SAFEGUARDING FOOD SECURITY IN VOLATILE GLOBAL MARKETS

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Chapter 23

Addressing the biofuels problem: food security options for agricultural feedstocks[1]

Brian Wright[2]

The recent history of grain markets is not the result of carefully planned public policy for agriculture, energy or the environment. Rather, it reflects the direct and indirect outcomes of errors of premature commitment to incompletely verified science-based initiatives for environmental protection and control of climate change, combined with lack of long-run commitment to necessary conservation. In science and environmental protection policy, the United States of America has continually failed to exploit opportunities to substantially reduce dependence on foreign oil supplies and to push for global collaboration on reduction of greenhouse gases, and the economics profession has offered confused analytical responses. These failures created an opportunity for United States of America farmers to co-opt supporters of green and secure energy supplies and establish a new higher level of grain price support, beyond the dreams of farm bill negotiators and currently unconstrained by World Trade Organization (WTO) disciplines.

First-generation biofuels increase the average cost of food consumption on the global market. Although many in the development community complained for decades that low global grain prices hurt the poor, the main negative effects were borne by farmers who produced, or could have produced, a significant surplus above subsistence. But the most desperately poor are not such commercial farmers; they are typically landless, and higher food prices have the greatest proportional negative effect on them, because they spend the highest share of income on food. Expansion of biofuels that is unpredicted, or so rapid that it outpaces the ability of the economy to accommodate it, increases the threat of further price spikes in response to an incompletely predictable demand shift. Such spikes undermine the well-being, and even the lives of those poor grain consumers in developing countries, whether exporters or importers, who are exposed to world grain price fluctuations, and threatens to destabilize their governments. This chapter explores how bio-fuels derived from staple foodstuffs, or from plants that compete with resources used to produce foods, pose a serious threat to the food security of the world's poor, and proposes measures that allow the diversion of agricultural feedstocks from biofuel production into the food chain in times of acute need.

1 This chapter is based on Wright (2010).

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Background

The production of biofuels has increased dramatically over the last decade, mainly in response to generous government mandates and subsidies, supported by import tariffs on cheaper supplies that would otherwise be available from overseas. The decision by United States of America authorities in 2007 to double the annual maize-based ethanol mandate from 7.5 to 15 billion gallons by 2015 set maize demand on a predictable, sharply upward trajectory over the following three years. This caused a squeeze on maize supplies available for feed and food. Substitution of wheat for maize in feed, and rice for maize and wheat as food, sent the globally available stocks of calories from the three major grains sharply down towards minimal levels necessary for efficient supply chain operation.

Without the cushion of discretionary stocks, the market for grain calories was especially vulnerable to what would otherwise have been modest global market disturbances. In 2008, the unprecedented extension of an Australian drought and other disturbances induced a spike in price of major grains in 2008, severely exacerbated by panic of importer and exporter governments intimidated by the outcries of their politically powerful urban consumers. Key exporter governments banned or taxed their exports. Their withdrawal from the global market place raised prices further, and increased domestic consumer pressure on other exporters to do likewise. Importers reduced tariffs, increased subsidies or relaxed quotas on grain imports, boosting demand and reinforcing international price jumps. In the international market for the major grains, there was a scramble by importer governments to move all the grain still available to the global marketplace behind their own borders. The panic level rose as suppliers of grain available for import became increasingly scarce. Prices paid by poor countries for their imported grain supplies surged, playing havoc with budgets of nations committed to insulating their consumers from price variation, or directly reducing the welfare of consumers forced to pay more, or cut back on consumption.

In mid-2008, real grain prices fell rather abruptly, but remained above pre-2007 levels, rather than following the downward trends established over most of the twentieth century, as reflected in the FAO Food Price Index. In mid-2010, drought and fires in Russia's wheat growing regions and a subsequent Russian announcement of an export ban, sent wheat prices gyrating. In early October, a United States Department of Agriculture (USDA) maize stocks report sent maize prices down one week, but a week later an unexpectedly low harvest report caused jumps in the prices of maize, wheat and soybeans. The market now expects sustained upward pressure on grain prices in the global marketplace. Prices will also be highly vulnerable to price jumps induced by unexpected demand or supply shocks, despite one of the highest aggregate grain harvests yet achieved.

Maize ethanol, and to a lesser extent biodiesel, is set on a path that is reducing the net economic contribution of the agricultural sector to the United States of America economy, destabilizing global food markets and threatening the security of all food consumers exposed to global markets. We have come so far down this path without a course correction for two main reasons. First, environmental economists and environmental scientists have been too slow to appreciate the weakness of the argument that maize bioethanol efficiently reduces global warming. For too long, economists focused on the direct effect on greenhouse gas emissions of substituting biofuel for petroleum as a essential transportation input in reducing greenhouse gases, while ignoring the indirect effects on emissions through changes on intensive margins, including increased chemical and water use and on the extensive margin through land use changes. It took a lawyer, Tim Searchinger (Searchinger & Heimlich, 2008),

to draw attention to our profession of the perils of an excessively narrow conception of market responses in the presence of market externalities.[3]

Second, economists have as a group been confused and confusing about the effect of bioethanol on grain prices. As in the first case, the failure was largely conceptual, a failure to comprehend the full range of relevant market interactions. For example, one study does not include biofuel demand among three possible causes of recent declines in grain stocks.

Similarly, economists have failed to reach a consensus on the effects of biofuels on food and feed markets. This is due in part to the relatively underdeveloped state of the economics of the behaviour of markets for storable commodities. Until very recently, reports of failure of empirical applications of the most promising type of storage arbitrage model, pioneered by Gustafson (1958), have hardly encouraged researchers to pay more attention to this issue. In a series of papers by Deaton & Laroque (1992), Deaton & Laroque (1995) and Deaton & Laroque (1996) made a persuasive empirical case for the proposition that storage arbitrage is incapable of explaining correlation in prices.[4] Empirical models used for policy analysis do not include tested and validated econometric models of storage behaviour because none has been available. In the absence of a well-accepted, empirically supported theoretical model, well-respected economists have identified a variety of drivers of recent price spikes, from low interest rates[5] to fertilizer prices to demand surges in China and India.[6] Several argued that the spikes are induced by financial inflows into commodity markets[7], without explaining how those financial flows could have reduced consumption and increased stocks, a necessary condition for the argument to hold.[8] In fact, aggregate stocks of calories in the major grains, wheat, maize and rice, available to the global market, were at minimal levels, consistent with the storage model, as observed in previous price spikes.

Economic critiques of unidentified domestic "hoarders" failed to observe that in reality the hoarding was being carried out by China (Mainland), India, Argentina and other potential exporters who had removed their stocks from the world market for domestic political reasons, and by frightened importing governments that had been able to grab a large share of available supplies, and put it behind their own borders. Within the global market, consumers with sufficient cash made runs on supplies of rice in retail stores to ensure their own shelves were stocked (Timmer, 2008).

Indeed, storage has often been neglected by economists. Some have even questioned the role of biofuels as a key element of price spikes on the grounds that the price spikes are not necessarily coincident with the largest market shocks, an argument that implicitly assumes

3 Some have argued that indirect land use effects can be ignored. In an undistorted market, such induced effects are reflected in the prices of inputs and outputs. However, the whole point of the exercise is that the indirect effects on welfare via greenhouse gas emissions are not priced, so the costs of conversion of land at the margin understate the true social costs, generating deadweight losses that are not the usual small "Harberger triangles" but larger rectangles.

4 See Chapter 15 as well as Cafiero et al. (forthcoming) for reconsiderations of the methodology and conclusions of Deaton and Laroque.

5 See Frankel, J. 2008. "Commodity Prices, Again: Are Speculators to Blame?" <http://content.ksg.harvard.edu/blog/jefffrankelsweblog/2008/07/25/commodity-prices-again-are-speculators-to-blame> and Calvo, G. 2008. "Exploding Commodity Prices, Lax Monetary policy and Sovereign Wealth Funds." <http//www.voxeu.org/index.php?q=node/ 1244>.

6 See Chapter 3 and Wright (2011) for a discussion.

7 See Chapter 14 for a discussion.

8 In an interesting exchange with Krugman, Calvo has argued that a bubble can occur without a change in stocks if demand is vertical. But Calvo's argument implies that food price spikes do not reduce consumption. Were that the case, effects of price spikes on the grain consumption of the poor would not be an issue.

grains are non-storable.[9] When a commodity is storable, the same shock in supply or demand can have very different effects on price depending on the availability of stocks.[10]

Farm interests in the United States of America, not similarly confused, have been able to exploit the window of opportunity afforded by analytical confusion of economists and environmentalists to unite their financial and political influence in favour of policy commitments to increased biofuels consumption. They intelligently support studies that defended those commitments, and have endeavoured with demonstrable success to suppress consideration of negative environmental effects, such as those associated with indirect land use, in government intervention in support of biofuels. They are currently striving to divert blame for high grain prices to petroleum producers, implying that high farm costs are causing grain price spikes. Recent large land price rises are one among many pieces of evidence that this argument is implausible. Yet it has support in some recent economic studies (see for example Baffes & Haniotis, 2010).

The dual challenges of biofuels

The expansion of biofuels has had two distinguishable effects. The first is to raise the level of prices by sustained diversion of supplies from food and feed consumption, much like the sustained decline in grain harvests that is feared by scholars of global warming. This happens directly via competition between food and feed users and biofuel users for the same grain, but also indirectly, via substitution of one grain, such as maize diverted to biofuel feedstock from use as food or feed rations, leading to substitution of a food grain, such as wheat, into animal feed. In turn, rice is substituted for wheat in human diets (as happens at the margins in India and Mainland China). Indirect competition also occurs via bids for land for the planting of crops for food, feed and biofuels, including possible future non-food crops such as miscanthus or switchgrass.

The second effect is to make market prices more volatile. In the short- to medium-run, this can happen owing to changes in mandates or subsidies, or changes in trade interventions, that are incompletely anticipated and difficult to accommodate. In the longer run, it will continue to reflect shifts and shocks in energy markets, which have hitherto been transmitted via input costs, which tend to have less abrupt effects, operating as they do via anticipated supply rather than current output, a link which is weakest when prices are spiking and storage is negligible.

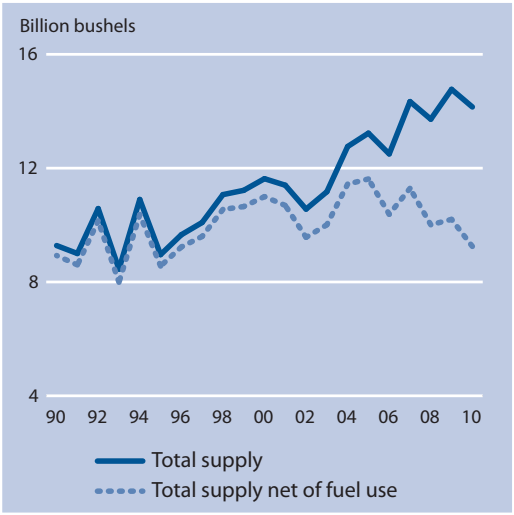
A sustained demand increase owing to large expansion of biofuels mandates and associated biofuels policies is so great that it cannot realistically be accommodated nearly as fast as smaller, less persistent shocks. Yield increases have in the long-term been impressive, but they cannot be expected to continue at more than a few percent per year. The gap caused by biofuels demand is much larger, even after accounting for the feed value of by-products such as distillers' grains (see Figure 23.1).

Diversion to biofuels can be reduced by improvements in biofuel production and processing efficiency. It is possible that current efforts to achieve efficient cellulosic biofuel production will succeed in a decade or two, boosting yields per acre and/or yield of biofuels per ton of harvest. Given great success, land demands to fulfill given mandates could decline, reducing pressure on food supplies and lowering food prices. But if biofuels are shown to be more efficient than expected, two quite different, less happy scenarios might ensue. In

9 See for example Baffes & Haniotis (2010).

10 See Cafiero et al. (2010) for an illustration using an empirical model of the sugar market.

Figure 23.1: US maize supply net of fuel use



Source: USDA, Feed Grain Database, data accessed on 5 February 2011.
Note: Total supply = beginning stocks + production; total supply net fuel use = total supply - fuel use.

one, mandates might be expanded in response to arguments by special interests that they are cheaper than expected, and substitution of food for liquid energy could expand, keeping prices high. Second, biofuels might become competitive with petroleum on a regular basis. In either case, pressure on food prices will increase, not decrease. It is hard to see a good end, from the point of view of food consumers over at least the next decade, to the long-run story of commitment to biofuels.

Maize ethanol and biodiesel have turned out to be ill-advised economic, social and environmental policy. The best policy response now, for those who care about the fate of the world's most vulnerable consumers, would be to reverse commitments to market interventions that favour these biofuels. However, we cannot ignore the possibility, even the likelihood, that current commitments to grain and oilseed biofuels will be maintained and even expanded in countries currently producing them, despite the misgivings of economists and policy analysts. Furthermore, recent reports raise the prospect of the spread of food-based biofuels to South Africa, Uganda, Kenya, the Republic of Mozambique and other developing countries. Prudence dictates that we consider in advance policies that merit consideration that could mitigate the effects of biofuels on shorter term price volatility.

Policies to mitigate effects of biofuels on vulnerable consumers

Flexible mandates

De Gorter & Just (2010), among others, have suggested that mandates be conditioned on prices of food, so that the mandates can be reduced or eliminated if food prices rise beyond some trigger point. This proposal would introduce some flexibility into a rather inflexible

policy. However, reduction of the mandate will not ensure that poor consumers have some protection from competition with energy use of their basic foods when petroleum prices are high enough to support biofuels production in excess of mandated levels.

Variable subsidies

Tyner (2008) has suggested that if the blending wall were shifted so that it does not bind policy in the United States of America, a variable subsidy on ethanol would be superior to the current fixed subsidy of USD 0.45 per gallon, because it would reduce the incentive for biofuels production when none is needed. Beyond this, however, it provides no protection of poor food consumers who must compete with biofuels producers for food when petroleum prices are high. When prices are low, public funds are being spent to keep biofuel plants running, a very inefficient way to ensure that capacity is maintained when production is uneconomical.

Box 23.1: The WTO and biofuels

WTO subsidy disciplines do not prohibit all subsidies or support to biofuels. Rather, the WTO rules concern themselves with subsidies that have a trade-distorting effect. Although often cited in discussions about the WTO and biofuel subsidies, the green box provisions of the WTO Agreement on Agriculture (AoA) do not provide a broad category sheltering measures on the basis that they offer some environmental benefits.

To qualify as green box support, specific requirements must be met. For example, payments under environmental programmes must be limited to the costs of compliance with the programme. The issue of whether subsidies have been passed on to the benefit of other participants in the biofuel production chain may be particularly relevant in a biofuels context, where subsidies are provided at various stages of the production and use chain.

Attempts to provide assistance by way of decoupled payments are likely to be scrutinized closely, and the requirement that a payment not be related to production will be applied strictly. Importantly, if there is some condition attached to the payment that would have an impact on production – positive or negative – then it is not likely to qualify as a decoupled payment. Many countries have sought to foster domestic production and use of biofuels, raising the prospect of policies that favour domestically sourced biofuels. For this reason, biofuel polices that express a preference for domestic over foreign sourced biofuels raise may present problems as prohibited on local content subsidies. In addition, this review has identified some complex issues that arise from the interaction between trade rules and biofuel subsidies that warrant further examination. These include:

- how ethanol subsidies should be notified under the WTO, in particular the scope of ethanol subsidies that should be properly included in a WTO Member's Agricultural Market Support (AMS) calculation. Given that ethanol is an agricultural product, it is conceivable that some subsidies to ethanol producers are provided in favour of the producer of the basic agricultural feedstock and thus should be included in the AMS;
- the multiplicity of biofuel subsidies and other incentives, which can lead to situations where the interaction between two measures has a trade-distorting impact. In such a case, the question arises as to whether the combination of the measures could be an actionable subsidy, where taken individually neither measure would meet the threshold requirements;
- how these biofuels and their feedstocks, such as switchgrass, would be classified for WTO purposes, given the shifting focus of support in many countries to second- and third-generation biofuels.

Source: Harmer (2009).

New WTO disciplines

A recurrent proposal is to have ethanol and biodiesel reclassified by the WTO as fuels rather than agricultural feedstuffs, exposing the sector to more competiveness. As agricultural products they are enmeshed in the tradition of wide-scale subsidization that has hindered world trade and stands as a principal obstacle to resolving the Doha round of world trade talks. Concerning subsidies, WTO member countries can file a case, if a subsidy provides an unfair advantage to another country. But if subsidies and other support measures are classified as part of an official mandated policy, for example environmental programmes, there is no case to answer by another country.

It is clear that both the above mitigation measures have merit, but equally obvious that they will not prevent the poor from suffering when biofuels demand soar. In the next section I propose that option contracts can be useful in attacking this problem directly.

Options to divert grains from biofuel and feed uses in emergencies

Biofuels production is significant in the United States of America, the European Union, Brazil and Argentina and is spreading to other countries in Latin America, as well as to some sub-Saharan African countries. The prospects of oil prices above USD 100 a barrel mean that even in the absence of mandates and subsidies, biofuels production may increase. If the pressure of energy demands on food supplies continues to increase, there will be a serious threat to the food security of the world's poor. I believe, therefore, that serious consideration needs to be given to the establishment of option contracts as "safety valves"– measures that allow the diversion of agricultural feedstocks from biofuel production into the food chain in times of acute need.

Option contracts to protect the poor

These options are of greatest relevance in those countries pursuing or contemplating ambitious biofuels programmes that have large populations vulnerable to food shortages. They may also be important for developing countries with export-oriented animal feeding industries to facilitate the diversion of animal feed supplies to food uses in emergencies. It should be possible, for example, to use options contracts to ensure diversion of some feed grains and oilseeds from use as biofuel feedstocks to domestic use as food distributed to vulnerable consumers during food price spikes, without undue hardship to the generally more prosperous consumers of substantial quantities of energy or meat.

This substitution might be direct, or indirect via substitution of biofuels feedstock for grains fed to animals, and diversion of that grain to human consumption. Governments wishing to protect the food consumption of the most vulnerable could purchase call options on grain from biofuel producers, with appropriate performance guarantees. This could be done by a sealed-bid auction, for example. Diversion could be triggered by specified indicators of food shortages, and the biofuels supplier would commit to making a corresponding reduction in output (rather than substitute other food grain as feedstock).

Delivery specifications could be designed to help ensure the grain will get to where it is expected to be needed in a market emergency. Various combinations of contingent contracts could be used to achieve the same end. As participation would be entirely voluntary, they are no threat to biofuel producers, who by revealed preference gain when they participate. Such contracts offer the additional advantage that they reduce the hazard, often non-negligible, that biofuels producers could have their stocks confiscated by the government or by a mob in

a food crisis, especially if government stability and public security are compromised. These arrangements, like domestic storage, facilitate fast response to domestic food emergencies, and offer freedom from uncertainty about foreign transport availability, timeliness or cost.

Governments might well find diversion option contracts cheaper in the long-run than storage of an equivalent amount of emergency supplies. If acute food supply emergencies are infrequent, the annual cost of the option should be low, relative to the expected cost, including interest on the capital invested in grain, of holding a given level of stocks off the market until the emergency occurs.

For a programme to protect the poor, the grain diversion trigger could, in principle, be related to a measure of the needs of the target population or the declaration of a regional food disaster. If necessary to assure that programme decisions are less subject to manipulation owing to pressure from interested parties, the trigger could be the local grain price. However, the programme is not designed to stabilize the price, but rather to assure the needs of the poor and vulnerable consumers. It is interesting to note that should future research successes mean that production of biofuels becomes dominated by cellulosic feedstocks, such as *miscanthus* or switchgrass, this potential flexibility provided through options could be lost. These second generation feedstocks cannot be economically diverted to food or feed uses to mitigate acute shortages. Reallocation of acreage to produce more food or feed would take too long to be useful in an acute food shortage. In the case of miscanthus, for example, planting is expensive as it involves rhizomes, not seeds, and establishment takes years, so a switch to such perennials is a relatively inflexible commitment.

In developing economies, the objective of the programme should be to protect the food supplies of the most vulnerable; effects on food prices would be a secondary consideration. The establishment of similar safety valve type measures might also be sensible in developed countries pursuing ambitious biofuels policies, in order to safeguard access to agricultural feedstocks for emergency food aid purposes. A larger programme might also serve to lessen pressure on global prices in tight markets, in particular if the country in question is a significant producer and exporter of a particular commodity, as is the case for United States maize production.

Biofuel feedstock diversion in the United States of America?

The United States of America is both the world's largest producer and exporter of maize. It is worth noting that United States maize exports, sizeable as they are, only account for ca. 15 percent of total demand for United States maize. Indeed, one hundred and twenty-five million tons of grain is now used annually for ethanol in the United States of America (Runge & Johnson, 2010). The mandated surge in ethanol consumption in the United States of America has now reached the size where it roughly matches the blending requirements in the United States of America. Ethanol supplies have hit the "blending wall" at which the renewable fuels standards are satisfied. Within two weeks of this conference, the United States Environmental Protection Agency decided to expand the ethanol-blending limit from 10 to 15 percent of gasoline consumption.

As pointed out by the USDA, "this means that prices are largely determined by supply and demand relationships in the market and the rest of the world must adjust to prevailing prices"

The argument for further expanding ethanol or biofuel consumption today is even weaker than the argument behind the 2007 decision. Prior to 2007, the encouragement of ethanol blending as a preferable alternative to the carcinogen Methyl Tert-Butyl Ether

(MTBE) as a pollution-mitigating fuel additive had arguably positive environmental and health effects.

A long-run feature of public policy in the United States of America has been the failure to charge car and truck drivers, and other consumers, the full marginal cost of their energy usage. Drivers do not pay the marginal cost of fuel consumption in terms of decreased safety and increased congestion, let alone the cost of energy dependence, pollution and global warming. Early gains in fuel economy after the oil shocks of the 1970s were not extended in later decades, as the market mix drifted in favour of larger, heavier, more profitable but not necessarily safer vehicles, whose size and configuration made drivers of smaller cars less secure, reinforcing the market drift. The shorter-run policy failure was the mistaken choice of MTBE as a fuel oxygenator designed to reduce atmospheric pollution. When it became widely recognized that the additive was carcinogenic, and reports indicated a threat to drinking water safety, regulators resorted to ethanol as an available and more environmentally friendly substitute. Thus, the United States of America biofuel industry is an accidental outcome of a failure to pursue energy conservation opportunities, a mistaken choice of additive to reduce atmospheric pollution, and an overly optimistic view of the prospects for second-generation biofuels.

Though the large 2007 expansion transformed bioethanol into a serious competitor for grain calories, and introduced energy market fluctuations into the grain market, the case can be made that these consequences were unforeseen by many economists and politicians far beyond the inner circle of the Bush Administration. Nor could the slowness of cellulosic ethanol to emerge as a significant source of biofuels have been perfectly anticipated by scientists or economists. The same case cannot be advanced as convincingly now, in defense of support of expanded bioethanol or biodiesel consumption.

However, biofuels expansion naturally pleases farmers at least in the short-run before land rents completely adjust, because it will raise prices and incomes. It especially favours landlords, agricultural or urban, because it boosts land prices in anticipation of higher future revenue flaws. The powerful constituency behind aggressive biofuels policy includes both groups, along with processors who want to keep their plants working at capacity, suppliers of agricultural inputs, such as fertilizers, machinery, seeds and pesticides and owners of agricultural land. This constituency has the money to support studies claiming that ethanol has no important effect on food availability or prices, and the influence to persuade politicians that mandates should be expanded. This constituency also has staying power as newly wealthy landholders realize their gains, and buyers who pay the expected present value of future gains will have to defend current policy just to prevent capital losses. The possibility that demand for food and feed for biofuels will increase as planned, or even be further boosted by expansion of biofuel mandates faster than currently planned, must be taken seriously in formulation of policy.

The United States decision on facilitating expansion of biofuels commitments by moving the "blending wall" has occurred at a critical juncture for the United States of America and the OECD. Public commitments made now will affect grain markets and grain consumers for years to come. Unfortunately, it is difficult to be optimistic that prudent decisions – decisions that protect public budgets, enhance national efficiency and competitiveness and protect poor food consumers worldwide – will be chosen.

Among those experienced observers of biofuels policy who are not financially committed to either side of the issue, there is an emerging consensus that grain ethanol and biodiesel based oilseeds have turned out to be unwise policy initiatives, scientifically, economically, socially and environmentally, both domestically and internationally. It is important to present

economic analyses that lead to that conclusion as clearly as possible, in the face of highly motivated efforts by special interests to divert attention.

In the current political climate in the United States of America, it appears unlikely that the current rising path of biofuel demand will be abandoned, and highly likely that it will be revised upwards. An options approach for ensuring diversion of agricultural feedstocks away from energy towards food uses could be a useful element of policy in the United States of America. Unlike variable mandates, options contracts would protect consumers not only from shocks to food supplies or changes in biofuels mandates or subsidies, but also from shocks that increase petroleum prices, which have been newly linked to food market demands via the advent of biofuels.

Are these options feasible?

The idea that fixed supply commitments might be improved by options to withdraw supply in specific circumstances is by now familiar in interruptible electricity supply contracts, typically offered by an electric power distributor to industrial users, with a lower supply cost as the incentive. These are imperfect analogies to what is proposed here, because the interruptions are generally brief, minutes or hours, rather than months or years. However, other more similar options, to increase security of water flow to hydropower generators using interruptible irrigation contracts, were discussed decades ago by Hamilton et al. (1989) and McCarl & Parandvash (1988).

Similar options, to secure security of urban water supplies, were evaluated by Michelsen & Young (1993). [11] Farmers or their water districts in effect agree to accept the possibility of interruption of irrigation water by diversion to urban use via "dry year options." Such options have been implemented to protect hydro electricity supplies and urban water supplies in the face of the prospect of a water shortage. For example, in the past decade, dry-year call options were negotiated between the Metropolitan Water District of Southern California (MWD) and Sacramento Valley irrigators at an option price of USD 10 per acre-foot. In 2003 the MWD exercised options at an exercise price of USD 90 per acre foot for transfer to urban consumers of almost 100 000 acre feet of water (Colby & Pittenger, 2006). Irrigators switched to less water intensive crop production to facilitate the transfer.

It is clear that such options can work to protect consumers' access to essential water supplies, protection of endangered species and other urgent or legally mandated requirements. The analogy to food security options to protect the essential food supplies of consumers is clear. As with dry-year water options, success will depend on careful attention to the details of contract design. In particular, the design of the exercise price or other trigger needs careful consideration, and plans to ensure that the food released goes to the most vulnerable, for example via "food for work" programmes, require careful *ex ante* investment of attention and funds.

Conclusion

It is becoming increasingly obvious that use of grain and oilseed for biofuels is of dubious benefit to the environment, uneconomical and a threat to global food security. The best policy would be to reverse the direction of policy and eliminate these ill-considered initiatives. Unfortunately, the policies have created constituencies with the power and financial strength

[11] Some technical issues are addressed in Hansen et al. (2008).

to exercise great influence over policy decisions. If, as is likely, these policies are maintained and even expanded, then their worst effects might be mitigated by food security option agreements similar to those I outline above.

These options are not a universal solution to the food security challenge and the exact nature of such contracts and their implementation would need to be tailored to the needs of specific markets. If designed carefully and implemented before a new, possibly much more serious, grain price spike occurs, such contracts could facilitate a diversion of commodities away from energy use to maintain the consumption of vulnerable populations during times of scarcity. They might also help to reduce pressure on global prices when undertaken by wealthier countries with significant food or feed-based biofuels industries and thus mitigate price hikes. Although the exact impact is debated, experts agree that an ongoing rapid expansion of biofuels from food and feed crops will increase the average cost of food consumption on the global market. In today's climate of high commodity prices, we must bear in mind that the most desperately poor are not the commercial farmers, who might indeed benefit from the effect of biofuels on the prices of what they produce. Those with most to lose are typically landless, and higher food prices have the greatest proportional negative effect on them, because they spend the highest share of income on food. Expansion of biofuels that is unpredicted, or so rapid that it outpaces the ability of the economy to accommodate it, reduces carryover stocks of grains and oilseeds, raises food price levels and increases the threat of further price spikes in response to any unforeseen short-run disturbance. Prudent humanitarian food policy would seek to mitigate the effects of such spikes to the wellbeing of poor grain consumers in affected developing countries, whether exporters or importers. Diversion option contracts for grains used as biofuels feedstocks could be part of such a policy.

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