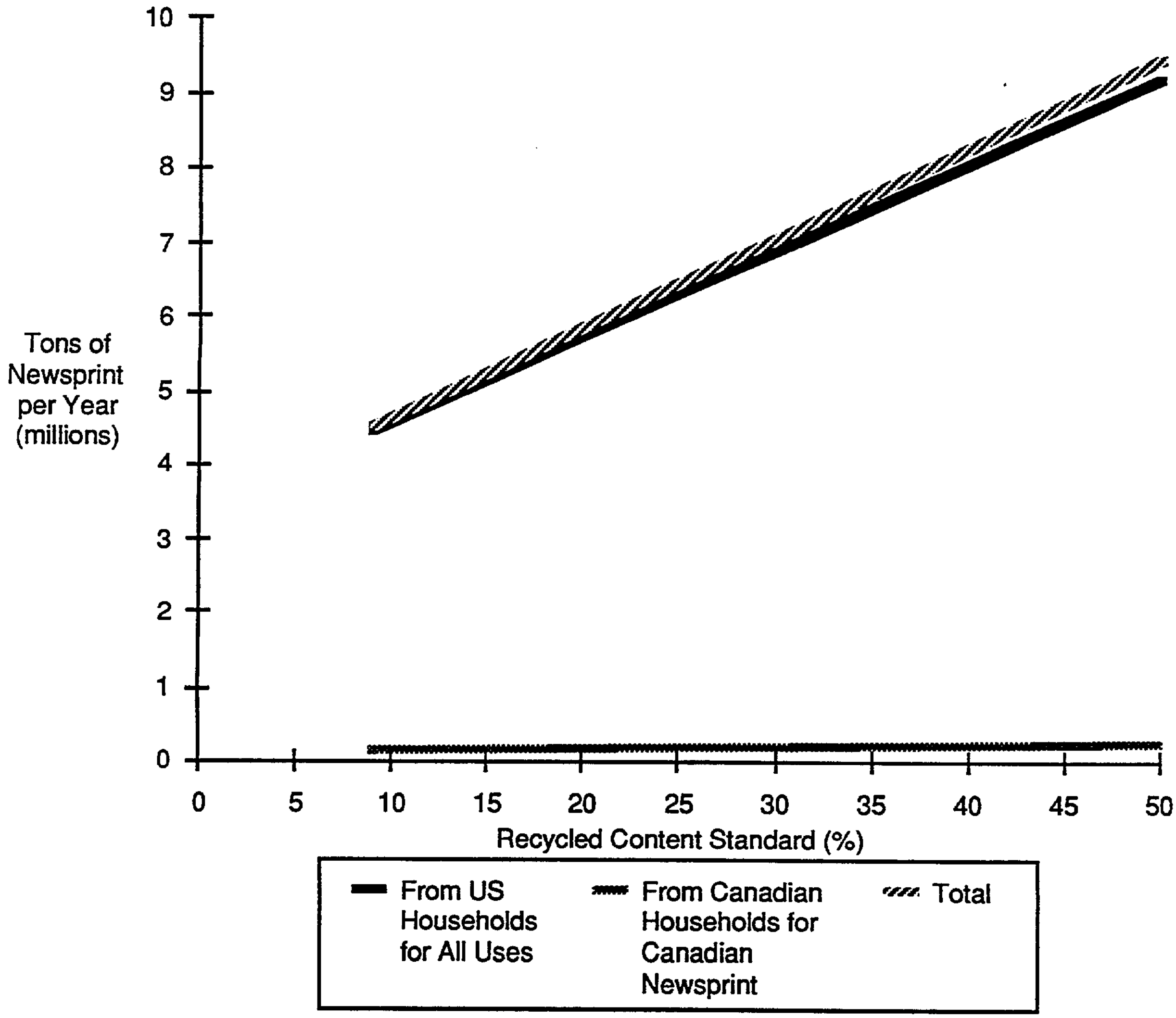


Figure 5-3. Old Newspaper Recovery by Source in North America with a Permit Policy, 1988

The ONP for Canadian secondary pulp production will come from both U.S. and Canadian sources. The economic distance for transporting ONP is influenced by transportation costs and the price and availability of ONP at the alternate sources. Southeast Paper Company in Dublin, Georgia, reports going as far north as Washington DC. to the north and New Orleans to the west for ONP (personal communication, Walker, 1989). Most Canadian newsprint mills are located near the U.S. border. Figure 5-4 shows the 250 mile radii from Canadian mills. These include major population centers in the Northwest, Midwest, and East of the United States. The projected country of origin of ONP for Canadian mills with the marketable permit policy is shown in Figure 5-5. These results are conjectural since there is no history on which to base the projections. However, it seems likely that since the U.S. is a major consumer of Canadian newsprint, the US will become a significant supplier of ONP to Canada under the marketable permit policy.

There may be a limit to ONP recovery. Although most observers agree that recovery rates of 50 percent or more are possible, the recovery rate critically depends on the actions of households and municipalities. Conventional economic reasoning argues that reducing households' costs of recovery (e.g., by providing curbside collection of separated ONP) and raising households' benefits of ONP recovery (e.g., by establishing a price for solid waste disposal for non-recovered wastes) will increase ONP recovery. Increased costs of solid waste management and increased prices paid for ONP will raise municipalities' incentive to promote ONP recovery. Thus, rather than placing an absolute limit on the recovery rate somewhere below 100 percent, we should consider the recovery rate as a variable influenced by economic and cultural factors. Figure 5-6 shows the projected ONP recovery rate of the marketable permit policy.

The policy's ***waste disposal effect*** is the effect of the policy on the total quantity of ONP disposed in the nation-the *waste generation effect* plus the *waste recovery effect.* In 1988, 8.9 million tons of ONP produced in North America were discarded to the nation's solid waste stream. The waste disposal effect is shown in Figure 5-1c. For example, with a 25 percent recycled content standard, the amount of ONP discarded to solid waste systems is projected to decline by 33 percent or 6 million tons annually based on 1988 rates.

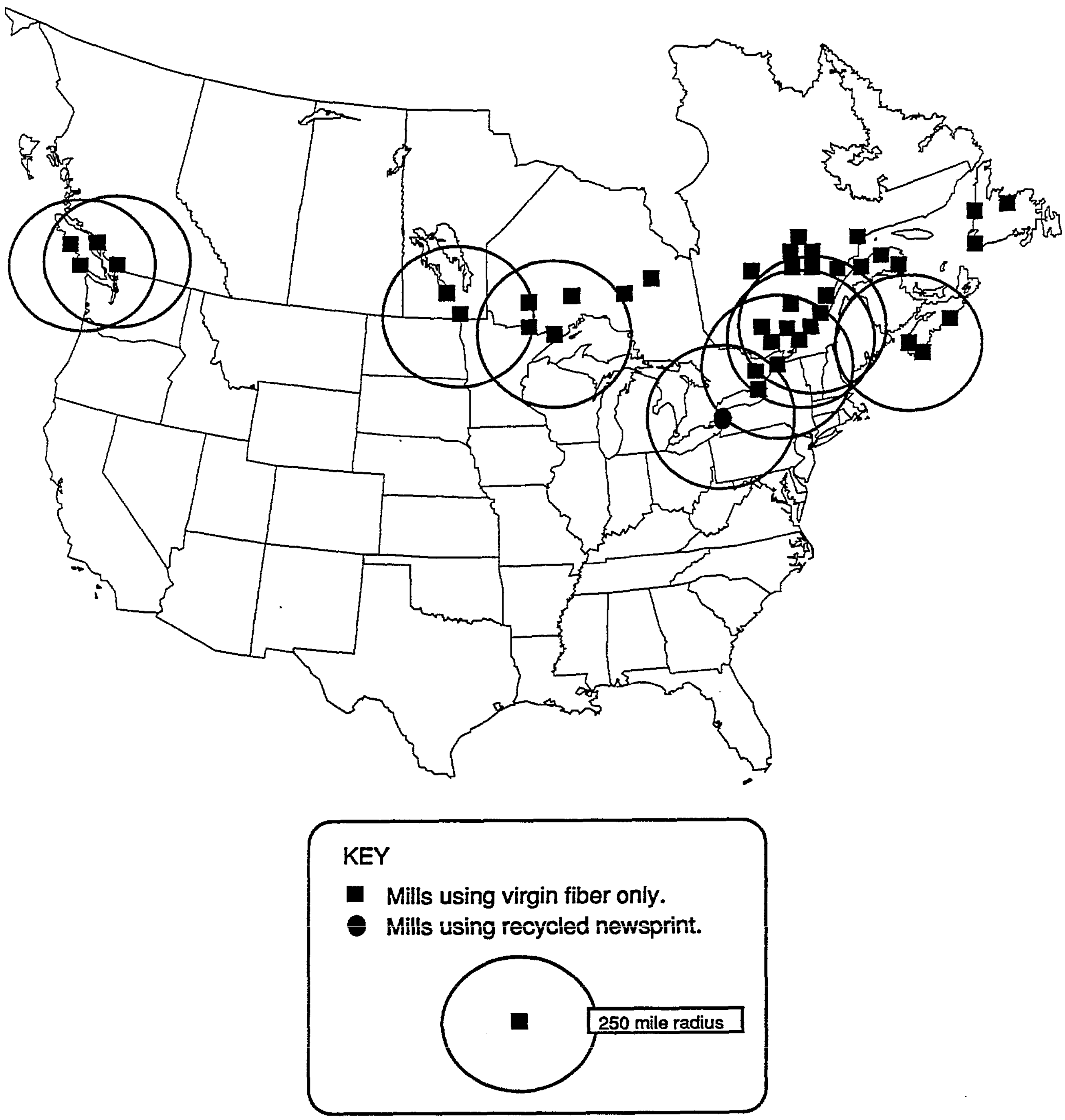


Figure 5-4. Locations of Canadian Paper Mills Producing Newsprint and Potential Regions for ONP

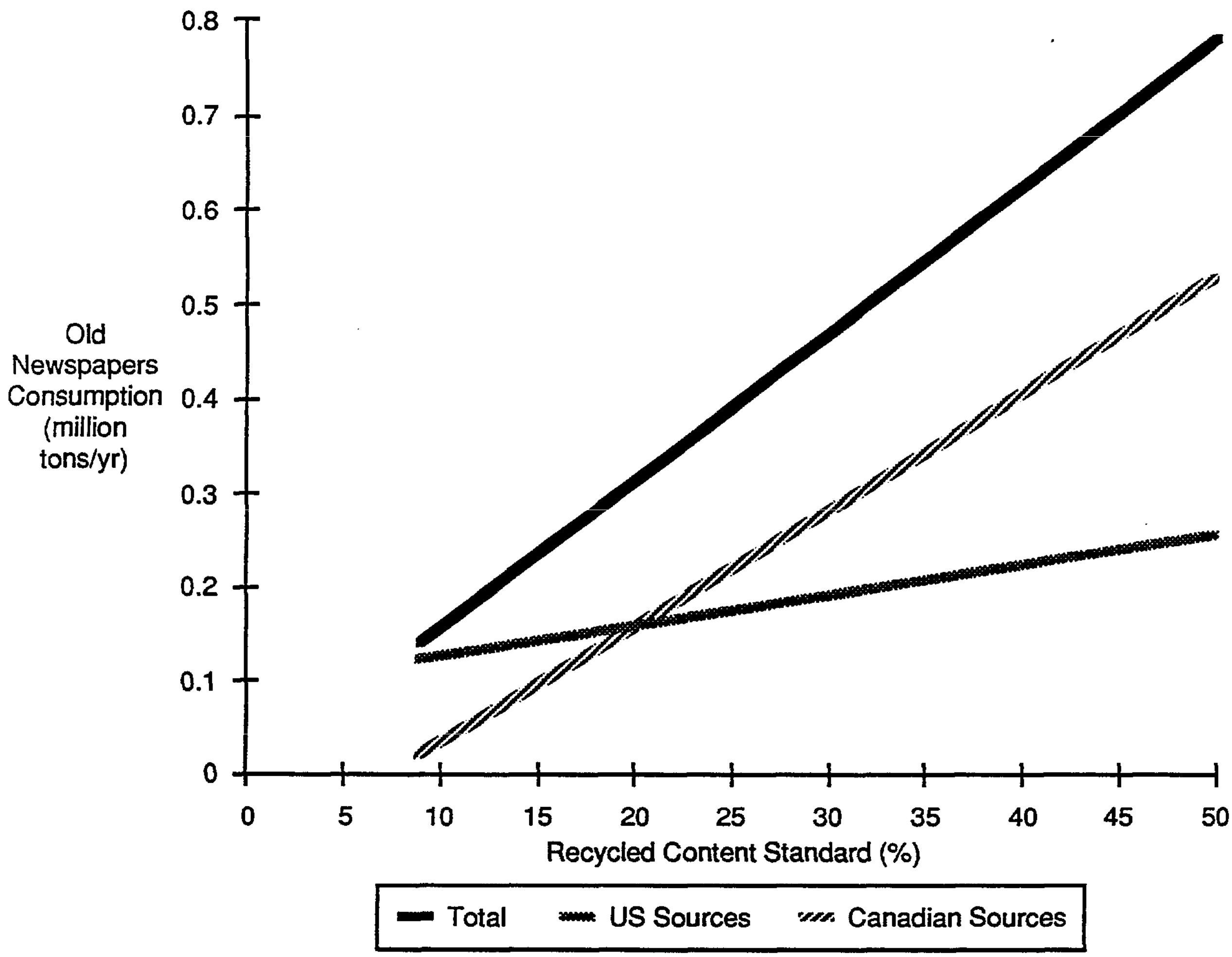


Figure 5-5. Sources of ONP Consumption by Canadian Mills with a Permit Policy, 1988

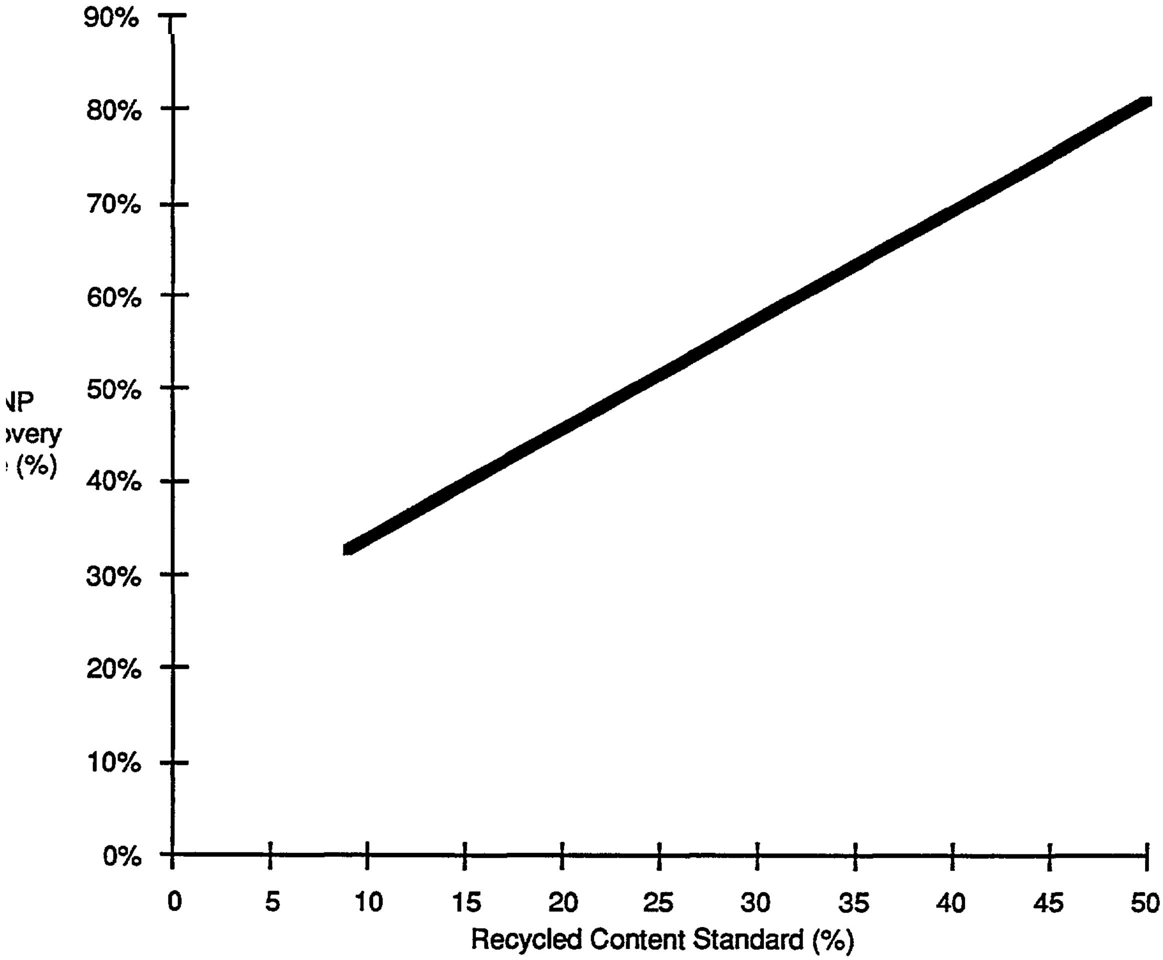


Figure 5-6. ONP Recovery Rate with a Permit Policy, 1988

5.3 PRICE EFFECTS

The policy raises the price of all commodities modeled.

The delivered price of newsprint averaged about $600 per ton in 1988. The newsprint price effects of the policy are shown in Figure 5-7a. These price effects result from substituting secondary for virgin fiber. They depend critically on the price of ONP, the capital and investment costs of deinking capacity, and the degree of difficulty in substituting fiber sources in newsprint manufacture.

The effect of the policy on the price of newspapers will depend on the share of newspaper publishing costs represented by the newsprint and the opportunities for substitution between newsprint and other inputs. We assume here that there is no potential for such substitutions. Figure 5-7b show the projected increases in newspaper prices.

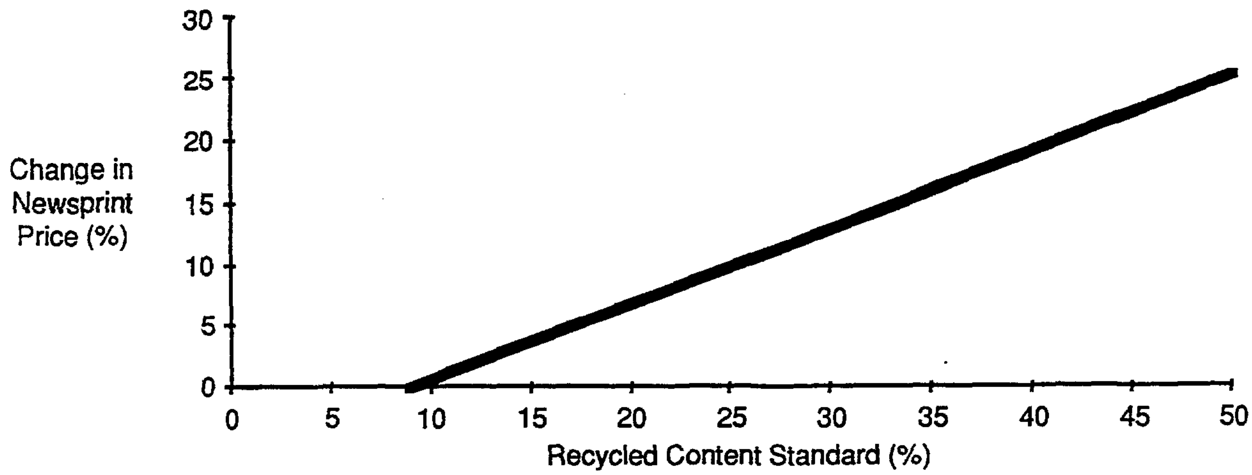
The price of ONP varies significantly across the nation. There are even reports of ONP surpluses resulting in negative prices for ONP-dealers must be paid to accept ONP. The price of ONP is also subject to large cyclical variations. For 1988, we assume an average national price for ONP of $25 per ton at the community level. The projected price effects for ONP in Figure 5-7c may thus be regarded as long-run national averages about which actual prices may cycle. For example, at a 25 percent recycled content standard, the price of ONP is projected to increase 29 percent,

5.4 PERMIT PRICES

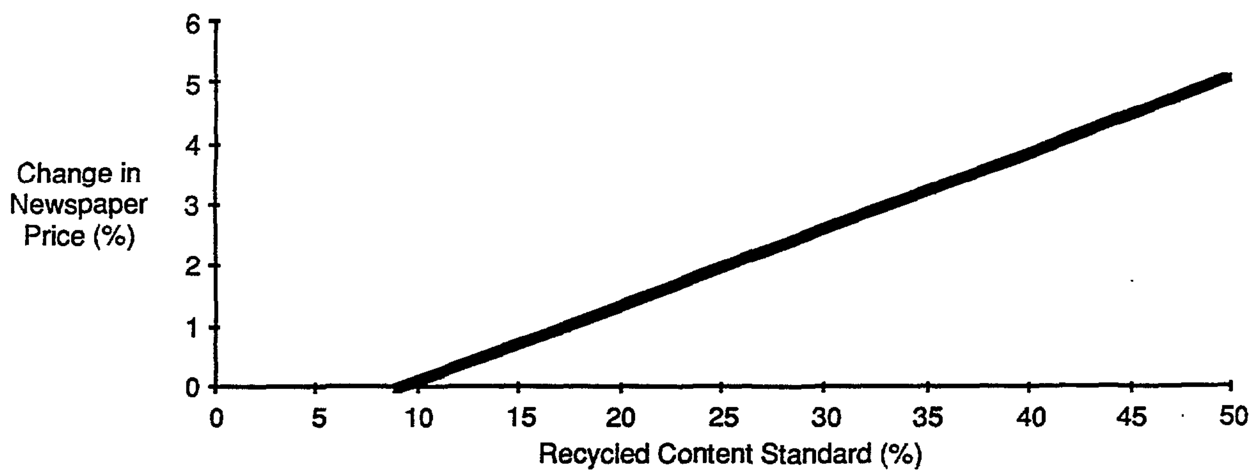
In addition to the 26 commodities modeled, the marketable permit policy creates an additional commodity-permits. Producers will need a permit for each ton of virgin pulp they use in newsprint production. The total number of permits available for a given recycled content standard is

$$\sum_{i=1}^{n} Q_i \, (1\text{-}RCS)$$

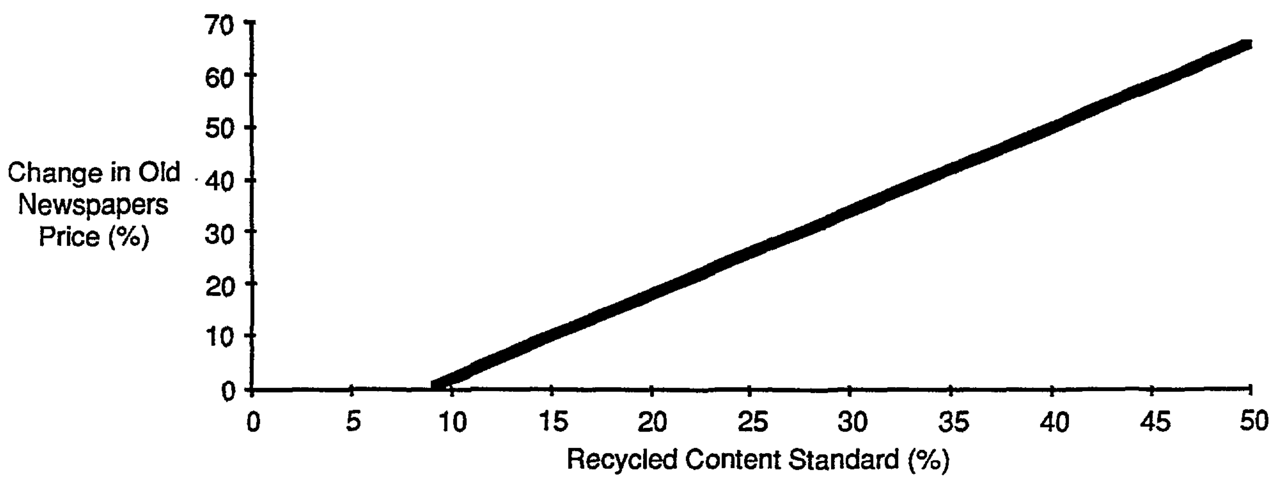
for **n** producers of newsprint. However, the actual number of permits exchanged will only be a fraction of this quantity because virgin newsprint producers must retain all their permits in order to meet the policy's requirements. Indeed, such producers will need to purchase additional permits from newsprint producers using secondary fiber.



a) **Newsprint price effect**



b) **Newspaper price effect**



c) **Old newspaper price effect**

Figure 5-7. Price Effects of a Permit Policy, 1988

Restricting the total quantity of virgin pulp available for newsprint production allows producers of virgin newsprint to earn additional economic surpluses on newsprint production. The amount of economic surplus they earn is reflected in the price they are willing. to pay for the right to use virgin pulp. Because the surpluses vary across producers, based on their costs of virgin pulp production, producers' willingness to pay for permits will vary. Since virgin newsprint producers will have to purchase permits from firms that make newsprint from recycled newspapers, the economic surpluses will be transferred to recycled newsprint producers. This transfer of revenues to firms making recycled newsprint will encourage the investment in deinking equipment necessary to achieve the recycled content standard. The projected price for permits is shown in Figure 5-8.

Figure 5-9 shows the recycled content of newsprint for each country for alternative recycled content standards. Since the recycled content for Canadian producers is less than the standard, they will be net purchasers of permits and U.S. producers, net suppliers.

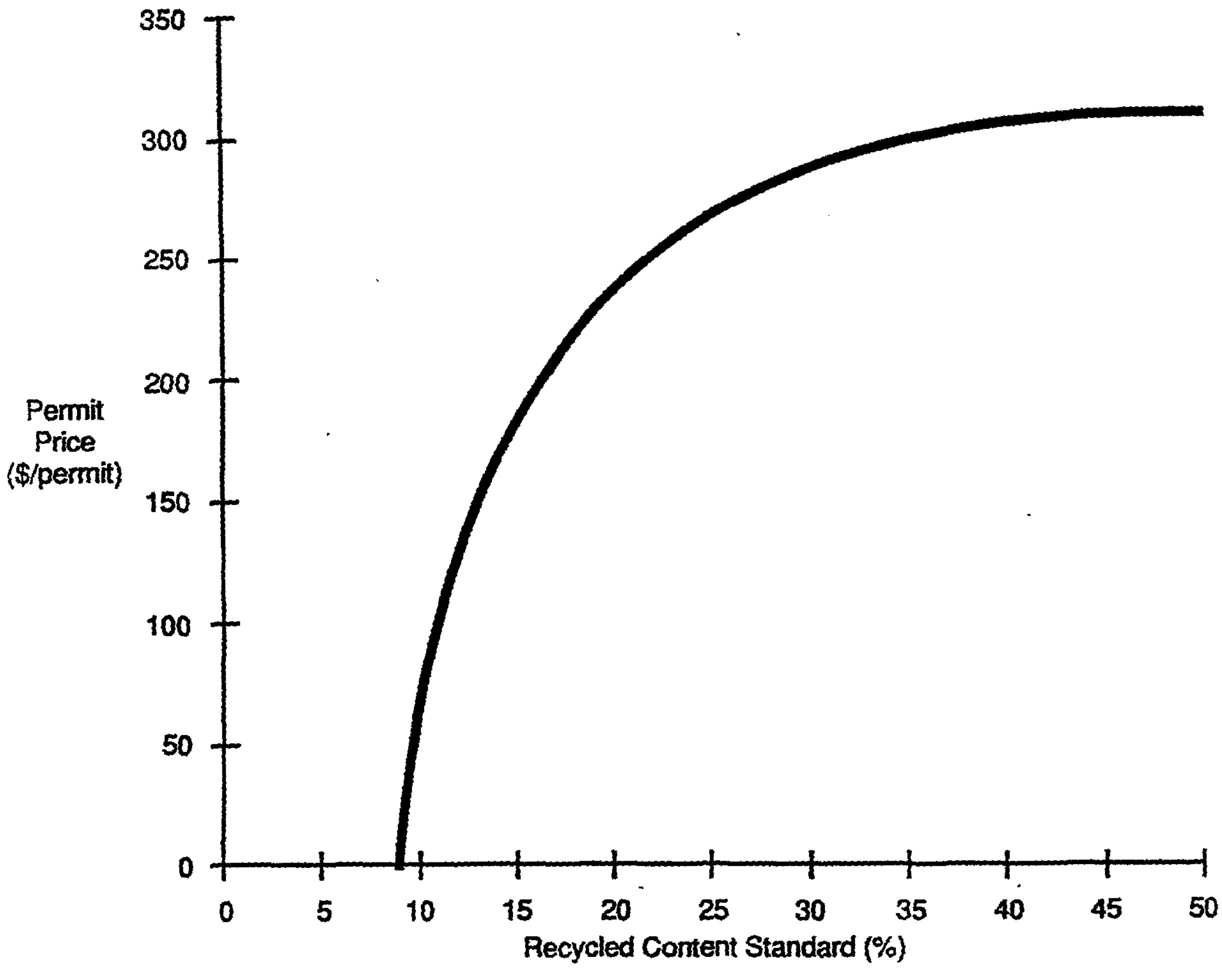


Figure 5-8. Permit Prices, 1988

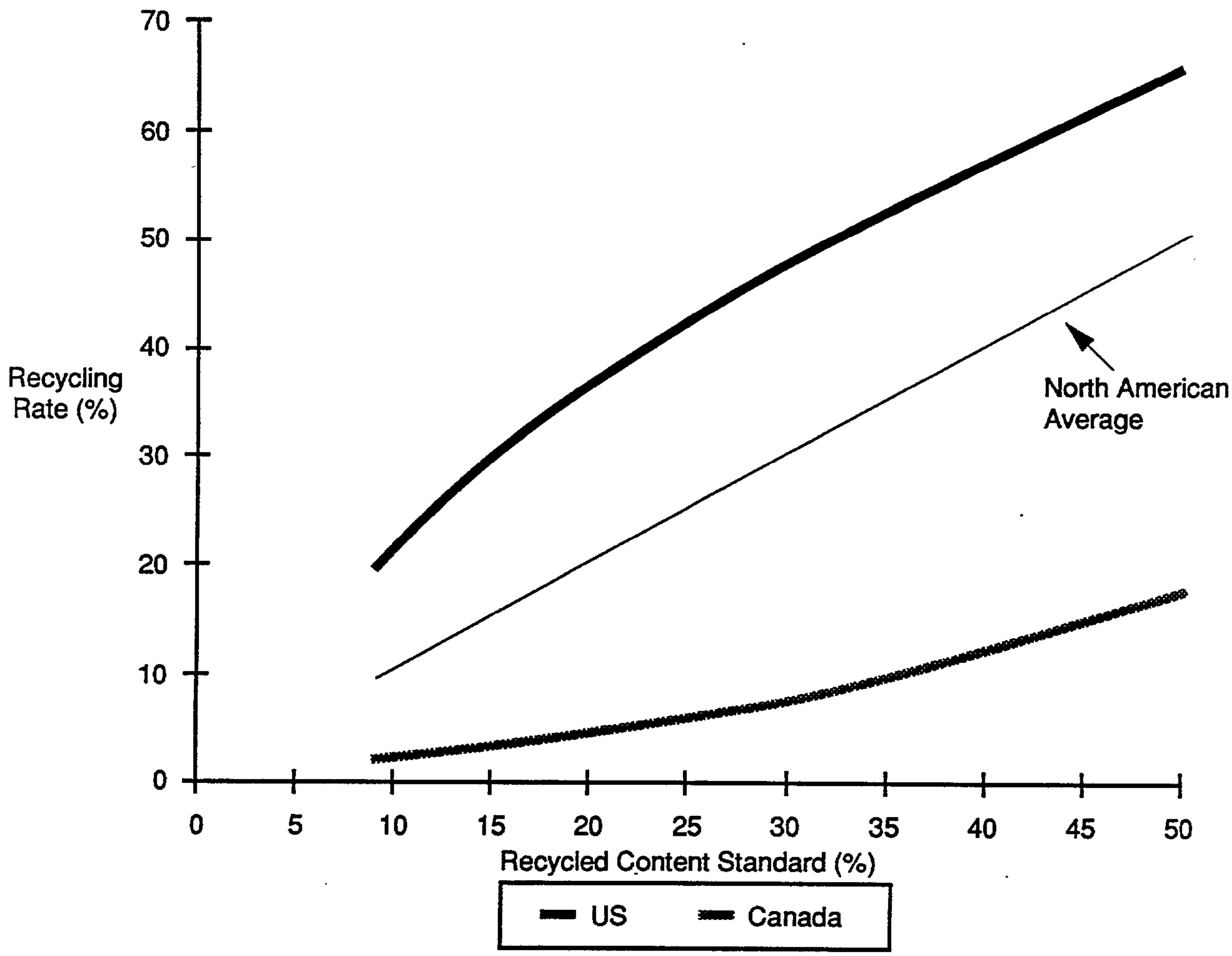


Figure 5-9. Country Recycling Rates with a Permit Policy, 1988

CHAPTER 6
WELFARE EFFECTS

The marketable permit policy will alter the prices and quantities of the commodities within the newsprint-newspaper-old newspapers system as described in Chapter 5. A critically important effect of the policy will be the reduction in the quantity of old newspapers discarded to the nation's solid waste stream, as secondary pulp is substituted for virgin pulp. At the same time, these substitutions will increase the cost and price of newsprint. This price increase will be reflected in higher costs and, hence prices, of newspapers. Two important questions are will society (the individuals affected by the policy) benefit more from the allocation of resources under a marketable permit policy or under the status quo, and which recycling content is "best"?

The economic welfare effects of the policy depend on the resource reallocations projected in Chapter 5 and the value of the reallocations to affected individuals. These welfare changes are the subject of this chapter. An important ethical principle incorporated in applied welfare analysis is that for most public choice problems, individuals' own judgments are the best indicators of their own welfare. Thus, the task ahead is to measure the value to affected individuals of the projected price and quantity changes in the newsprint-newspaper-old newspapers system.

One feature of the marketable permit policy that will influence its welfare effects is whether or not the policy is phased in. Phasing in the policy postpones its benefits but may potentially reduce some of its costs. Because of the complexity of modeling the phase-in option, we assume for this study that the policy is not phased in or changed once it is in place. However, we conclude this chapter with a discussion of the phase-in option.

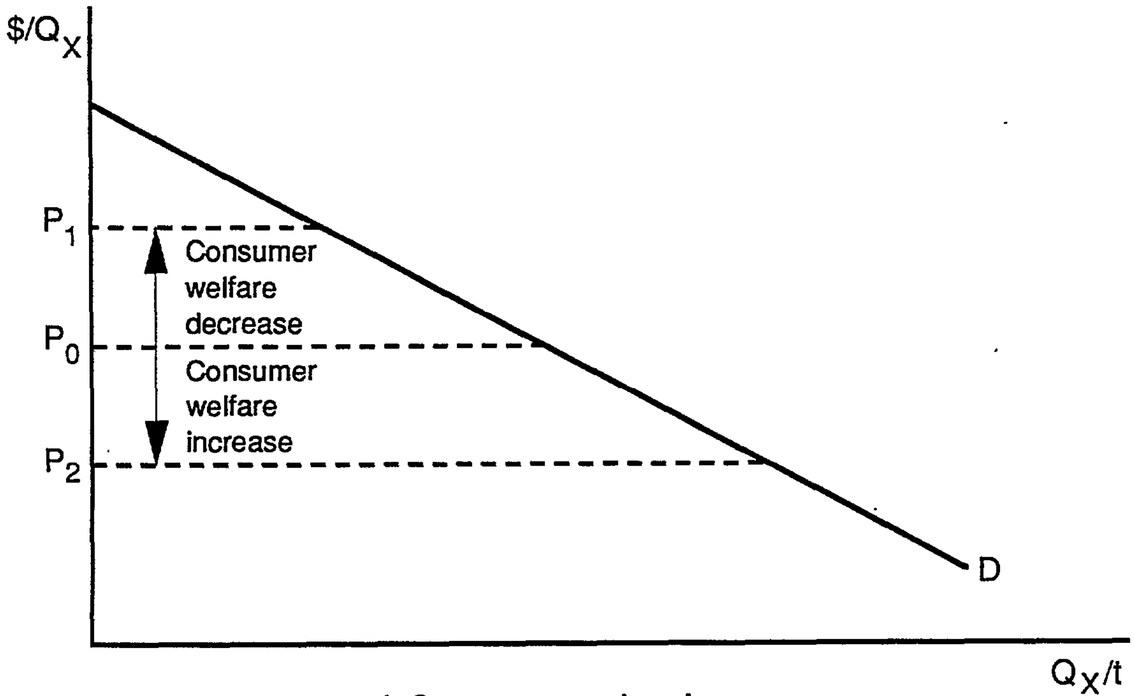
6.1 ECONOMIC WELFARE

The economic welfare of individuals is not directly observable. In principle, an individual's economic welfare is measured by their utility level. Utility is a cardinal measure of well-being. It is usually assumed to vary directly with the absolute quantity of commodities consumed. In the context of the marketable permit policy, an individual's utility level depends on their consumption rate of market commodities, which is affected by the prices of commodities the individual desires, and on their disposable income. Price increases reduce the individual's consumption opportunities, thereby reducing their economic welfare. Disposable income is the difference between the individual's earnings from supplying labor services (and any income from other sources) and their tax payments. Changes in wage rates and employment opportunities change income and hence also affect the individual's consumption opportunities. Similarly, changes in the returns to capital resources also affect the incomes of owners of those resources. Finally, changes in the payment of taxes change the disposable income of the individual, also altering their consumption opportunities.

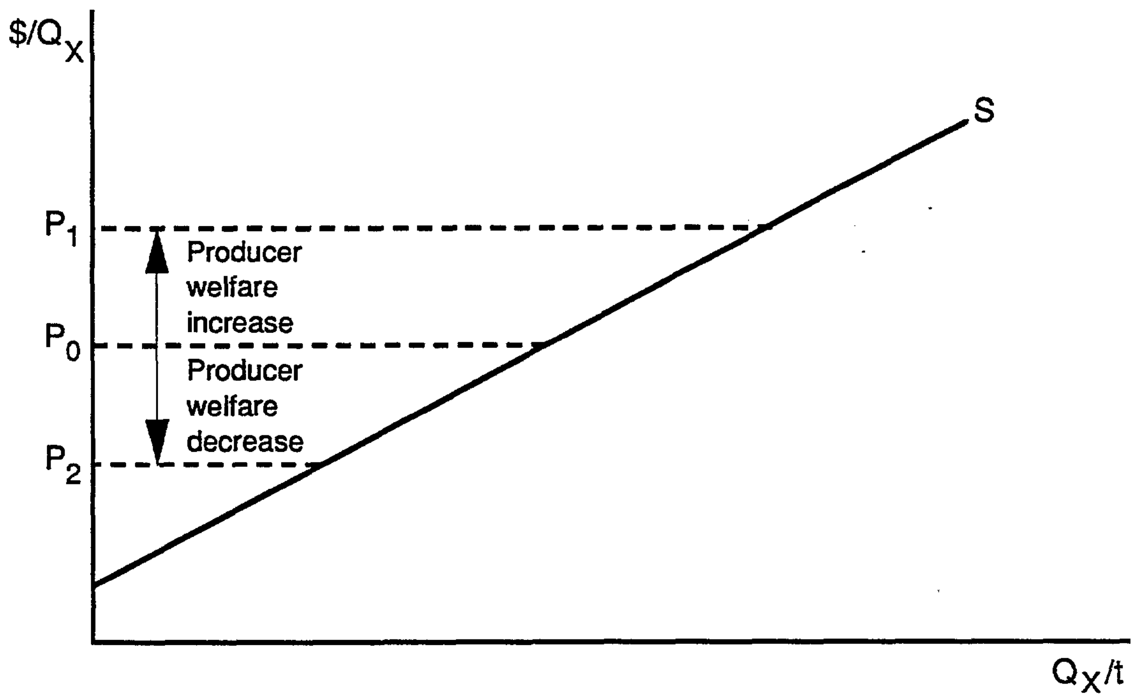
The utility surrogate used in applied welfare economics is the amount of money that would have to be given to or taken away from the individual to make their utility level be the same with the marketable permit policy as without it. This amount provides a cardinal measure of the intensity of the individual's preference for the status quo or the policy. However, the amount of money depends on the individual's endowment of human and physical capital when the policy is introduced. This raises significant problems when (as virtually always happens) the policy negatively affects some individuals and positively affects others. We further discuss this issue below.

Ordinary demand-and-supply curves used to predict the effects of a policy may also be used to estimate the changes in individuals' welfare when the policy changes the prices they pay for commodities or receive for providing labor and capital services. Consumer surplus is the difference between the amount of money consumers' pay for the commodity and the amount they are willing to pay-the area under consumers' demand curves to the price line. Consumer surplus is a measure of the net benefits of consumption. Increases (decreases) in the price of a commodity reduce (increase) the amount of consumer surplus enjoyed-as shown in Figure 6-1a. Willig (1976) has shown that the change in consumer surplus approximates a more conceptually correct measure of consumer welfare change. Further, the change in consumer surplus is a midpoint measure of two equally appropriate variants of the correct measure. It, therefore, is the money measure typically used in applied welfare economics studies, and we use it here to measure the changes in consumer welfare from the marketable permit policy.

Producer surplus is the difference between the amount of money the producers actually receive for the commodity and the amount they must receive to provide the commodity-the area under the price line to the supply curve. Increases (decreases) in the price of a commodity increase (decrease) the amount of producer surplus enjoyed-as shown in Figure 6-1b. For produced commodities it is simply the difference between revenues and variable costs, and it is the exact measure of willingness to pay. Thus, the change in producer surplus is the correct measure of the welfare effects of price changes for suppliers of production factors that do not provide nonpecuniary returns to their owners. Randall and Stoll (1980) have shown that the change in producer surplus approximates a more conceptually correct measure of labor supplier



a) Consumer surplus changes



b) Producer surplus changes

Figure 6-1. Welfare Effects of Price Changes

welfare change. Further, the change in producer surplus is a midpoint measure of two equally appropriate variants of the correct measure. Therefore, we use the change in producer surplus as the money measure of changes in producer welfare.

6.2 STAKEHOLDERS AND THE DISTRIBUTIVE EFFECTS

The economic effects of public policy changes may be far-reaching. In the extreme, changes in public policy may directly or indirectly impact virtually all members of society. The reach of the marketable permit policy for virgin newsprint pulp is broad. Indeed; the policy is designed to alter the waste management practices of our society. Newsprint producers are encouraged to substitute secondary for virgin fiber; and newspaper consumers, to supply the old newspapers from which secondary pulp is produced.

It is impractical, if not impossible, to gauge the policy's effect on each individual separately, reflecting their unique production/consumption patterns and ownership of physical and human capital. Some aggregation is necessary. We begin this aggregation by identifying the economic roles individuals may play. These include

- suppliers of labor services,
- suppliers of capital services,
- consumers of marketed goods,
- consumers of non-marketed goods provided by government,
- consumers of public goods, and
- taxpayers.

The resource reallocations induced by the marketable permit policy will alter the number of employment opportunities and perhaps the wage rate of labor services suppliers in the sectors of the newsprint-newspaper-old newspapers system. Where commodity production/consumption rates are projected to decline, the need for the services of the existing stock of capital will decrease, probably lowering the value of these resources. However, the permits will be a financial asset to their recipients. Increases in the price of newspapers will reduce the purchasing power of consumers' incomes, thus reducing their welfare. Less ONP discarded to the solid waste stream will result in savings in expenditures on solid waste management, These savings may result in 'a reduced tax burden or increases in other publicly provided commodities. The reduced rate of waste generation may also lower external costs associated with transporting and disposing municipal solid waste (e.g., noise, odor, traffic, and air, soil and water contamination) and deforestation, thereby increasing the quality of public goods.

Many individuals play several of these economic roles concurrently. Most people both read newspapers and pay taxes. Some of these people also supply labor and capital services in the above sectors. An individual's change in economic welfare as a result of the policy is the summation of the welfare changes in each role that individual plays in the system.

We use commodity price and quantity changes, projected in Chapter 5, to estimate the monetary value of the welfare changes as a result of the marketable permit policy for key stakeholders affected by the policy. However, the market for labor services and Canadian households are not explicitly represented in the ONP policy model; thus the welfare changes for these stakeholders are not estimated.

Welfare changes are estimated below for the following groups of stakeholders: (1) newsprint producers, (2) newspaper producers, (3) U.S. households, (4) U.S. taxpayers, and (5) U.S. and foreign consumers of ONP for packaging and similar purposes.

6.2.1 Newsprint Producers

Newsprint producers experience welfare effects from several sources. Production costs decrease with the projected decrease in the production of virgin pulp and newsprint. Costs increase with the projected increase in the production of secondary pulp. Within the industry as a whole, expenditures by virgin newsprint producers for permits are exactly offset by an equal amount of increased revenues from permit sales by producers of secondary pulp. On the revenue side, the reduction in newsprint production will tend to reduce the revenues of newsprint producers. At the same time, the projected increases in the price of newsprint will tend to increase industry revenues. The net effect of the policy is to increase industry revenues somewhat.

Figure 6-2 shows the net welfare effects (changes in producer surplus) for U.S. and Canadian newsprint producers. As shown in Figure 6-2a, the welfare of Canadian producers is projected to decline and that of U.S. producers to increase somewhat more than Canadian's welfare losses. The difference in the outcomes for Canadian and U.S. producers is due to the differences in the current capacity of each country to produce newsprint from secondary pulp. The U.S. has eight mills, Canada, one. Canadian producers are projected to add more secondary pulp capacity in percentage terms than the U.S. producers. However, because of its larger base of existing capacity and the modeling assumption of proportional changes in prices inducing

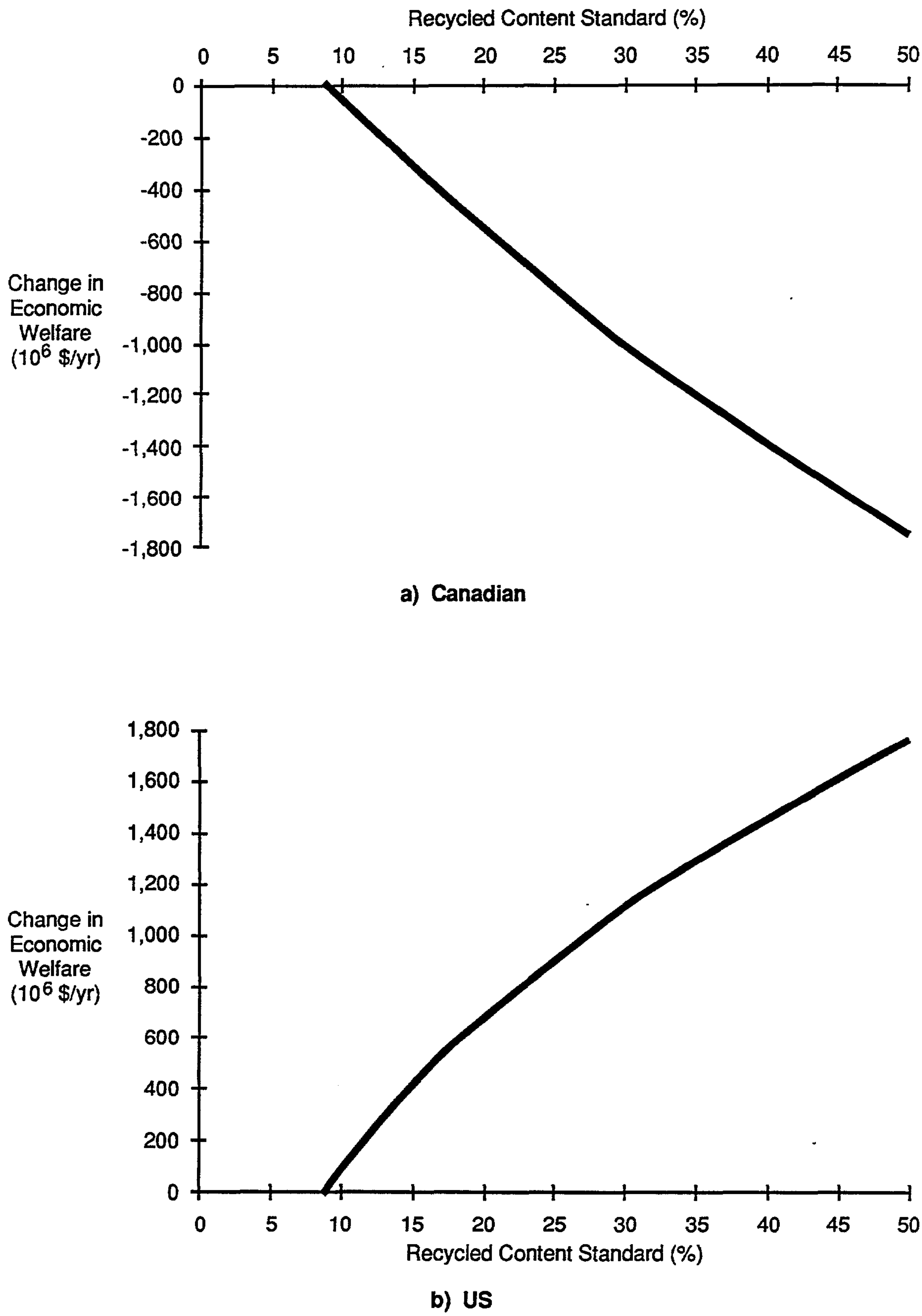


Figure 6-2. Welfare Effects of a Permit Policy, 1988: Newsprint Producers

proportional changes in quantity, U.S. newsprint producers are still projected to add substantially more capacity than Canadian producers. If Canadian producers find it economic to respond in a similar absolute manner as their U.S. counterparts, then their welfare losses will be reduced, perhaps reversed, from those projected.

6.2.2 Newspaper Publishers

Publishers of U.S. newspapers will experience higher costs for newsprint. At the same time, costs will decrease somewhat with less newsprint produced. The unit cost increases from higher newsprint are projected to induce publishers to raise newspaper prices. This reduction in prices will have two effects. Newspaper circulation will decline, thereby reducing revenues (and also the costs of this quantity). On the remaining circulation, revenues will increase. Figure 6-3 shows the net welfare effects for U.S. newspaper producers.

6.2.3 U.S. Households

The welfare of U.S. households is affected because they are consumers of newspapers and of public goods, and they pay taxes. Increases in newspaper prices will tend to reduce the households' welfare. As shown in Table 6-1, about two-thirds of the population over 18 read newspapers. Assuming the purchase pattern is similar to the readership pattern, newspapers are a normal good in economic terms-higher incomes lead to higher purchases. Thus, the welfare effects of newspaper price increases will fall disproportionately on upper-income groups.

In 1988 there were about 93 million households in the U.S. Figure 6-4 shows the net changes in the welfare of U.S. households on a per-household basis. On an aggregate basis, these changes are substantial; on a per-household basis, minimal.

6.2.4 U.S. Taxpayers

Increases in ONP recovery increase taxpayers' welfare because revenue from ONP sales can be used to offset the costs of separate collection of ONP and other tax-financed services and because reductions in the quantity of ONP disposed reduces the tax payments necessary to finance ONP disposal.

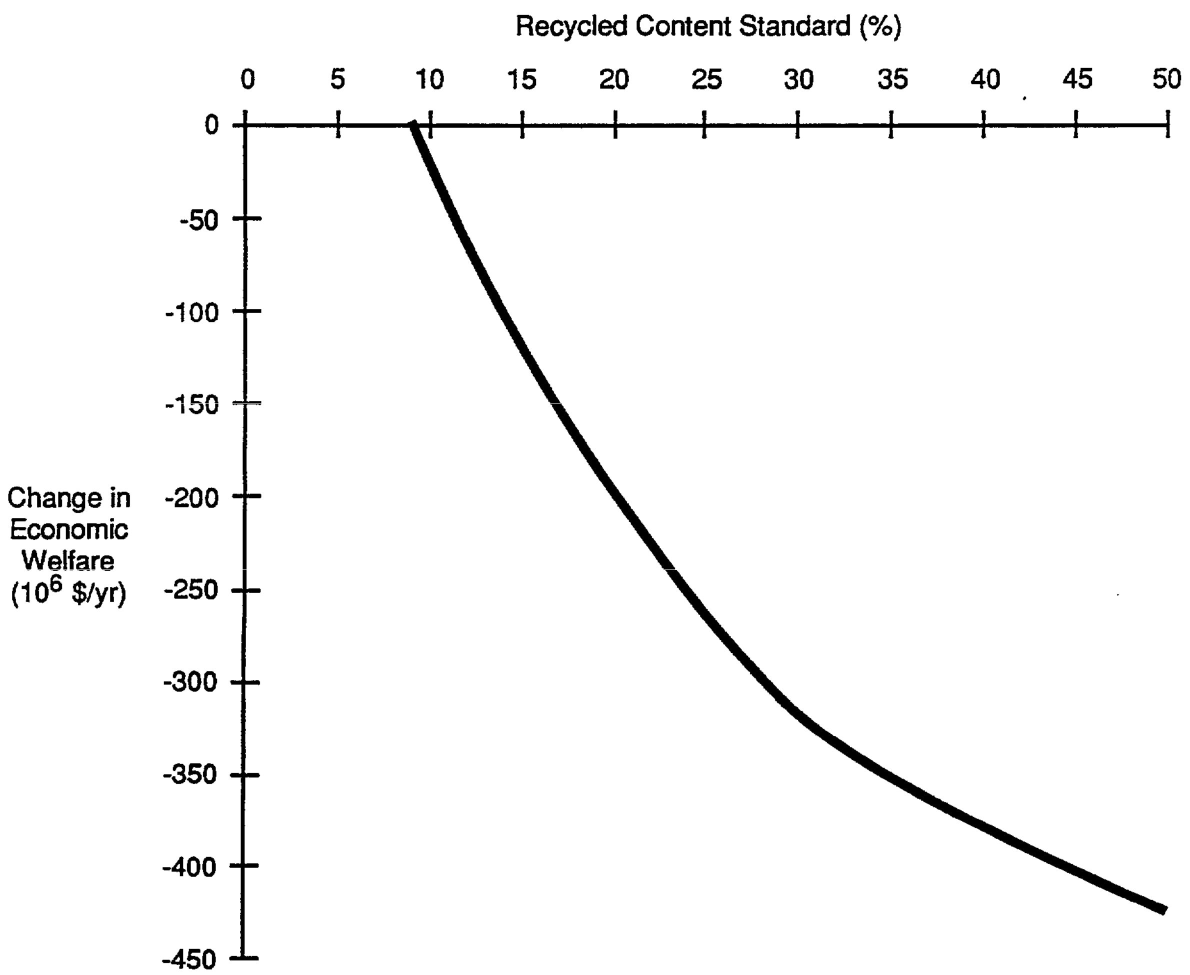


Figure 6-3. Welfare Effects of a Permit Policy, 1988: Newspaper Publishers

TABLE 6-1. NEWSPAPER READERS, 1987
(Percent of Population 18 years of Age and Over)

Item	Daily	Sunday
Total, 1987	**60.1**	**63.8**
18-24 years old	48.3	58.8
25-34 years old	54.4	60.4
35-44 years old	62.0	66.7
45-54 years old	68.1	70.7
55-64 years old	68.0	68.1
65 years old and over	65.6	61.6
Male	62.4	64.8
Female	58.1	63.0
White	61.7	64.9
Black	51.1	58.8
Other	42.3	44.4
Spanish speaking	50.0	52.9
College graduate	71.9	78.0
Attended college	66.2	72.1
High school graduate	59.7	64.2
Not high school graduate	48.4	47.7
Employed: Full-time	60.9	66.3
Part-time	59.9	69.3
Not employed	59.0	59.4
Household income:		
Less than $10,000	43.1	44.4
$10,000 to $19,999	49.0	50.8
$20,000 to $29,999	58.1	59.6
$30,000 to $34,999	63.2	65.3
$35,000 to $39,999	63.7	66.0
$40,000 to $49,999	67.3	75.0
$50,000 or more	72.5	79.6

Source: Mediamark Research Inc., New York, NY, *Multimedia Audiences*, Spring 1987.

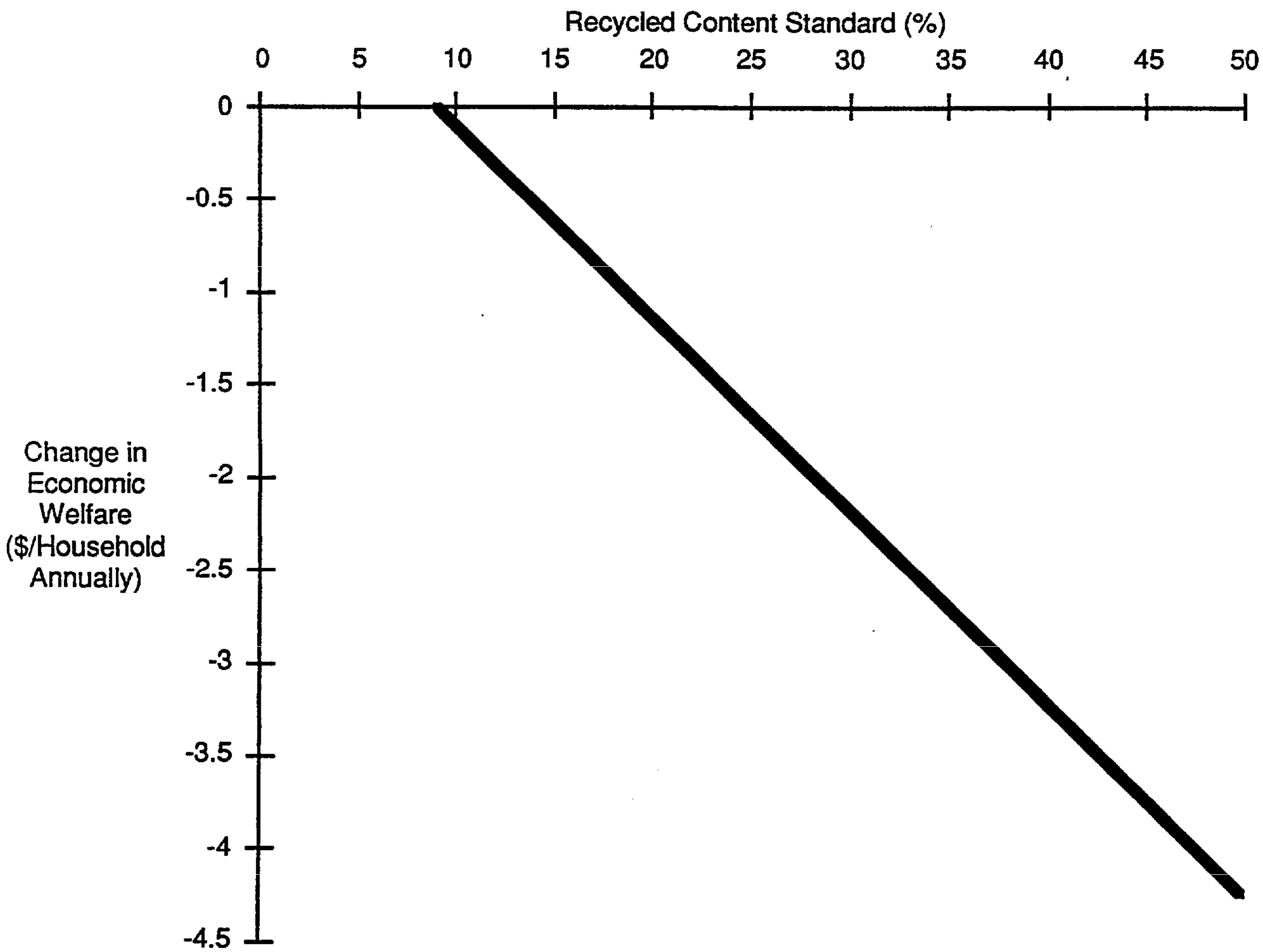


Figure 6-4. Welfare Effects of a Permit Policy, 1988: Households

Unfortunately, comprehensive estimates of the marginal costs of solid waste disposal are not available. These costs certainly vary across the nation due to differences in labor and land prices. Three estimates of the average unit cost of solid waste disposal are used to value the savings in tax payments: $50, $75, $100, and $125 per ton from reductions in the quantity of ONP disposed. Figure 6-5 shows the welfare gains of taxpayers.

6.2.5 Consumers of ONP for Packaging and Other Uses

U.S. consumers of ONP for packaging and other uses and foreign producers will pay higher prices for ONP due to the marketable permit policy. The reductions in consumer surplus for these consumers is shown in Figure 6-6.

6.2.6 Recyclers of ONP

The increase in ONP's price will increase its recycling. U.S. and Canadian firms with specialized advantages in recycling will gain from this increase in the demand for their services. Figure 6-7 shows their gains in producer surplus.

6.3 SOCIAL WELFARE

As presented above, adopting a marketable permit policy will change the welfare of individuals' with interests in the outcomes in the newsprint-newspaper-old newspapers system Examining the desirability of the policy from a social context requires aggregating the welfare effects across these individuals.

The Pareto criterion for social welfare analysis argues that one allocation of resources is preferred to another if at least one person's situation is improved under the new allocation and no one's is weakened. All values for the recycling content standard, as shown above, improve the welfare of some members of society while reducing the welfare of others. Clearly, this situation is not unique to the marketable permit policy. Most government policies have the same feature. Accepting the Pareto criterion for public policy would halt many governmental initiatives that find common support. Further, the Pareto criterion implies acceptance of the underlying distribution of incomes and property rights.

A relaxed version of the Pareto criterion has become the cornerstone of benefit-cost analysis-the Kaldor-Hicks criterion. They counsel that the policy should be adopted if the gainers from the policy could compensate the losers so that everyone would be better off with the policy than without it. There is a *potential* Pareto improvement in social welfare. However,

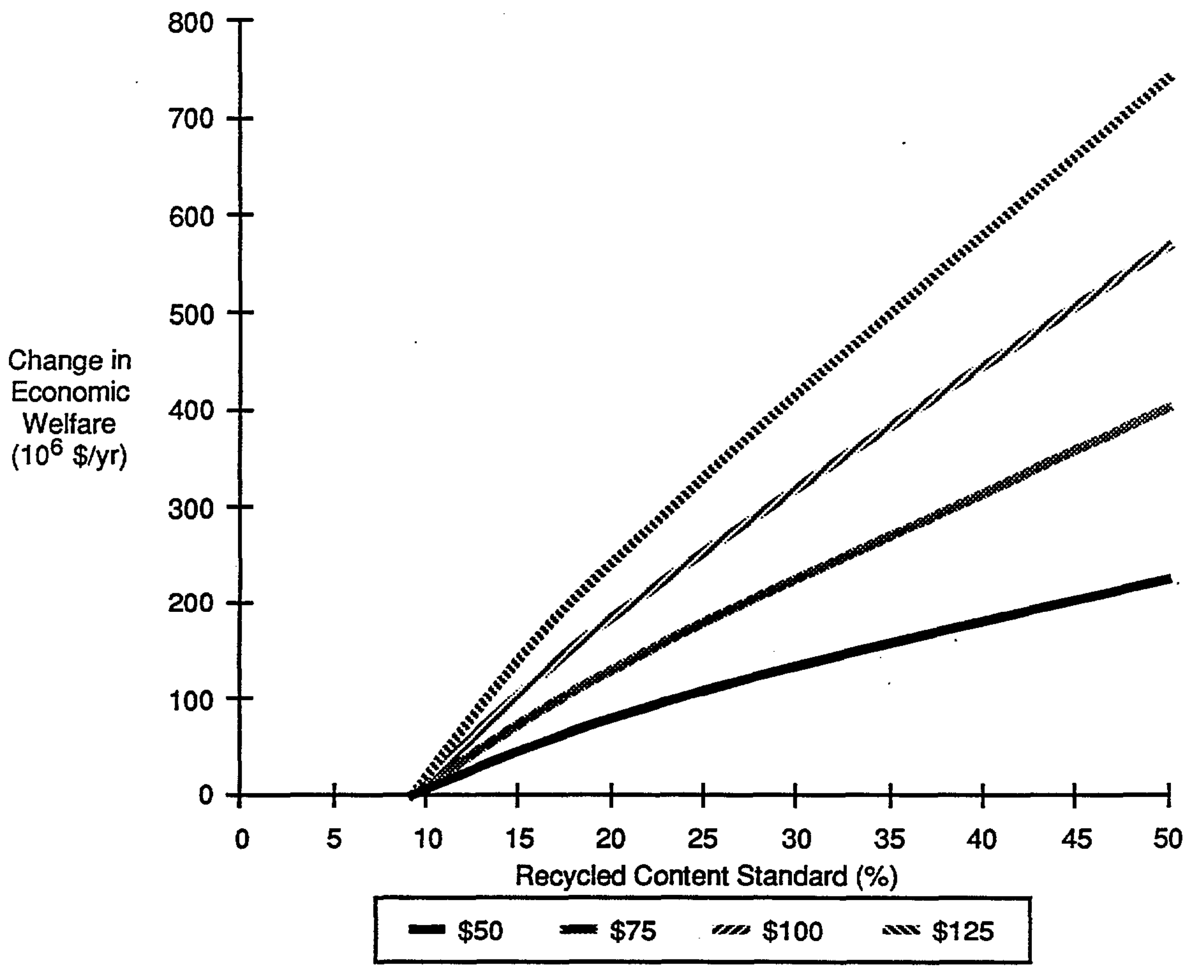
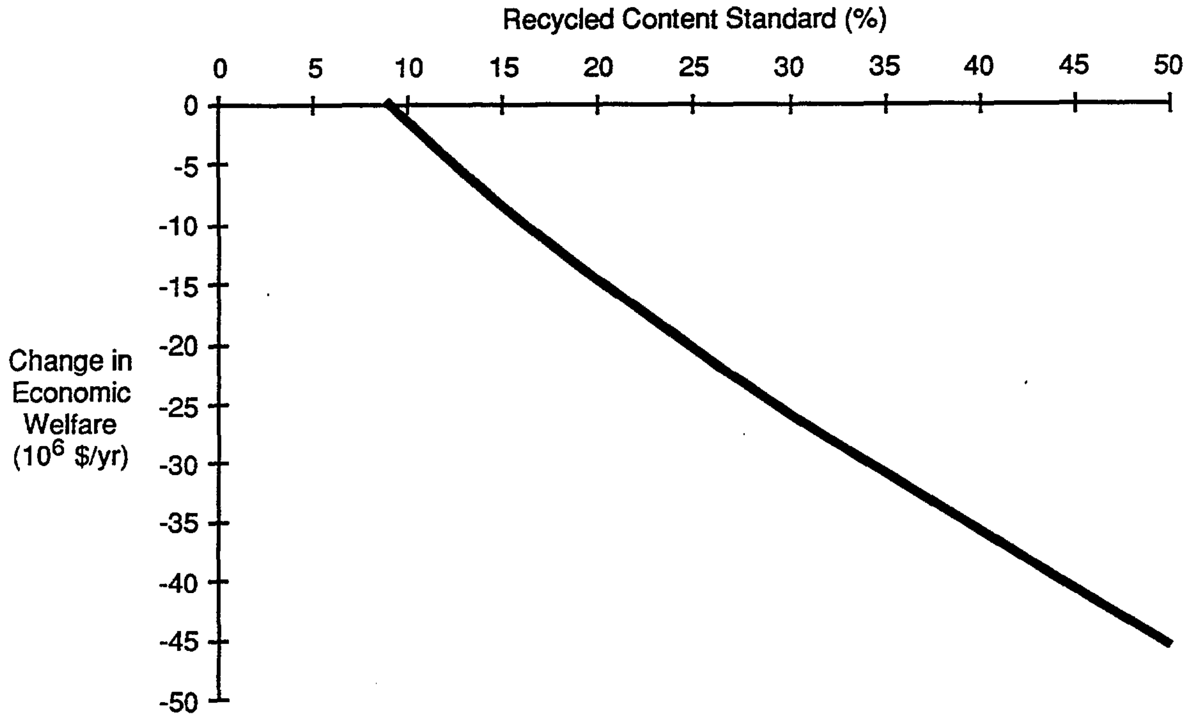
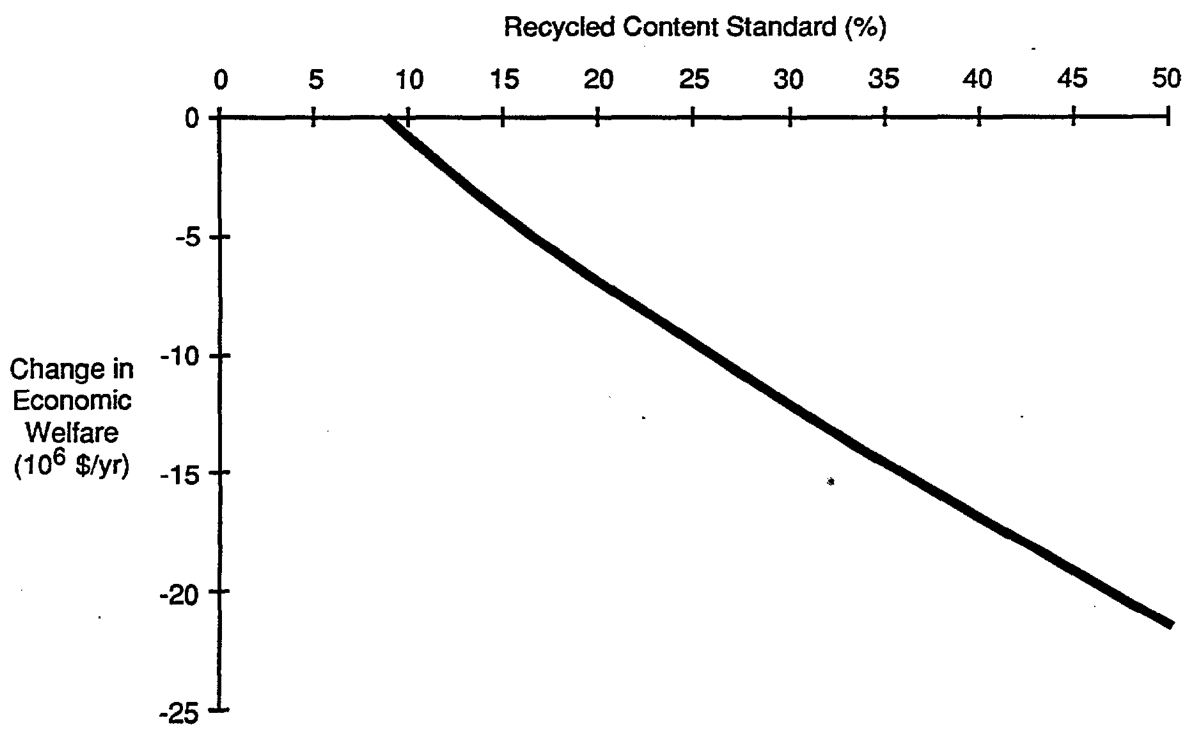


Figure 6-5. Welfare Effects of a Permit Policy, 1988: Taxpayers



a) U.S. Consumers of ONP



b) Foreign Consumers of ONP

Figure 6-6. Welfare Effects of a Permit Policy, 1988: Non-Newsprint ONP Consumers

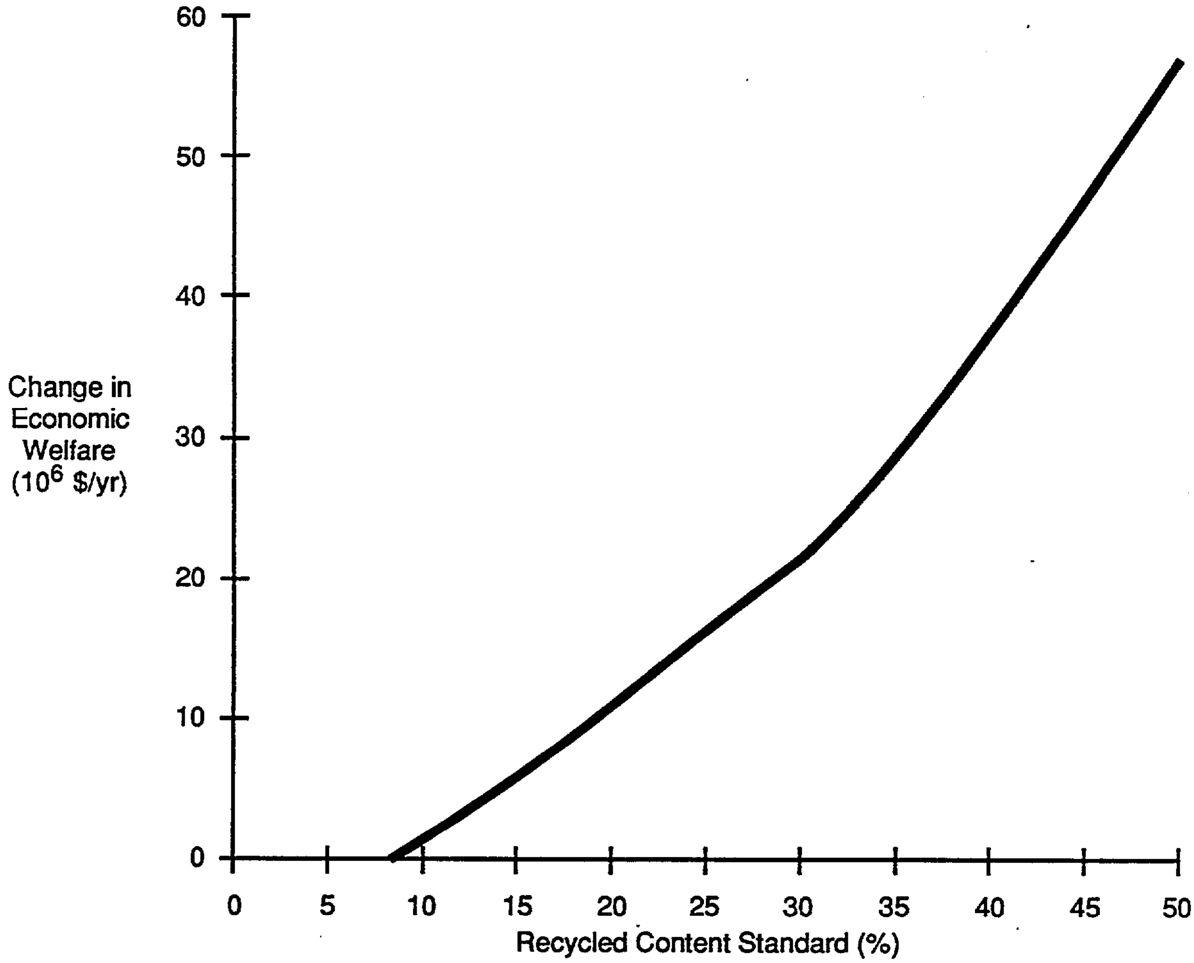


Figure 6-7. Welfare Effects of a Permit Policy, 1988: Recyclers

since compensation is not actually made there is an implicit interpersonal welfare comparison embedded in the Kaldor-Hicks criterion-individuals have equal capacity to enjoy income at the margin and individuals are equally weighted in the decision maker's calculus. When the welfare effects of the policy are small, equally-circumstanced individuals affected, or the policy promotes a beneficial distribution of income, many would argue that the simple maximization of net benefits goal implied by the Kaldor-Hicks criterion is acceptable.

The marketable permit policy will have significant spillover effects on Canadians. We examine the policy's implications for all North American citizens and for only the subset of U.S. citizens. The social welfare of the marketable permit policy for virgin newsprint is the change for individuals in the difference between the value of the environmental benefits and the net costs of the resource reallocations induced by the policy.

6.3.1 Policy Benefits

The policy's primary environmental benefit is the value of reducing the quantity of old newspapers disposed to landfills and incinerators. As argued earlier, municipalities typically understate the actual costs of solid waste management. The costs not included in most estimates include the negative externalities associated with solid waste management (e.g., noise, odor, traffic, litter, contamination of air, soil, and water), and landfill space depletion. Therefore, Figure 6-8 estimates the national benefits of the alternative recycling content standards using three unit cost assumptions for the avoided solid waste management costs with the permit policy-$50, $75, $100, and $125 per ton. The projected value of these benefits is shown in Figure 6-8. These projections are only for U.S. citizens. The solid waste burden of Canada will be reduced also but is not projected here. Thus, our estimates of the solid waste benefits of the policy understate the benefits to all North American citizens. We also understate the benefits for another reason.

As we observed above, the marketable permit policy will cause virgin newsprint production to decrease. The associated reduction in pulp wood production will reduce the harvesting of timber, possibly reducing the logging of primeval forests. These forests are irreplaceable-replanting a harvested stand of ancient trees does not recreate the primeval forest. Therefore, an additional but unquantified benefit of the marketable permit policy that both U.S. and Canadian citizens would enjoy is the preservation of a unique community of plants and animals-such as the spotted owl-which are critically dependent on the habitat provided by these woodlands. The value of the preservation of these resources is not estimated here.

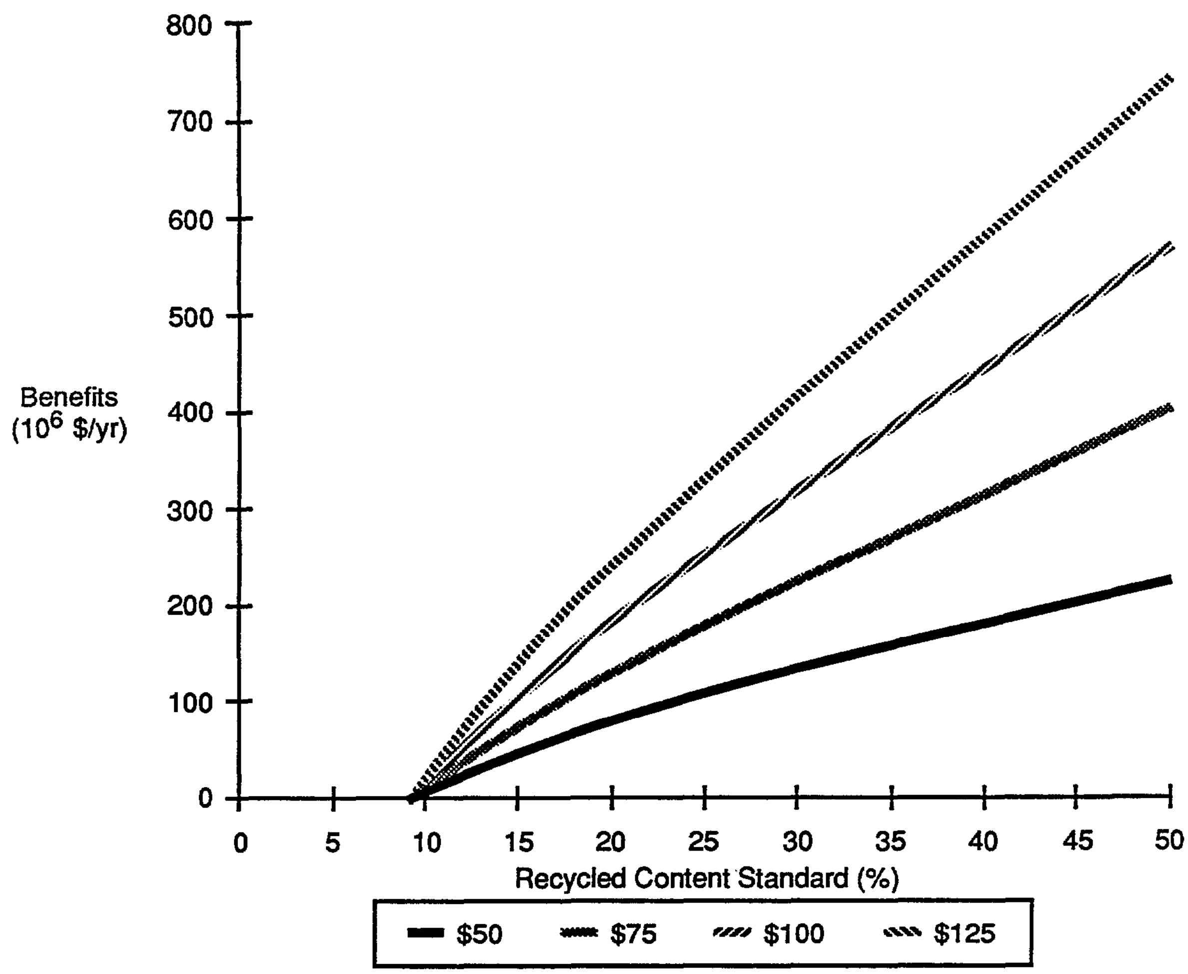


Figure 6-8. Benefits of a Permit Policy, 1988

6.3.2 Policy Costs

The resource costs of the marketable permit policy are the sum of the changes in consumer and producer surpluses in all markets in the newsprint-newspaper-old newspapers system. Just and Hueth (1979) and Just, Hueth, and Schmitz (1982) show that the resource costs of such a policy can be estimated in the market where the policy is introduced. Figure 6-9 shows the social costs of the policy to be estimated. The marketable permit reduces the consumption of virgin pulp from Q_1 to Q_2. The resource cost is represented by the crosshatched triangle. It is the difference between the change in the total benefits of virgin pulp consumption (the area under the demand curve) and the change in the total cost of production (the area under the supply curve). Please note that the demand curve must be an equilibrium demand curve. That is, it must represent the demand for virgin pulp after all adjustments throughout the newsprint-newspaper-old newspaper system are accounted for.

The policy will reduce the quantity of virgin pulp used by both U.S. and Canadian producers. Figure 6-10a shows the policy costs for all individuals in the newsprint-newspapers-old newspapers system. However, some of these costs will be incurred by Canadians and other non-U.S. citizens. Subtracting out their costs yields the cost to U.S. citizens as shown in Figure 6-10b. These costs are negative. In the aggregate, U.S. citizens gain with all values for the recycling content standard, primarily because of the large gains projected for U.S. newsprint producers.

6.3.3 Optimal Policy Choices

The recycling content standard may be set at any value. Each value will have unique benefits and costs. The question is, what is the optimum value? Given a criterion of the efficient allocation of resources, the optimum value is one that maximizes the net economic welfare of society- that is, the value for which the policy's total benefits exceed total costs by the largest margin possible.

The net benefit functions for all stakeholders modeled and for just the subset of U.S. citizens is shown in Figure 6-11. Because the model is linear, corner solutions are indicated as optimal. Specifically, when all stakeholders are considered, the optimum recycling content standard is close to the status quo; when only U.S. citizens are included, the optimum standard is the highest value examined-50 percent.

Modifying the model to express the cost and quantity shares as the cost of secondary pulp, fiber furnish, and newsprint change would improve the accuracy of the model and may lead to an interior (non-extreme) solution.

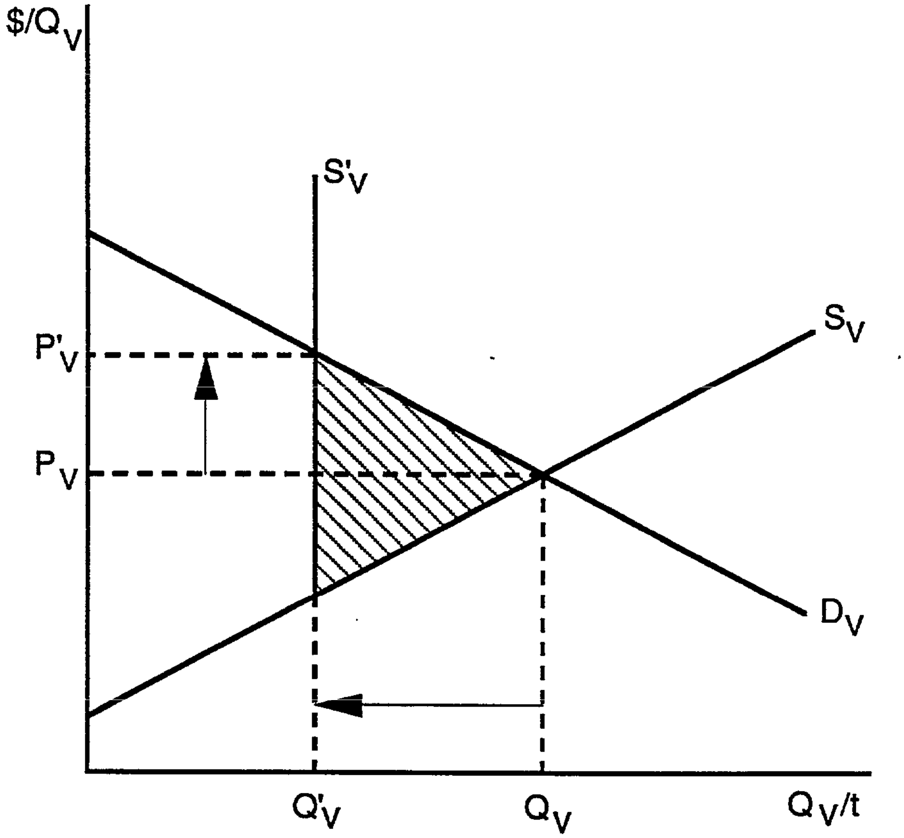
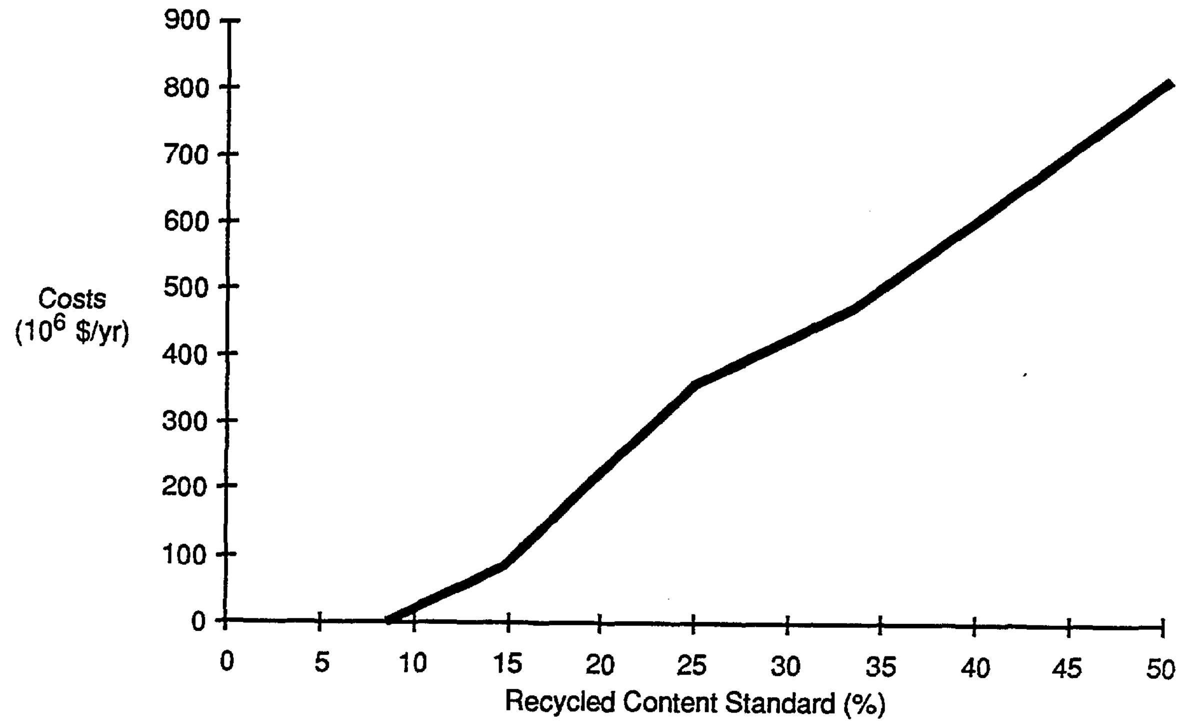
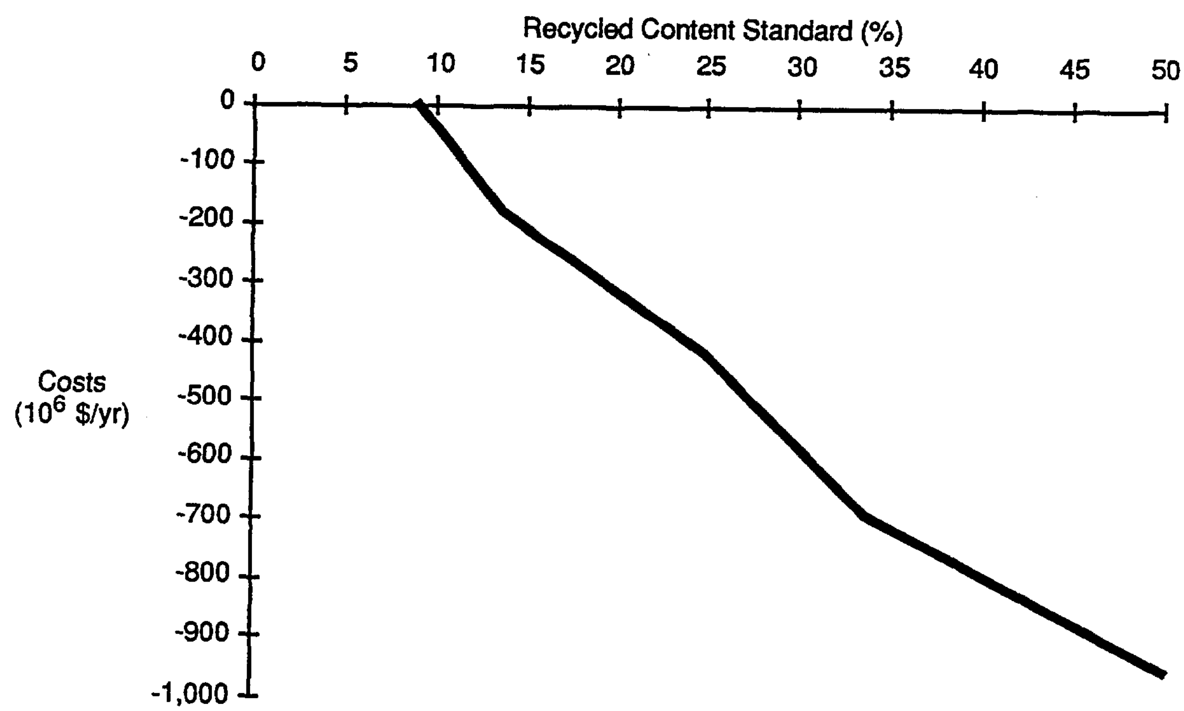


Figure 6-9. Social Costs of a Permit Policy

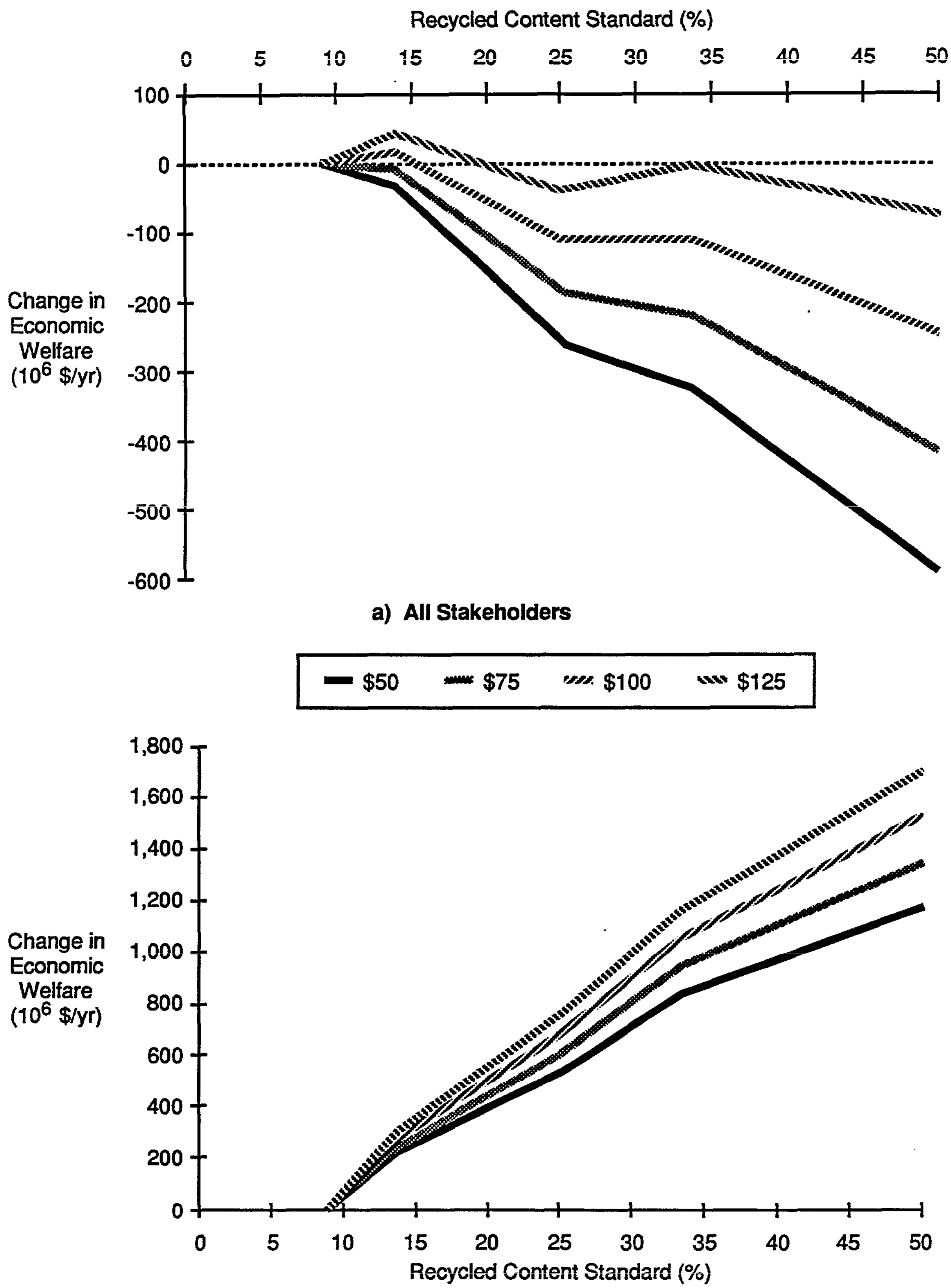


a) All Stakeholders



b) US Stakeholders Only

Figure 6-10. Costs of a Permit Policy, 1988



a) All Stakeholders

b) US Stakeholders Only

Figure 6-11. Net Benefits of a Permit Policy, 1988

6.4 THE PHASE-IN OPTION

The market for newsprint is a growing one. Udell (1988) finds that U.S. newsprint consumption has grown about two-thirds the rate of GNP growth. Introducing the marketable permit policy into this environment means that reduced employment opportunities for labor and capital due to the policy will be regained in the future. How far in the future depends on the growth in newsprint consumption and the selected recycling content standard

An obvious way to reduce the costs of the policy is to phase in the recycling content standard over a period of years and take advantage of the expected newsprint growth. Specifically, this means changing the recycling content standard annually as follows

$$\Delta RCS_t = (1 - RCS_{t-1})\,G$$

where RCS_t is the recycling content standard in time t, and G is the rate of growth in pulp consumption. Assuming the growth of pulp consumption is 3 percent, and the baseline share of secondary pulp is 9 percent, the recycling content standard in Table 6-2 would maintain virgin pulp consumption at the baseline value and cause no virgin pulp facilities or employees to become redundant with the policy.

TABLE 6-2. PHASE-IN RECYCLING CONTENT STANDARD

Year	Recycling Content Standard
Baseline	9% (the baseline value)
1	11.73
2	14.38
3	16.96
4	19.43
5	21.86

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APPENDIX A

COMPARISON OF ALTERNATIVE POLICIES FOR ACHIEVING RECYCLING CONTENT GOALS

Command and control is the traditional approach used by governments worldwide to regulate the residuals management behaviors of polluters. Under command and control policies, government attempts to dictate the residuals management practices of dischargers by specifying control equipment they must install, operating practices they must follow, or the quantity of residuals they are allowed to discharge to the environment. An alternative to command and control policies are incentive or market-type policies. These policies give dischargers more flexibility in making residuals-management decisions than under a command and control approach. This increased flexibility can reduce costs for achieving a given environmental quality goal. There are two major incentive approaches: marketable permits, the policy option examined in this report, and disposal charges.

This appendix briefly demonstrates why an incentive based approach is likely to be more cost-effective than a command and control approach to increasing the secondary fiber content of newsprint. Then some key differences between a marketable permit and disposal charge policy are discussed.

A.1 COMMAND AND CONTROL VS. INCENTIVE POLICIES

The command and control approach to increasing the secondary fiber content of newsprint could be implemented by setting an industry standard that applies uniformly to all producers of newsprint. For example, the goverment might require that all newsprint sold in the U.S. contain at least 30 percent secondary fiber content. Under a uniform industry standard, all firms must increase the recycled content of their newsprint to this amount, regardless of the cost they incur. By using a marketable permit or charge policy to achieve the same *overall* increase in the recycled content of newsprint, however, firms that can increase the recycled content of the newsprint most economically will do so, while firms with higher costs are not compelled to meet the content requirement. In this way, the same aggregate recycled content goal is reached at a lower expenditure of real resources.

Consider a simplified case where only two firms produce newsprint, Firm A and Firm B. Currently, neither uses secondary fiber. Table A-1 indicates the amount of total newsprint each produces, and the additional cost that they each incur to produce newsprint using secondary rather than virgin fiber.

TABLE A-1. HYPOTHETICAL COST OF NEWSPRINT PRODUCED WITH SECONDARY FIBER

Firm	Total Production	Additional Cost With Recycling ($/ton)
Firm A	100	25
Firm B	100	50

Suppose government establishes a goal of increasing the overall recycled content of newsprint to 50 percent. If a uniform industry-wide standard is used to achieve this goal, each firm will need to produce 50 tons of newsprint using secondary fiber. Firm A would incur an additional cost of $1,250 (50 tons x $25/ton), while Firm B would incur an additional cost of $2,500 (50 tons x $50/ton). The total cost increase to achieve the goal with a uniform industry standard (resulting in 100 tons of recycled content) is the total of Firm A and Firm B's additional costs, or $3,750.

However, if government knew the additional cost of recycling that each firm would incur, it could achieve the same aggregate goal at lower cost by setting firm-specific standards. Specifically, it could require firm A to produce only recycled newsprint The aggregate cost of achieving the same goal (50 percent or 100 tons) is $2,500 (100 tons x $25/ton). This information, however, is not available to government unless is spends substantial resources to acquire it. Further, these costs may change, and when they do, government will have to discover the changes and reset the firm-specific standards.

The next example shows another problem in implementing any policy-the distribution of costs. The political acceptability of any policy is affected by stakeholders' perceptions of the effect of the policy on them. As shown in table A-2, Firm A would prefer the uniform standard, Firm B, the firm-specific standard.

TABLE A-2. COST OF UNIFORM AND TAILORED SECONDARY FIBER STANDARD

Firm	Uniform Standard	Firm-Specific Standard
Firm A	$1,250	$2,500
Firm B	$2,500	**0**
Total	$3,750	$2,500

Putting aside these distributional implications for the moment, the question arises as to whether there is an approach to environmental policy design that can achieve the economies of the firm-specific standard without requiring government to acquire expensive information. Both incentive policies can achieve the desired least-cost result.

Suppose a charge of $30/ton were levied on the production of all virgin newsprint. Under this charge, Firm A would choose to produce all recycled newsprint since the additional cost of producing recycled newsprint is less than the cost of the charge. Firm B would choose to pay the charge rather than produce recycled newsprint. The resulting increase in the production of recycled newsprint would be 100 tons, yet the increase in production cost would be $2,500 (Firm A's 100 tons x $25/ton). (This does not include the charge payments, which are a transfer from industry to government.)

As an alternative to using a charge as an incentive to increase the secondary fiber content of newsprint, the same effect might be obtained by assigning transferable property rights for the production of a limited quantity of virgin newsprint. For example, suppose each firm was given rights to produce 50 tons of virgin newsprint. Each firm may either produce 50 tons of virgin content newsprint (as entitled to by their property rights) and the remaining 50 tons of recycled newsprint, or they can buy or sell these property rights. Since Firm A can produce recycled content newsprint at a lower cost than Firm B, both firms can be made better off if Firm A sells its property rights to Firm B. Firm A will be willing to sell its property rights at a price greater than $25/ton (the additional cost it incurs to produce recycled newsprint) while Firm B will be willing to buy Firm A's property rights at any price less than $50/ton. Provided that the firms both act to minimize their production costs, Firm A will sell its virgin newsprint property rights to Firm B. Firm A will then produce 100 tons of recycled newsprint at an additional production cost of $2,500. The revenue received from the permits is a transfer from Firm B to Firm A.

Note that the same results may be obtained by either a charge on virgin newsprint, or by assigning transferable property rights for the production of virgin newsprint. In both cases, Firm A produces 100 tons of recycled newsprint, Firm B produces all virgin newsprint, and the resulting increase in production costs are $2,500 (lower than the $3,750 increase in production costs brought about by a uniform standard). However, there are important differences between charges and rights policies as discussed below.

A.2 CHARGES VS. TRANSFERABLE PERMITS

A.2.1. Similarity of Allocative Effects

The effects of a charge on virgin pulp and the assignment of transferable rights to use a limited quantity of virgin pulp on the market for pulp and the market for old newspapers (ONP) are illustrated in Figures A-1 through A-3. For simplicity, assume that pulp is an intermediate product sold to newsprint producers. This assumption enables us to better illustrate the effects of the charge and transferable permit systems. Two types of pulp are available-secondary pulp, which is made from ONP, and virgin pulp, which is made from wood. In this section we demonstrate that equivalent changes in prices and quantities (allocative effects) may be obtained through either a charge on virgin pulp or by assigning transferable property rights to the use of virgin pulp.

In Figure A-1, the supply of secondary pulp is represented by S^o_w, the initial supply of virgin pulp by S^o_v, and the initial total supply of pulp feedstock by S^o_t (S^o_t is the horizontal sum of S^o_w and S^o_v). Line D represents the demand for pulp. The market price for pulp is P^o_p, with Q^o_w, Q^o_v, and Q^o_t, representing the amounts of secondary pulp, virgin pulp, and total pulp consumed, respectively.

A charge on virgin pulp shifts the supply of virgin pulp upward by the amount of the charge, C, resulting in a new virgin pulp supply curve, S'_v (line e-f-g). As a result of the charge, the amount of virgin pulp supplied at any given price is less since suppliers now need to cover not only their production costs, but also the amount of the charge, C. The upward shift of the virgin pulp supply results in an upward shift in the total supply curve as well, since the total supply is the horizontal sum of virgin and secondary pulp supplies. The new total supply curve following the charge is depicted by S'_t (line e-f-h). This upward shift in total pulp supply results in a new pulp price, P'_p The quantity of virgin pulp and total pulp consumed both decrease to Q'_v and Q'_t, respectively. The quantity of secondary pulp used increases to Q'_w

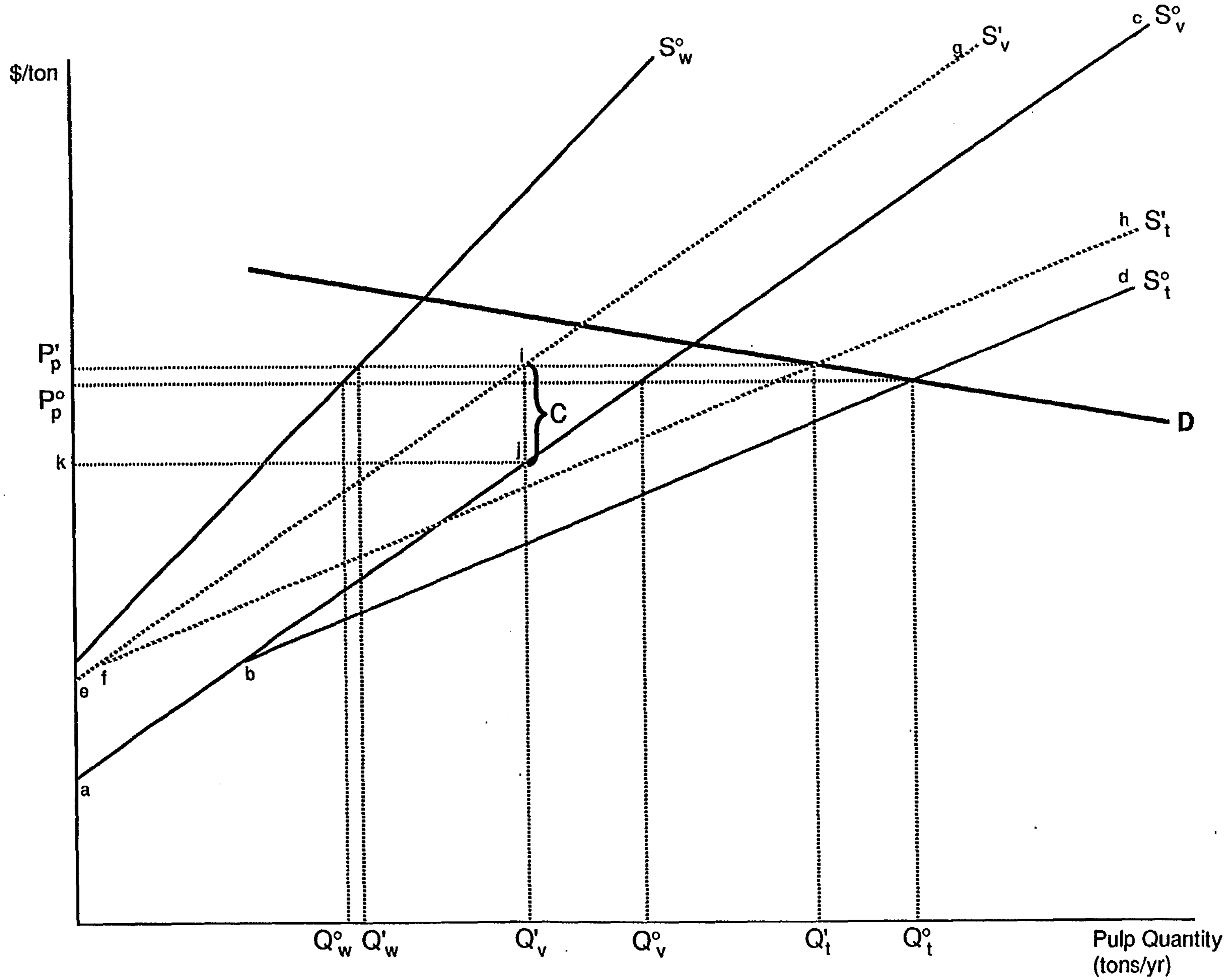

Figure A-1. Allocative Effects of a Charge Policy in Pulp Market

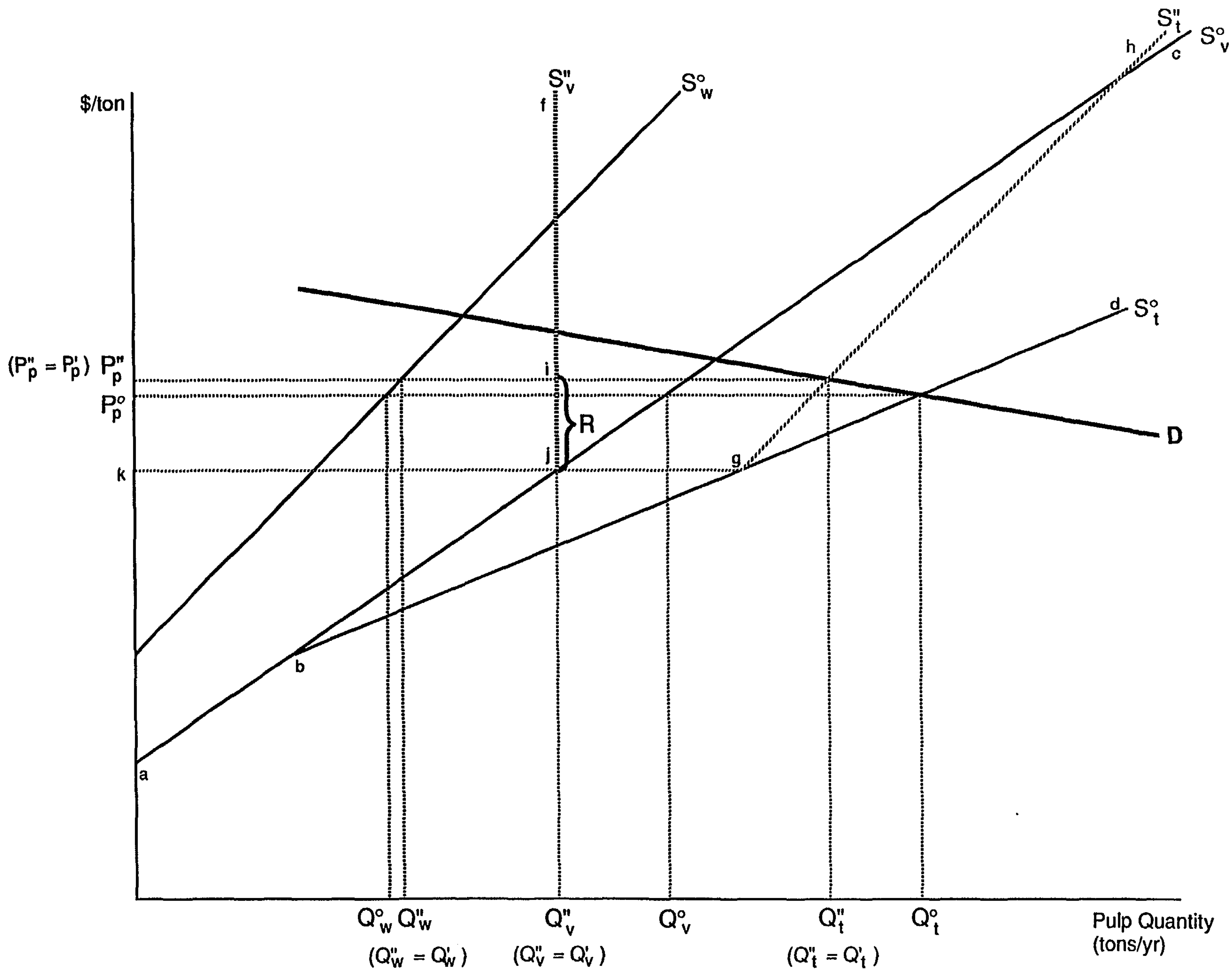

Figure A-2. Allocative Effects of a Permit Policy in the Pulp Market

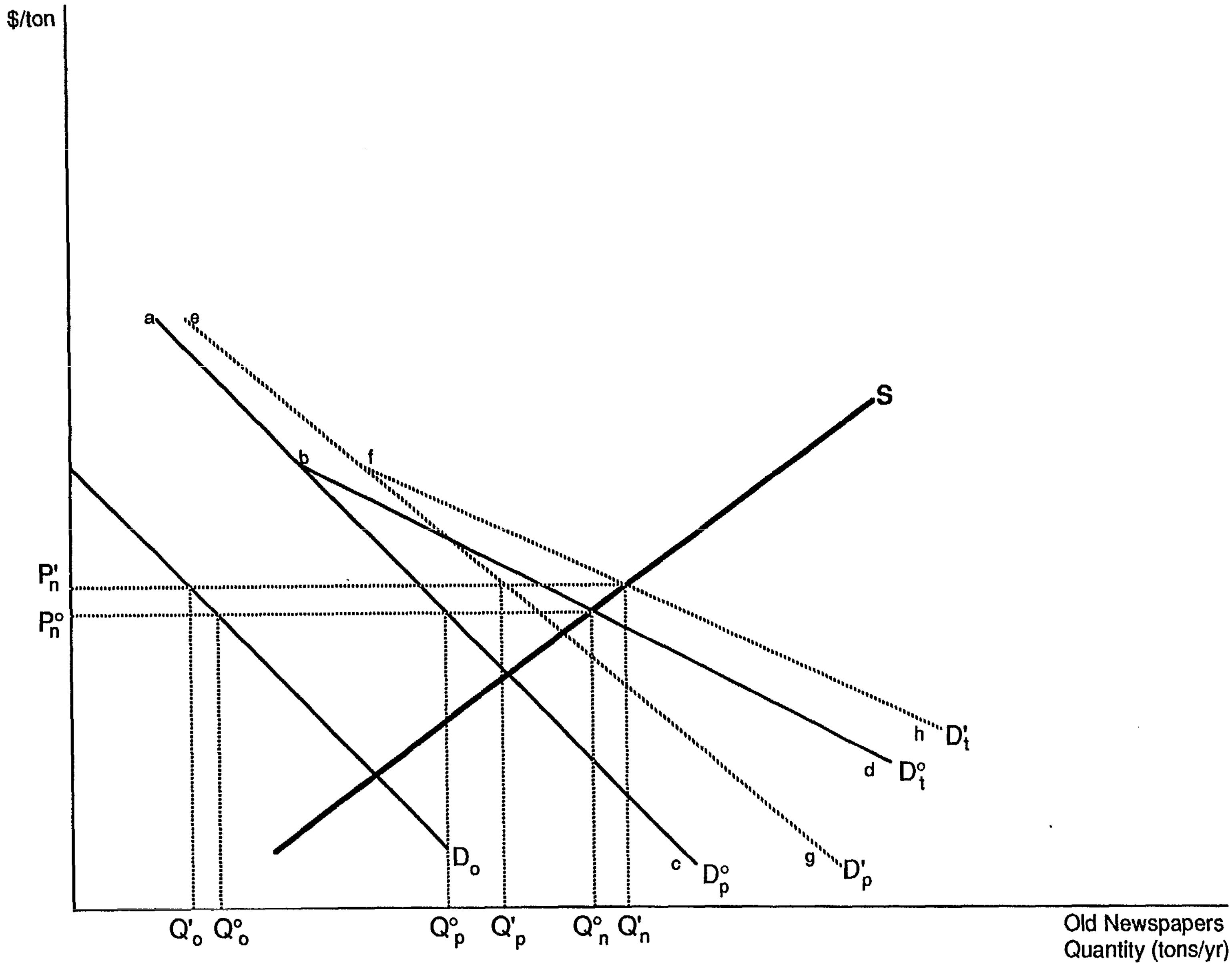

Figure A-3. Allocative Effects of Incentive Policies in Old Newspaper Market

Figure A-2 illustrates that the same changes in pulp price and quantities may be brought about by a transferable permit system. Suppose that government limits the amount of virgin pulp consumption to Q''_v, where Q''_v is equal to Q'_v, the quantity of virgin pulp consumption under a charge of size C. Rights, or permits, for Q''_v units of virgin pulp are issued. The owners of these rights may exchange them selling them to the highest bidders. Under this restriction, the new supply curve for virgin pulp is indicated by S''_v, defined by line a-j-f. The new total pulp supply curve resulting from this quantity restriction is S''_t, the horizontal sum of S^o_w and S''_v. The new price for pulp resulting from this quantity restriction is P”,, which is the same as P'_p, the price resulting from a charge of size C. Likewise the new quantities of secondary pulp and total pulp increase and decrease, respectively, by the same amounts as with a charge of size C, i.e., the amount of secondary pulp consumed increases to Q''_w, which equals Q'_w (the amount under charge C), and total pulp demand decreases to Q''_t, which is the same as Q'_t in Figure A-1. Therefore, the same changes in prices and quantities may be brought about by either a charge or a quantity restriction. The charge and quantity restriction have both resulted in an increase in the secondary fiber content of newsprint. The recycled content in the initial equilibrium is Q^o_w/Q^o_t. With each policy, the content recycled is Q'_w/Q'_t. Since $Q'_w > Q^o_w$ and $Q'_t < Q^o_t$, it follows that $Q'_w/Q'_t > Q^o_w/Q^o_t$.

These figures simply show the directions of the shifts brought about by incentive systems and the potential for equivalence of a charge and a permit system. The actual magnitude of the changes in prices and quantities brought about by a charge or a transferable permit system will depend on the slope of the demand and supply curves.

Next, consider the effect of the virgin pulp charge or transferable permit system on the market for ONP. Figure A-3 shows the market for ONP. Here we assume that ONP is used both for newsprint pulp and for other uses. The demand for ONP for use as newsprint pulp is represented by D^o_p The demand for ONP for use in other goods (e.g., to produce boxboard) is represented by D_o and line D^o_t represents the total demand for ONP. The supply of ONP is represented by S. The demand for ONP for use as newsprint pulp is a derived demand, i.e., it is a function of the demand for secondary pulp. To maximize profits, firms that produce secondary pulp will consume ONP such that:

$$P_p MP_n = P_n.$$

Where, P_p is the price of pulp, MP_n is the marginal productivity of ONP in pulp production, and P_n is the price of ONP.

In the initial equilibrium, the price of ONP is P^o_n and the amounts of ONP consumed for use as pulp, for other uses, and in total are Q^o_p, Q^o_o, and Q^o_T, respectively. A charge or a transferable permit both result in an increase in the price of pulp to P'_p. This increase in pulp price shifts the derived demand for ONP in the production of pulp out to D'_p and the total demand curve for ONP out to D'_t. The new price of ONP increases to P'_n, and the quantities of ONP consumed for use in pulp and in total increase to Q'_p and Q'_n, respectively. The amount of pulp consumed for other uses, however, decreases to Q'_o This decrease is, of course, brought about the increase in the price of ONP.

A.2.2 Differences Between a Charge and a Permit Approach

The above discussion reveals important similarities between using a charge and using a transferable permit approach. A charge or a transferable permits can induce the same changes in prices and quantities both in the market for pulp and in the market for ONP. There are, however, several important differences between the charge and the permit approach.

A.2.2.1 Distributional Effects

The charge and the permit approaches differ in the costs they impose on firms. As indicated in Figure A-1 a charge of size C results in a decrease of virgin pulp consumption from Q^o_v to Q'_v. The amount of revenue collected by the charge is equal to $(C)(Q_v)$, indicated by the area of the rectangle P'_p-i-j-k. This represents a transfer of monies from producers of virgin pulp to government.

Under a permit system that limits the consumption of virgin pulp to Q'' (where Q''_v = Q'_v), the scarcity of the virgin pulp results in a positive value for each permit. The price of a permit is indicated in Figure A-2 by distance R. It is the difference between the price at which producers would be willing to supply Q''_v units of virgin pulp (price k) and the price received for each unit of virgin pulp following the quantity restriction, P''_p. Note that the price of the permit, R, is equal to the amount of the charge, C. The amount of revenue generated by the permits is equal to the product of the number of permits sold, Q''_v, and the price of each permit, R. Since C = R, and $Q''_v = Q'_v$, it follows that $(C)(Q'_v) = (R)(Q''_v)$— the same amount of revenue generated by the charge and the marketable permit approach. The revenue generated by the permits is illustrated in Figure A-2 by the area of rectangle P''_v-i-j-k.

Whereas the government receives revenue generated under a charge system, the revenue received under the permit system is received by whoever is endowed with the rights to virgin pulp. An important issue, therefore, is how to assign the property rights, i.e., who initially receives the permits that allow them to consume Q''_v units of pulp? Three alternative approaches for distributing the permits have been proposed: revenue auctions, grandfathering and non-revenue auctions (see Tietenberg, 1985).

In a revenue auction, the government auctions off the number of permits necessary to meet the established goal for reducing virgin pulp use in newsprint. In our example, Q''_v permits are auctioned off. Each firm producing pulp submits a bid indicating the number of permits it is willing to buy for alternative prices. The government then identifies the price that results in the desired number of permits (Q''_v) being sold. Like a charge on virgin pulp, the funds generated by the revenue auction are a transfer from the firms producing pulp to government.

Under a grandfathering approach, firms receive permits according to a predetermined distribution rule. For example, each firm might receive permits for 70 percent of all the pulp that it produces. If it choose to produce more than 70 percent of its pulp from virgin materials, it would need to buy additional permits. If it chose to produce less than 70 percent of its pulp from virgin materials, it could sell its excess permits. Under the grandfathering approach, the revenue generated by the sale of permits is a transfer of funds between firms within the industry.

The zero-revenue auction combines the two approaches described above. In a zero-revenue auction, each firm receives credits for a given number permits under a predetermined distribution rule. Unlike the grandfathering approach, however, all permits are required to be offered for auction. As in the revenue auction, each firm submits a bid indicating the number of permits it is willing to buy at a variety of prices and government then sets the price at the point where the desired number of permits are sold Each firm receives the number of permits it bid for at the selected market price; however, its payment would be equal to $p(q^*_i - q^o_i)$, where p is the government selected price, q^*_i, is the number of permits firm i bid for and q^o_i is the number of permits that firm i received an initial credit for. Firms that bid for more permits than they initially received credit for would pay for the additional permits. Firms that bid for less permits than they were credited for would receive payment for their unused credits. Under the zero-revenue auction, therefore, revenue is transferred among firms in the industry as with the grandfathering approach. However, an advantage of a zero-revenue auction over the grandfathering approach is that all the permits that are used must be received through an auction, thus assuring that they go to their highest valued use.

A.2.2.2 Uncertainty Effects

An important implicit assumption made when demonstrating the equivalent allocative effects of a charge and a marketable permit system is that policy makers know for certain the shape of the supply and demand curves for pulp. Given uncertainty about the parameters of supply and demand, however, a marketable permit approach rather than a charge gives more certainty about the quantity of virgin pulp actually consumed following an incentive policy.

Suppose government introduces a charge system and assumes that the demand and supply curves are as Figure A-1 pictures. The goal of the charge (set equal to C) is to reduce the quantity of virgin pulp consumed to Q'_v. But suppose that the information about the demand curve was incorrect and that, in fact, the demand was much more inelastic than thought, as shown by D^a (the actual demand curve) in Figure A-4. Under these conditions, the amount of virgin pulp actually consumed following the charge, Q^2_v, would be greater than the amount expected, Q'_v. Similar implications are present with a different supply curve than the one shown.

Under a charge system, therefore, uncertainty about the actual shape of the demand and supply curves results in uncertainty about the actual change in the quantity of virgin pulp consumed. In addition to the change in the amount of virgin pulp consumed, the amount of total pulp consumed would decrease less (to Q^2_t as opposed to Q'_t) and the amount of secondary pulp consumed would increase more (to Q^2_w, as opposed to Q'_w).

Under a permit system, the amount of virgin pulp consumed is fixed. This outcome is known. However, uncertainty about the parameters of demand and supply result in uncertainty regarding the price of permits. If, as in the above example, the demand curve is less elastic than assumed in Figure A-2, a quantity restriction of Q''_v results in a permit price greater than R. This is illustrated in Figure A-5, where D^a once again represents the actual demand curve and D the assumed demand curve. As shown in Figure A-5, given the actual demand curve, Da, the price of the permit increases to Ra as opposed to R, the expected permit price under the assumed demand, D. Although the price of the permit has risen above the expected amount, the amount of virgin pulp consumed, Q^3_v, is unaffected by the difference in demand elasticity. The increase in the amount of secondary pulp consumed (From Q^o_w to Q^3_w), however, is greater that the expected increase to Q''_w. It is also greater than the increase obtained with a charge of size C, given Da -- i.e., $Q^3_w > Q^2_w$.

A.2.2.3 Dynamic Effects

As indicated in Figures A-1 and A-2, equivalent allocative effects may be obtained in equilibrium with a charge and a permit approach if government has perfect knowledge of the relevant functions. As illustrated in Figure A-6, however, if there are shifts from this equilibrium point the two systems will not result in equivalent effects. The total supply curve for pulp following the introduction of a charge, is illustrated by S'_t and the total supply curve for pulp following a quantity restriction, Q''_v is illustrated by S''_t. (These are the total supply curves from Figures A-1 and A-2.) Under the original demand curve, D, the two systems result in the same price of pulp (now labeled P^o_p) and the same quantity of total pulp consumed (now labeled Q^o_t). If the demand curve were to shift out to D*, however, the two systems result in different prices and quantities. In this case, the total amount of pulp consumed following a shift in demand is greater under the charge, Q'_t, than under the permit system, Q''_t. Conversely, the price of pulp following the shift in demand is greater under the permit system, P''_p, than under the charge, P'_p. These results occur because the new total supply curve resulting from a permit system is less elastic than the one which results from a charge. In addition to resulting in different total pulp quantities consumed following a shift in demand, the two systems also result in different amounts of virgin pulp and secondary pulp consumed. The amount of virgin pulp consumed will be higher under the charge than under the permit system

A.2.2.4 Opportunity for Outside Players

A potentially important difference between the charge and permit system is the opportunity for individuals outside the firms in the pulp industry to affect the amount virgin pulp that is available for use in newsprint. Under the charge system, each firm chooses the amounts of virgin and secondary pulp to produce based on the their relative prices (including the charge) and production costs. Under a permit system, however, individuals outside the industry may purchase permits. For example, an environmental group may decide to buy some of the permits. This reduces the total quantity of virgin pulp that may be used by industry.

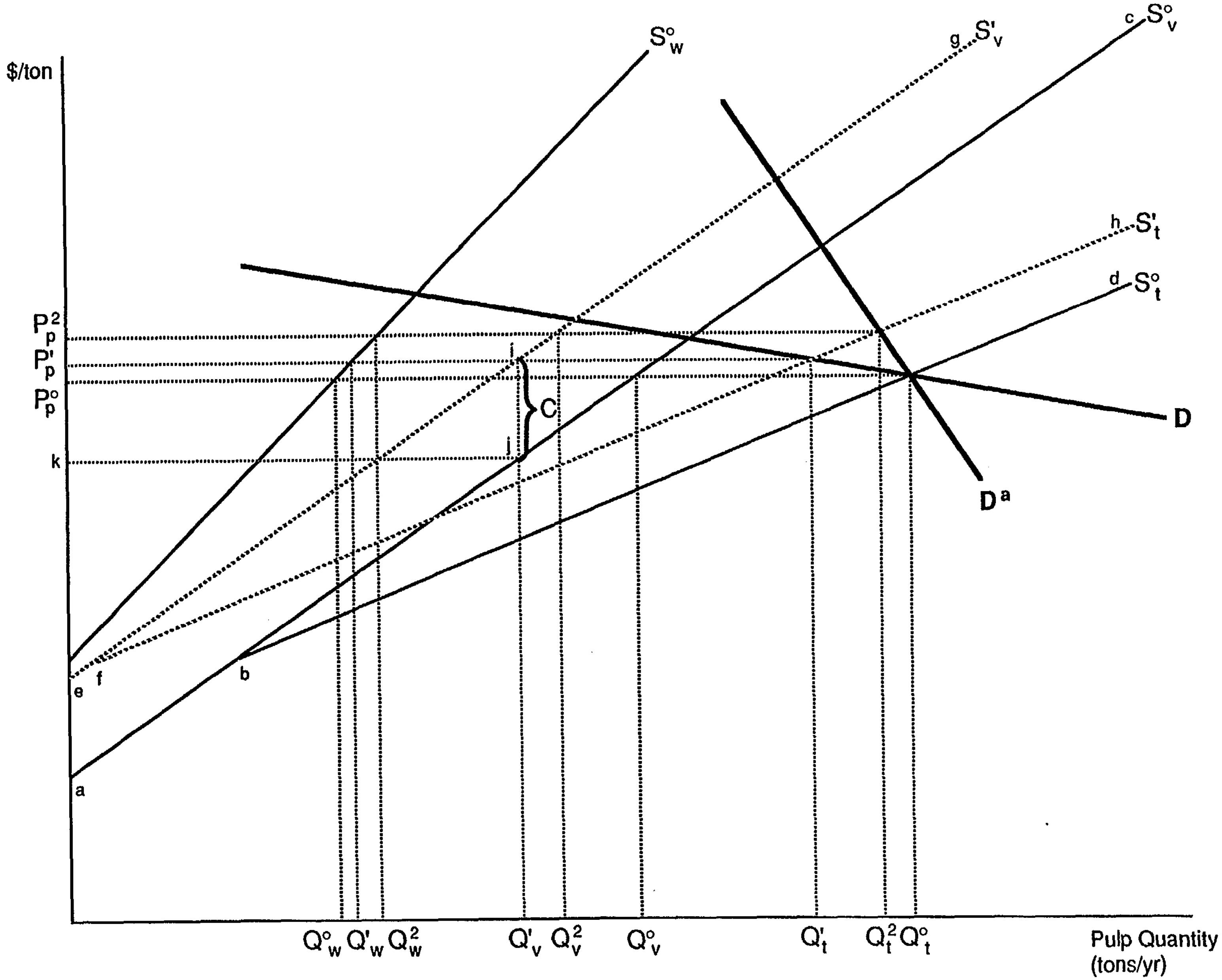

Figure A-4. Effect of Demand Uncertainty on the Quantity Effects of a Charge Policy in the Pulp Market

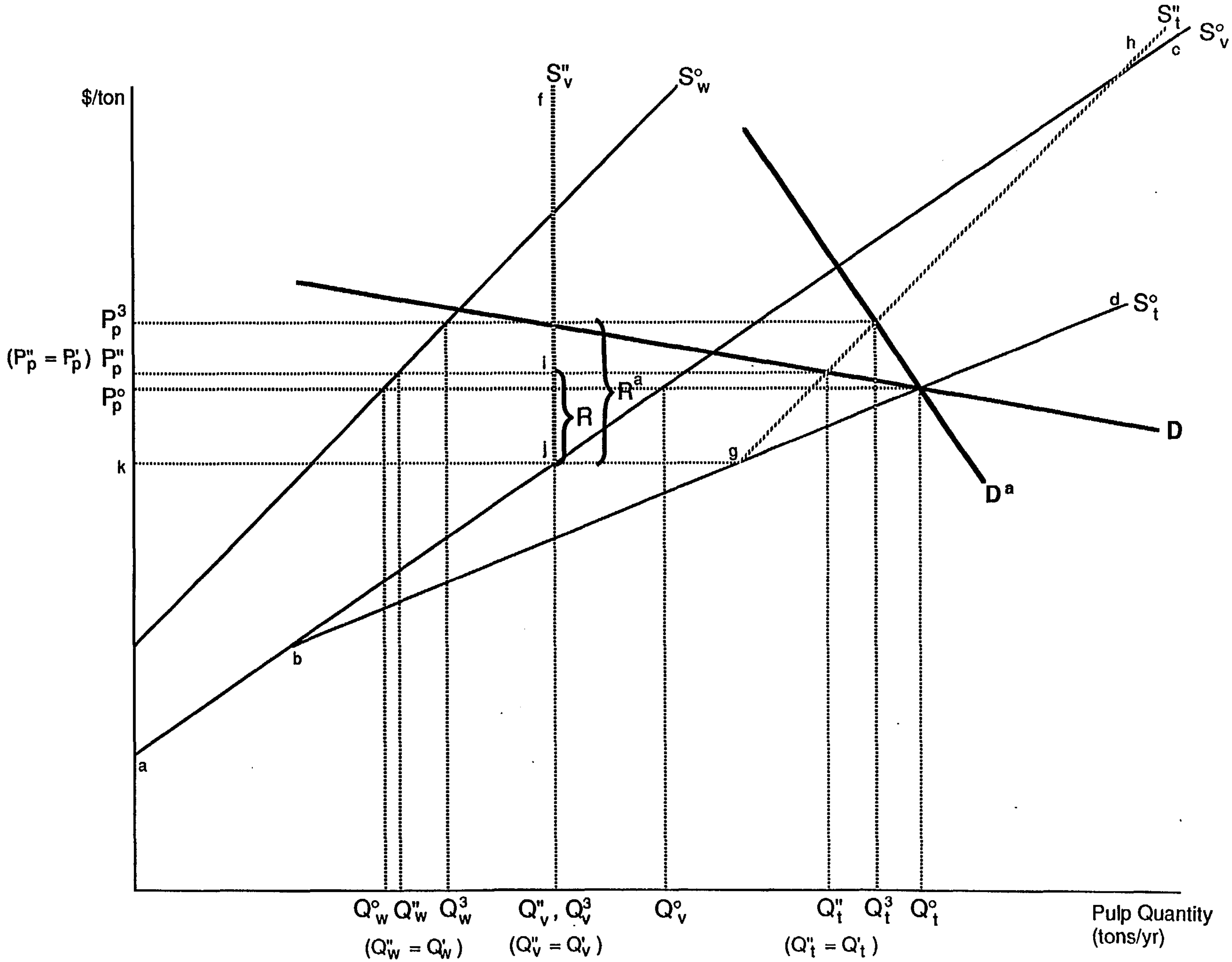

Figure A-5. Effect of Demand Uncertainty on the Price Effects of a Permit Policy in the Pulp Market

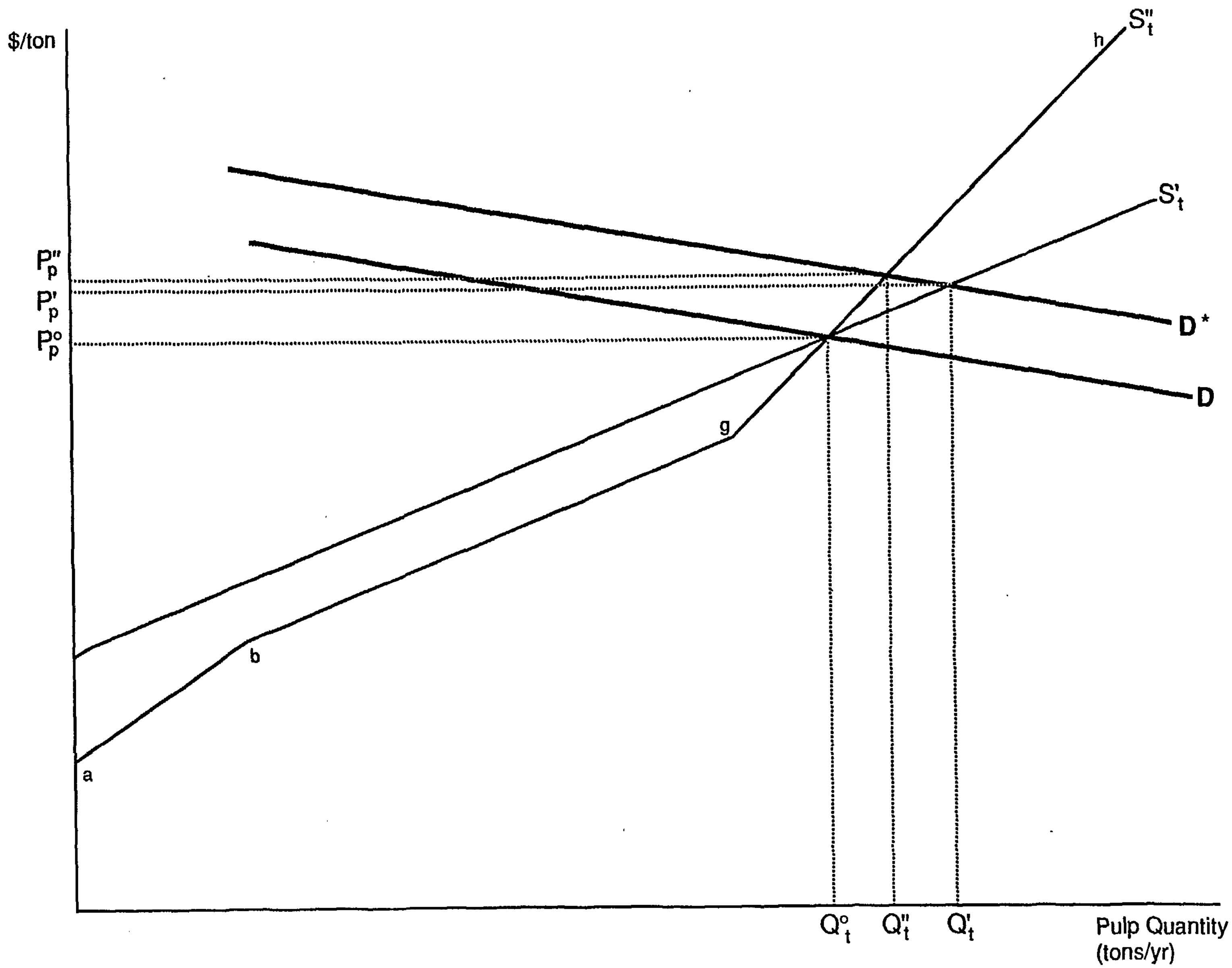

Figure A-6. Dynamic Implications of Charges and Permits

APPENDIX B

IMPLEMENTATION OF A PRODUCER DISPOSAL CHARGE OR MARKETABLE DISPOSAL PERMIT SYSTEM

An important issue is how a producer disposal charge or a marketable disposal permit system would actually be implemented. This appendix discusses options for the implementation and enforcement of both policies.

B.1 IMPLEMENTATION OF A MARKETABLE PERMIT SYSTEM

B.l.l Policy Description

Under a marketable permit system an industry wide minimum standard for the amount of recycled pulp used in the production newsprint is set, e.g., 20 percent All producers and importers of newsprint are required to comply with this regulation. Rather than requiring each individual producer or importer to meet the standard, however, a trading scheme would be utilized to ensure that the industry wide standard was met in a least cost way. Two alternative trading schemes for permits are considered. Under a "grandfathering approach," producers/importers that wish to use less than 20 percent wastepaper pulp may buy virgin pulp permits from producers/importers that use greater than 20 percent wastepaper pulp. Under a "zero revenue auction approach" firms buy and sell permits under an auction run by the government.

B.1.2 Defining the Standard

The standard specifies the industry wide minimum ratio of secondary fiber content to total fiber content for all newsprint consumed in the U.S. For example, a standard of 20 percent requires that at least 20 percent of the total fiber weight of the finished newsprint must be supplied by secondary fibers (called wastepaper pulp).

B.1.3 Complying with the Standard

An individual producer or importer may comply with the requirements in one of three ways:

(1) Demonstrate that at least 20 percent of the fiber weight of the finished newsprint he produces or imports is supplied by wastepaper pulp; or

(2) Purchase virgin pulp permits from another producer or importer (under the grandfathering approach) or through an auction (under the zero-auction approach) for

an amount equal to at least 20 percent of the fiber weight of the paper that he produces or imports; or

(3) Some combination of the two methods described above, e.g., demonstrate that 10 percent of the fiber weight was supplied by wastepaper pulp and buy virgin pulp permits for the remaining 10 percent.

B.1.4 What Exactly Is a Permit?

Permits are transferable property "rights" that may be bought or sold as evidenced by an official record of an agreement. Each permit entitles the owner to the right to use one ton of virgin pulp in supplying the fiber content of newsprint. Each producer and importer is required to have a permit for each ton of virgin pulp fiber content contained in the newsprint that he produces or imports. Under the grandfathering approach official records of agreement (e.g. letters) document the sale of the permits between firms in the industry. Under the zero revenue auction approach official records of agreement document the purchase of permits from the federal government.

B.1.5 Parties Affected by the Standard

All U.S. producers of newsprint must comply with the standard There are currently 21 newsprint mills operated by 18 companies in the U.S. Of these mills, eight produce recycled newsprint. A listing of these mills and their total and recycled newsprint capacity is provided in Table B-1. In addition to these existing mills, four additional mills are expected to come on line by 1991. These mills and their planned capacities, are listed in Table B-2. All firms operating these mills need to comply with the standard by one of the three methods listed above. The thirteen mills without deinking capacity must: (1) invest in deinking capacity; (2) purchase wastepaper pulp; or (3) purchase virgin pulp permits.

All importers of newsprint must also comply with the standard. Foreign producers, U.S. publishers, or customs brokers may all be importers of newsprint. Fifty-seven percent of the newsprint consumed in the U.S. comes from Canada, no significant quantities of newsprint come from other countries (imports from countries other than Canada account for only 2.2 percent of U.S. consumption). According the Canadian Pulp and Paper Institute, the most common importers of record are either producers or customs brokers. There are 41 newsprint mills in Canada, one uses wastepaper pulp. Since all *importers* must comply with the policy and importers may be foreign producers, customs brokers or U.S. publishers, the number of parties involved could be less than or greater than the 41 Canadian producers. Information on the number and types of importers of newsprint has been requested from the U.S. Customs Office.

TABLE B-1. NORTH AMERICAN NEWSPRINT PRODUCERS AND MILL CAPACITIES, 1989

		Mill Capacity (tons/day)	
Company	**Mill Location(s)**	**Newsprint**	**Deinking**
Canadian Producers			
Abitibi-Price Inc.	Alma	423	0
	Beaupre	1,040	0
	Chandler	651	0
	Fort William	443	0
	Grand Falls	777	0
	Iroquois Falls	803	0
	Kenogami	349	0
	Pine Falls	549	0
	Stephenville	514	0
	Thunder Bay	520	0
Boise Cascade Canada Ltd.	Kenora	714	0
Bowater Mersey Paper Co.	Liverpool	706	0
Canadian Pacific Forest Products Ltd.	Dalhousie	894	0
	Gatineau	1,754	0
	Gold River	86	0
	Thunder Bay	1,274	0
	Trois-Rivieres	809	0
Consolidated-Bathurst Inc.	Grand'Mere	586	0
	La Baie	1,177	0
	Shawinigan	986	0
	Troid-Rivieres	251	0
Daishowa Forest Products Ltd.	Quebec City	1,423	0
Domtar Newsprint	Dolbeau	483	0
	Donnacona	146	0
	Red Rock	220	0
Donohue Inc.	Amos	554	0
	Clermont	1,097	0
F. F. Soucy Inc.	Riviere du Loup	534	0
Finlay Forest Industries Ltd.	Mackenzie	426	0
Fletcher Challenge Canada Ltd.	Crofton	1,511	0
	Elk Fails	1,591	

CONTINUED

TABLE B-1. NORTH AMERICAN NEWSPRINT PRODUCERS AND MILL CAPACITIES, 1989 (CONTINUED)

Company	Mill Location(s)	Mill Capacity (tons/day)	
		Newsprint	Deinking
James Maclaren Industries Inc.	Masson	589	0
Kruger Inc.	Bromptonville	629	0
	Comer Brook	1,083	0
	Trois-Rivieres	774	0
MacMillan Bloedel Ltd.	Port Albemi	460	0
	Powell River	1,500	0
Quebec and Ontario Paper Company Ltd.	Baie Comeau	1,420	0
	Thorold	977	595
Rothesay Paper Ltd.	Saint John	1,009	0
St. Raymond Paper Ltd.	Chute Panet	103	0
Spruce Falls Power & Paper Co. Ltd.	Kapuskasing	1,080	0
Stora Forest Industries	Point Tupper	534	0
U.S. Producers			
Augusta Newsprint Co.	Augusta, GA	1,085	0
Bear Island Paper Co.	Ashland, VA	631	0
Boise Cascade Corp.	DeRidder, LA	1,042	0
	Steilacoom, WA	583	0
Bowater Southern Paper Co.	Calhoun, TN	2,228	0
Catawba Newsprint Co.	Catawba, LSC	699	0
Champion International	Houston, TX	1,332	0
	Lufkin, TX	1,085	0
FSC Paper Co.	Alsip, IL	377	350
Garden State Paper Co Inc.	Garfield, NJ	611	700
Golden State Paper Co Inc.	Pomona, CA	380	420

CONTINUED

TABLE B-1. NORTH AMERICAN NEWSPRINT PRODUCERS AND MILL CAPACITIES, 1989 (CONTINUED)

Company	Mill Location(s)	Mill Capacity (tons/day)	
		Newsprint	Deinking
Great Northern Paper Co.	East Millinocket, ME	989	0
Inland Empire Paper Co.	Millwood, WA	206	0
James River Corp.	Wauna, OR	93	0
Kimberly-Clark Corp.	Coosa Pines, AL	1,180	0
Manistique Papers, Inc.	Manistique, MI	175	500
Newsprint South Inc.	Grenada, MS	186	0
North Pacific Paper Corp.	Longview, WA	1,470	0
Ponderay Newsprint Co.	Usk, WA	62	0
Smurfit Newspaper Corp.	Newberg, OR	1,087	475
	Oregon City, OR	673	300
Southeast Paper Mfg Co.	Dublin, GA	659	495
Stone Container Corp.	Snowflake, AZ	820	550

Source: American Newspaper Publishers Association. Newsprint Statistics 1988, as provided by Franklin Associates, Ltd.

B.1.6 How Are the Virgin Permits Distributed?

As described in Appendix A, a marketable permit system depends on the trading of permits to achieve its allocative efficiency properties. However, the initial allocation of permits has important implications for the distributional impacts of the policy. Appendix A discusses three approaches for allocating permits-a revenue auction, grandfathering, and a zero-revenue auction.

Under a revenue auction, the federal government auctions off a fixed number of permits. All firms wishing to use virgin pulp must buy the necessary number of permits. A revenue auction, therefore, results in a transfer of funds from firms in the industry to the federal government. Although this approach has been described in theory, there has never been an auction of pollution permits as such distribution schemes have lacked political support. Industry is likely to oppose to such an option, since it results in a net loss to them. Environmentalists have in the past objected to revenue auctions as selling the “rights” to pollute. However, there are cases where government allocates the rights to use a public resource through a auction approach (e.g., off-shore oil and gas exploration rights). The revenue auction is not developed in this appendix.

Under a grandfathering approach, existing firms receive permits according to a predetermined distribution rule. A grandfathering rule was used in the marketable permit approach to phasing down the lead in gasoline and in the initial allocation of rights to air emissions under the emissions trading policy.

Following our example of a 20 percent industry standard, one method for distributing permits is to grant all firms permits for 80 percent of their fiber weight. For example, a firm producing newsprint containing using 100 tons of fiber content in a quarter would be “issued” 80 virgin pulp permits each quarter. If the firm uses more than 80 tons worth of virgin pulp during the quarter it must purchase permits for its virgin pulp use beyond 80 tons. If the firm uses only 50 tons worth of virgin pulp, it may sell its 20 extra virgin pulp permits to another firm or importer.

Industry is likely to favor a grandfathering approach over a revenue auction since: (1) firms are only required to buy permits for the amount of virgin pulp used beyond 80 percent, as opposed to purchasing permits for *all* virgin pulp used, and (2) the revenue generated by the sale of the permits is transferred among firms in the industry rather than received by the federal government.

A potential limitation associated with the grandfathering approach is the possibility that firms that produce newsprint from wastepaper pulp will attempt to receive excessive profits from the sale of their unused virgin permits thereby thwarting the efficiency properties of the marketable permit system Currently only eight mills in the U.S. (representing 6 companies) would have the potential to sell virgin pulp permits. Since less than 2 percent of the newsprint produced in Canada is made from recycled newsprint, most importers would be purchasers rather than sellers of permits. Firms without deinking capacity would need to either buy virgin pulp permits or install deinking capacity. Such investments are costly - ranging from $66 to $120 million dollars, depending on production capacity (see Appendix D). Given the major capital investment involved to add deinking equipment and the relatively small number of potential sellers of virgin permits, the possibility exists that permit sellers may be able to exert sufficient market power to extract excessive profits (at least in the short term). As a result, the permits may be priced above the competitive equilibrium inducing uneconomic decisions and resulting in excessive returns to the permit holders. An option for eliminating the potential for a small number of firms to use their market power to obtain excessive profits from the sale of permits is to conduct a zero revenue auction.

In a zero-revenue auction, each firm receives credits for a given number permits under a predetermined distribution rule (such as the one described above). Unlike the grandfathering approach, however, *all* permits must be offered for sale at a government held auction. As in the revenue auction, each firm submits a bid indicating the number of permits it is be willing to buy at a variety of prices and the government then sets the price at the point where the desired number of permits are sold. Each firm receives the number of permits it has bid for at the selected market price, however, its payment would be equal to $p(q_1 - q_2)$, where p is the government selected price, q_1 is the number of permits firm i bid for and q_2 is the number of permits that firm i received an initial credit for. Firms that bid for more permits than they receive credit for pay for the additional permits and firms that bid for less permits than they are credited for receive payment for their unused credits. Under the zero-revenue auction; therefore, revenue is transferred among firms in the industry. An advantage of a zero-revenue auction over the grandfathering approach is that all the permits used must be received through an auction, thus assuring that they go to their highest valued use at the competitive market price. In addition, the auction prevents firms from obtaining excessive profits from the sale of the permits.

B.1.7 Administration and Enforcement of a Grandfathering Approach and a Zero Revenue Auction

Grandfathering Approach

Under the grandfathering approach the role of the government is mainly to enforce the policy. After the government has determined the distribution rule, it is up to individual firms to decide whether they wish to buy or sell permits, with whom, and at what price. The role for the government in this case is to ensure that each firm is in compliance with the policy, i.e., that they have complied with the standard by one of the three ways described above in the section ‘Complying with the Standard.”

To enforce the policy, EPA would need to obtain the following information from each producer/importer on a quarterly basis:

(1) the total fiber weight of the finished newsprint produced/imported,

(2) certification of the percent of the total fiber content of the finished newsprint supplied by wastepaper pulp (secondary fibers). This certification would be obtained from the newsprint producer and indicate the mill where the newsprint was produced,

(3) the number of “permits” that purchased from other producers or importers, and

(4) the number of “permits” that sold to other producers or importers.

Producers/importers would be required to report each of the four items listed above to EPA at the end of each quarter. EPA would use available information about the deinking capacity of mills (item 2) to verify the accuracy of the recycled content certification reports. Accuracy of reports about permit purchases and sales would be increased by cross checking purchase and sale information across firms.

Enforcement for importers is complicated by the fact that it would be more difficult to verify the number of permits that they are likely to require. Item 2 in the above reporting requirements (certification of recycled content) is particularly important for importers. Given information about domestic producers’ deinking capacity, it should be relatively easy to verify the accuracy of reported recycled content. Since importers may be brokers rather than foreign producers it is relatively more difficult to verify the recycled content of their newsprint. An effective certification system is essential to the success of enforcement of imports. Knowledge of the mills where the newsprint is produced will aid in checking certification accuracy.

An additional dimension associated with imports is the involvement of the U.S. Customs Office in enforcement. For each shipment of newsprint, the Customs Office currently collects information on the importer of record, the quantity imported, the value of the shipment, and the date of import. To have knowledge of the parties that should be filing quarterly reports with EPA, the Agency will need to obtain a listing of all of the importers of record for each quarter, along with the quantity of newsprint they imported. Such information is currently transmitted from Customs to the Census Department electronically under a "harmonized" data system. Importers of record are identified by IRS numbers. By linking with the IRS data; importer of record names and addresses may be obtained. Such information is confidential, therefore, Agency clearance would be required.

Zero Revenue Auction

Under the zero revenue auction, EPA's function would include both enforcement and administering the auction. To enforce the policy, EPA would need to obtain the following information from each producer/importer on a quarterly basis:

(1) the total fiber weight of tons of pulp used in the newsprint produced/imported,

(2) certification of the percent of the total fiber content of the finished newsprint supplied by wastepaper pulp (secondary fibers). This certification would need to be obtained from the newsprint producer and would need to indicate the mill at where the newsprint was produced, and,

(3) the number of "permits" he purchased from the zero revenue auction.

Because firms would buy permits from the government rather than other firms, the government may easily verify the accuracy of reports of permit purchases and the process of cross checking purchases and sales across firms would be eliminated. Given information about the deinking capacity of mills and the fact that permits are purchased directly from the government, enforcement for domestic producers should be relatively simple under a zero revenue auction. As in the approach of the grandfathering approach, effective enforcement for importers requires certification of recycled content.

In addition to its enforcement responsibilities, the federal government would also run the auction. This might be done by mail or electronically. Firms could be sent the schedule of prices and informed of the date for submittal of bids. The government would choose the price that resulted in the desired number of permit sales once all bids had been submitted. Firms would then be charged or paid based on the number of permits they requested at the selected price and the number of permits they received credit for under the credit distribution rule.

An important issue under the zero-revenue auction is how firms that under- or over-estimate their permit needs should be handled At the beginning of each quarter firms would estimate their permit needs based on their estimates of total use of pulp (determined through total sales of newsprint). If their actual sale of newsprint differed from their estimates, then their actual permit requirements would differ from their estimated permit requirements. One option for over and underestimates is to allow carryover from one quarter to the next. Firms that bought more permits than they needed would be able to use those in the following quarter. Firms that bought less permits than they need would be able to buy those in the next quarter's auctions. Penalties might be built in to prevent consistent underestimating of permit requirements, e.g, there may be a 20 percent surcharge on permits bought to cover the previous quarter's shortfall.

Expansions in the Industry

Under both the grandfathering approach and the zero-auction approach, firms receive permits or credits for permits based upon their level of production. If new firms enter the industry or existing firms increase their capacity, the number of virgin pulp permits (or credits for them under a zero revenue auction) would expand proportionately. This implies that although the recycled content of newsprint would stay constant the absolute quantity of virgin pulp consumed would increase. Over time the government may want the alter its permit (or permit credit) distribution rule to further increase the recycled content or to keep the amount of virgin pulp consumed constant.

Under the grandfathering approach this simply entails announcing a new distribution of permits that are "given" to a firm, e.g., firms may be told that they will be given permits for 70 percent of their pulp use as opposed to 80 percent. Firms that wish to use more than 70 percent virgin pulp must buy the remaining permits. This results in a lowering of the number of permits that are available for sale and an increase in the value of the permits.

Under the zero revenue approach, changes in the number of permits in circulation would involve both altering the distribution rule for permit credits (e.g., firms might now receive credits for only 40 percent of their pulp use) and choosing the price that corresponds to the new number of permits desired.

Penalties for Non-compliance

Each firm would be charged a penalty based on their shortfall of permits, e.g. a firm producing newsprint containing 220,000 tons of fiber weight in a given year must have 220,000 permits at the end of the year. (Under the grandfathering approach it would be "given" 176,000 permits and the under the zero-revenue approach it would be given credit for 176,000 permits.) If the firm had only 215,000 permits it would be fined by and amount of 5,000 times the penalty charge. To be effective, penalties must be higher than the price of a permit, e.g., the penalty charge might be double or triple the estimated price of a permit. The estimated permit price depends on the recycled content standard and the underlying market conditions.

A Variation on the Permit Approaches: Applying Them at the Publisher Level

The above discussion has explored the implementation of a permit policy at the producer level. Under both permit approaches considered (grandfathering and a zero revenue auction) enforcement difficulties are expected for importers of newsprint. This presents a significant obstacle since 57 percent of the newsprint consumed in the U.S. is imported. A variation of these approaches, therefore, is to implement the policies at the publisher level.

Under the grandfathering approach, publishers would be required to report:

(1) the total tons of fiber content in the newsprint used,

(2) certification of the percent of the total fiber content of the finished newsprint supplied by wastepaper pulp (secondary fibers). This certification would be obtained from the newsprint producer and indicate the mill where the newsprint was produced,

(3) the number of ‘permits” purchased from other publishers, and

(4) the number of “permits” sold to other publishers.

Under the zero revenue auction, publishers would be required to report:

(1) the total tons of fiber content in the newsprint used,

(2) certification of the percent of the total fiber content of the finished newsprint supplied by wastepaper pulp (secondary fibers). This certification would be obtained from the newsprint producer and would indicate the mill where the newsprint was produced, and

(3) the number of "permits” that he purchased from the zero revenue auction.

Implementing the two approaches at the publisher level would share many similarities with implementation at the producer level. Publishers rather than producers would be grandfathered permits (grandfathering approach) or issued credits for permits (zero-revenue auction) based on their use of newsprint. Publishers would then either trade permits among themselves (grandfathering approach) or buy permits through a government run auction (zero revenue approach) just as producers would in the above descriptions. Several important differences are worthy of note, however:

- All direct enforcement would involve domestic firms (i.e., U.S. newspaper publishers). This means that EPA would have all direct enforcement responsibility and the U.S. Customs Office would not be involved, as it was in the case of a permit requirement at the producer/importer level.

- The number of firms involved in enforcement efforts would be significantly larger. There are over 1,600 daily newspapers published in the U.S. and many more non-daily papers. Daily papers account for 85 percent of the newsprint consumed.

- Enforcement efforts would be complicated by the fact that verifying publishers permit requirements would require knowledge of the recycled content of the newsprint they purchase. This issue is similar to the one for importers discussed earlier: Item (2), certification of the recycled content, of the above reporting requirements is crucial to effective enforcement at the publisher level. There is no existing way to test for recycled content, therefore, the certification must come from the producer.

Applying the permit approach at the publisher level eliminates the involvement of the U.S. Customs Office in relaying information to the Agency for enforcement purposes. However, it greatly increases the number of firms that must comply with policy and, therefore, adds to enforcement costs. In addition, the success of the permit approach at the publisher level requires accurate certification of the recycled content of purchased newsprint.

B.2 IMPLEMENTATION OF A PRODUCER DISPOSAL CHARGE ON VIRGIN CONTENT

As an alternative to using a marketable permit system to increase the recycled content of newsprint, a producer disposal charge on the virgin content of newsprint might be instituted. Appendix A discusses some of the similarities and differences among charges and permits. As described in Appendix A, given adequate information about the market; a producer disposal charge and permit approach may be designed to bring about the same changes in the recycled content of newsprint.

B.2.1 Policy Description

Under this policy, all producers and importers of newsprint are charged based on the virgin content of the newsprint they produce or import. Producers and importers would be charged on the total tons of pulp used unless they provide certification of the recycled content.

B.2.2. Parties Affected by the Charge

All U.S. producers of newsprint would be subject to the producer disposal charge. All importers of newsprint would also be subject to the charge.

B.2.3 Determining the Required Payment

As indicated above, the producer disposal charge would be levied on the total pulp content of the newsprint unless producers or importers provide certification of the recycled content. Each producer/importer that does not certify the recycled content would determine his payment by multiplying the fiber weight of the finished newsprint produced or imported by the level of the charge. Each producer and importer that supplies certification of the recycled content would determine his charge payment by multiplying the ratio of the recycled fiber content to total fiber content by the total fiber weight and by the level of the charge.

B.2.4 Administration and Enforcement of the Producer Disposal Charge

The charge for domestic producers would be collected by the IRS on a quarterly basis. For imports, the charge would be collected by the U.S. Customs Office with every shipment of newsprint., Each producer/importer would be required to provide the following information in order to document the accuracy of his charge payments:

(1) the total tons of fiber weight used in the newsprint produced/imported,

(2) certification of the percent of the total fiber content of the finished newsprint was by wastepaper pulp (secondary fibers). This certification would be obtained from the newsprint producer and indicate the mill where the newsprint was produced, and

(3) the level of the payment required as determined by the method described above.

Unlike the permit approach, the Agency would not be responsible for enforcement. This responsibility would rest on the IRS in the case of domestic producers and on the U.S. Custom Office in the case of imports. The level of payment would be determined by individual producers and imports by the method indicated above. Enforcement would consist of spot checks by the IRS and Customs. When requested, producers and importers would be required to provide the information described above to verify the correctness of their computed payment.

As was the case for the permit approach, a producer disposal charge could be levied U.S. publishers as opposed to being levied on producers and importers. In this case, the IRS would have sole responsibility for enforcement. The enforcement and administration method would be the same as for a producer and importer charge. Publishers would determine their own level of payment and provide certification of the recycled content of their newsprint purchases to verify the accuracy of their payment. Spot checks would be conducted by the IRS.

APPENDIX C

OLD NEWSPAPERS POLICY MODEL

The policy model presented here incorporates derived demand principles to link the 26 sectors in the newsprint-newspapers-old newspapers system shown in Figure C-1. The model provides estimates of the proportional change in the endogenous variables given a shift in any of the exogenously supplied functions.

GENERAL NOTATION

$E(\cdot) = \frac{d(\cdot)}{(\cdot)}$ = proportional change of a variable

k_i = cost-share of the ith commodity

g_i = quantity-share of the ith commodity

σ_i = elasticity of substitution of the ith commodity

η_i = demand elasticity of the ith commodity

ε_i = supply elasticity of the ith commodity

Q_i = quantity of the ith commodity

P_i = price of the ith commodity

COMMODITIES

Table C-1 lists the 26 commodities in the model.

VARIABLES

Exogenous

λ_i = proportional shift in the supply of the ith commodity, 1 = 1, 8, 11, 12, 20, 21, 26.

μ_i = proportional shift in the demand of the ith commodity, i = 18, 23, 24

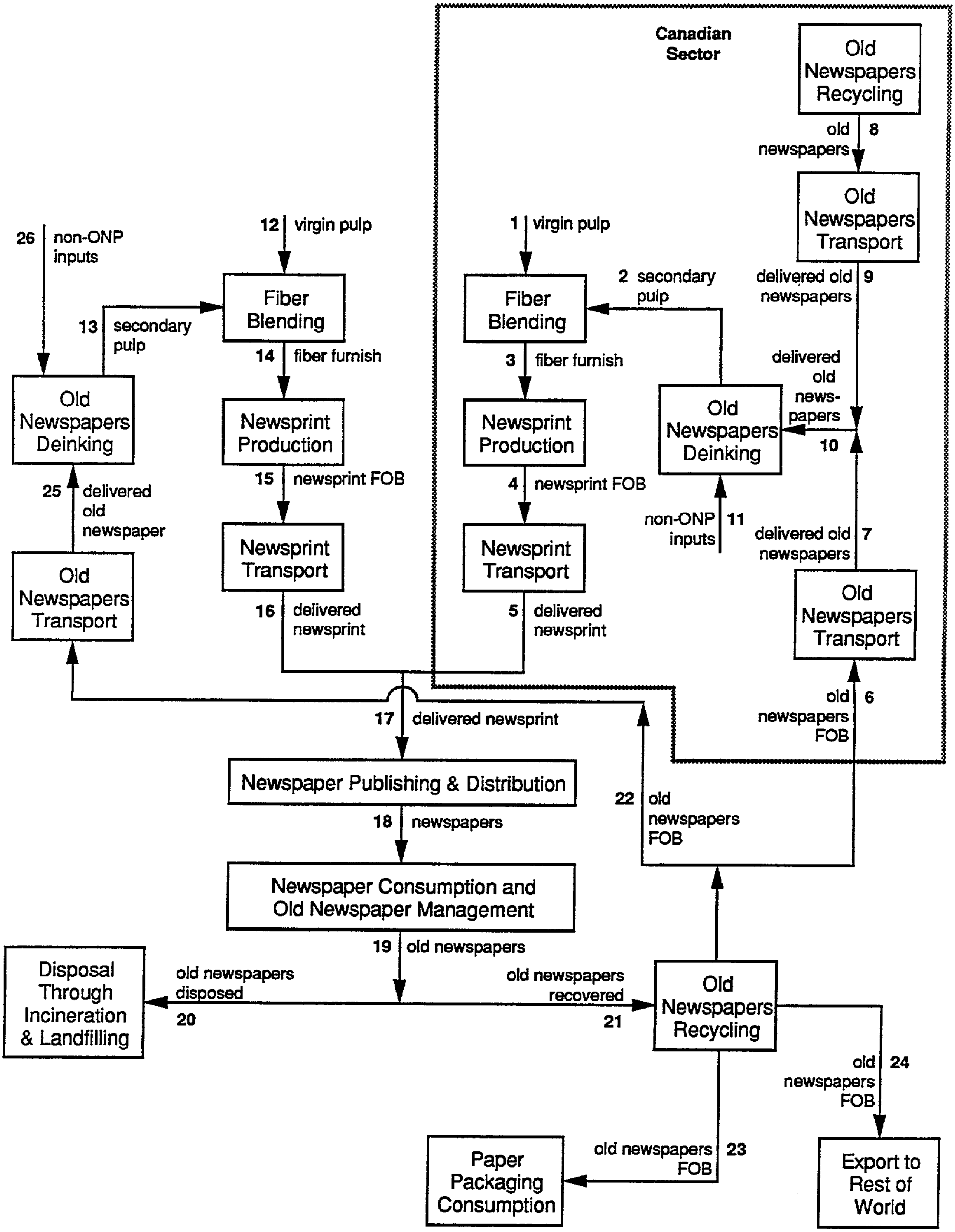

Figure C-1. Commodities in ONP Policy Model

Endogenous

$E(P_i)$ = proportional change in the price of the ith commodity

$E(Q_i)$ = proportional change in the quantity of the ith commodity

i = 1, 2, 3, ... 26.

PARMETERS

ε_i ; i = 1, 8, 11, 12, 20, 21, 26

η_i ; i = 18, 23

σ_i ; i = 2-10; 13-18; 25

k_i ; i = 2-10; 13-18, 25

g_i ; i = 2, 6, 20, 23, 24

EQUATIONS

$$E(Q_1) - \varepsilon_1 E(P_1) = \lambda_1 \tag{1}$$

$$E(P_2) - k_2 E(P_9) - (1-k_2) E(P_{11}) = 0 \tag{2}$$

$$E(Q_{10}) - (1-k_2) \sigma_2 [E(P_{11}) - E(P_{10})] - E(Q_2) = 0 \tag{3}$$

$$E(Q_{11}) - k_2 \sigma_2 [E(P_9) - E(P_{11})] - E(Q_2) = 0 \tag{4}$$

$$E(P_3) - k_3 E(P_1) - (1-k_3) E(P_2) = 0 \tag{5}$$

$$E(Q_1) - (1-k_3) \sigma_3 [E(P_2) - E(P_1)] - E(Q_3) = 0 \tag{6}$$

$$E(Q_2) - k_3 \sigma_3 [E(P_1) - E(P_2)] - E(Q_3) = 0 \tag{7}$$

$$E(P_4) - k_4 E(P_3) = 0 \tag{8}$$

$$E(Q_3) + (1-k_4) \sigma_4 E(P_3) - E(Q_4) = 0 \tag{9}$$

$$E(P_5) - k_5 E(P_4) = 0 \quad (10)$$

$$E(Q_4) + (1\text{-}k_5)\, \sigma_5 E(P_4) - E(Q_5) = 0 \quad (11)$$

$$E(P_7) - k_7 E(P_6) = 0 \quad (12)$$

$$E(Q_6) + (1\text{-}k_7)\, \sigma_7 E(P_6) - E(Q_7) = 0 \quad (13)$$

$$E(P_9) - k_9 E(P_8) = 0 \quad (14)$$

$$E(Q_8) + (1\text{-}k_9)\, \sigma_9 E(P_8) - E(Q_9) = 0 \quad (15)$$

$$E(Q_8) - \varepsilon_8 E(P_8) = \lambda_8 \quad (16)$$

$$E(Q_{10}) - k_{10} E(Q_7) - (1-k_{10}) E(Q_9) = 0 \quad (17)$$

$$E(P_{10}) - E(P_7) = 0 \quad (18)$$

$$E(P_{10}) - E(P_9) = 0 \quad (19)$$

$$E(Q_{11}) - \varepsilon_{11} E(P_{11}) = \lambda_{11} \quad (20)$$

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$$E(Q_{12}) - \varepsilon_{12} E(P_{12}) = \lambda_{12} \quad (21)$$

$$E(P_{13}) - k_{13} E(P_{25}) - (1-k_{13}) E(P_{26}) = 0 \quad (22)$$

$$E(Q_{25}) - (1\text{-}k_{13})\, \sigma_{13} [E(P_{26}) - E(P_{25})] - E(Q_{13}) = 0 \quad (23)$$

$$E(Q_{26}) - k_{13}\, \sigma_{13} [E(P_{25}) - E(P_{26})] - E(Q_{13}) = 0 \quad (24)$$

$$E(P_{14}) - k_{14} E(P_{12}) - (1-k_{14}) E(P_{13}) = 0 \quad (25)$$

$$E(Q_{12}) - (1\text{-}k_{14})\, \sigma_{14} [E(P_{13}) - E(P_{12})] - E(Q_{14}) = 0 \quad (26)$$

$$E(Q_{13}) - k_{14}\,\sigma_{14}\,[E(P_{12}) - E(P_{13})] - E(Q_{14}) = 0 \tag{27}$$

$$E(P_{15}) - k_{15}\,E(P_{14}) = 0 \tag{28}$$

$$E(Q_{14}) + (1\text{-}k_{15})\,\sigma_{15}\,E(P_{14}) - E(Q_{15}) = 0 \tag{29}$$

$$E(P_{16}) - k_{16}\,E(P_{16}) = 0 \tag{30}$$

$$E(Q_{15}) + (1\text{-}k_{16})\,\sigma_{16}\,E(P_{15}) - E(Q_{16}) = 0 \tag{31}$$

$$E(Q_{17}) - k_{17}\,E(Q_{16}) - (1\text{–}k_{17})\,E(Q_5) = 0 \tag{32}$$

$$E(P_5) - E(P_{17}) = 0 \tag{33}$$

$$E(P_{16}) - E(P_{17}) = 0 \tag{34}$$

$$E(P_{18}) - k_{18}\,E(P_{17}) = 0 \tag{35}$$

$$E(Q_{17}) - (1\text{-}k_{18})\,\sigma_{18}\,E(P_{17}) - E(Q_{18}) = 0 \tag{36}$$

$$E(Q_{18}) - \eta_{18}\,E(P_{18}) = \mu_{18} \tag{37}$$

$$E(Q_{19}) - E(Q_{18}) = 0 \tag{38}$$

$$E(Q_{19}) - g_{20}\,E(Q_{20}) - (1\text{-}g_{20})\,E(Q_{21}) = 0 \tag{39}$$

$$E(Q_{21}) - g_{22}\,E(Q_{22}) - g_{23}\,E(Q_{23}) - g_{24}\,E(Q_{24}) - g_6\,E(Q_6) = 0 \tag{40}$$

$$E(P_{19}) = 0 \tag{41}$$

$$E(Q_{21}) - \varepsilon_{21}\,E(P_{21}) = \lambda_{21} \tag{42}$$

$$E(P_{20}) = 0 \tag{43}$$

$$E(P_{22}) - E(P_{21}) = 0 \tag{44}$$

$$E(P_6) - E(P_{21}) = 0 \tag{45}$$

$$E(P_{25}) - k_{25}\, E(P_{22}) = 0 \tag{46}$$

$$E(Q_{21}) + (1\text{-}k_{25})\, \sigma_{25}\, E(P_{22}) - E(Q_{25}) = 0 \tag{47}$$

$$E(Q_{23}) - \eta_{23}\, E(P_{23}) = \mu_{23} \tag{48}$$

$$E(P_{23}) - E(P_{21}) = 0 \tag{49}$$

$$E(Q_{24}) - \eta_{24}\, E(P_{24}) = \mu_{24} \tag{50}$$

$$E(P_{24}) - E(P_{21}) = 0 \tag{51}$$

$$E(Q_{26}) - \varepsilon_{26}\, E(P_{26}) = \lambda_{23} \tag{52}$$

EQUILIBRIUM CONDITIONS

The equilibrium condition is

$$ZE = \Lambda \tag{53}$$

where E =

$$\begin{bmatrix} EQ_1 \\ EQ_2 \\ \cdot \\ \cdot \\ \cdot \\ EQ_{26} \\ EP_1 \\ EP_2 \\ EP_3 \\ \cdot \\ \cdot \\ \cdot \\ EP_{26} \end{bmatrix}_{52x1}$$

and A =

$$
\begin{bmatrix}
\lambda_1 \\ 0_1 \\ \cdot \\ \cdot \\ \cdot \\ 0_{14} \\ \lambda_8 \\ 0 \\ 0 \\ 0 \\ \lambda_{11} \\ \lambda_{12} \\ 0_1 \\ \cdot \\ \cdot \\ \cdot \\ 0_{15} \\ \mu_{18} \\ 0 \\ 0 \\ 0 \\ 0 \\ \lambda_{21} \\ \lambda_{20} \\ 0 \\ 0 \\ 0 \\ 0 \\ \mu_{23} \\ 0 \\ \mu_{24} \\ 0 \\ \lambda_{26}
\end{bmatrix}_{52x1}
$$

Z is 52X52 coefficient matrix.

The new equilibrium after an exogenous shift is given by

$$E = Z^{-1}\Lambda \tag{54}$$