



Review

Market behavior and policy in the recycled paper industry: A critical survey of price elasticity research [☆]



Anna Mansikkasalo ^a, Robert Lundmark ^b, Patrik Söderholm ^{b,*}

^a National Institute of Economic Research, Environmental Economics Research Division, Box 3116, 103 62 Stockholm, Sweden

^b Luleå University of Technology, Economics Unit, 971 87 Luleå, Sweden

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ABSTRACT

The objectives of this paper are to: (a) provide a critical survey of existing econometric analyses of supply and demand elasticities in recycled paper markets and (b) discuss a number of implications of the results from this work. Specifically, the survey adds to our understanding of the functioning of recycled paper markets, points towards some important policy lessons, and identifies gaps in the economic literature on recycled paper market behavior. The analysis builds on the scope, methodology and data used by 21 previous studies, which all estimate the own-price elasticities of recycled paper demand and/or supply. One key finding is that the own-price elasticity of recycled paper supply is positive but low (around 0.20–0.30). This helps explain the often high price volatility in recycled paper markets, and carries important implications for the impacts of, and the choice between, price- and quantity-based waste management policies. Finally, the analysis also suggests that future research should devote increased attention to different non-environmental market imperfections (e.g., market power, information asymmetries) that could discourage the uptake of recycled materials in the market place. A stronger research focus on recycled paper use in developing countries, not the least China, is also needed.

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1. Introduction

1.1. Background

Far-reaching policy measures have been undertaken in many economically advanced countries to promote the recycling of different raw materials. The array of public policies includes, for example, surcharges on the disposal of recyclable materials, tax incentives and subsidies to recycling programs, mandated minimum recycled material content to products, and virgin material taxes. However, the rationale for and the understanding of the consequences of these policy measures are often less than complete, and any attempt to promote material recycling ought to take into account that in many cases (e.g., metal scrap and recycled paper) there exist more or less well-functioning economic markets for the recovered (secondary) materials. These markets not only are often highly competitive but they also have unique features, not the least since the supply of recycled materials largely is a function of previous consumption patterns. Moreover, the prices are often subject to substantial short-run instability, something which in

turn may hamper the willingness to invest in increased recycling capacity (Ackerman, 1997).

Policy instruments that attempt to promote recycling efforts beyond the market-clearing level need to address the consequences and the importance of the behavior of the relevant market actors (e.g., Anderson and Spiegelman, 1977; Brouillat and Oltra, 2012). For instance, if the supply of old newsprint is very own-price inelastic, subsidies directed towards the recovery of used newsprint will have only limited impacts on recovery rates. The relative cost effectiveness of different public policies aimed at reducing waste disposal will also depend on market behavior, and on the price responsiveness of demand and supply (e.g., Palmer et al., 1997; Sigman, 1995). A more in-depth understanding of market behavior in general and price responses in particular can also shed light on important market characteristics, such as the high price volatilities (e.g., Kusa et al., 2001) and the occasional concerns about the exercise of market power (e.g., Hervani, 2005). This paper therefore reviews and synthesizes the existing empirical literature on price elasticities in recycled paper markets.

1.2. Objectives, scope and approach

The objectives of this paper are to: (a) provide a critical survey of previous econometric analyses of supply and demand price elasticities in recycled paper markets and (b) discuss important implications of these findings. Specifically, the survey adds to our understanding of recycled paper markets, it points towards some important policy lessons, and identifies gaps in the economic literature on recycled paper

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* Corresponding author.

E-mail address: patrik.soderholm@ltu.se (P. Söderholm).

markets. We devote specific attention to econometric research that has provided estimates of the own-price elasticities of recycled paper demand and/or supply, most of these also addressing the role of other independent variables (e.g., consumption of final products and prices of substitutes such as wood pulp).

The above implies that we do not discuss studies that analyze the demand and supply behavior in other forest raw material markets (e.g., McCarthy and Urmanbetova, 2011; Tang et al., 2008). Our sole focus on recycled paper markets therefore also complements previous survey articles of forest sector modeling in economics (e.g., Buongiorno, 1996; Toppinen and Kuuluvainen, 2010), which typically have had a broader scope as well as focusing mainly on virgin forest raw materials. Moreover, although the development of an increasingly international market for recycled paper provides an important context for the paper (see Section 1.3), we do not explicitly survey previous research on international trade patterns in recycled paper (e.g., Michael, 1998; Van Beukering and Bouman, 2001).

Our survey of recycled paper price elasticity research is comprehensive although not necessarily exhaustive, and it permits a synthesis of important empirical results and of some of the dominant themes and methodological challenges in the microeconomic literature on paper recycling. The earliest elasticity studies are from the mid-1970s, and the survey shows that in spite of a growing interest in waste management policy and resource efficiency issues most previous research is of an early date. This provides scope for future research, and indeed for revitalizing important issues with new economic modeling tools.

1.3. An introduction to the recycled paper market

For recycled paper an essentially global industry has since long developed on the basis of profit incentives and early on in the absence of any policy intervention; prices have been determined by demand and supply in the associated markets. Paper products such as newsprint and paper packaging generally account for a large share of total municipal waste in the developed world (over a third in terms of quantity generated), and the use of recovered paper as an input in the production of paper and paperboard has increased worldwide during the last decades (e.g., Berglund and Söderholm, 2003; Hujala et al., 2010). In the early 1970s governments in the developed world began to promote additional paper recycling, and over the period 1970–2010 recycled paper collection worldwide increased from about 31 million tons to over 210 million tons (FAO, 2013).

Table 1 displays the development of recycled paper collection and use by different geographical regions over a more recent time period, 1992–2008. During this period paper recycling more than doubled at the global level, but the table also displays important regional differences. The use of recovered paper in Asia has more than tripled during the period, while the corresponding growth rates in Europe and North America have been much more modest. Still, overall the developed countries have higher recycled paper collection rates (see also Berglund and Söderholm, 2003), leading to increased international trade and significant imports from the latter regions into Asia (see also FAO, 2013). For instance, in the year 2011 over half of the recycled paper and one third of the wood pulp traded globally was imported into China. Increasing domestic use of paper and board products as well as soaring packaging needs for the export-oriented manufacturing industry in China explain these large import figures (He and Barr, 2004).

The policy support for increased recycled paper collection has been spurred by the perceived environmental benefits of substituting recycled for virgin fibers. Paper recycling typically leads to natural resource conservation and reduced emissions (e.g., carbon dioxide emissions) compared to other waste management options such as landfilling and incineration (e.g., Laurijssen et al., 2010; Finnveden and Ekvall, 1998). Moreover, the increased international trade in paper making fibers has led to concerns about wood pulp imports from countries with unsustainable harvesting practices (Lang and Chan, 2006). In this way

Table 1

Recovered paper collection and use by geographical region, 1992–2008. Sources: Hujala et al. (2010) and the RISI industry statistics database.

	1992		2000		2008	
	Collection	Use	Collection	Use	Collection	Use
<i>Asia</i>						
Quantity (Mt)	28	33	47	59	78	103
Market share (%)	28	33	30	37	33	49
<i>Europe</i>						
Quantity (Mt)	29	30	47	44	62	54
Market share (%)	30	30	30	29	30	25
<i>Latin America</i>						
Quantity (Mt)	4	6	7	8	10	10
Market share (%)	4	6	4	5	5	5
<i>North America</i>						
Quantity (Mt)	35	28	49	40	51	35
Market share (%)	36	28	32	25	24	16
<i>Other</i>						
Quantity (Mt)	3	3	6	6	10	8
Market share (%)	3	3	3	3	5	4
<i>World total</i>						
Quantity (Mt)	99	100	156	157	211	210
Market share (%)	100	100	100	100	100	100

increased imports of recycled paper rather than wood pulp could benefit the environment and the conservation of forest resources.

Policies to promote paper recycling and the substitution of recycled paper for virgin fiber have typically focused solely on the supply side of the market by mandating the removal of used paper and paperboard from the solid waste stream (e.g., Smith, 1997; Nestor, 1994). Generally such policy efforts increase supply, but they will only boost the equilibrium rate of paper recycling as long as the demand for recycled paper is relatively own-price sensitive. In practice, however, many collection schemes have simply led to abundant supplies of used paper and price slumps, and therefore to moderate increases in recycled paper demand.¹ In times of a soaring demand, prices can in turn be very high, and there is evidence of significant price spikes in recycled paper markets (Ackerman and Gallagher, 2002).

As a response to the failure of paper collection programs to increase paper recycling, attempts to directly stimulate the demand for recycled paper (e.g., mandatory content legislation) have become more common (Nestor, 1994). An important example is the scheme for tradable so-called Packaging Recovery Notes (PRN) introduced in the UK in 1997 to implement the country's packaging regulation (O'Doherty et al., 2003; Matsuda and Nagase, 2012). This type of policy instrument imposes a minimum share of recycled content in a particular material and allows trading between the responsible firms to reduce (minimize) the cost of achieving this level. The choice between price- and quantity-based waste management policies has thus become an important topic for evaluation and research (see also Finnveden et al., 2012).

Finally, the status and the development of paper producing technology largely determine the supply and use of recycled paper, including the possibility to substitute recycled paper for other raw materials such as wood pulp. According to a number of previous studies (e.g., Zavatta, 1993; Rehn, 1995; Lundmark and Söderholm, 2004), technological change has had a positive impact on the use of recycled paper in the paper and board industry. One important outcome of this development during the last decades, it is argued (e.g., Collins, 1992), is increased substitution possibilities between recycled paper and wood pulp. This fact should, if valid, facilitate the use of price-based policy efforts aimed at encouraging greater use of used paper in the production of new paper and paperboard products. For this reason our survey also

¹ See, for instance, Browne (1996) and Nestor (1992) for analyses of such market developments in the U.S. market for old newsprint.

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