

## ***Global Competition in Pulp and Paper Markets***

**By Pat McCarthy, Director**

How competitive are global pulp and paper markets? Are global markets becoming more competitive or less competitive? Indeed, how do we know whether any industry is competitive? In exploring these questions, it is useful to consider what we mean by competitive markets. Highly competitive market environments are typically markets with no barriers to entry or exit and in which a large number of firms produce a similar or identical product. No single firm's market share is large and any firm's production will have a negligible effect upon market price. No matter how much or how little a firm produces, its output is so small relative to the total industry's output that market price will be unaffected. Under these conditions, firms are price takers, not price makers. Conversely, the greater the market share that one or a few firms capture, the less competitive the market will likely be.

A second characteristic of competitive markets is price sensitivity. When markets are competitive, buyers will be very responsive to price changes. A 1% increase in price will cause buyers to reduce their purchases by more than 1%, and this causes revenues to fall. When markets are less competitive, there is less price sensitivity – more pricing power on the part of firms – so that a 1% increase in price has a disproportionately small effect on purchases, causing revenues to rise.

The law of one price also characterizes highly competitive markets. Seeking to maximize profits, in competitive markets, firms will continue to produce up to the point at which the marginal cost of the last unit (or last batch of units) produced equals market price. And buyers will continue to purchase the product up to the point at which the marginal value to the buyer just equals the market price. In other words, when highly competitive markets are in equilibrium, market price equals marginal cost for the last unit (or batch of units)

bought and sold. For companies that compete in global markets, the law of one price means that the price of traded goods will be equal, net of transportation costs and exchange rate differences. The persistence of price differences, however, suggests that markets are less competitive.

So what does all of this mean for the global pulp and paper market? At first blush, it would seem that global pulp and paper markets are not very competitive. After all, there are not many firms the size of International Paper, Stora Enso, Weyerhaeuser, and UPM. And although there are no explicit entry or exit barriers in the major producing countries, pulp and paper industries are very capital intensive. Amcor, for example, opened a new production line at its Botany Mill (Australia) site in 2012 to produce high-quality 100% recycled testliner and fluting grades. Cost of the project was \$500 million with a capacity of 400,000 tons. Such a high cost of capital investment in the industry can act as an entry barrier as well as an exit barrier when ROIs fall below normal.

At the same time, IBISWorld reports 4,007 mills worldwide in 2012 with \$575 billion in revenues (<http://www.prweb.com/releases/2012/7/prweb9706537.htm>) and RISI tracks 3,800 mills in its online database (<http://www.risiinfo.com/pages/product/pulp-paper/mill-intelligence.jsp>). In 2011, the value of paper and paperboard traded was \$219.4 billion. And the 221 million tonnes of paper and paperboard trade that occurred accounted for more than 54.8% of the world's production capacity (<http://faostat.fao.org/site/613/default.aspx#ancor>). As well, many of the industry's traded goods, such as copy paper, coated papers, and recycled paper, are commoditized goods, i.e. goods which buyers see as virtually identical regardless of which company produces the good. From this perspective, the global market is quite competitive in the array of pulp and paper goods that the industry trades.

Thus, there are several competitive-market indicators, indeed more than identified here, and if one is to evaluate whether the global market for pulp and paper is competitive, looking at more than one indicator provides a broader perspective on the competitive landscape.

In a recent paper, Karikallio, Maki-Franti, and Suhonen (2011) considered the question of global competition and used market share, price sensitivity, and the law of one price as global competition indicators.

**Market Share** – The study found that the market share of the top 100 pulp and paper firms in the world experienced a 20% decrease, from 55% in 2002 to 44% in 2006. The percentage decrease was similar for the top 10 firms in the world, whose share dropped 17.5%, from 20% to 16.5% during the same period. This suggests that there is a more competitive global market and the competition is coming from South America, Asia and, somewhat surprisingly, Africa. But Asia is dominant. Among the 100 top pulp and paper firms, according to the study, 60% of pulp investments and 70% of paper investments during the 2005-2010 period occurred in Asia.

**Price Sensitivity** – Using FAO data for 7 exporting countries (Finland, Sweden, Canada, Indonesia, Brazil, China and the US) and 6 importing countries (China, France, Germany, Japan, UK and the US), the study reported the results of statistical models that provided measures of price sensitivities. In general, the authors found export and import demands for paper and paperboard to be price sensitive; in contrast, the study found the export and import demand for pulp to be price insensitive. At a minimum, these findings suggest that the global market for paper and paperboard is more competitive than the global market for pulp. Whereas price increases in the pulp market may increase revenues since output does not proportionately fall, this would not be true in the paper and paperboard market, according to the study, whose demands are more sensitive to price.

**Law of One Price** – Based upon price data for selected products and selected countries/regions – pulp (USA, Europe, Asia), newsprint (USA, China, Germany UK), lightweight coated paper (USA, China, Germany, UK), and uncoated woodfree paper (USA, Taiwan, Germany, UK ) – the study examined whether prices in one country/region were independent from prices in another country/region. The strongest results indicated that prices for lightweight coated paper,

uncoated woodfree paper, and pulp are consistent with the law of one price and market competitiveness.

Overall, the study's authors conclude that the global markets for pulp and paper 'are competitive in the sense that a single firm, no matter how large, cannot increase the price of its products without losing market share and experiencing a fall in total revenue' [1, p. 98].

A large number of individual products comprise the aggregate categories analyzed in this research and undoubtedly global markets in all of these products are not competitive. The fortunes of large pulp and paper companies do not rise and fall on a few products but on a large portfolio of products that collectively define the aggregate grouping. The finding that global pulp and paper markets are broadly competitive and whose prices are consistent with the law of one price is all the more worrisome for companies and regions whose market shares are falling as global market entrants with state of the art technology put continuing pressure on incumbents through lower costs and prices.

#### Reference

(1) Karikallio, H., Maki-Franti, P. and Suhonen, N. (2011). "Competition in the global pulp and paper industries – An evaluation based on three approaches", *Journal of Forest Economics*, 91-104.

### ***Advanced Paper Could be Foundation for Inexpensive Biomedical and Diagnostic Devices***

*(Reprinted from the Georgia Tech Daily Digest, June 4, 2013)*

Paper is known for its ability to absorb liquids, making it ideal for products such as paper towels. But by modifying the underlying network of cellulose fibers, etching off surface "fluff" and applying a thin chemical coating, researchers have created a new type of paper that repels a wide variety of liquids – including water and oil.

The paper takes advantage of the so-called "lotus effect" – used by leaves of the lotus plant – to repel liquids through the creation of surface patterns at two different size scales and the application of a chemical coating. The material, developed at the Georgia Institute of Technology, uses nanometer- and micron-scale structures, plus a surface fluorocarbon, to turn old-fashioned paper into an advanced material.

The modified paper could be used as the foundation for a new generation of inexpensive biomedical diagnostics in which liquid samples would flow along patterns printed on the paper using special hydrophobic ink and an ordinary desktop printer. This paper could also provide an improved packaging material that would be less expensive than other oil- and water-repelling materials, while being both recyclable and sustainable.

“Paper is a very heterogeneous material composed of fibers with different sizes, different lengths and a non-circular cross-section,” said [Dennis Hess](#), a professor in the Georgia Tech [School of Chemical and Biomolecular Engineering](#). “We believe this is the first time that a superamphiphobic surface – one that repels all fluids – has been created on a flexible, traditional and heterogeneous material like paper.”

Research leading to development of the superamphiphobic paper has been supported by the Institute for Paper Science and Technology (IPST) at Georgia Tech. Details were published online May 24 in the journal *ACS Applied Materials & Interfaces*.

The new paper, which is both superhydrophobic (water-repelling) and super oleophobic (oil-repelling), can be made from standard softwood and hardwood fibers using a modified paper process. In addition to Hess, the research team included Lester Li, a graduate research assistant, and Victor Breedveld, an associate professor in the School of Chemical and Biomolecular Engineering

Producing the new paper begins with breaking up cellulose fibers into smaller structures using a mechanical grinding process. As in traditional paper processing, the fibers are then pressed in the presence of water – but then the water is removed and additional processing is done with the chemical butanol. Use of butanol inhibits the hydrogen bonding that normally takes place between cellulose fibers, allowing better control of their spacing.

“The desirable properties we are seeking are mainly controlled by the geometry of the fibers,” Hess explained.

The second step involves using an oxygen plasma etching process – a technique commonly used in the microelectronics industry – to remove the layer of amorphous “fluffy” cellulose surface material, exposing the crystalline cellulose nanofibrils. The process thereby uncovers smaller cellulose structures

and provides a second level of “roughness” with the proper geometry needed to repel liquids.

Finally, a thin coating of a fluoropolymer is applied over the network of cellulose fibers. In testing, the paper was able to repel water, motor oil, ethylene glycol and n-hexadecane solvent.

The researchers have printed patterns onto their paper using a hydrophobic ink and a desktop printer. Droplets applied to the pattern remain on the ink pattern, repelled by the adjacent superamphiphobic surface.

That capability could facilitate development of inexpensive biomedical diagnostic tests in which a droplet containing antigens could be rolled along a printed surface where it would encounter diagnostic chemicals. If appropriate reagents are used, the specific color or color intensity of the patterns could indicate the presence of a disease. Because the droplets adhere tightly to the printed lines or dots, the samples can be sent to a laboratory for additional testing.

“We have shown that we can do the operations necessary for a microfluidic device,” Hess said. “We can move the droplet along a pattern, split the droplet and transfer the droplet from one piece of paper to another. We can do all of these operations on a two-dimensional surface.”

For Hess, Li and Breedveld, creating a superhydrophobic surface was relatively straightforward because water has a high surface tension. For oils, which have a low surface tension, the key to creating the repellent surface is to create re-entrant – or undercut – angles between the droplets and the surface.

Previous examples of superamphiphobic surfaces have been made on rigid surfaces through lithographic techniques. Such processes tend to produce fragile surfaces that are prone to damage, Hess said.

The principal challenge has been to create high-performance in a material that is anything but geometrically regular and consistent.

“Working with heterogeneous materials is fascinating, but it’s very difficult not just to control them, because there is no inherent consistent structure, but also to change the processing conditions so you can get something that, on average, is what you need,” he said. “It’s been a real learning experience for us.”

The new paper has so far been made in samples about four inches on a side, but Hess sees no reason why the

process couldn't be scaled up. Though long-term testing of the new paper hasn't been done, Hess is encouraged by what he's seen so far.

**CITATION:** Lester Li, Victor Breedveld and Dennis Hess, "Design and Fabrication of Superamphiphobic Paper Surfaces," (ACS Applied Materials & Interfaces, 2013).

*Editor's note: As indicated in the article, the research was supported by the Institute of Paper Science and Technology (IPST), a principal founding body of CPBIS. The first author, Lester Li, is an IPST@GeorgiaTech Paper Science and Engineering graduate student.*

## **Trend Indicators from Industry Intelligence Inc.**

[Industry Intelligence Inc.](http://www.industryintel.com) has provided market intelligence to more than 600 companies worldwide since it began as Forestweb in 1999. Industry Intelligence delivers a daily report featuring news of the paper and forest products industries. For your subscription visit: <http://www.industryintel.com>

Below is a selection of recent headlines chosen to mirror significant trends in and around the paper and forest products industries.

***Washington State University to showcase its efforts to develop viable alternative jet fuels at Paris Air Show from June 17-23; university-led consortium is attempting to overcome barriers to developing wood-based jet fuel, says school official***

Called the Northwest Advanced Renewables Alliance, the consortium envisions developing a new, viable aviation fuel industry using wood wastes in the Pacific Northwest.

***Green energy developer New Biomass Energy to boost output at its torrefied wood pellet plant in Quitman, Mississippi, to 250,000 tons/year, up from 50,000 tons/year, with completion slated for late 2013, citing rising European demand***

The products will be utilized to fuel coal-fired power facilities.

***Stora Enso studying the financial feasibility of converting its 285,000 tonnes/year uncoated fine paper mill in Varkaus, Finland, to 350,000 tonnes/year virgin fiber-based containerboard, expects to complete the study of the one-machine mill by Q1 2014***

"This is an opportunity to take advantage of two market forces, where one can see a decreasing global

market for paper but an increasing global market for board. It is an opportunity to grow in the containerboard market at competitive investment cost," says Hannu Alalauri, SVP Packaging Solutions at Stora Enso Renewable Packaging.

***Lee & Man Paper to build 2.5 million tonnes/year of high-end packaging output, 300,000 tonnes/year tissue paper production in China's Jiangxi province, at Matou Town, Ruichang; 10B-yuan project to be done in separate phases***

Some 3,000 jobs will be provided.

***Global print newspaper circulations down 0.9% year-over-year as rising circulations in Asia offset losses in mature Western markets; newspaper ad revenues down 2%, growth in digital not followed by growth in ad revenues as digital engagement remains low***

A World Press Trends survey showed newspaper circulation declined over one year by 6.6 per cent in North America, 5.3 per cent in western Europe, 8.2 per cent in eastern Europe, and 1.4 per cent in the Middle East and North Africa. It increased 1.2 per cent in Asia, 3.5 per cent in Australia and New Zealand, and 0.1 per cent in Latin America. Circulation declined over five years by 13 per cent in North America, 0.8 per cent in Latin America, 24.8 per cent in western Europe, and 27.4 per cent in eastern Europe. Circulation increased over five years by 9.8 per cent in Asia, 10.5 per cent in the Middle East and North Africa and 1.0 per cent in Australia and New Zealand.

***Michigan State University scheduled to do test burn of 300 tons of torrefied biomass in 2013, has planted first of six planned 10-acre plots of hybrid poplar trees for use as biomass fuel to further goal of using 100% renewable energy***

Torrefaction occurs when a plant material is roasted to eliminate moisture and unstable chemicals. These chemicals can then be burned to power the process. The result is a concentrated material that can be transported and burned like coal.

***Kruger dedicates new tissue paper machine in Memphis, Tennessee, says US\$316M project included through-air-dried paper machine capable of producing high-end tissue paper; the mill makes White Cloud brand for Wal-Mart stores in US***

Through-air drying is among the industry's most advanced technologies for the production of premium quality tissue. It is extremely effective for increasing bulk and softness, as well as strength and absorption.

***Forest fires will increase 50% in the US by 2050 as climate warms, with 100% increase in parts of West,***

*US, Forest Service meteorologists predict; fire emissions of CO2 could further contribute to global greenhouse effect*

The authors of the report also found that, because smoke particles suppress cloud formation and precipitation, fire events could lead to more droughts.

*Stora Enso inaugurates 455,000 tonnes/year containerboard machine at its Ostroleka, Poland, mill, amid projected 5%/year market growth in Central, Eastern Europe, says company official; the €285M PM No. 5 now in ramp-up stage*

The machine runs exclusively on recovered fiber from the company's own collection and sorting around the country.

### **Statistics Corner: Municipal Solid Waste Recovery Rates**

The figure below summarizes US Environmental Protection Agency statistics on rates of recovery of packaging materials for the period 1980 - 2011. By this recyclability criterion, paper and paperboard are clearly superior to the other materials. The contrast with plastics recovery rates is especially notable. ■

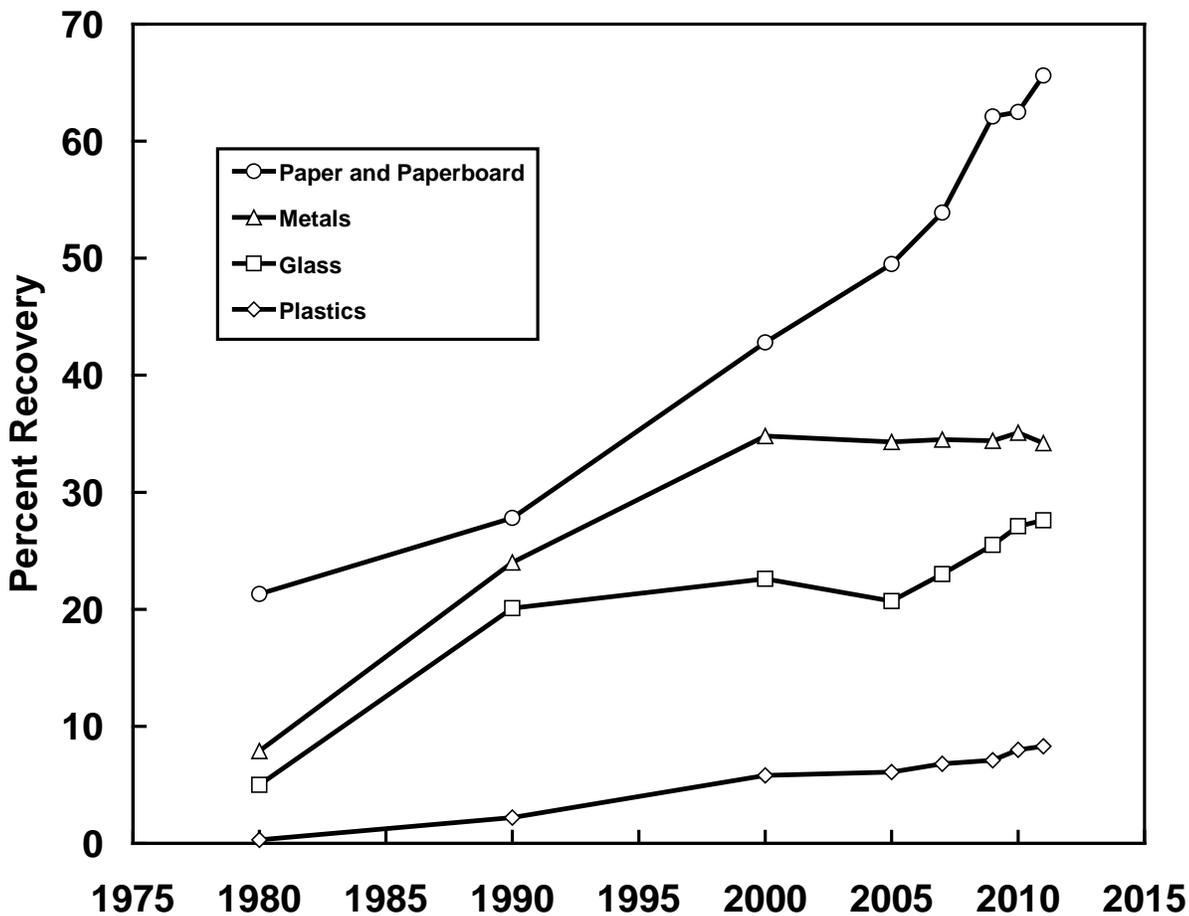


Figure 1. Municipal solid waste recovery rates. (USEPA)