

Policies, learning-by-doing played important role in reducing ethanol costs

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A new study co-authored by Madhu Khanna, a professor of agricultural and consumer economics at Illinois, and Xiaoguang Chen, of the U. of I. Energy Biosciences Institute, quantifies the role that factors such as economies of scale and learning-by-doing played in reducing the processing costs of corn ethanol. Credit: L. Brian Stauffer

A new study from the University of Illinois concludes that learning-by-doing, stimulated by increased ethanol production, played an important role in inducing technological progress in the corn ethanol industry. It also suggests that biofuel policies, which induced ethanol production beyond the free-market level, served to increase the competitiveness of the industry over time.

The study, co-written by Madhu Khanna, a professor of agricultural and consumer economics at Illinois, and Xiaoguang Chen, of the U. of I.

Energy Biosciences Institute, quantifies the role that factors such as economies of scale, learning-by-doing, induced [technological innovation](#) as a result of rising input prices and trade-induced competition played in reducing the processing [costs](#) of corn ethanol in the U.S. by 45 percent while also increasing production volumes seventeen-fold from 1983 to 2005.

"The purpose of this article was to see if we could disaggregate the extent to which various factors contributed to a reduction in cost," Khanna said. "The existence of learning-by-doing has been empirically validated for many technologies, including other forms of [renewable energy](#). But in the case of corn ethanol, the main contribution of this paper was to see if there were some missing variables that had affected the estimate. We found that the impact of learning-by-doing in reducing the processing costs of dry-mill corn ethanol from 1983 to 2005 was twice as high as previously estimated."

For a [retrospective analysis](#), a long time-series of data is necessary, the researchers say.

"The main limitation to conducting a retrospective analysis is that it takes 20 years to get 20 observations," Khanna said. "Looking forward, what this suggests is that one can expect similar cost reductions through learning-by-doing with new technologies and that there is, in fact, a case for providing [government support](#) for nurturing new innovations in energy."

"If we think about what it might mean for second-generation biofuels, it suggests a need to continue mandates despite all the skepticism about their efficacy," Chen said. "This definitely shows that government mandates that accelerate production to higher levels than would otherwise occur can induce cost reductions in the future."

The study also concludes that the tariff on Brazilian sugar-cane ethanol imports made the corn [ethanol industry](#) more competitive, but only slightly.

"On the one hand, because the tariffs protect the domestic corn ethanol industry they can induce more domestic ethanol production, which can contribute to lowering costs," Khanna said. "But on the other hand, it also reduces competition, which reduces the incentives for the corn ethanol industry to be as efficient as it might have been otherwise. We found the latter effect offset the benefits of the larger domestic production induced by the tariff."

The researchers also say the learning-induced cost reductions are flattening out.

"The reduction in cost is approaching its limit," Chen said. "Additional reductions in production costs of corn ethanol, simply based on learning-by-doing, will become a lot more harder to come by because they would require very large additional production over already-high current levels. The gains from learning are largest for an infant industry in its initial stages of growth; the justification for policy support decreases as the industry expands."

"Our estimates show that each doubling of cumulative corn [ethanol production](#) decreased its unit costs by 25 percent," Khanna said. "But there's an upper limit that has been reached to increasing [corn ethanol](#) production because of the concerns about its impact on food prices. So we may never get to that level where we see further reductions in costs as a result of an increase in total production – not because the technology has hit a wall, but simply because current policy does not allow production to expand to that level."

Other factors such as the rising prices of energy and labor did serve to

lower processing costs, but the effect was not statistically significant.

"One of the standard theories about induced innovation is that higher input prices will lead the industry to become more efficient and lower costs," Chen said. "But we didn't find any strong evidence of that here despite the increase in energy prices and labor costs. Instead, we found it's really experience and learning-by-doing that's working."

"The demand for those inputs is not very responsive to prices, so that's not where industry would make significant improvements," Khanna said. "I think it's improving the process of conversion, and improving conversion efficiencies; that's where the real gains came from."

More information: The study will be published in the May issue of the journal *Energy Policy*.

Provided by University of Illinois at Urbana-Champaign

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