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IN BRIEF

Mathieu Frigon
31 May 2007

Corn Ethanolomics: A Look at the Recent US Experience

Ethanol production reached an estimated 4.9 billion gallons in the United States in 2006, which corresponds to an increase of 25% over 2005 and an increase of 130% over 2002. There are 116 ethanol plants located throughout the United States. A further 81 facilities under construction and at least 8 expansions underway will add 6 billion gallons of new production capacity by 2009.⁽¹⁾⁽²⁾ Given the various incentive measures that are and will be implemented in Canada to promote ethanol production and use, together with the significant influence of the United States in this market, it is worthwhile for policy makers to examine how energy and corn prices affect the US corn ethanol industry.

At least five factors explain the expansion in ethanol production in the United States:⁽³⁾

1. a tax credit provided to blenders of ethanol with motor fuel;
2. regulations regarding minimum ethanol content for blended fuel;
3. the elimination of ethanol's main oxygenate competitor, methyl tertiary butyl ether (MTBE);
4. high and volatile fossil fuel prices, which make ethanol relatively more competitive; and
5. low corn prices.

Of particular note are the fourth and fifth factors. As shown in Figure 1 (see Appendix), ethanol prices have closely followed the price of other fuels in the last 25 years. The evolution of ethanol prices could thus be seen as a function of energy prices in general. Corn, which is currently by far the main feedstock used to produce ethanol in the United States, represents close to 60% of the total cash cost of producing ethanol.⁽⁴⁾ A low corn price combined with

a high energy price typically creates higher profits for ethanol producers, thus stimulating the expansion of ethanol production. Paradoxically, given that energy costs represent 50% of the total operating cost of corn farmers, low corn prices and high energy prices can reduce the operating margin of corn growers.⁽⁵⁾⁽⁶⁾ This effect was experienced in the United States between 2002 and 2005. As illustrated in Figure 1, energy prices (including ethanol) rose almost without interruption between 2002 and 2005. In that same period, US corn operating costs per acre increased by \$52.77, or 38%.⁽⁷⁾ Escalating energy costs for corn growers between 2002 and 2005 accounted for 75% of that change.

Rapid and profitable growth in ethanol production typically generates substantial increases in demand for corn and can eventually trigger an increase in corn prices. Such an increase, assuming energy prices stay the same, is good news for corn growers, but it can reduce the operating margin of ethanol processors (the selling price of ethanol stays the same, but the cost of corn used in production increases). It appears that this is what has happened in the United States over the last two years. The combination of low corn prices, high energy prices, and strong ethanol demand encouraged by various government measures, stimulated the rapid expansion of corn-based ethanol production. This expansion is deemed to be the main factor that drove the price of corn up by approximately 90% from August 2006 to February 2007. According to Credit Suisse, the estimated profit from ethanol processing decreased from US\$1.06 per gallon to a net average of US\$0.03 per gallon in that period as a direct result of higher corn prices.⁽⁸⁾ It should be noted that direct energy usage is itself a major cash operating expense of corn-based ethanol production, representing more than 40% of the processing cost.⁽⁹⁾⁽¹⁰⁾ Therefore, high

energy prices and high corn prices could prove to be a double challenge for ethanol producers.

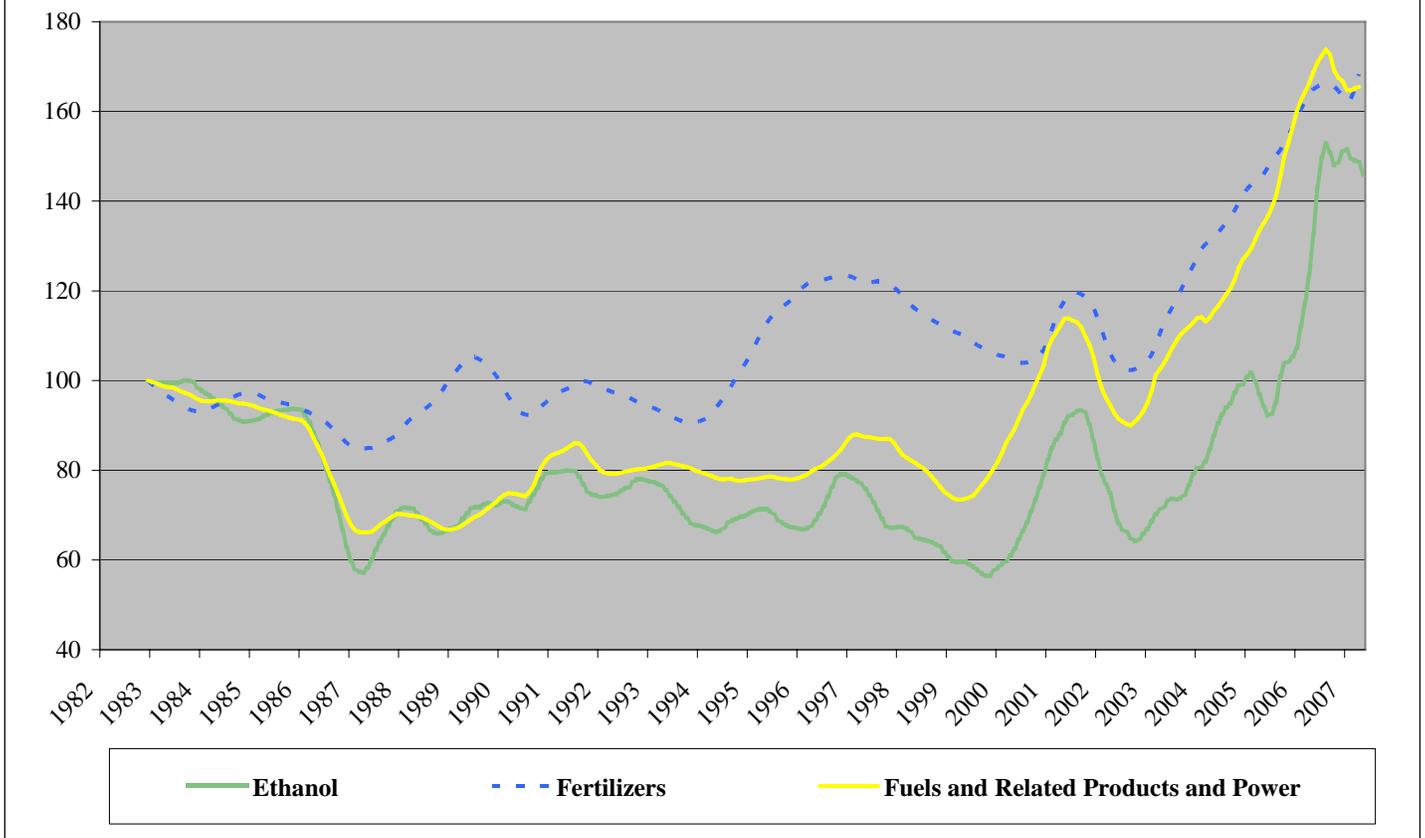
It seems that business cycles in the ethanol supply chain may have a tendency to alternate from circumstances beneficial to ethanol processing plants and difficult for corn growers, to circumstances that are beneficial to corn growers and difficult for ethanol processing plants. Although some authors⁽¹¹⁾ have attempted to estimate the long-term equilibrium with respect to price and margin in the corn-based ethanol industry, the erratic behaviour of both energy and corn prices (see Figure 2 in Appendix), as well as the more recent US experience, suggests that the path to any potential long-term equilibrium might be something of a roller-coaster ride for stakeholders. Potential means to a smoother business cycle in the corn-based ethanol industry include vertical integration (whereby corn growers invest in ethanol plants, or ethanol plants invest in corn production) and price hedging (whereby buyers or sellers use financial instruments to offset the risk of any adverse movements in price).

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- (1) Source: US Renewable Fuels Association, *Ethanol Industry Outlook 2007: Building New Horizons*, Washington, DC, 2007, <http://www.ethanolrfa.org/industry/outlook>.
 - (2) House of Commons Standing Committee on Agriculture and Agri-Food, *Report on the Fact-Finding Mission on Canada's New Agriculture and Agri-Food Policy*, 14th Report, 1st Session, 39th Parliament, June 2007, p. 25.
 - (3) Economic Issues Related to Biofuels, Statement of Keith Collins, Chief Economist, US Department of Agriculture, Before the US Senate Committee on Appropriations Subcommittee on Agriculture, Rural Development, and Related Agencies, August 2006, <http://www.usda.gov/oce/newsroom/index.htm#congressional>.
 - (4) H. Shapouri and P. Gallagher, *USDA's 2002 Ethanol Cost-of-Production Survey*, United States Department of Agriculture, Agricultural Economic Report No. 841, 2005, p. 8, http://www.usda.gov/oce/reports/energy/USDA_2002_ETHANOL.pdf.
 - (5) R. Shoemaker, D. McGranahan and W. McBride, "Agriculture and Rural Communities are Resilient to High Energy Costs," Economic Research Services, United States Department of Agriculture, 2006, <http://www.ers.usda.gov/AmberWaves/April06/Features/Energy.htm>.

- (6) The definition of energy cost employed by Shoemaker et al., (2006) encompasses the direct on-farm energy usage (diesel, gas) and fertilizers, which have a significant energy component. In fact, the price of fertilizers tends to track fuel price closely, as illustrated in Figure 1. It should be noted that energy prices have other indirect effects on the operating costs of corn growers (for example, pesticides are also influenced by energy prices), and so the estimate that 50% of operating cost of growing corn relates to energy should be seen as conservative.
- (7) Economic Research Service, United States Department of Agriculture, *Commodity Costs and Returns: US and Regional Cost and Return Data*, <http://151.121.68.30/Data/CostsAndReturns/testpick.htm>.
- (8) Jon Birger, *The Great Corn Gold Rush*, *Fortune*, 29 March 2007, http://money.cnn.com/2007/03/29/magazines/fortune/corn_gold_rush.fortune/index.htm (accessed 26 June 2007).
- (9) Taking into account only the process operating cost of ethanol, therefore excluding the cost of the corn feedstock.
- (10) Shapouri and Gallagher, *USDA's 2002 Ethanol Cost-of-Production Survey*, p. 8.
- (11) A. Elobeid, S. Tokgoz, D.J. Hayes, B.A. Babcock and C.E. Hart, *The Long-Run Impact of Corn-Based Ethanol on the Grain, Oilseed, and Livestock Sectors: A Preliminary Assessment*, Centre for Agricultural and Rural Development, 2006, p. 13, <http://www.card.iastate.edu/publications/index.aspx>.

APPENDIX

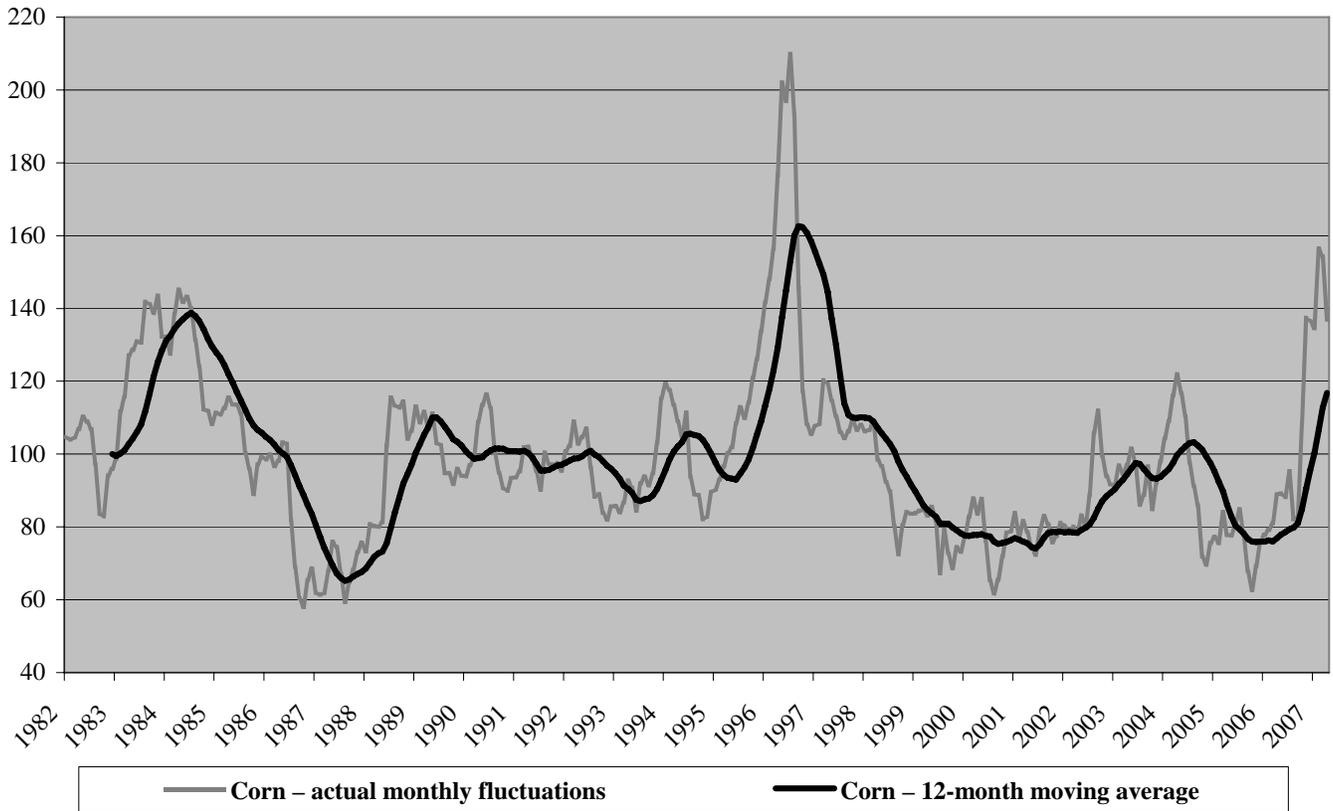
**Figure 1 – Evolution of Ethanol, Fuels and Fertilizer Prices
(12-month moving average, 1982 = 100)**



Note: Data are presented as 12-month moving averages to smooth monthly and seasonal fluctuations.

Data sources: US Bureau of Labor Statistics and Nebraska Energy Office.

Figure 2 – Evolution of Corn Prices
(actual monthly fluctuations and 12-month moving average, 1982 = 100)



Data source: US Bureau of Labor Statistics.