



The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.

Oligopsony/Oligopoly Power and Factor Market Performance: The Case of U.S. Old Newspapers

Aref A. Hervani

This paper derives price–cost margins for the old newspaper (ONP) input market for newsprint manufacture and then examines the effects of two government policies and two variables measuring the market performances of ONP input and newsprint output on the oligopsonist's ONP price–cost margins. In the wastepaper recycling market in particular, the ONP input market has not been successful in using the ONP generated. The outcomes of the study are that various degrees of price distortions existed in the ONP input markets in four regions of the United States during 1972–1995. Demand-side policy had a positive effect and supply-side policy had a negative effect on ONP price–cost margins in all regions.

Key Words: buyer and seller market shares, mandated recycling programs, minimum content standards, oligopsony

JEL Classifications: R51, R58, 021, 023, R11, R38

The increasing volume of municipal solid waste (MSW) disposal and limited landfill availability for disposal purposes in the late 1980s and early 1990s raised concerns for the future of landfill space as the number of landfills in operation in the United States declined by almost 75% between 1963 and 1993 (Hervani). As a result of higher costs associated with landfill disposal fees, land filling became less economical. A lack of landfill availability necessitated reducing the volume of the waste stream by source reduction or recycling. Underutilization of old newspaper (ONP) is important because ONP is the second largest component of wastepaper and it makes up 14% of total waste in MSW. The best disposal

option for ONP seems to be recycling, and the highest value within recycling is in the manufacture of newsprint.

Two state government policies in several specific states were implemented to increase ONP utilization: the mandatory recycling programs (a supply-side policy) and minimum content standards (a demand-side policy). The supply-side policy would help increase ONP recovery rates, and demand-side policy would help encourage ONP utilization rate among newsprint mills. The government-mandated recycling program was enacted in 1987 in the state of Vermont, and the minimum content standards were enacted in 1989 in the state of California; in the following years, several other states took similar measures to help boost their recycling programs and solve the lack of landfill availability. Table 1 shows the states and years that demand- and supply-sides policies were enacted.

Aref A. Hervani is professor, Business Division, Dalton State College, Dalton, GA. The author thanks Jim Brock, Kyriacaus Aristotelous, Alan Collins, and anonymous reviewers of the manuscript for their useful comments and insights.

Table 1. ONP Consumption by Mills and Shares of Recycled Newsprint Firms in the Region of Dominance, 1995^a

Mills ^b	ONP Consumption (1,000 mt)			ONP Market Shares in Regions (%)			Recycling Programs	
	1985	1990	1995	1985	1990	1995	Demand	Supply
Northeast								
Great Northern, ME (1)	0	0	102	0	0	10	—	1994
Garden State, NJ (1)	243	248	259	38	31	26	—	1988
Boise Cascade, ME (2)	0	0	62	0	0	6	—	1994
Total	243	248	425	38	31	42		
Midwest								
FSC Paper, IL (1)	125	132	164	19	13	12	1990	1991
Manistique Paper, MI (1)	27	131	130	4	13	10	—	—
Total	152	263	295	23	26	22		
South								
Augusta Newsprint, GA (1)	0	0	110	0	42	13	—	1992
Southeast Paper, GA (1)	142	180	428	27	17	40	—	
Alabama River, AL (1)	0	0	45	0	0	4	—	1991
Bowater Inc., SC (3)	0	0	110	0	0	13	—	—
Champion Intl, TX (2)	0	0	114	0	0	9	1991	1994
Kimberly Clark, AL (1)	0	0	35	0	0	4	—	1994
Bear Island, VA (1)	0	0	55	0	0	4	—	1991
Total	142	180	846	27	59	87		
West								
Smurfit Newsprint, CA/OR (3)	273	458	498	48	61	41	1989	1989
Southwest Forest, AZ (1)	135	141	194	18	17	17	1990	1990
North Pacific, WA (1)	0	0	141	0	0	12	—	1991
Inland Empire, WA (1)	0	0	37	0	0	4	—	1991
Total	408	599	870	66	78	74		

Source: Constructed from Lockwood's Posts-Directory, 1996.

^a The Canadian share of newsprint is not included in calculations.

^b The numbers in parentheses represent the number of mills.

The existence of an oligopolistic market power in newsprint output might allow the exploitation of ONP by input buyers. The interdependence between oligopolistic and (possible) oligopsonistic market structure and market imperfections could affect the effectiveness of government policies dealing with the ONP market. The market demand for ONP has been limited, hampering the success of collection efforts and recycling programs. The limited demand for ONP might be due to the structure of the ONP market. Three market observations indicate the possible existence of oligopsonistic elements in the ONP market: (1) the existence of barriers to entry; (2) rel-

atively few buyers and many sellers; and (3) historically large price variations.

The three problems might be linked to an imperfect market structure of ONP. First, the lack of de-inking capacity to utilize ONP can stem from the high capital cost of entry into the de-inking market (Booth et al.; Nestor). Second, there are few large buyers and many sellers of ONP, and the fewness of buyers (oligopolies in the output market) results in market power (Galbraith). Third, widely fluctuating input prices can be an outcome of an imperfect market structure in which sudden changes in quantity of input demanded by large potential buyers can have a great effect

on prices. The ONP input prices have fluctuated widely over U.S. regions between the years 1972 and 1995, with wider swings in the 1989–1995 period (Hervani).

This study investigated the possible existence of imperfect market structures in the ONP input market among newsprint mills and further examined the effect of two government policies and two market performance variables on ONP price distortions. The imperfect market structure of the newsprint output market is well documented (Booth et al.; Schaefer). The existence of market power in the ONP input market was investigated for several reasons. First, relatively few larger buyers of ONP exist in the four U.S. regions (Northeast, Midwest, South, and West), and they happened to be newsprint mills with significant shares of ONP input. Second, ONP has had historically large price variations with relatively lower prices paid. Third, there were low ONP recovery rates in the years prior to mandated recycling programs.

The goal of this study is to test the hypothesis that buyer market power increases input price distortion levels and that government policies are ineffective in the presence of market power. In testing the hypothesis, an evaluation is made of (1) the degree of price distortions exerted by these buyers and (2) the sensitivity of price distortions in the presence of market power when government policies are aimed at the industry. The present investigation is significant for three reasons: landfill crisis, limited effectiveness of government policies in the presence of market power, and theoretical and empirical contributions to the theory of oligopsony.

Four newsprint mills in the United States have produced 100% recycled content newsprint since the 1970s. In 1990, 18 newsprint firms produced recycled content newsprint paper, and the number increased to 20 firms in 1995 (24 mills). The top four mills in recycled newsprint production had nearly 100% of the market shares of the total recycled newsprint produced in 1970, 59% in 1990, and 44% in 1995. The market shares of ONP consumption among newsprint mills were nearly 16% in 1970 from total ONP consumed in the United

States, 43% in 1988, and nearly 40% in 1995 (Hervani). Table 1 shows the market shares of ONP consumption among newsprint mills. U.S. ONP de-inking capacity has increased, with the largest increases occurring in the late 1980s and early 1990s (API). The factors that could have had a significant effect on de-inking capacity increases of newsprint and non-newsprint de-inking mills were the mandated recycling programs on the supply side and the minimum content standards on the demand side. Figure 1 shows the pattern of entry into the de-inking market among newsprint mills.

Structural indicators of market concentration are often used as proxy indicators of the presence/absence/danger of market power (Cowley; Lustgarten; Newmark; Ornstein). Several studies have used the price–cost margin to examine the firm's profitability (Clarke, Davies, and Waterson; Coate; Collins and Preston; Comanor and Wilson 1967, 1974; Cotterill; Hazledine; Marvel; Shepherd).

Ornstein used industry-level data and reported a positive correlation between concentration and the advertising–sales ratio. Lustgarten showed results that support the “countervailing power” hypothesis that concentration on the buying side of a market limits its control of price on the supply side of a market. Newmark observed that extensive buyer concentration is an inducement for sellers to integrate vertically. Cowley analyzed the effect of buyer market structure on margins and found a positive relationship. Collins and Preston concluded that market concentration would increase the profits of large firms, but not the profits of small firms. Hazledine reported a positive concentration–profitability relationship for large firms and an insignificant concentration–profitability relationship for small firms.

Comanor and Wilson (1967, 1974) concluded that profitability would be higher the greater the product differentiation. Shepherd concluded that market share and concentration had a significant, positive effect on firm profitability. Clarke, Davies, and Waterson concluded that concentration and industry profitability are correlated and that more concentrated industries tend to be more col-

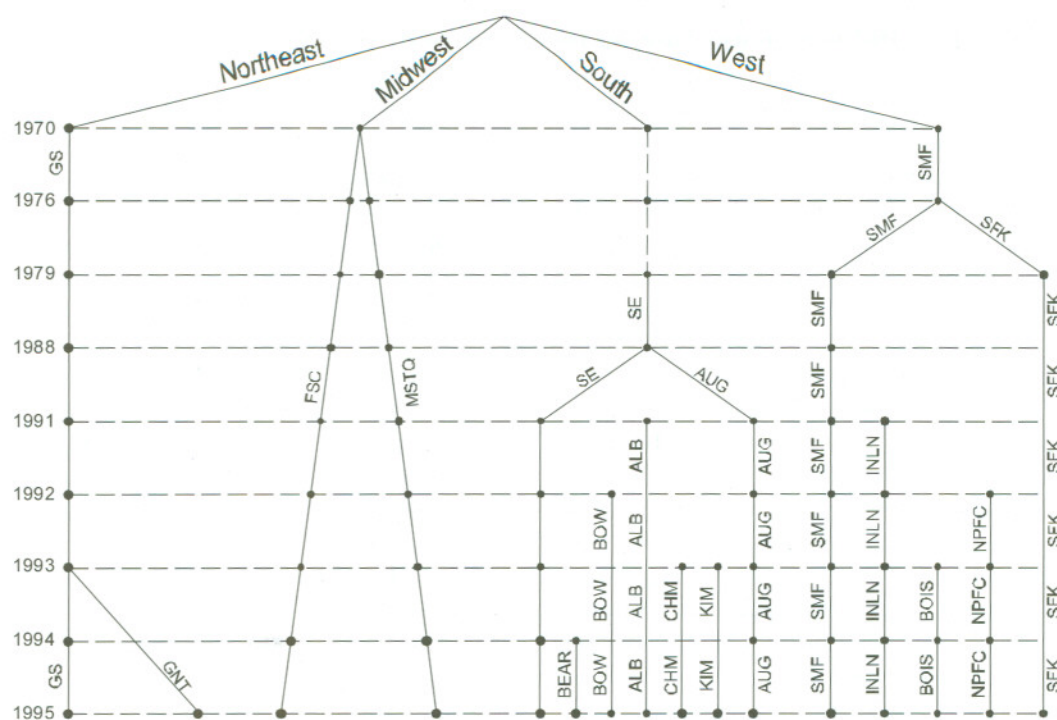


Figure 1. De-inking Entry Formation and Makeup Among Newsprint Mills in the U.S. (GS: Garden State Paper; GNT: Great Northern; FSC: FSC Paper; MSTQ: Manistique Paper; SE: Southeast Paper; BEAR: Bear Island Paper; BOW: Bowater Paper; ALB: Alabama River Paper; CHM: Champion International Paper; KLM: Kimberly-Clark Paper; AUG: Augusta Newsprint; SMF: Smurfit Newsprint Inc.; INLN: Inland Empire Paper; BOIS: Boise Cascade Paper; NPFC: North Pacific Paper; SFK: Southwest Forest Paper)

lusive. Cotterill suggested that retail supermarkets in concentrated markets are able to exercise some market power and that this result is more related to firm-specific market power than to tacit collusion. Marvel found a positive relationship between price and market concentration in the retail price of gasoline, and Coate, with the use of a time series cross-sectional sample of observations of 48 U.S. industries found a positive relationship between price and concentration.

The effects of monopsony on wage levels have been investigated in several occupations in which specialized skills are required and close substitutes are not available. Monopsony power varies substantially among areas, and with the geographic mobility of the labor force and the narrower geographic markets, allows monopsonists to pay lower wage rates (Bootton; Just and Chern; Link and Landon). Sev-

eral studies have analyzed the monopsonistic effect for public school teachers, newspaper printing employees, construction workers, and nurses (Hurd; Landon; Landon and Peirce). These studies concluded that monopsony market power allows an employer to depress the wage rates paid to these input resources. Lerner defined the index of monopoly price distortions as the difference between the (output) price and marginal cost divided by the price. Chang and Tremblay defined the firm index of input distortions as the difference between the value of the marginal product and the input price divided by the value of the marginal product.

Theory

Oligopsony elements can exist when there are few large buyers and many sellers, allowing

the buyers to operate in a wider geographic scope where there is less interdependence among large buyers. ONP buyers among newsprint mills in the four regions of the United States are the largest buyers of ONP input among all ONP-consuming mills in their own states and do not face competition from other newsprint mills. The fewness of buyers present in the ONP input market indicates that the quantity taken by each buyer has a significant influence on market price. The oligopsonist, instead of setting up a demand function, attempts to select a definite quantity and the price to be paid for the materials and services. Newsprint mills announce the daily ONP prices that the firms are willing to pay for ONP at the mills, but the quantity the mill is capable of buying at any given price depends on the prices paid by the firm's competitors, who, in turn, are appreciably affected by what price the firm pays. Therefore, an oligopsonist is uncertain about the shape of the supply function the firm faces as an individual buyer.

For an oligopsonist, the additional cost of hiring another unit of input, its marginal factor cost, is higher than the price of the input, except for the first unit purchased. If the price of an input is rising, so is the average cost of the input, and the marginal factor cost exceeds the average factor cost. In addition, the many suppliers of the inputs are price takers, and their collective behavior can be represented by an upward supply curve. In the general linear case, the supply curve of ONP input can be described as an upward-sloping curve. If the supply curve for any input is upward sloping, the marginal factor cost of the input exceeds its price, and if the supply curve of labor input is linear, the marginal factor cost curve will be twice as steep as the supply curve. Oligopsony will set the price of input at $MRP = MFC$ but will pay the input a price below this price, such as W_0 , as shown in Figure 2. The oligopsonist confronts an increasing supply curve because there are many sellers from which to buy. Oligopsony is analogous to oligopoly, in which the few sellers are uncertain with regard to the rivals' demands and their reactions to match price increases or decreases, in that the actions of buyers are also uncertain with re-

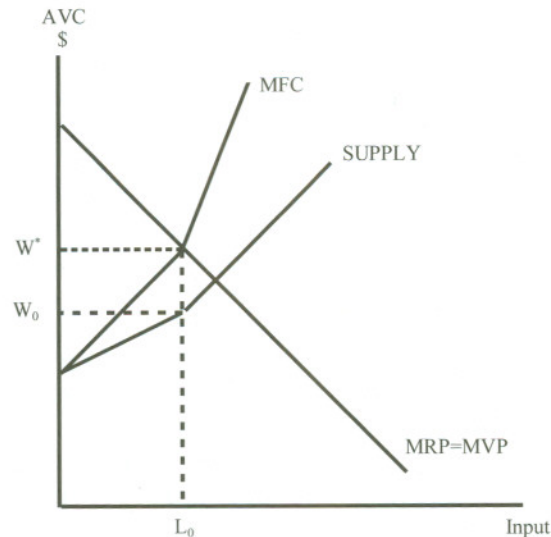


Figure 2. Oligopsony and Kinked Supply Curve

gard to the rivals' supplies and their reactions to price cuts or increases. As in oligopolies, an oligopsonist can face a kinked supply curve, as presented in Figure 2. This study postulates that oligopsony power will have a negative effect on ONP input prices in the absence of other powerful buyers or rivals, and the intensity of the negative effect is reduced with the presence of other powerful rivals.

Empirical Approach

The objective of this research is to identify the possible degree of market powers that can exist within the ONP input market among newsprint mills and to measure the effectiveness of government policies that are aimed at the industry. Market measures of imperfect competition used in this study are the Lerner index, buyers' market shares, and the seller concentration ratio.

Methodological procedures to assess the source of imperfect competition include two goals. First, derivation of regional price-cost margins or input price distortions (IPD) for ONP buyers among newsprint mills, which measures market power. Second, use buyers' share and sellers' concentration ratio (ad hoc models) as input and output market imperfec-

tion indicators to explain the level of imperfect competition in the ONP market. The latter objective is achieved through IPD equation estimation on the basis of the price–cost margins, in which price–cost margins are used as dependent variables and are related to market performance indicators. Several studies conclude that the most obvious explanation of price greater than marginal cost is monopoly power in the product market. Monopsony in input markets is another explanation (Hall; Lebow). Government policy effects were evaluated with estimated ad hoc index models with variables that measure the percentage of the population exposed to mandated recycling or minimum content standards.

The regional firm-level indices (IPDs) are derived for oligopsony/oligopoly in recycled newsprint mills for the years 1972–1995. The indices are used to derive the weighted average of aggregated regional indices. Derivation of IPDs requires estimation of group-level production functions for newsprint mills. Next, the regional IPDs derived earlier are regressed against four variables: minimum content standards, mandated recycling programs, ONP buyer's market shares, and newsprint four-firm seller's concentration ratios. The IPD equations are estimated as single equations with pooled regional data for years 1972–1995 and time series and cross-sectional estimation procedures (TSCS). The TSCS estimation method produces nine tables and enables one to test for groupwise heteroskedasticity, cross-group correlation, and within-group autocorrelation. Several required tests are performed for selecting the appropriate table to report.

The use of panel data to estimate the IPD equation might be preferred because cross-sectional studies cannot control for state-specific effects, and the time series studies cannot control for unobservable state-specific effects. The advantage of using panel data is its ability to control for all time-variant variables or state-invariant variables, whose exclusion could bias the estimates in a typical cross-sectional or time series study. Statistical price analysis was performed to determine whether a national or regional study would be appropriate. The results suggest the use of regional

data in ONP input market and national data for the newsprint market.

Oligopsony Index

The methodological approach includes the use of an oligopsony/oligopoly index suggested by Chang and Tremblay to derive the IPD. The IPD can be used to analyze the market structures of both ONP input and newsprint output markets. The use of this index for ONP market analysis is appropriate because the index measures the market powers of both ONP buyers and recycled newsprint producers. The firm index of input distortions is defined as the difference between the value of the marginal product and the input price divided by the value of the marginal product (MVP). The index measures the extent to which an input price actually paid by a firm deviates from the value of the factor's marginal product. The index could be used in industry-level, firm-level, or regional markets. A regional weighted average index of oligopsony/oligopoly power for the specific factor, developed by Chang and Tremblay, is defined as

$$(1) \quad I = \sum \frac{[p(MP_{x_i}) - w]}{[p(MP_{x_i})]} Sx_i = \sum I_i Sx_i,$$

where I is the input price distortion index for the region, P is price of output, MP is the marginal product of input, w is the price of input x , and $Sx_i = x_i/X$ (the input market share of the i th firm). The regional measure is a weighted average of each firm's index of power, with input shares used for weights in a given region. The oligopsony/oligopoly index measures the degree of market imperfection (i.e., the market imperfection can be inferred from the variations in the value of the index, which lies anywhere between 0 and 1) and does not indicate where the market power originates.

The value of the index is 0 when the specific factor is paid the value of its marginal product and the factor market is allocatively efficient. The greater inefficiency under imperfect markets is implied as I_i moves toward 1. The index directly reflects the allocative in-

efficiency due to market power by measuring the noncompetitive rents acquired by the firm as a proportion of the MVP. The data required to derive the index is obtained by estimating a production function for each mill. Firm-level or, where applicable, group production functions for the mills in the sample are estimated to obtain the marginal physical products (MPPs) of ONP input that goes into the production of recycled newsprint. Furthermore, the MPPs are used to derive the input price distortion levels at firm and regional levels for all the mills that utilize ONP as a portion of their primary input into newsprint production.

Production Estimations

The U.S. newsprint mills have used various technologies in producing wood pulp such as kraft, chemical, semichemical, bleached, and mechanical or thermomechanical, along with recycled fiber (de-inked pulp). The production function for recycled content newsprint mills selected here has its theoretical basis from the neoclassical production functions (Cobb and Douglas). The neoclassical production function is also assumed to be homogeneous (Bairam; Chambers), in which the doubling of inputs can increase the output in the same proportion or by some larger or smaller proportion.

The production function for the newsprint industry measures the amount of recycled content newsprint output produced with various amounts of recycled fiber or virgin fiber as the primary inputs, given the amount of labor and energy required to produce a ton of newsprint. For estimation purposes, the choice was made to consider three inputs: raw materials, labor, and energy. Technically, production of newsprint is not limited to the three inputs defined here, and our choices of inputs were shaped by data constraints. A production function for recycled content newsprint can be defined with old newspapers (*ONP*), groundwood pulp (*GWOOD*), kraft pulp (*KRAFT*), labor (*L*), and energy (*E*) as

$$(2) \quad q_i = f(ONP_i, GWOOD_i, KRAFT_i, L_i, E_i, TE, TRD).$$

The amount of labor required per ton of newsprint produced is dependent on the size and age of the paper machines. The larger machines substitute capital for labor, and newly built machines have an effect on labor productivity (Booth). However, a limit exists as to the substitutability of labor for machine because each machine requires a certain number of laborers, and hiring more labor beyond that point will not increase the productivity of that machine.

Proxy measures for capital in the production process can be represented as the amount of energy input used because the pulp and paper industry is very energy intensive. The cost of energy per ton of newsprint produced in the United States among newsprint mills varies by region, the pulpwood type, the pulping process, the type of fuel used, and the amount of fuel purchased as compared to generated energy. The amount of energy required to produce a ton of newsprint for each individual mill in a region is constructed by adjusting the average required numbers for production levels by each individual mill.

Mills were divided into three separate groups because of differences in the types of inputs used. Group I mills have one production technology process, and ONP input is the primary input used in production of 100% recycled newsprint. The labor and energy inputs used in production are merely complementary inputs to ONP in newsprint production. A simple Cobb-Douglas production function is selected for estimation purposes for Group I mills. Group II and III mills use two or three homogeneous technologies and production processes to produce groundwood, kraft, or both (from wood pulp) and de-inked pulp from ONP. There are various technical relationships among the inputs: kraft and groundwood are complements, kraft and de-inked pulp are complements, and de-inked pulp and groundwood are substitutes. A variable elasticity of substitution (*VES*) among de-inked pulp, groundwood, and kraft inputs exists. A generalized Cobb-Douglas production function for Groups II and III is selected for estimation purposes. This selection of functional form was motivated by several factors. First,

Table 1A. Selected Functional Forms and First Derivatives of Selected Functional Forms

$\ln Y = \alpha + \sum_i \beta_i \ln X_i$	Cobb-Douglas
$\ln Y = \alpha + \sum_i \sum_j \delta_{ij} \ln(X_i + X_j)/2$	Generalized Cobb-Douglas
$MPP = \partial Y / \partial X_i$ $= (\partial \ln Y / \partial \ln \partial X_i) \cdot 1/Y$	Cobb-Douglas
$MPP = \partial Y / \partial X_i$ $= y \sum_j 2\beta_{ij} / (X_i + X_j)$	Generalized Cobb-Douglas

the generalized Cobb-Douglas function is a flexible production form that allows various relationships among the inputs. Second, it holds the maintained hypothesis that substitutability and complementarity (i.e., variable elasticity of substitution) exists among various raw material inputs used in production. Third, in prior research in newsprint industry, the most common functional form used is the generalized Cobb-Douglas production function. The functional forms used are presented in Table 1A.

The market environment and the firm's behavior in the recycled newsprint industry indicate the possible time differences in the sample period during this study. These time differences were hypothesized to be attributable to several factors. The technological efficiency of production had changed over time, landfill tipping fees had increased in the 1990s, the enacted government-mandated recycling programs (the earliest began in 1987), and minimum content standards in newsprint production were enacted (the earliest period is 1989). The results of Chow tests confirmed that differences exist in the time period under consideration for all mills and that mills differ with respect to their efficiencies in production processes and technologies.

For Group I, four separate estimations were performed for each mill with simple Cobb-Douglas functional forms using sample data for the period 1972–1995 and OLS methods. Variables were included in the production function to capture the technological change (*TE*), and a time trend dummy variable (*TRD*)

was used to account for the time differences. The production function estimation for Group II and III mills required pooling data across mills within groups and estimating one common equation with the generalized Cobb-Douglas production function and sample data for the period 1972–1995 with OLS methods. A time trend dummy variable to capture the time difference and the dummy variables that represented each mill are included in the generalized Cobb-Douglas functional form. The methods to derive the MPPs from estimated parameters are presented in Table 1A. The parameter coefficients, along with the mills' data on amounts of input and output, are used to derive the MPPs.

IPD Index Equation

The IPD index is used as a dependent variable and regressed against two market structure variables and two government policy variables. Government policy variables were included to examine the effect of state-level programs on mandated recycling, and minimum content standards for recycled newsprint content on market power within the ONP market. This investigation follows past research that used input and output market structure variables to explain changes in the index (Coate; Lustgarten; Marion et al.; Marvel; Newmark; Shepherd). Other methods have included the nonstructural approach to measuring market power on the input side (Hall), in which the gap between marginal costs and price are evaluated by examining changes in output and corresponding changes in inputs. The majority of the previous research was focused on the seller's side of the market, whereas the buyer's side has been neglected.

Goodwin argues that aggregation and other measurement errors could lead to index values greater than 0 without implying statistically significant market power. Hall suggests that firm-level data might be more suitable for such considerations of market power. Newmark comments that past tests of the buyer concentration effect are misleading and the buyer concentration effect is overstated because the price-cost margins of some industries are mis-

measured. Ornstein suggests that misspecification bias and errors in measuring the price-cost margins can be corrected if the researchers avoid using the Census measures of the price-cost margin. Equation (3) is the general functional form that will be used for estimation purposes.

$$(3) \quad I^* = f(BRSH, SCR4, OMCS, NMCS).$$

The IPD index (I^*) measures the degree of market power in the ONP input market. Both the sellers' concentration ratio ($SCR4$) and buyers' market shares ($BRSH$) were expected to be positively associated with the IPD index (Murray). As these market structure variables increase, the ability to exert market power in the ONP input market should increase. The supply policy ($OMCS$) was expected to have a positive coefficient because mandated recycling programs would create additional ONP supplies and would decrease ONP prices (as was observed in the late 1980s and early 1990s). Decreased ONP prices would increase the IPD index. The demand policy ($NMCS$) variable was expected to be negatively associated with the IPD index. Minimum content standards were expected to create new entries into the de-inking market.

Regional data for price-cost margins (IPDs), buyers' market shares, and mandated recycling programs were obtained. National data for minimum content standards and four-firm seller concentration ratios were obtained. Regional data were pooled, and a single equation was estimated. Regional dummy variables were constructed for the Northeast ($NEDUMY$), Midwest ($MWDUMY$), and South ($SHDUMY$) to allow intercepts to differ across regions. Also, product dummy variables were constructed for buyers' market shares to allow the slope coefficients to differ for these variables across the regions. The model includes panel data and is estimated with TSCS methods. After several hypothesis tests were performed, the selected model is reported. A version of the Chow test is used to test the hypothesis of whether the two regions' data can be pooled and whether the regional data of all four mills can be pooled for IPD equa-

tion estimation purposes. The results of the hypothesis testing indicated that regional data could be pooled for estimation purposes.

Several forms of model were estimated to allow for a full-effect study, thus allowing for regional differences in some explanatory variables. The fixed-effect model was selected for our estimation purposes. It uses dummy variables in panel data, and it assumes that the intercept varies across the cross-sectional units, the time periods, or both. The results of the Hausman test indicated that the fixed-effect model is preferred in this case; therefore, the IPD equation is estimated with TSCS methods.

Estimation Results

Oligopsony Index

Firm-level indices are computed for recycled newsprint mills by obtaining data for newsprint and ONP prices and the calculated MPPs of individual mills. With Equation (1), regional oligopsony/oligopoly indices are constructed. These indices are reported in Table 2.

The results imply that variations in the level of price distortions exist in all four regions. The greatest level of price distortion occurred in the West, followed by the South, Midwest, and Northeast. The magnitude of indices in the West and the South is greater relative to the indices derived for the Northeast and Midwest. There were more entries into de-inking industry by large newsprint mills in the West and South. This could explain the differences in the magnitude of indices in the regions.

The differences in oligopsony/oligopoly price distortion indices across regions could be due mainly to the level of market shares of ONP held by newsprint mills from total ONP inputs consumed in the given region where few large buyers exist. The Northeast, Midwest, and West were the regions with fewer large ONP buyers. The few large buyers of ONP in the West consumed nearly 75% of the total ONP input consumed by all mills in the region and by newsprint mills in the Northeast (45%); Midwest (8–25%), and South (22–67%).

Table 2. Regional Price Distortion Indices Derivation Results, 1972–1995

Year	Northeast	Midwest	South	West
1972	0.15	0.21	*	0.25
1973	0.16	0.19	*	0.20
1974	0.14	0.19	*	0.25
1975	0.18	0.23	*	0.26
1976	0.17	0.19	*	0.39
1977	0.16	0.25	*	0.35
1978	0.18	0.24	*	0.35
1979	0.19	0.25	0.11	0.35
1980	0.19	0.24	0.12	0.37
1981	0.20	0.27	0.13	0.36
1982	0.18	0.28	0.14	0.32
1983	0.19	0.23	0.15	0.43
1984	0.18	0.27	0.12	0.49
1985	0.19	0.25	0.12	0.46
1986	0.28	0.27	0.10	0.50
1987	0.28	0.25	0.10	0.45
1988	0.27	0.23	0.09	0.41
1989	0.23	0.20	0.10	0.41
1990	0.22	0.19	0.09	0.42
1991	0.23	0.17	0.24	0.41
1992	0.22	0.16	0.37	0.38
1993	0.23	0.22	0.44	0.43
1994	0.19	0.20	0.37	0.43
1995	0.15	0.16	0.26	0.38

* De-inking among newsprint mills did not exist prior to 1979 in the South.

The change in the magnitude of oligopsony price distortion levels is explained by the changes in the magnitude of MPPs and ONP input prices. However, changes in ONP price levels have been similar for all regions, except in the Northeast. The main factor in explaining the higher magnitude of oligopsony indices has been higher MVPs. The magnitude of MVP is influenced by the MPPs of the ONP input and the output prices. Uniform output prices exist across regions; therefore, the only factor explaining the differences in MVPs would be the differences in marginal products of ONP input. In general, similar trends exist in oligopsony input price distortion levels across four regions and indicate that there have been rising price distortions over the last two decades, with a sudden drop in 1994 and 1995. The highest price distortion levels have been in the West and the lowest were among

the newsprint mills in the South in early years and in the Midwest in later years.

The degree of input price distortions seems to be greater in the regions where buyers of ONP are a few large newsprint mills that have larger market shares of ONP input. The mills with the greatest market shares of ONP in their regions were in the West and Northeast, and they seemed to exercise a greater price–cost margin. Statistical procedures were undertaken to test the hypothesis to see whether there were differences in the means of ONP prices paid and the MVPs obtained by the few large buyers in the four regions. The results of statistical mean analysis undertaken indicate that there are larger gaps between ONP price and MVPs in the West and Northeast regions than in the Midwest and South.

MPP Derivation

The MPP of ONP input is obtained through the estimations of production functions for mills in the newsprint industry. Mean MPP of ONP for groups of mills is derived and is 0.82 for Group I, 0.81 for Group II, and 0.80 for Group III. The MPPs were similar across regions for mills and tended to be slightly greater for mills with 100% recycled newsprint production technologies. The magnitude of MPPs derived also could have been affected by the exclusion of several variables in the production function estimations.

The capital and other purchased inputs in the production process were not included in the production function estimations because of the lack of data and accuracy of the numbers. The capital and other purchased inputs used in production can affect the efficiency of production and could produce different marginal productivity of inputs. The omission of these variables could have affected the parameter estimates and further produced values for marginal products of inputs that are to be interpreted with care.

A loss of weight is associated with groundwood, kraft, and recycled fiber inputs that go into recycled newsprint production. A ton of ONP going into newsprint production yields around 0.84 ton of newsprint, whereas virgin

pulps have yields of around 0.94 (Mckinney), which implies a loss of around 6–16% mass. Some variation in MPPs across mills could be a result of different levels of efficiencies in production processes. The returns to scale of group production were derived and implied a value of less than 1 (0.91), indicating that if all inputs increase proportionally, outputs increase less than proportionally.

The magnitudes of MPPs for Group I depend on the estimated ONP coefficient and the input/output ratios for each individual mill. The loss of mass for de-inked pulp is nearly 16% (Mckinney), which indicates MPPs will be lower than unity and should be approximately 0.80. The MPPs for the ONP input from a generalized Cobb-Douglas (Groups II and III) are dependent on the estimated coefficients of ONP, the coefficient terms for interactions between ONP and the other inputs, and levels of other inputs used in production. The MPPs of ONP, therefore, will vary among the mills that have various input combinations and newsprint output production levels. The MPPs will differ among mills because of various efficiency levels related to production processes. The magnitudes of MPPs, in general, are dependent on the output levels and the various input ratios used in production and, therefore, will vary to some degree among the mills that have various input combinations and newsprint output production levels.

IPD Index Equation

The regional IPD equations (market performance equations) were estimated, in which the dependent variable is IPD (i.e., price–cost margin) and the independent variables are mandated recycling program; minimum content standard, and buyer market shares and four-firm seller concentration ratios. The estimated model is reported in Table 3. The regional dummy variables had negative and statistically significant coefficients in four regions, implying that regions are different in price distortions exercised by the established buyers.

The pooled estimation results for all four

Table 3. Regional Price Distortion Index Estimation Results, United States, 1972–1995

Variable	Coefficient
Constant	16237*
	(0.0740)
Sellers' Share	0.0926
(<i>SCR4</i>)	(0.0613)
Buyers' Share	0.3247**
(<i>BRSH</i>)	(0.1024)
Demand Policy	0.1112**
(<i>NMCS</i>)	(0.0288)
Supply Policy	–0.1433**
(<i>OMCS</i>)	(0.0231)
Buyers' Dummy	0.3097*
(Northeast)	(0.1926)
Buyers' Dummy	0.3244**
(Midwest)	(0.1156)
Buyers' Dummy	0.3435*
(South)	(0.1411)
<i>NEDUMMY</i>	–0.1597*
(Northeast Dummy Variable)	(0.0878)
<i>MWDUMMY</i>	–0.15317*
(Midwest Dummy Variable)	(0.070438)
<i>SHDUMMY</i>	–0.26349**
(South Dummy Variable)	(0.80593)

* Significant at $p < .01$.

** Significant at $.01 < p < .10$.

regions show that the sellers' share (*SCR4*) variable had no effect on IPD indices. This result implies that any oligopolistic market structure of newsprint industry had no effect on the distortion between MVP and ONP price. The largest newsprint mills in the United States and Canada are virgin fiber-based mills (i.e., mills that utilize only pulpwood as a source of fiber). These virgin mills have the largest shares of output market and are price leaders in newsprint output pricing (Dagenais). Market power in the output market (newsprint) did not translate into ONP input price distortion because the largest newsprint sellers have smaller shares of the input market.

As expected, the buyers' share (*BRSH*) variable had a positive, statistically significant coefficient. The positive effect on price distortions means that, as large buyers of ONP, ONP fiber-based mills (100% recycled mills) were capable of exercising their market power

by keeping ONP prices low relative to MVP of ONP. The ONP fiber-based newsprint mills in the Northeast, Midwest, South, and West are few. Large potential ONP buyers have significant shares of ONP input in their region of dominance. The regional dummy variables had positive, statistically significant coefficients, implying that the *BRS*H variable had greater effects in the Northeast, Midwest, and South.

The coefficient for the demand policy (*NMCS*) variable had a statistically significant positive effect on ONP price distortions. The results show that the state policies to require minimum content standards for recycled newsprint enhanced the market power of ONP fiber-based mill buyers. These mills acquired large shares of ONP input either by established ONP fiber-based mills adding to their existing de-inking capacities (as occurred in the Northeast, Midwest, and West) or by existing virgin-based mills adding de-inking capacity to their current operation (as occurred in the South).

The supply policy (*OMCS*) variable showed that the mandated recycling programs had negative effects on the ONP price distortion levels. These mandated recycling programs dramatically increased the supply of ONP and reduced ONP prices, even to negative levels in the Northeast. However, these price reductions encouraged competition for ONP input through a greater number of entries into the de-inking market among nonnewsprint de-inking mills along with other uses of ONP—export markets and animal bedding. The increased competition for ONP caused by supply-side policy allows the ONP suppliers to have a greater bargaining power for sales of their inputs when faced with relatively few additional buyers and ultimately lower price distortions exercised by established incumbents.

Summary of Results and Policy Implications

First, the derivation of the price distortion indices of individual mills led to the conclusion that different input price distortion levels exist

among the mills involved in the study. The greatest level of input price distortions occurred in the West (Table 2), where the largest buyers of ONP in the region were a few, large, recycled newsprint mills (Table 1). In the South, larger input price distortions occurred in the period 1991–1995 as the number of de-inking mills owned by newsprint mills increased and their market shares of ONP input grew (Table 1). The Northeast and Midwest had relatively smaller degrees of input price distortions and the shares of ONP input among newsprint mills remained nearly the same (Table 1).

Second, the regional IPD index equations estimation results imply that three variables explained the price–cost margins: ONP buyers' market shares (positive effects), minimum content standards (positive effects), and mandated recycling programs (negative effects). The IPD index showed greater values in the second period of sample data, which coincided with increased buyers' market shares. Newsprint mills exerted market power by limiting quantities used and prices paid to limit non-newsprint mills to the influx of input. Demand-side policy induced new newsprint de-inking entries (Figure 1), allowed mills to acquire larger market shares of ONP, and led to greater input price distortion levels. The supply-side policy increased the amount of ONP recovered and recycled, creating more reliable sources of supply and helping to attract more buyers of ONP, leading to a more competitive market environment and less price distortion.

The effect of government policies, in general, was affected by the existing market structures in both input and output markets that existed prior to, during, and after the legislation was implemented. The effectiveness of the government policies aimed at the input supply and output demand markets also depended upon the time of implementation of each individual policy and the time gap that existed between the two policy enactments. The implementation of one policy option by itself could have contributed to market fluctuations and disequilibrium conditions, allowing higher exploitation by one group at a cost of other

groups. The oligopsonistic market structure of the ONP input market has been the major drawback to increasing demand levels for ONP in periods where (1) only mandated recycling programs promoted increased recovery of ONP supply levels and (2) no legislation was directed in promoting demand levels.

The regional examination of the ONP input market in the United States showed four different market environments under which the ONP input buyers were operating. First, prior to the introduction of the policies, the ONP input market was dominated by one large buyer in the Northeast and two large buyers in the Midwest. The mandated recycling programs helped to increase ONP supply levels with relatively low increases in demand for ONP, leading to excess supply levels and lower input prices. An additional ton of ONP input, which was supplied to the industry, received a price well below the marginal cost of providing the input, leading to a larger gap between marginal revenue product (MRP) and the marginal factor costs (MFC) for the buyers. After that legislation was intact, demand for ONP increased because of the additions of de-inking capacity by the newsprint mills (in the Northeast) and new entries into de-inking capacity by nonnewsprint mills (in the Midwest). The overall effect of the policies has been to lower the market power of larger ONP input buyers by encouraging new entries by smaller de-inking plants.

In the South and West, prior to the introduction of the policies, a few large buyers of ONP (newsprint mills) had dominated the market. The introduction of mandated recycling programs in the absence of minimum content standards encouraged new entries (plus increased ONP exports in the West) and higher demands for ONP input, therefore leading to lower input price distortion levels. The minimum content standards had the opposite effect on ONP input price distortion levels by encouraging more de-inking capacities in the newsprint industry, leading to higher ONP market shares by newsprint mills, greater market power, lower prices, and larger price distortions.

Conclusions

The objectives of this study were to investigate the possible existence of oligopsony elements in the ONP input market among recycled newsprint producers in the United States. The effects of imperfect market structures on ONP price-cost margins were examined, and the effects of two government policies on imperfect market structures were investigated. The imperfect market structures of ONP input and newsprint output markets were expected to lead to greater price distortions and input exploitation that would translate to underutilization of recovered ONP supply levels. The policies were expected to have negative effects on oligopsonists' price-cost margins at higher ONP prices (as a result of enhanced competition for ONP).

Findings in the study confirmed most of the expected outcomes of the imperfect market structures in the ONP input market. The presence of oligopsonists was strongly associated with fewness of buyers and their large potential purchases of ONP inputs in four regions. The oligopsonistic behavior of ONP buyers led to greater price distortions in all four regions. Presence of oligopsony led to lower ONP prices in all four regions that could not pay for the cost of collection, and recovery efforts therefore led to relatively low ONP recovery rates in all regions and underutilization of recovered ONP supplies in the Northeast and West. The two policies examined under this study had different effects on ONP price distortions.

[Received April 2002; Accepted May 2003.]

Reference

- American Paper Institute (API). *Annual Statistical Summary Recovered Paper Utilization*. Paper Recycling Group, American Forest & Paper Association, Washington, DC, April 1995 and 1996.
- Bairam, E.L. *Homogenous and Nonhomogenous Production Functions*. Hampshire, UK: Ashgate Publishing Ltd., 1991.
- Booth, D.L., V. Kanetkar, I. Vertinsky, and D.

- Whistler. "An Empirical Model of Capacity Expansion and Pricing in an Oligopoly with Barometric Price Leadership: A Case Study of the Newsprint Industry in North America." *Journal of Industrial Economics* 39(March 1991):255-76.
- Booton, L.A. "Hospital Market Structure and the Return to Nursing Education." *The Journal of Human Resources* 20(1985):185-96.
- Chambers, R.G. *Applied Production Analysis*. Cambridge, MA: Cambridge University Press, 1988.
- Chang, Y.-M., and V.J. Tremblay. "Oligopoly Power and Factor Market Performance." *Managerial and Decision Economics* 12(1991):401-409.
- Clarke, R., S.W. Davies, and M. Waterson. "The Profitability Concentration Relation: Market Power or Efficiency?" *Journal of Industrial Economics* 32(April 1984):435-50.
- Coate, M.B. "The Dynamics of Price-Cost Margins in Concentrated Industries." *Applied Economics* 21(February 1989):261-72.
- Cobb, C.W., and P.H. Douglas. "A Theory of Production." *American Economic Review* 18(1928):139-65.
- Collins, N.R., and L.E. Preston. "Price-Cost Margins and Industry Structure." *Review of Economics and Statistics* 51(August 1969):226-42.
- Comanor, W.S., and T.A. Wilson. "Advertising Market Structure and Performance." *Review of Economics and Statistics* 49(April 1967):423-40.
- . *Advertising and Market Power*. Cambridge, MA: Harvard University Press, 1974.
- Cotterill, R.W. "Market Power in the Retail Food Industry: Evidence from Vermont." *Review of Economics and Statistics* 68(March 1986):379-86.
- Cowley, P.R. "Business Margins and Buyer/Seller Power." *Review of Economics and Statistics* 68(February 1986):333-37.
- Dagenais, M.G. "The Determination of Newsprint Prices." *Canadian Journal of Economic Review* 9(March 1976):442-61.
- Galbraith, J. *American Capitalism, the Concept of Countervailing Power*. Boston, MA: Houghton, Mifflin, 1952.
- Goodwin, B.K. "Oligopoly Power: A Forgotten Dimension of Food Marketing? Discussion." *American Journal of Agricultural Economics* 76(December 1994):1163-65.
- Hall, R.E. "The Relation between Price and Marginal Cost in U.S. Industry." *Journal of Political Economy* 96(May 1988):921-47.
- Hausman, J.A. "Specification Tests in Econometrics." *Econometrica* 46(1978):1251-71.
- Hazledine, T. "The Possibility of Price Umbrellas in Canadian Manufacturing Industries." *International Journal of Industrial Organization* 2(March 1984):251-62.
- Hervani, A.A. "Oligopsony Elements in the Recycled Wastepaper Market: Existence and Implications." Ph.D. dissertation. West Virginia University, Morgantown, December 1997.
- Hurd, R. "Equilibrium Vacancies in a Labor Market Dominated by Non-Profit Firms: The Shortages of Nurses." *Review of Economics and Statistics* 5(1973):234-40.
- Just, R.E., and W.S. Chern. "Tomatoes, Technology, and Oligopsony." *Bell Journal of Economics* 11(1980):584-602.
- Landon, J. "The Effects of Product Market Concentration on Wage Levels: An Intra-Industry Approach." *Industrial and Labor Relations Review* 1(1971):237-47.
- Landon, J., and W. Peirce. "Discrimination, Monopsony, and Union Power in the Building Trades: A Cross Sectional Analysis." *Industrial and Labor Relations Research Association Proceedings* 12(1971):254-61.
- LeBow, D.E. "Imperfect Competition and Business Cycles: An Empirical Investigation." *Economic Inquiry* 30(December 1992):177-93.
- Lerner, A.P. "The Concept of Monopoly and the Measurement of Monopoly Power." *Review of Economic Studies* 29(1934):291-99.
- Link, C.R., and J.H. Landon. "Monopsony and Union Power in the Market for Nurses." *American Economic Review* 9(1990):649-59.
- Lockwood Post's Directory of the Pulp & Paper Allied Trades. Pulp & Paper Publication (1970-1995). San Francisco: Miller Freeman Publications.
- Lustgarten, S.H. "The Impact of Buyer Concentration in Manufacturing Industries." *The Review of Economics and Statistics* 57(April 1975):125-32.
- Marion, B.W., W.F. Mueller, R.W. Cotterill, F.E. Geithman, and J.R. Schmelzer. *The Food Retailing Industry: Market Structure, Profits, and Prices*. New York: Praeger, 1979.
- Marvel, H.P. "Concentration and Price in Gasoline Retailing." *Concentration and Price*. Leonard W. Weiss, ed. Cambridge, MA: MIT Press, 1989.
- Mckinney, R.W.J. *Technology of Paper Recycling*. Fiber Research Consultants Ltd, New York, NY, 1995.
- Murray, B.C. "Oligopsony, Vertical Integration,

- and Output Substitution: Welfare Effects in U.S. Pulpwood Markets." *Land Economics* 71(May 1995):193-206.
- Nestor, D.V. "Partial Static Equilibrium Model of Newsprint Recycling." *Applied Economics* 24(1992):411-17.
- Newmark, C.M. "Administrative Control, Buyer Concentration, and Price-Cost Margins." *The Review of Economics and Statistics* (1986):74-79.
- Ornstein, S.I. "Empirical Uses of the Price-Cost Margins." *The Journal of Industrial Economics* 24(February 1975):105-17.
- Schaefer, G.P. *The Canadian Newsprint Industry: Econometric Models of Different Market Structures*. Bank of Canada Technical Report No. 17, Ontario, 1979.
- Shepherd, W.G. "The Elements of Market Structure." *Review of Economics and Statistics* 54(January 1972):25-37.