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Ethanol and Food Prices - Preliminary Assessment

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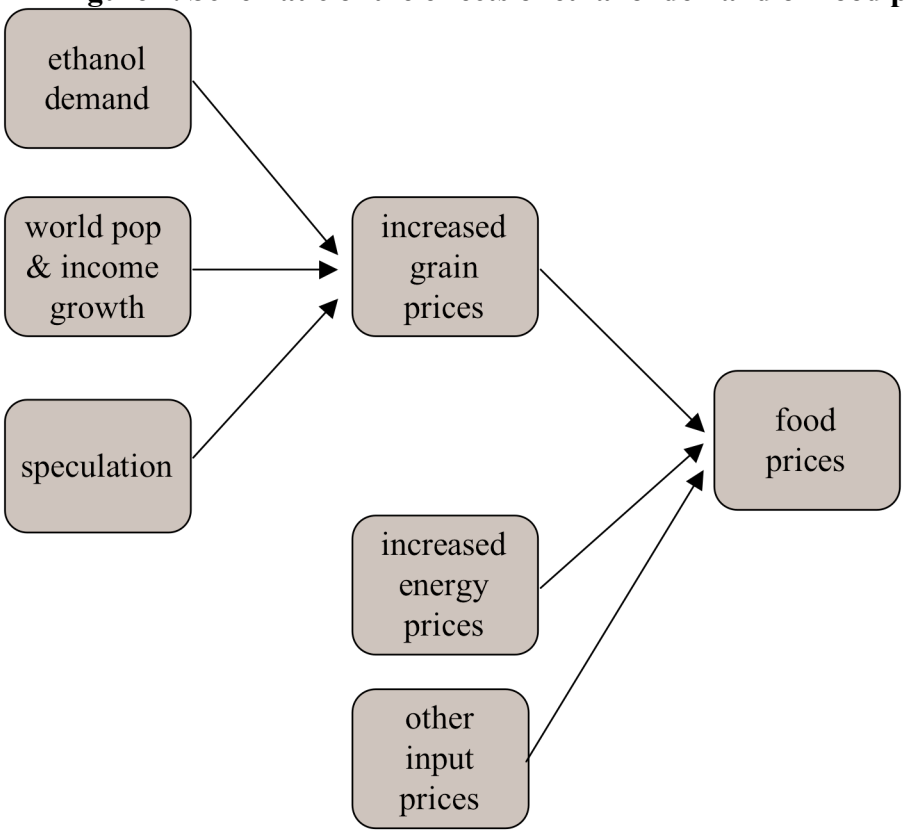
ABSTRACT:
Food prices in the U.S. rose dramatically in 2007 and early 2008. Given the integration of the world markets for foodstuffs, prices increased around the world as well, leading to riots in a number of countries in early 2008. The popular press has tended to attribute these food price increases to demand for corn by the ethanol industry. Grain prices are one determinant of food prices, but they constitute less than 5% of food costs in the U.S. (a higher percentage elsewhere.) This paper focuses on the likely relationship between ethanol and food prices, ignoring the potential role of other important contributors. It finds that ethanol is responsible for no more than 30-40% of the grain price increases of the last 18 months. Food prices in the US increased about 16% over the last five years, 7% over the past 18 months, but rising grain prices have contributed only about a 3% cost increase over these periods. It is reasonable to conclude that ethanol is responsible for increases in US food prices about 1% in the last two years – a relatively small proportion of actual of U.S. food price increases. In food-insecure areas of the world, however, the impact of ethanol on food prices has been higher, perhaps as much as a 15% increase, simply because the typical food basket in those areas contains more direct grain consumption.

Overview

Food prices in the U.S. rose dramatically in 2007 and early 2008. Given the integration of the world markets for foodstuffs, prices increased around the world as well, leading to riots in a number of countries in early 2008. The popular press has tended to attribute these food price increases to demand for corn by the ethanol industry. Grain prices are one determinant of food prices, but they constitute less than 5% of food costs in the U.S. (a higher percentage elsewhere.) Other factors that may have contributed to food price increases (see the schematic in Figure 1.) Rising energy prices have clearly increased both food processing and transportation costs. Rising world demand and some crop failures are other potential contributors to increases in world grain prices, along with speculative activity. This preliminary assessment will consider the potential impact of these various components, with emphasis on the role of ethanol as one component.

Figure 1. Schematic of the effects of ethanol demand on food prices



Ethanol Demand and Grain Prices

To examine the effect of ethanol demand on grain prices, we can first consider what economic modeling would suggest to be the impact. Economic models are of course imperfect representations of the way the world works, but the question of ethanol's impact on food prices is essentially a counter-factual question – what would the world have been like if there were no ethanol production in the U.S. To construct a counterfactual outcome, one needs some kind of theory of how things work, whether that theory be naïve or sophisticated. Here I consider results from three theoretical models, one from the Center for Agricultural and Rural Development (CARD) at Iowa State University, on from the USDA, and a simple one of my own.

The CARD report describes and contrasts the results of several model simulations of the future, starting with a 2006 baseline and charting a path to 2016. The main ("baseline") scenario was driven by a petroleum price path that started at about $60/bbl and ended at $54/bbl[1]. The baseline 2016 outcome resulted in 14.8 billion gallons per year (bgy) of ethanol being produced, coincidentally very close to the 15 bgy mandated by the Energy Independence and Security Act (EISA)passed by Congress in December, 2007, but about twice the level of production capacity as of January, 2008. Another simulation projected differed by increasing oil prices by $10/bbl, which resulted in 29.6 bgy, coincidentally very close to double the mandated level.

Table 1. Analytical estimates of the effect of ethanol demand alone on U. S. crop prices

Source of estimate	supposed ethanol production (b. gal/yr)	predicted % price increase		
		corn	soybeans	wheat
CARD/FAPRI[a] (relative to 2006 pr	14.8	6	15	0
	29.6	38	27	18
USDA[b] (relative to 2004)	13	23	38	29
My quick analysis, from 4 to 8 bgy	8	5 to 22	-	-
Actual, '02-'04 vs Jan-Feb '08	8	80	165	70
Actual, '02-'04 vs April '08	8	129	191	98

[a]Togloz, et al, 2007
[b] USDA(a)

The CARD results indicate that the 14.8 bgy of ethanol production alone would increase corn price less than 10% - from the 2006 level of about $3.20/bu to about $3.40/bu by 2010. Soybean prices would rise 15% (from $6.20 to $7.11/bu), wheat would remain constant at $4.25/bu, and rice would fall from $9.75 to $8.53/cwt. These are small changes, but bear in mind that this is a world model, in which only US ethanol production is changing, while the entire world agricultural system is responding to the price increases, over a several-year period. These wide-spread production and

[1] This price trajectory was at that time being projected by the U.S. Department of Energy.

consumption responses over time tend to reduce price effects through increased production and reduced consumption.

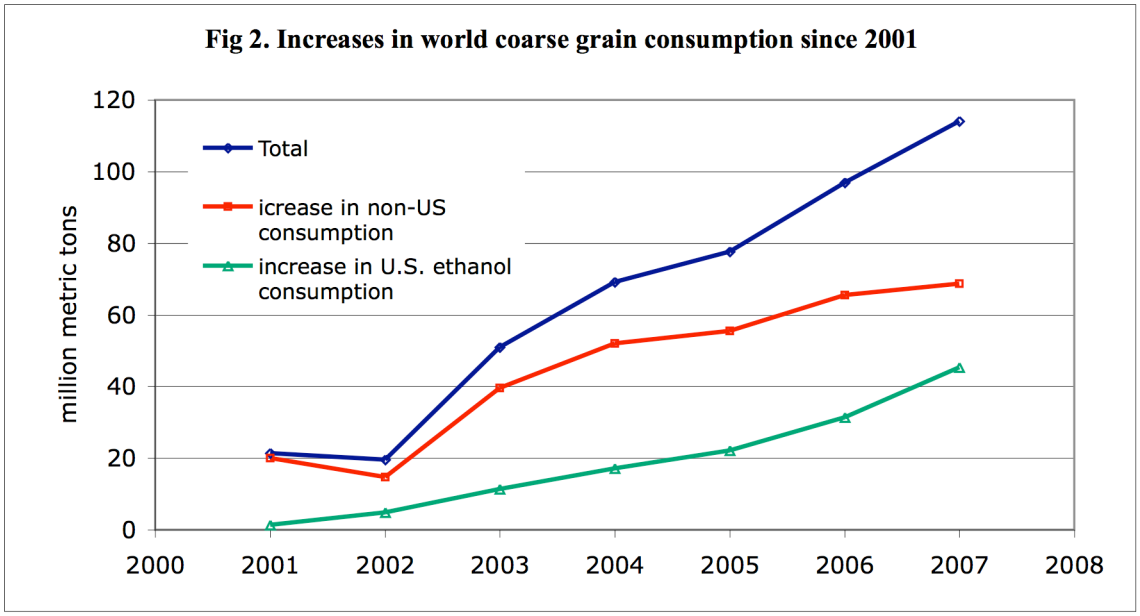
USDA's projections, based mostly on econometric models and published in February, 2008, included the impact of ethanol production at levels corresponding to plants in production (8-9bgy). They project that near-term grain prices (next two years) should be about 30% higher than 2004, about the same as the CARD/FAPRI predictions corresponding to ethanol at 30bgy. The implications of these studies for food prices is not so much that economic models are inconsistent, but that independent models, making projections under assumptions that differ considerably, nonetheless agree that ethanol production alone should have been expected to increase grain prices by less than 30%, rather than the 100-200% that we have observed in the past two years.

As an alternative to intricate econometric models, a simple supply-demand comparative statics analysis offers another way to estimate the impact of ethanol on grain prices. Consider a trade model for US feed grains with domestic feed grains being supplied with price elasticity of 0 to 1, livestock demand with elasticity -0.5 to -1.0, and food/fuel demand with demand elasticity -1 to -3. Finally, add an export demand with elasticity -1 to -4. Given current recent shares of the corn market (65% to livestock, 15% to food and fuel, and 20% to export), we can calculate the theoretical effect of a 100% increase in the food/fuel demand (ethanol increasing from 4 to 8 bgy) on feedgrain prices. At the smaller set of elasticities (reflecting a short run of perhaps a year or so for adjustment), this quick analysis predicts a price increase of 22%. At the larger elasticities (reflecting longer-run adjustments), the predicted increase is only 5%.

While my quick analysis abstracts from a great deal of economic activity, the results are broadly consistent with the predictions from the CARD and USDA models. All of them suggest that ethanol production on the scale we are now observing should have resulted in grain price increases of 15-30%, rather than the 100-200% we have observed in the past two years. In other words, the economic models suggest that ethanol is responsible for no more than 15-20% of the grain price increases we have seen in the past two years.

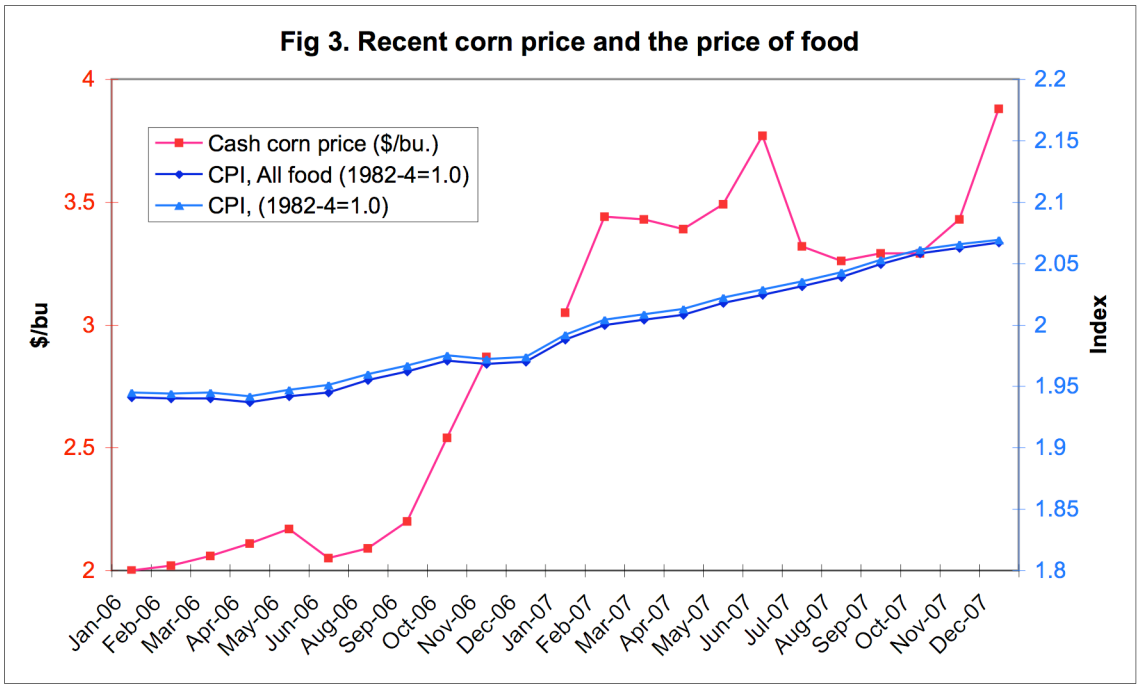
Sources of world grain consumption increases, 2003-2007

Another way to evaluate the impact of U.S. ethanol demand on grain prices is to examine where the increases in grain consumption have occurred. Figure 2 charts the increase in U.S. ethanol grain use in the context of total world consumption increases. As is evident from the chart, US ethanol production is responsible for only about 40% of the cumulative increase in world coarse grain consumption. The remaining increases are presumably due to increases in world populations and to more livestock feed due to higher demand for livestock products in other countries. If increased grain prices are due to new consumption patterns, US ethanol is responsible for only 40% of the price rise.



The Effect of Grain Prices on Food Prices

As we have heard, food prices around the world have risen sharply in the last year, leading to both political concern in the U.S. and food riots in several countries. Grain prices vary in their importance to food prices in different parts of the world. In the US, for example, the farm-gate value of grains are equivalent to only about 3% of the value of consumer food expenditures. By contrast, in poorer countries direct consumption of grains such as wheat, maize and rice means that grains constitute as much as 70% of consumer food expenditures. So U.S. food prices are much less affected by grain prices than are food prices in other parts of the world.



In the U.S. we have seen food prices increase in recent years, but at a rate far lower than grain price increases (Figure 3.) The Department of Labor's food subcomponent of the CPI (the consumer price index) indexes these prices. During 2006 and 2007, this measure of food prices increased by 8%. Although the index rose another 1,3% during the first three months of 2008, to 209.7, those increases have still been very modest relative to corn price increases.

One would not expect the price of grains to have much effect on US food prices, simply because they constitute such a small component of the total cost of consumer food purchases (see Table 2.) All these grains that are neither exported nor converted to ethanol are consumed by US consumers as food, either directly or indirectly through consumption of livestock products which the grain was used to produce. The value of this grain (at farm prices) thus represents the contribution of grains to the total cost of food as consumed by U.S. consumers.

Table 2. Grains as a cost component of U.S. food value (in million $)

Value, at farm prices, of domestic grains consumption[a]				
	2004/05	2005/06	total	percent of all grains
Wheat	3,975	3,940	7,916	12.2
Rice	899	920	1,819	2.8
Corn	15,493	15,072	30,565	47.2
Sorghum	441	353	794	1.2
Barley	646	531	1,177	1.8
Oats	311	341	652	1.0
Soybeans	10,842	10,942	21,783	33.7
total	32,608	32,099	64,707	100.0
Value of food sales				
	2005	2006	total	all grain as percent of food
At home	515,100	546,900	1,062,000	6.1
Away from home	451,600	486,200	937,800	6.9
total	966,700	1,033,100	1,999,800	3.2

[a] All food and feed use except ethanol

Sources: USDA (c), Tables 17 and 36

As previously mentioned, the grain share of total food cost is very small, just 3.2%. Thus if those grains doubled in price, a simple pass-through of that cost increase would increase food prices only about 3%. The CPI food price index has in fact risen 7% since the grain price rise began in September, 2006. This indicates that the increased cost of grain has so far contributed only about half the rise in food prices.

The econometric models mentioned earlier provide an alternative way to estimate the effect of grain prices on food prices. Table 3 shows the predictions of the CARD and USDA models for food prices. Again the CARD/FAPRI estimates are quite low,

Table 3. Analytical estimates of the effect of crop prices on food prices

	predicted % grain price increase			predicted % U.S. food price increase		
Source of estimate	corn	soybeans	wheat	meat	dairy	all food
CARD/FAPRI[a] -14.8 bgy	6	15	0	2.3	1.3	0.6
29.6 bgy	38	27	18	6.3	3.5	1.8
USDA[b] 2008 vs 2004	23	38	29	8.3	11.5	12.8
My cost pass-through analysis	100	100	100			3.2
Actual, '02-'04 vs Jan-Feb '08	81	69	165	16.2	18.7	16.2

[a]Togloz, et al, 2007(revised) - baseline results for 14.8 b. gal ethanol/yr

[b] USDA (a)

indicating that even with an extraordinarily large ethanol production of 30 bgy, the price index for all food should rise only about 2%. The USDA projections indicate a much higher increase of 12.8% between 2004 and 2008, but this is the result of increases in energy prices and other factors, in addition to increase grain use by the ethanol industry. It seems reasonable to conclude that grain price increase alone could not have directly increased food prices by more than 3-4%.

In any case, the increase in food prices since '03-'04 has amounted to 16.2%, or 7% since September 2006, much more than would be due to ethanol, as predicted by the econometric models or the cost pass- through approach. If grain price increases are responsible for at most, say, 20% of US food price increases, and ethanol is responsible for, say at most 40% of grain price increases, then ethanol is responsible for about 8% (40% of 20%) of recent US food price increases. But ethanol would be responsible for a larger portion of final food price increases in food-insecure areas of the world.

Grain Prices Affect the Poor Much More Than the Rich

As previously suggested, the poorest countries of the world suffer from high grain prices much more than the U.S. Table 4 shows some calculations that illustrate this.

Table 4. Effects of grain price increases on US vs third-world consumers

	USA	world's most food insecure
grain as % of all food	5%	30%
food as % of income	10%	70%
grain as % of income	0.50%	21%
income equivalent of a grain price increase of: 100%	0.50%	21%

Sources: USDA(b), Ahmed.

The value of grain in US consumers' expenditures constitutes only about one-half of one percent of consumer income, while in food insecure countries it may constitute 20% or more of total consumer income. Thus a doubling of grain prices can absolutely devastate

families in poor countries and put them at the edge of starvation, even though it constitutes a barely-noticeable inconvenience to most families in the U.S.

If U.S. ethanol is responsible for as much as 40% of grain price increases, simple cost pass-through reasoning indicates that ethanol may be responsible for as much as 12% (40% of 30%) of food price increases in food-insecure areas.

Conclusions

This has been a preliminary evaluation of the effects of the U.S. ethanol industry on food prices. The evidence available suggests that the ethanol industry alone is responsible for perhaps 30-40% of the increase in grain prices over the past two years, while these high grain prices themselves are responsible for no more than a 4% increase in U.S. food prices. This implies that ethanol is responsible for a 1-2% rise in US food prices. On the other hand, the high grain prices are very much related to food prices in poorer countries where direct grain purchases are a much higher portion of the food bill, and similar reasoning suggests that US ethanol may be responsible for a 12-15% increase in food price in those areas.

The evidence regarding the effect of ethanol on grain prices comes partly from several economic modeling efforts indicating that increases in ethanol-based grain consumption of recent magnitudes or greater should have been expected to increase grain prices by less than 30%, rather than the 100-200% that has occurred in the past two years. Further corroboration of this conclusion is the fact that of the increases in world coarse grain usage since 2001, U.S. ethanol is responsible for only about 40%, and of course this usage would be a much smaller fraction of the increase in use of all grains, rather then just coarse grains.

One might object that ethanol uses only corn, and only corn in the U.S., independent of other grains and independent of the rest of the world. It is clear, however, that in this age of globalization, grain prices are set by the world market as a whole, and it is evident from recent production adjustments that all grain prices are closely related, primarily because of their substitutability in production agriculture, but also because of substitutability in consumption.

If ethanol is not responsible for sharp increases in grain and food prices, what is? Hypotheses that have been offered include increasing energy costs in the production and distribution of food, higher demand for food grains because of increasing consumer incomes in China and India, unusually low world production of wheat, and speculative purchasing (acquisition of quantities to store for future use in case prices continue to climb.) Additional effort is required to examine the impact of these various factors.

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