AGRICULTURAL ECONOMICS

Agricultural Economics 39 (2008) supplement 375–391

Anatomy of a crisis: the causes and consequences of surging food prices

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Received 23 August 2008; received in revised form 19 September 2008; accepted 21 September 2008

Abstract

Although the potential causes and consequences of recent rising international food prices have attracted widespread attention, many existing appraisals are superficial and/or piecemeal. This article attempts to provide a more comprehensive review of these issues based on the best and most recent research, as well as on fresh theoretical and empirical analysis. We first analyze the causes of the current crisis by considering how well standard explanations hold up against relevant economic theory and important stylized facts. Some explanations turn out to hold up much better than others, especially rising oil prices, the depreciation of the U.S. dollar, biofuels demand, and some commodity-specific explanations. We then provide an appraisal of the likely macro- and microeconomic impacts of the crisis on developing countries. We observe a large gap between macro and micro factors, which, when identifying the most vulnerable countries, often point in different directions. We conclude with a brief discussion of what ought to be learned from this crisis.

JEL classification: N50, O11, O12, O13

Keywords: Agricultural policy; Commodity markets; Biofuels

1. Introduction

Since 2003, international prices of a wide range of commodities have surged upward in dramatic fashion, in many cases more than doubling within a few years, in some cases a few months. A surge in the price of food is of special concern to the world's poor. Many impoverished people depend upon food production for their livelihood, and virtually all poor people spend large portions of their household income on food. Sharply rising prices offer few means of substitution and adjustment, especially for the urban poor, and there are justifiable concerns that millions of people may be plunged into poverty by this crisis, and that those who are already poor may suffer still more through increased hunger and malnutrition. Equally grave concerns are felt with respect to the impacts that food and fuel inflation may have on macroeconomic stability and economic growth, given that the first global commodity crisis of 1974 coincided with an end to the "Golden Age" of post-War economic growth. Since the current crisis most likely involves a more persistent rise in commodity prices, there is considerable uncertainty about how well the world economy in general, and developing economies in particular, will be able to effectively respond to these challenges.

The first objective of this article is to provide a comprehensive assessment of the potential causes of recent food price surges. The second objective is to review the potential consequences on the poor, either directly through increased costs of living, or indirectly through changes in macroeconomic conditions. The approach we use is to review the most credible and most recent literature on the issue, although we occasionally augment existing evidence where necessary and feasible (a fuller working paper version of this article provides much of this analysis). We also highlight research questions that remain largely unanswered, and comment briefly upon the central challenges facing policymakers in the midst of the crisis.

2. The causes of the crisis

A wide range of research has attempted to identify which factors might have caused the recent surge in food prices (Abbott et al., 2008; Baltzer et al., 2008; Helbling et al., 2008; Schnepf, 2008; Trostle, 2008; von Braun, 2008), and only one paper to date has attempted to add explicit orders of magnitude to different factors (Mitchell, 2008). In this section we

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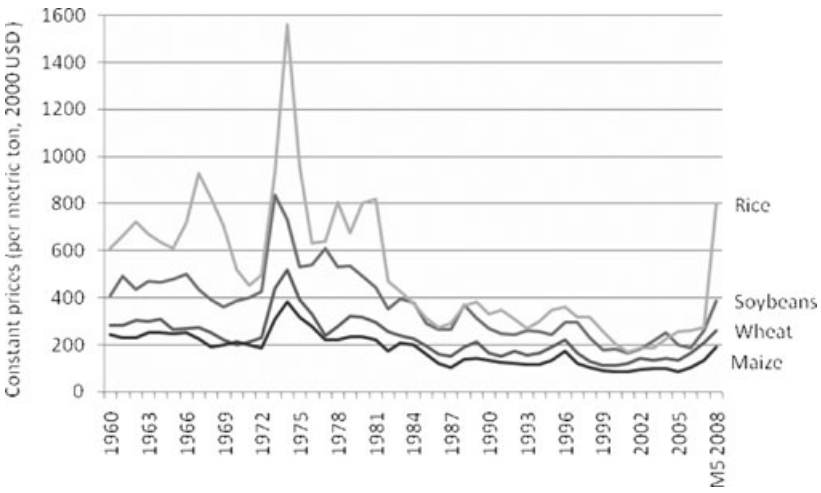
DOI: 10.1111/j.1574-0862.2008.00345.x



Source: IMF (2008b). Data are deflated by the U.S. GDP deflator.

Fig. 1. Trends in real international prices of key cereals: 1960 to May 2008.

review, reassess, and extend the evidence on this issue. The current crisis is a global phenomenon, and one that is regarded by many as a distinct event. This means that some of the usual tools favored by economists for uncovering causality, such as regression analysis, are quite limited in this context. Instead, the most appropriate research on this issue needs to rely on some less formal detective work, involving a mix of economic theory and reasoning, economic history, and rudimentary statistical analysis. Within the latter, the most important questions we must ask are whether individual explanations of the crisis are consistent with the stylized facts of the crisis. What are these facts?

2.1. The stylized facts of surging commodity prices

Fig. 1 presents export price series from 1960 to May of 2008 for four major staples—maize, wheat, soybeans, and rice—as measured in key markets in the United States, and in the case of rice, Thailand (Bangkok). All measures are in U.S. dollars (USD) and are deflated by the U.S. GDP deflator. Table 1 presents some of the same data, but more narrowly examines changes of real prices over particular periods of interest. From these data, we garner the following factors.

First, *the most recent (May 2008) price levels are about as high as they were in the late 1970s or early 1980s, in real terms*. Second, *prices have risen very quickly.* The rise in prices in the current crisis is similarly sharp in percentage terms to the price shocks of 1974 crisis, although somewhat more spread out (also see Table 1). In both crises, rice prices shot up the most (200% in the 1974 crisis, 255% in the most recent crisis), but wheat prices rose very sharply in 1974 (160%), and maize and soybeans both exhibited rapid price increases on the order of 50–90%. Third, *prior to the current price rise the real prices of staple foods were at an all time low after declining for the best part of 30 years*. Whether these long-run trends and the similarities of the 1974 crisis are truly integral components of the current crisis remains to be seen, but we will argue below that there are good grounds to argue that they are.

A fourth stylized fact is that *prices of a wide range of commodities have increased sharply*. The surge in the price of oil is

Table 1
Percentage changes of prices across commodity groups in the 1974 crisis and today (2000 USD)

Commodity	% Change from:		
	1970–1974	2004–2008	01/08–05/08 (% 2004–2008)
Food			
Staple crops	148.4	101.9	61.7 (60%)
Wheat	159.8	81.4	23.6 (29%)
Maize	80.4	88.5	43.1 (49%)
Soybeans	88.0	52.9	47.9 (48%)
Rice (Thailand)	200.6	255.4	191.4 (75%)
Nonstaple crops	159.3	58.3	45.8 (79%)
Meat	24.5	4.5	10.7 (100%)
Beef (Brazil)	n/a	40.2	21.7 (54%)
Seafood	53.0	18.0	−5.7 (0%)
Other agricultural commodities			
Textiles	107.5	5.5	2.3 (42%)
Wood	34.7	13.2	4.5 (34%)
Cash crops	49.4	61.3	17.8 (29%)
Fertilizers	299.4	379.4	200 (53%)
DAP: U.S. GULF*	389.0	369.1	166.0 (45%)
Potash	475.3	381.8	193.5 (51%)
Metals	79.9	119.3	7.9 (6.6%)
Energy			
All energy	274.9	127.3	59.7 (47%)
Petroleum	325.0	182.8	65.7 (36%)
Coal	74.3	81.3	85.8 (100%)
Natural gas	n/a	98.5	38.9 (39%)
General prices			
U.S. GDP deflator	26.0	15.5	4.2 (27%)
USD per SDR	22.4	9.1	2.6 (28%)

Notes: The source is IMF (2008b). All commodity prices are deflated by the U.S. GDP deflator so as to be expressed in constant (2000 USD) terms. *DAP is Di-ammonium Phosphate. The full list of commodities can be found in the appendix.

well known, of course, as is the fact that this was a leading factor in the 1974 food crisis, but all energy prices have recently risen by 80–120%, as have the prices of metals and minerals, and fertilizer prices have roughly quadrupled in both crises. Other agricultural commodities (e.g., cash crops) have not risen anywhere near as quickly, however. These patterns beg the question of whether food-specific factors are driving the surge in food prices, or some other factors that have common effects across these commodity groups, such as increasing energy costs, the depreciation of the USD, growing commodity demand from China and India, or investment portfolio adjustments related to low interest rates and the bursting of the U.S. real estate bubble.

A fifth stylized fact is that *the timing of price rises is somewhat different across commodities, and even across staple foods.* Most of the price rise in wheat and maize occurred prior to 2008, but three-quarters of the increase in the price of rice occurred in 2008. A sixth stylized fact is that *the USD has depreciated against a wide range of currencies*. Against the other SDR currencies (UK pound, Euro, and the Japanese yen), the USD has depreciated some 30% since the start of 2002. Since all of the commodities in Table 1 are expressed in USD, the price increases are much less sharp when measured in Euros, for example, than in USD. The increase in nominal prices of key staples is around 25% less when measured in Euros, somewhat less than that when measured against USDA trade-weighted agricultural exchange index, and roughly the same as the pound and the yen. Some authors also consider USD depreciation to be a causal factor, an issue we take up again below.

In addition to these stylized facts, we might posit one additional criterion that any plausible explanation of the crisis must satisfy: a potential determinant of the crisis must either precede the crisis, or at least distribute its effects contemporaneously to the rise in prices. The implication of this is that a factor that emerged long before the crisis (e.g., 10 years), or only emerged very late in the game (e.g., 2008), would be a significant determinant of price rises.

2.2. Assessing the principal causes of the crisis

Against these stylized facts, let us then consider each of the widely posited explanations of the crisis. These are listed individually in Table 2, which also provides an assessment of the strengths and weaknesses of each explanation. One might also add the hypothesis of a "Perfect storm"—an interaction and conflagration of factors—which we will consider in more detail below.

Our basic conclusions are as follows. First, we more or less unequivocally reject rising demand from China and India as an important cause of the crisis. Many writings on the crisis have specifically referred to changing consumption patterns in China and India, particularly the rapid growth in meat and vegetable consumption. Unfortunately for advocates of this explanation, both India and China have long been self-sufficient in food, including the staple commodities for which international prices have been rising. In fact, China imported less wheat in 2000–2007 (33.8 million metric tons) than it did in the preceding eight years (40.3 million mt), and its rice imports also declined slightly from already low levels (just over 5 million mt). Indian imports of wheat and corn have also been negligible, and India is generally a net exporter of rice. If there is a China–India story, it is through very indirect channels by which these countries have influenced demand for oil (IEA, 2007) and global trends in stocks (see below). Also, the one agricultural commodity group for which China and India have sizably increased their demand is oilseeds, but this "surge" began in the mid 1990s, rather than recently. We do know that increased oilseeds demand from Asia had some effect on global markets—soybean imports within the developing world rose from 20.4 to 33.5 million tons from the mid-1990s to the present, a trend that contributed to U.S. farmers increasing soybean production area by over 11 million hectares—but we estimate that grain production in the United States would only have been 3% higher today than if this switch had not been made.[1] Moreover, it seems unlikely that rising soybean demand from the early- to mid-1990s is likely to explain a sudden and largely unforeseen price shock 10 years later. In fact, China and India's steadily growing demand may provide a unique opportunity for many of the developing world's smallholders to increase their production and incomes (Obwona and Chirwa, 2006).

Another factor we are less than convinced by is speculation in financial markets, an explanation widely discussed but poorly understood and only superficially researched. However, a recent Conference Board of Canada working paper on this issue provides an authoritative review of the issue (CBC, 2008). One of the principal reasons for concern over futures markets is that their emergence has brought the increasing participation of "noncommercial" participants in agricultural markets, or speculators.[2] However, causal linkages between futures and spot prices are unclear. Part of the recent comovements between rising spot prices and rising futures prices has

[1] This is a simple back-of-the-envelope calculation. If new areas of U.S. farmland devoted to soybeans since 1994 had been used for corn, and those areas followed yield growth of the actual areas of land used for corn, then corn production today would be 3% higher. However, this shock is very small in comparison to the reduction in corn food supply from increased biofuels demand.

[2] The U.S. Commodity Futures Trading Commission (CFTC) has gradually loosened the rules over who may trade in agricultural futures markets to the point that by 2008, index funds, for example, accounted for about 40% of the futures contract trading in wheat. Nontraditional participants can now speculate on food price trends since the value of a futures contract varies in relationship to the commodity prices in the current spot market, much as bond prices vary in response to changing interest rates. The further in time the futures contracts are, the more they are likely to reflect *expectations* of future prices as opposed to the actual prices that exist today. This affords speculators an opportunity to bet on futures contracts as a separate asset class quite apart from the spot prices of agricultural commodities in today's market.

Table 2
Explanations of the 2005–2008 global food crisis, and their strengths and weaknesses

Explanation	Strengths	Weaknesses
Growth in demand from China and India	Partly explains rising oil prices, partly explains demand for oilseeds.	China and India are self-sufficient in most major grains, but have not increased imports of any staple foods.
Financial market speculation	Increased financial market activity coincides with rise in prices.	Higher prices induce speculation, so causality argument is weak; no clear evidence yet of causal link.
Hoarding: export restrictions	Price rises for rice were preceded by export restrictions by countries that account for 40% of global rice exports.	Wheat, maize, and soybean price rises generally preceded restrictions; biggest players did not impose restrictions
Weather shocks	Australian wheat production 50–60% below trend growth rates in 2005 and 2006; there were also moderately poor harvests in United States, Russia, and Ukraine.	Only explains wheat prices; production shocks of this magnitude are common in international wheat markets, and in Australia over the last 15–20 years.
Productivity slowdown	Production and yield growth of rice, wheat and maize has slowed down over the last 20 years or so.	Productivity slowed, but it is not clear that demand outpaced supply over this time period.
Low interest rates	Low interest rates ought to increase demand for storable commodities, increase stocks, and shift investors from treasury bills to commodity contracts.	Stocks/inventories of gold and oil are reasonably high, but stocks of staples are low; no clear evidence that futures markets are affecting spot prices (see above).
Depreciation of the USD	Real agricultural trade-weighted index for United States depreciated 22% over 2002–2007; USD and commodity prices are covariate.	No critical weaknesses; Mitchell (2008) calculates that this factor probably increased dollar-denominated prices by 20%.
Rising oil prices	Have risen sharply and somewhat preceded food prices; large component of production and transport costs, especially in wheat and corn production.	No critical weaknesses, although some authors expect the effects of rising oil prices on food prices to be more delayed and to have a larger impact via biofuels demand.
Biofuels demand	Has surged since 2003, and consumed 25% of U.S. corn crop in 2007; two-thirds of global maize exports are from United States.	Strong for corn, less so for wheat, although substitution effects could account for rise in other products.
Decline of stocks	Low stocks are traditionally associated with increased sensitivity to shocks; stocks of all major cereals declined prior to the price surge.	Netting out China makes the decline in stocks less dramatic. Unless stock declines result from policies, declines only represent the effects of other factors.

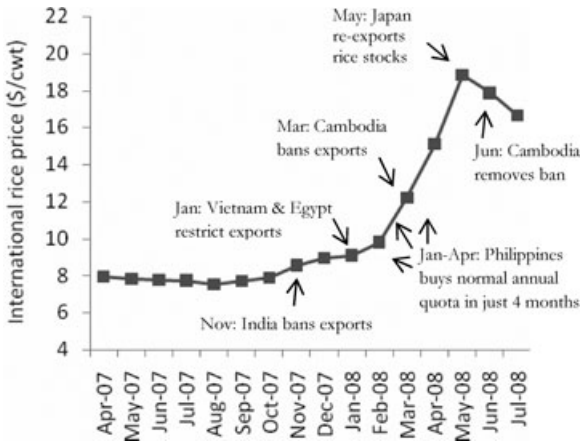
Source: Authors' construction.

to do with the fact that financial speculation through securitization is most profitable when there is substantial volatility in the underlying markets: when markets are in turmoil, expectations of future prices may vary considerably (CBC, 2008). This suggests that speculation may be more a symptom of underlying volatility than a cause of that volatility. Also, many of the charges made against financial markets relate to their efficient function more than their effect on spot prices *per se*.[3]

Finally, what evidence there is of impacts on spot prices is largely anecdotal, and again, rarely indicative of causality. The contract price volatilities of corn and wheat futures price indexes have increased from 19.7% and 22.2% since 1980 to 28.8% and 31.4% in 2006–2007, respectively (Schnepf, 2008), and both the price level and volatility for most agricultural commodities have continued to rise in 2008. However, a study of the emerging lack of convergence between cash and futures prices has not identified any significant causal factor (Irwin et al., 2007). Other analysts have suggested that agricultural commodity markets are now playing a role traditionally reserved for gold and other precious metals—a safe haven for investors—but data from the U.S. Commodity Futures Trading Commission (CFTC) suggest that the balance between long (noncommercial) and short (commercial) positions has been more or less maintained. Another charge is that securitized foods have experienced more price volatility than nonsecuritized foods (van Ark, 2008). Yet several nonsecuritized foods have indeed experienced rapid price increases,[4] and the fact that the securitized commodities may have been selected for futures markets precisely because of some distinguishing characteristics—for example, rising or less elastic demand, greater volatility, larger U.S. production—suggests that simple comparisons of securitized and nonsecuritized futures prices may not be valid in any case. In summary, we conclude that although futures markets may have exacerbated the volatility in agricultural markets, they

[3] Since 2006 the convergence between futures contracts and spot prices has been incomplete, perhaps indicating that the price discovery mechanism of futures markets has been compromised by speculative activity. Second, hedging against risk may become more complex for producers if the futures market is driven less by agricultural fundamentals of supply and demand and more by the speculative activity of uninformed noncommercial investors. Third, since futures contract market participants are required to sustain a maintenance margin of around 75% of the initial margin position, speculation and exaggerated reaction to markets news ("animal spirits") could induce excessive volatility in the market, which could lead to margin calls that significantly impinge on the working capital of smaller agricultural players.

[4] For example, some nonsecuritized commodities have experienced considerable prices increases, including rubber, onions, and wide range of metal and energy commodities (coal, iron ore, minor metals, steel) (Gilbert, 2008).



Source: Price data are from USDA (2008d).

Fig. 2. The effect of export restrictions on rice prices.

are unlikely to be a leading cause of the overall price surge, since there is little evidence that these markets significantly influence "real" supply and demand factors.

Next are a series of commodity-specific factors that probably played some role in increasing the prices of the three or four commodities in question (rice, wheat, maize, soybeans). For rice, in particular, export restrictions are a very compelling explanation because of the number of important exporting countries that imposed restrictions, and because rice is much more thinly traded relative to other staples, with only around 7% of global production being traded over the last five years (USDA, 2008c).[5] Looking more closely at the timing of export restrictions and rice price increases is also suggestive of causality (Fig. 2). From August 2005 until November 2007 rice prices increased steadily but significantly, by about 50% (in real terms) from an all time trough in 2005. In November of 2007 India imposed the first major export restriction, perhaps because India has not keep large stocks relative to its high levels of consumption and volatile production patterns. In any event this appears to have been the turning point for rice prices. From November 2007 to May 2008 rice prices increased by 140%, despite production reaching an all time high in 2007, the complete absence of any significant increase in demand, and fairly stable rice stocks, with the exception of nontrading China. In early 2008, panic ensued as the rise in other commodity prices began to attract much more concern in Asian markets. This prompted further export restrictions from Vietnam, Cambodia, and Egypt, and precautionary rice purchases by the Philippines, which imported 1.3 million tons of rice in just the first four months of 2008 (an amount that exceeded their entire import bill of 2007). This surge continued until May when Japan released 200,000 tons of rice to the Philippines, partly as a result of work by Slayton and Timmer (2008). Prices fell almost immediately. This was followed by further price declines after Cambodia lifted its export ban in June. Hence, it appears that the remarkable and very costly surge in rice prices in 2008 was largely due to the reactions of traders to export restrictions and hoarding by a number of important players in what was already an unusually thin market. Similar outcomes were observed in the 1974 crisis as a result of export restrictions on soybeans, wheat, rice, and fertilizers. The tragedy of these restrictions is that they effectively sacrifice international price stability for the sake of domestic price stability, as Johnson (1975) noted after the 1974 crisis.

Weather shocks offer another commodity-specific explanation of price rises, the commodity in question being wheat. Most spectacularly, Australian wheat production in 2006 was 50–60% below trend growth rates in two successive years (2005–2006). The United States also experienced a poor harvest, some 14% lower than the previous year, and there were more modest declines in Russian and Ukrainian production. But a closer inspection of the data suggests that this intuitively attractive explanation is not as convincing as it first appears. The main problem is that annual production shortfalls are a normal occurrence in agricultural production and in wheat production in particular. Global wheat production declined by 5% in 2006/2007, but it also declined by 11% in 2000/2001 and 6% in 1993/1994. The U.S. wheat production fell by bigger margins in 1991/1992 (27%), 2001/2002 (13%), and 2002/2003 (18%), and a closer inspection of Australia's wheat production since 1990 shows a number of other years when harvests were well below trend: 51% in 2002, and three years from 1993 to 1995 when the shortfalls varied from 50% to 100%. Moreover, declines in output in several countries in 2007 were offset by large crops in Argentina, Kazakhstan, Russia, and the United States, whose wheat exports increased by around 13% (or an additional 7.5 million mt) from 2006. So overall, global grain production did decline by 1.3% in 2006, but it then increased 4.7% in 2007. At best, then, these rather minimal shocks must have significantly interacted with other events, such as much lower buffer stocks (see below) or increased market sensitivity. But in that case the deeper causes ultimately lie elsewhere, not in the vagaries of the weather.

For maize, some oilseeds, and soybeans, increased biofuels production offers a strong explanation of rapidly increasing prices across a number of different commodities, especially once one considers substitution effects. Once oil prices top $60 a barrel biofuels became substantially more competitive against oil, such that it is the surge in oil prices that appears to have prompted the surge in biofuels demand (Schmidhuber, 2006). Moreover, most analyses to date conclude that diversion of the U.S. corn crop is the largest source of biofuels demand and the largest demand-induced price pressure (Abbott et al., 2008;

[5] Export bans for other commodities probably also made matters worse (e.g., soybeans in Argentina, wheat in Kazakhstan), but prices of these commodities had already risen significantly before the bans were in place, and the largest producers of other important grains did not engage in export bans. Moreover, whereas only about 7% of rice production is traded, over 12% of corn production is traded, and over 18% of wheat production is traded, so markets for these commodities are much thicker.

Mitchell, 2008; Schnepf, 2008; von Braun et al., 2008). This is because: (a) the use of maize for ethanol grew especially rapidly from 2004 to 2007, such that the ethanol industry used 70% of the increase in global maize production over that period; (b) the United States is the largest producer of ethanol from maize and is expected to use about 81 million tons for ethanol in the 2007/2008 crop year (USDA, 2008a); (c) the U.S. accounts for about one-third of global maize production and two-thirds of global exports (Mitchell, 2008); (d) European biofuel production is more concentrated on biodiesels that use about 7% of global vegetable oil supplies for biodiesel (amounting to about one-third of the increase in vegetable oil consumption from 2004 to 2007); and (e) biofuel production in other parts of the world is either relatively small, or uses different crops (e.g., sugarcane in Brazil), which have not experienced price surges. As for impacts, increased maize production (and to a lesser extent oilseed production) has had strong knock-on effects to other foods. In the United States, rapid expansion of maize area by 23% in 2007 resulted in a 16% decline in soybean area, which reduced soybean production and contributed to the 75% rise in soybean prices from April 2007 to April 2008 (Mitchell, 2008). In Europe, other oilseeds displaced wheat for the same reason. Another knock-on effect of significant concern is that biofuels have contributed to substantially depleting grain stocks, especially in the United States (see Fig. 4 in Helbling et al., 2008).[6]

A range of more formal modeling exercises also suggest significant impacts of biofuels on grain prices, even though these simulations vary substantially in terms of time periods considered, prices used (export, import, wholesale, retail), coverage of food products, the currency in which prices are expressed, and whether prices are real or nominal (Schnepf, 2008).[7] The more rigorous methodologies suggest that biofuels accounts for 60–70% of the increase in corn prices and maybe 40% of soybean price increases (Collins, 2008; Lipsky, 2008), while Rosegrant et al. (2008) find that the long-term impact of accelerated biofuel production on maize prices is about 47%. This model also finds strong substitution effects on wheat and rice price, with price increases of 26% and 25%, respectively (using Schnepf's conversion from the real price estimates of the model), which is of a similar order of magnitude to results from the World Bank's linkages model (World Bank, 2008).[8] So biofuels holds some distinction in that it strongly accounts for maize prices, in particular, but can also explain price rises in other staples (although doubts have been expressed about how realistic these sizeable substation effects are; see Abbott et al., 2008).

The remaining explanations—oil prices, global macroeconomic phenomena, and declining stocks—are even less crop-specific. Relative to its output, agriculture does not use that much energy, but several facts suggest oil probably has a large impact on the costs of agricultural production (see Table 3, and Appendix A in Headey and Fan, 2008). First, the energy used in agricultural production is mostly oil-related, and oil prices have risen faster than prices of other energy sources (Table 1). Moreover, U.S. food production—which dominates world food production and export markets—is especially oil-intensive. Second, oil prices affect the prices of fertilizers, as well as other chemicals used in crop production. For wheat and corn, fertilizer prices alone account for over a third of total operating costs and 15–20% of total costs. Factoring in rising costs of fuel, fertilizers, and other oil-related farm productions, we estimate that oil prices increased the costs of U.S. production of corn, wheat, and soybeans by 30–40% over 2001–2007 relative to a baseline scenario in which oil-related prices only increased by the inflation of the U.S. GDP deflator (Table 3).[9] These fuel-based cost increases are about 8% of corn price increases, 11% of soybean price increases, and about 20% of wheat price increases. Finally, oil prices also affect transport costs, such that the margin between domestic and export prices has added as much as 10.2% to the export prices of corn and wheat (Mitchell, 2008). Hence, the combined increase in production and transport costs for the major U.S. food commodities—corn, soybeans, and wheat—could account for 20–30% of the increase in U.S. export prices (Mitchell, 2008).[10]

A second commodity-wide explanation of surging prices is the depreciation of the USD over the last six years, especially against the Euro. The depreciation of the USD can clearly account for the rise in dollar-denominated food prices in an arithmetical sense, cutting off 20–30% of the nominal dollar increase in the case of conversion from USD to Euros. But as Abbott et al. (2008) discuss, when the dollar weakens, agricultural

[6] Mitchell estimates that had vegetable oil areas for biodiesel been used for wheat production then European wheat stocks would have been almost as large in 2007 as they were in 2001, rather than lower by almost half (although it is not clear that in the absence of biofuel production farmers would increase harvest areas devoted to wheat).

[7] General equilibrium models generate long-term price impacts resulting from specific shocks by factoring in interactions between markets, but their ability to capture short-term price dynamics is highly constrained. Conversely, detailed studies of specific crops may include the short-term dynamics, but often exclude the impact on other markets. There are also issues as to whether shocks are considered to be independent (Schnepf, 2008).

[8] The role of biofuel policies is beyond the scope of this review, but readers are referred to reviews by Schnepf (2008) and Abbott et al. (2008). The latter also offers a critical appraisal of some of these simulations, but even so, shocks of this magnitude are a compelling explanation of rapid price rises in several commodities, and reasonably significant substitution effects across others.

[9] Mitchell (2008) uses different assumptions to find that the production-weighted average increase in the cost of production due to these energy-intensive inputs for maize, wheat, and soybeans was 11.5% between 2002 and 2007. However, he deflates yields by 2002, which was a poor harvest in the United States, and does not distinguish between total costs. See Headey and Fan (2008).

[10] Of course, these are not very sophisticated estimates as they do not utilize supply and demand elasticities, which influence the degree to which increased production costs affect supply responses and market prices.

Table 3
The estimated impact of fuel-related costs on U.S. farming costs, 2001–2007

	Corn	Soybeans	Wheat
(1) Yield gap, 2001–2007	0.9	0.9	1.0
(2) Projected costs in 2007 with 2001 cost levels extrapolated to 2007 via the U.S. GDP deflator	325.1	225.6	180.1
(3) Actual total costs in 2007	453.5	295.4	235.7
(4) Difference = (3) − (2)	39.5	30.9	30.9
(5) Difference deflated by yield growth = (4) × (1)	35.5	27.8	27.8
(6) Percentage change in prices received by farmers*	132.6	99.0	101.7
(7) Oil-related cost increase as percentage of total price increase paid to farmers = (5)/(6)	8.0	11.0	20.3

Notes: Authors' calculations from USDA (USDA, 2008b) data.
*The percentage change in prices uses actual prices received by farmers for 2000/2001, and actual prices received by farmers in 2006 multiplied by the percentage change in U.S. export prices, since actual prices received by farmers in 2007 are not yet available. If farmers received less than the full U.S. export price change from 2006 to 2007, then row (7) is underestimated.

exports (particularly grain and oilseeds) also increase, *ceteris paribus*. Using USDA's agricultural trade-weighted index of real foreign currency per unit of deflated dollars, Abbott et al find that from 2002 to 2007 the dollar depreciated 22%, and the value of agricultural exports increased 54%. Assuming that the United States is a large country in international agricultural markets—which it certainly is in wheat, corn, and soybeans—depreciation of the USD should lead to higher prices in the United States, but lower prices in the rest of the world. Previous research has indicated that a depreciation of the dollar increases dollar-denominated commodity prices with an elasticity of between 0.5 and 1.0 (Gilbert, 1989). Mitchell (2008) therefore calculates that the depreciation of the dollar has increased food prices by around 20%, assuming an elasticity of 0.75. Abbott et al. (2008) also show that in the current crisis the divergence between the dollar and many (but not all) other currencies is quite stark compared to previous increases in nominal dollar-denominated food price increases (e.g., 1995/1996).

Another theory that has been advanced in some quarters is that low real interest rates, especially in the United States, have caused a general price increase in a wide range of commodities (for a discussion of the theory, see Frankel, 1984).[11] Low interest rates increase the demand for storable commodities, increase firms' desire to carry inventories, and encourage speculators to shift out of treasury bills and into commodity contracts. All three mechanisms work to increase the market price of commodities, in what is often known as "carry trade." How consistent this explanation is with the evidence is questionable, however. One inconsistency is that agricultural inventories are not high, but low (see the discussion below). Moreover, the diversion of assets from treasury bills and the like to commodities may have influenced agricultural futures prices, but as we noted above, the jury is still out as to whether that constitutes a substantial effect on spot prices.

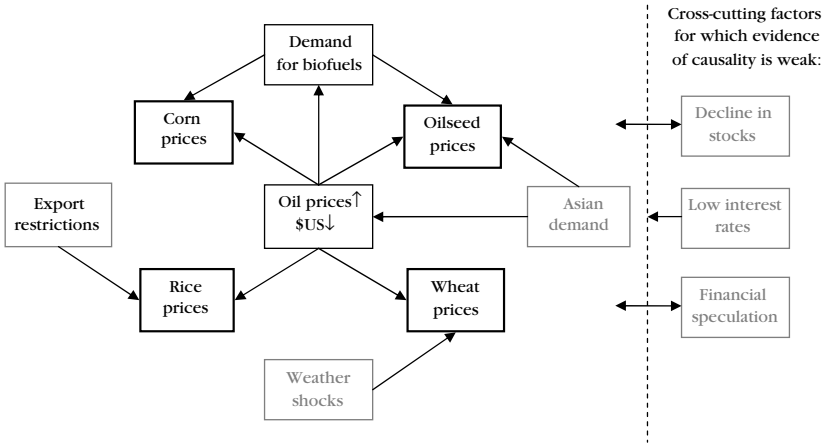
What about the decline in stocks, then, which influence price volatility by determining the stability of supply? This might constitute a crop-specific explanation, but it so happens that stocks have declined for maize, wheat, and rice, often below the FAO (1983) benchmark of 17–18% of total consumption that is predicted to substantially stabilize prices and consumption (see Table A1 in our Appendix).[12] So recent data and strong historical covariance between prices and stocks superficially suggest that stock declines could substantially account for recent price movements. However, there are some significant caveats to this conclusion. Most importantly, declining stocks might simply reflect increased demand or reduced production levels. Biofuels offer a promising explanation of declines in maize stocks (see above), and bad weather, stagnating production growth, and low prices seem to account for the almost pervasive decline in wheat stocks (although unexpectedly, wheat stocks have risen in Australia). For the stocks story to be causally interesting there must therefore be a role for exogenous policy decisions, or other forces, to have reduced stocks.

Three such explanations are possible. First, it may be that stocks were so high prior to 2000, and prices so low, that there appeared to be a need to reduce stocks. Second, the increasing use of just-in-time inventory systems may have led to lower stocks. These two explanations are plausible but generally difficult to prove. One exception is the explicit policy decision made by China to reduce stocks of major cereals, which were inefficiently high in the 1990s. But why China's stocks should have had any direct effect on international prices is difficult to fathom (unless market actors irrationally took heed of these declines), since China is self-sufficient in major grains. Indeed, netting out China from global stocks trends turns out to be very important (see Table A1). World stocks for maize, for example, declined from 26% of usage over 1990–2000 to just 14% of consumption from 2005 to 2008, but excluding China from the global figures suggests that world stocks remained the same over the two periods, at just 12%. Nevertheless, a large number of major producing and exporting countries did incur substantial stock declines in recent years.

All in all, our conclusion is that stock declines are consistent with rising prices, but are not as causally convincing as they appear at first glance, partly because they are a symptom of

[11] Frankel is also the main proponent of this theory as an explanation of the current crisis. Several discussions can be found on his website at: http://content.ksg.harvard.edu/blog/jeff_frankels_weblog/

[12] However, one clearly needs to distinguish between optimal stocks for countries that predominantly consume staples, and countries that predominantly export staples. The latter type of country generally has little interest in keeping reserves in excess of the "carryover" stocks designed to ensure steady supply of staples to its export destinations.



Notes: Authors' construction. Boxes in gray denote weaker, crop-specific causes. The decline of the USD and the rise in oil prices are shown together because they are both universal factors, and because they may be causally related to each other.

Fig. 3. A summary model of the principal causes of the crisis: a near-perfect storm.

deeper causes, and partly because what effects they do have on prices are enacted through interactions with other factors (e.g., exacerbating shocks). It is also possible that excessively high stocks in the 1990s (and before the 1974 crisis) were actually an underlying cause of the crisis: the use of stocks to satisfy increasing demand may have delayed price rises that would otherwise have provided a stronger signal of rising demand. A policy implication of this is that it is not altogether clear that increasing stocks once more would prevent further food crises.

2.3. A simple model of the 2005–2008 food crisis

The analysis above indicates that some of the proposed explanations of the food crisis are more convincing than others. Two or three factors offer convincing commodity-wide explanations of rising prices, although declining stocks, low interest rates, and financial speculation are less well documented and less theoretically convincing than oil prices, depreciation of the USD, and biofuels. In addition, several explanations offer commodity-specific explanations, although these too vary between the highly convincing (export restrictions on rice) to somewhat less convincing explanations (weather shocks). There are, moreover, some complex interactions between these factors that generally reinforce each other, in what the director of the WFP has called "a perfect storm." We therefore conclude this section by outlining a model that we believe broadly captures the main causal mechanisms of the current crisis (Fig. 3).

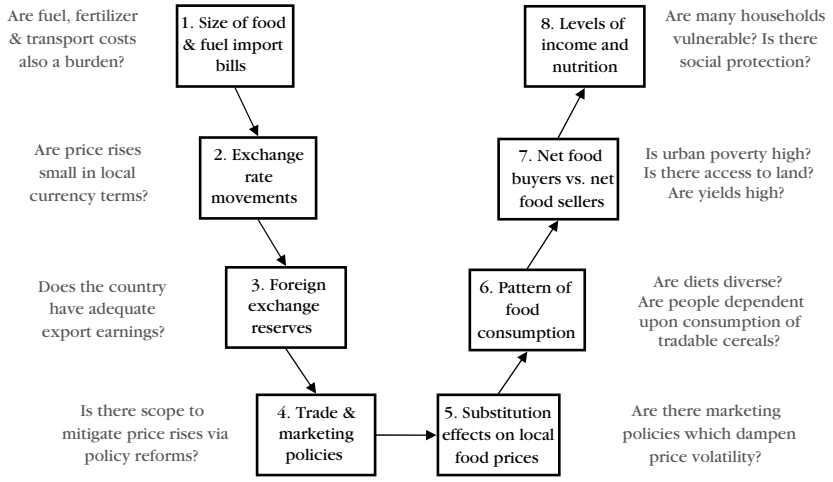
3. The consequences of the crisis

A number of factors—food riots, export restrictions, dependency on food imports, the persistency of food, and oil price rises—suggest that the recent surge in food prices will have a severe impact on the poorer populations of the world, perhaps even throwing more than 100 million people into poverty (Ivanic and Martin, 2008; World Bank, 2008). These predictions, however, require closer examination, and often significant qualification. The group most vulnerable to rising food prices is generally the urban poor, but this group is also far more vociferous than the rural poor (Bezemer and Headey, 2008). Thus, protests may be evidence of suffering, but not of net suffering: price changes always create winners and losers, and judging who is who requires accurate data and careful analysis at both the macro- and microlevel. In Fig. 4 we depict eight steps through which international prices influence households, with pertinent policy questions listed in gray outside each box. Most macroeconomic studies focus on the areas listed in boxes 1 through 4 (a few focus on substitution effects of box 5), and most microeconomic studies focus on boxes 6 through 8. This dichotomy is unfortunate, because it is by no means clear that countries that are vulnerable in a microeconomic sense (i.e., high rates of poverty and hunger), are automatically vulnerable in a macroeconomic sense (high import bills, low reserves, high rates of transmission), and vice versa. In this section, we will attempt to bridge the disparate findings of different studies and different data as best we can, and provide some conceptual analysis of the analytical issues involved.

3.1. Macroeconomic impacts

3.1.1. Import bills

Many recent impact studies refer solely to food prices, but any comprehensive assessment of current poverty trends needs to incorporate changes in a range of prices, including fuel costs and fertilizers. Oil prices, in particular, will have a pervasive effect on a country's vulnerability to the current crisis through



Notes: Authors' construction.

Fig. 4. The transmission from international markets to household welfare.

their impact on exchange rates, foreign reserves, transport costs, and domestic inflation. For these reasons the most relevant macroeconomic assessments of the crisis incorporate the effects of rising oil prices as well. Particularly useful in this regard is a recent IMF (2008a) assessment of import bill based on net import positions with respect to food, oil, and other commodities.

As for food imports in particular, the dependency of the LDCs on food imports has attracted considerable attention since the crisis began, but it is a question that merits closer inspection.[13] Ng and Aksoy (2008) recalculate net food imports, but disaggregate their outcomes by oil exporters, conflict states, small islanders, and "normal" countries. They find that a typical "normal" low- and middle-income country has gone from being a net food importer in 1980/1981 to being a net food exporter in 2004/2005. Moreover, only six low-income countries have food deficits that are more than 10% of their imports. The main exceptions to these conclusions are African countries, which tend to have a heavier reliance on cash crop production. As for oil producers, their terms of trade (TOT) and reserve status have improved so much in recent years that they should be less vulnerable to rising food prices in a purely macroeconomic sense. Net exporters of other minerals have also benefited (e.g., Zambia, Mozambique), albeit to a lesser degree, as have countries that are net exporters of labor to oil producing countries (South Asian countries, Philippines) (Rosen and Shapouri, 2008).

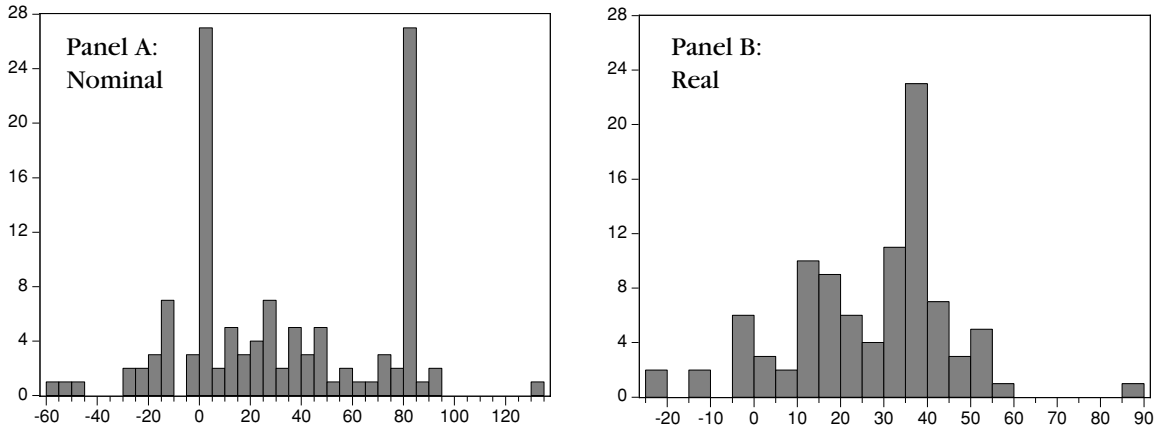
For these reasons, one might regard the greater geographical concentration of oil production—and the larger rise in oil prices—as a greater macroeconomic threat to the developing countries. Indeed, oil imports are 2.5 times larger than food imports for low-income countries and twice as large for middle-income countries, so the impact of commensurate price increases is much greater for oil, as Table 3 confirms (IMF, 2008a).

3.1.2. Exchange rate movements and foreign reserves

The next two components of food price impacts—exchange rate movements and foreign reserves—are best discussed jointly since the two are causally linked. As noted in Section 2, a number of currencies have appreciated against the USD, but by no means all. The distribution of nominal appreciations is bipolar, with one pole representing the Euro countries and the West African CFA France zone (which is pegged to the Euro) whose common currency has appreciated by some 80% over this period, and a second pole denoting the Central American and Caribbean, which includes countries formally and informally pegged to the USD. Real exchange rate movements—from a somewhat small sample of countries—are still centered around a positive mean, but the distribution is slightly less bimodal. The main message of Fig. 5 is that movements against the USD have generally been positive, but still varied substantially, especially across developing regions.

These variations—along with dependence on food/cereal imports—will significantly determine the degree of macroeconomic transmission of rising USD-denominated prices. Consider, for example, a Central American or Caribbean country that is formally or loosely pegged to the USD. This country's exchange rate will generally have appreciated against the Euro and other currencies, making the possibility of finding cheaper imports from outside the United States unlikely (especially once transport and other transaction costs are factored in). Moreover, variations in trade patterns determine the composition of foreign

[13] The FAO classify 82 developing countries as low-income food-deficit countries (LIFDC), largely based on the idea that national food demand exceeds production. Gürkan et al. (2003) also calculate food import bills from 1970 to 2001 and find that developing countries have become more dependent upon food imports for consumption.



Notes: Panel A: Authors' calculations from IMF (2008b) data covering 124 countries. Panel B: Authors' calculations from USDA (USDA, 2008c) data covering 95 countries.

Fig. 5. Exchange rate appreciations against the USD: Q1-2002 to Q2-2008.

exchange reserves for countries, so limited trade with non-U.S. countries also limits the foreign exchange capacity of such a country. Since the United States is the only highly dominant cereal exporter in the world, it is therefore worth investigating the relationship between dependency on U.S. food imports and exchange rate movements against the USD (see Appendix Table A2). Unsurprisingly, such an analysis suggests that the regions that are most dependent on the United States as a source of food imports are Central America, the Caribbean, and some of the more northern countries of South America. A few other countries and regions are fairly dependent on the United States for food imports, but many such countries are either wealthy or experienced large real appreciations against the USD (e.g., Nigeria).[14]

As for foreign exchange reserves, the IMF has calculated months of imports as of 2008. Disconcertingly, the Caribbean and Central American countries also look highly vulnerable in this dimension as well, although South American countries generally seem somewhat better off. In Africa, there is some discrepancy between oil exporters (generally with large reserves) and nonoil exporters (with smaller reserves), so few generalizations can be made, and many countries have sufficiently low reserves to warrant concern. The same is true of Asia. Of greatest concern is that rising oil prices will eat up foreign exchange reserves (Table 3), leaving only scarce reserves left for food imports.

3.1.3. Transmission in domestic markets and the impact on inflation

Despite reasonable data on export prices, exchange rates, and import dependency, very little up-to-date data are available on food prices in developing countries. A few recent studies have examined price transmission in selected countries or regions, but so far very little in the way of a big picture has emerged.[15] One recent FAO study on the current crisis reanalyzes the extent of price transmission in seven large Asian countries from the fourth quarter of 2003 to the fourth quarter of 2007 (Dawe, 2008), a period which admittedly does not capture the full international price increase, especially in rice. Overall transmission—measured as the ratio of LCU-denominated retail price changes to USD-denominated export prices—varied considerably among the seven countries. In India, the Philippines, and Vietnam, the pass through was just 6–11%, but in the remaining countries it was 41–65%. Interestingly, movements in the real exchange rate explain more than half of the price difference between USD-denominated export prices and LCU-denominated local currencies, the main exception being Bangladesh.[16] Dawe also found that transmission of wheat prices appeared to be partial in India and Indonesia, but fully transmitted in Bangladesh. Some of the impacts of food price increases on inflation in Asian countries are also estimated by the ADB (2008), while some recent data on international price changes (U.S., Thailand, and South African markets) and domestic price changes for African countries are

[14] A complementary pattern in the data relates to corn and wheat exports. The USDA's trade-weighted real exchange rate index for corn—which is mostly exported to Latin America —fell by just over 4%, from January 2005 to July 2008, while the analogous index for wheat fell by almost 19%.

[15] On commodity-specific price transmissions, historical evidence certainly suggests that these will probably vary considerably over commodities, over regions and over time, but are generally lower than one might expect *a priori* (see Baffes and Gardner, 2003; Conforti, 2004; Sharma, 1996, 2002). However, previous studies offer little specific guidance as to the overall transmission of international prices to particular countries because of context-specific circumstances (e.g., exchange rate movements, rising oil prices).

[16] In an update for 2008, Dawe also found that Bangladeshi wholesale prices rose by 29% from December 2007 to March 2008, Philippino prices increased by 25% from February to early April 2008, Indian prices rose 18% from October 2007 to March 2008, and Thai prices increased by 17% from January 2008 to February 2008. As of the middle of March, wholesale prices in both China and Indonesia had remained relatively stable.

Table 4
Number of countries affected by food and oil price increases

	Low income	Middle income
Countries with severe negative shocks:[1]		
Oil price shock	48	33
Food price shock	13	3
Combined shock	42	30
Countries with positive shocks:[2]		
Oil price shock	11	23
Food price shock	30	28
Combined shock	23	23
Countries with less-than-adequate reserves:		
Before the shocks	30	18
After the oil price increase	37	26
After the food price increase	27	19
After the combined shock	37	25
Total countries	74	71

Notes: [1]drop in reserves larger than 0.5 months of imports. [2]shock results in an increase in reserves.
Source: IMF (2008b).

presented in Appendix C of Headey and Fan (2008). While that data need to be interpreted with great care because of the lack of a suitable price deflator, the data generally suggest that commodity-specific price transmission in Africa has thus far been limited, the main exception being Ethiopia (see Ulimwengu et al., 2008).[17]

As for a broader picture of price changes, more comprehensive but less detailed data can be obtained by examining recent inflation trends, such as data on food inflation and total inflation presented by the World Bank (2008) for 2007 and early 2008. In Table 5, we present that data by regions and use it to calculate nonfood inflation based on estimates of household food expenditure shares (Column 3). We then calculate the difference between food and nonfood inflation as a measure of relative price change (Column 4). Among these patterns we find that food inflation is high in all regions, varying from around 9.5% to 18%. However, this in itself is not indicative of real or relative prices changes. Column 4 shows the differential that can be thought of as the change in the TOT for food. On average, food inflation has outpaced nonfood inflation at a faster rate outside of Africa than it has in Africa.[18]

[17] Ethiopia's example is instructive, however, because it illustrates that the term "transmission" can be somewhat misleading insofar as domestic factors can both depress transmission (as with rice in Asia), but also accelerate domestic price changes. Quite rapid price accelerations in Ethiopia, and also Kenya, are substantially a consequence of domestic factors (drought and domestic policies in Ethiopia, drought and conflict in Kenya).

[18] We have confirmed the statistical significance of the difference between Africa terms of trade trends and other regions with *t*-tests for differences in means, although it is still important to note that there is substantial variation within this African sample, which is also relatively small (12 countries). So with caution we might say that the effects within Africa, easily the poorest developing region, have so far been limited.

Because of the limited time frame of the data in Table 5 (the data only cover 2007 and the first few months of 2008), Fig. 6 looks at inflation from 2005 to July 2008 (although in some cases the data terminate in May or June). Our basic strategy in Fig. 6 is to group data by smaller regions and extract countries from those regions that constitute outliers. In one case we also look at five mineral exporters in Africa. The data tell an interesting story by appearing to confirm some of the conjectures made earlier. First, prices have risen most quickly in three countries in which domestic factors (weather shocks and/or conflict) have also contributed substantially to price increases: Myanmar, Ethiopia, and Kenya. Ghana is also something of an outlier, but it is also a country in which transmission of rising international prices could not be the whole story. Although Ghana imports wheat, rice and some maize, Ghanaian diets are diverse, and the Ghanaian currency has appreciated against the dollar (a combination of higher oil prices, large remittances, and increased government spending are usually blamed for Ghana's inflation). Yemen is perhaps a more conventional example of a country being vulnerable to rising prices, since it is heavily dependent upon food imports.

As for the other groups, five mineral exporters have also experienced high inflation, but this is surely due in large part to increased export earnings and Dutch Disease. Nonfood inflation in Nigeria, for example, appears to have surpassed food inflation. South Asia also experienced accelerated inflation due to a mix of dependency on oil imports, dependence on rice, limited exchange rate movements (especially Bangladesh), and domestic factors. Several Central Asian countries have experienced rapid inflation, although mineral exports and Dutch Disease may well be a story here too. Central America and the low-income Caribbean countries have also experienced fairly high inflation, as expected. As for the other groups, the main story is that inflation has averaged around 6–8% per annum in most African countries. West Africa—a region largely tied to the Euro—has the lowest inflation of all the regions sampled. So although many African countries are highly vulnerable in a microeconomic sense—poverty and hunger rates are high, and many Africans seem to be net food buyers—it is not obvious that actual price rises have thus had a major impact in most of Africa.

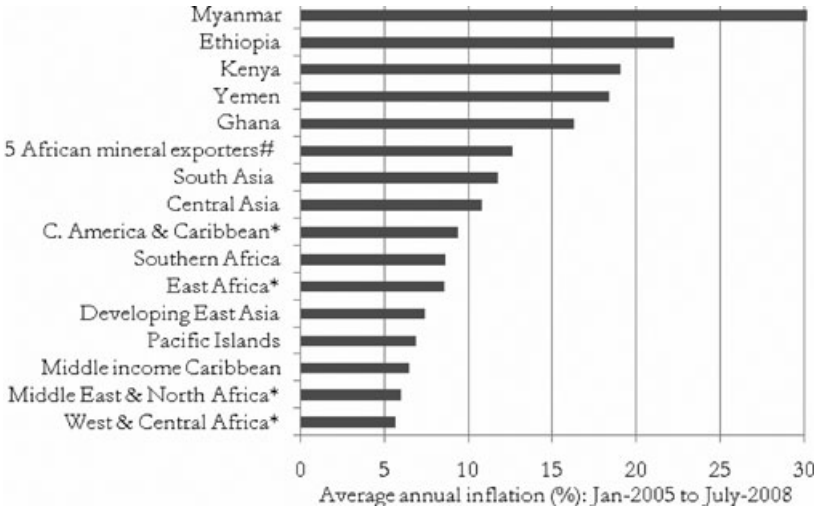
Against these relatively optimistic conclusions we should make some important caveats. First, the buffer to larger price transmissions that has been provided by the depreciation of the USD over the past few years is not a permanent one. Several important currencies, including the Euro, are now considered by many to be highly overvalued, perhaps indicating that the dollar may strengthen in the near future, thus leading to faster price transmissions in regions such as West Africa.

Second, price transmission may be low because of costly government policies aimed at dampening price rises. The World Bank (2008) provides data indicating that some 84 countries reduced the net taxation of food, and around 30 imposed export restrictions of one form or another. The IMF (2008a) estimates

Table 5
Food inflation, total inflation, and estimates of trends in the TOT: 2007/2008

Region (sample size)	(1) Total inflation	(2) Food inflation	(3) Nonfood inflation*	(4) $\Delta TOT_{food} = (2)–(3)$	(5) Std. dev. of ΔTOT_{food}
South Asia (5)	11.1	15.1	5.9	8.0	11.4
East Asia (8)	5.9	10.1	0.8	8.4	7.8
Sub-Saharan Africa (12)	7.9	9.5	6.1	3.0	8.2
Middle East & N. Africa (4)	6.6	9.4	2.4	5.7	2.3
C. America & Caribbean (11)	9.0	13.1	5.6	8.2	7.1
S. America (8)	6.4	11.4	2.7	10.0	6.0
E. Europe & C. Asia (9)	14.0	18.2	7.1	8.4	9.3
Small Islands (3)	8.3	15.7	0.6	14.8	12.6

Source: World Bank (2008) for total and food inflation data, with authors' own estimates of nonfood inflation based on FAO data on food expenditures shares from http://www.fao.org/faostat/foodsecurity/index_en.htm.
Notes: *Nonfood inflation is calculated with estimates of the share of food in total household expenditure, which were derived from a regression of sample food expenditure shares from 36 countries against GDP per capita and continental dummy variables. All variables were significant at the 10% level or higher, and the R^2 was 0.52.



Source: IMF (2008b).
Notes: Inflation is calculated until July 2008 wherever possible, although in many cases data were only available up to May or June, and in a few cases (Pacific Islands and middle-income Caribbean) only March or April. #The five mineral exporters are Nigeria, Zambia, Botswana, Angola, Sierra Leone (the latter is only a moderate exporter, however). *Indicates that the regional group excludes any counties that are listed individually or in the mineral exporter category; for example, West and Central Africa excludes Nigeria, Ghana, and Sierra Leone and East Africa excludes Kenya and Ethiopia.

Fig. 6. Average annual CPI inflation from January 2005 to July 2008.

the fiscal cost of these actions for both food and fuel. In many instances, these taxes and subsidies transfer the burden of rising prices from the market to the government's coffer, on average adding at least one percentage point to budget deficits (% GDP) (or otherwise require cutback in other expenditures that may also be important for the poor, at least in the longer run—for example, expenditure, health, agricultural investment). Whether it is better to absorb international price rises through these taxes, subsidies, or export restrictions is a complicated calculus that is beyond the scope of the present analysis, but certainly an issue worthy of further study. As Valdes and Siamwalla (1981) noted after the 1974 crisis, volatile food prices are a problem because of the inability of the poor to smooth their consumption via capital markets. Insofar as governments have better access to capital markets than the poor, government policies that transfer the burden of rising international food prices to fiscal deficits may be preferable to allowing full price transmission. The second issue, of course, is the distributional implications of each of these tax and transfer programs (e.g., see Essama-Nssah, 2008, for a conceptual analysis and review, and Arndt et al., 2008, for an application to rising food prices in Mozambique).

A final caveat is that the full transmission of international prices may take some time. Some of the transmission mechanisms are quite complex. Food prices can be directly imported, but producers of tradable foods (or exporters of food) can also experience rising prices. In some cases, such as Uganda, a country may not be directly vulnerable because of diverse diets and production systems, but rising prices in neighboring countries (e.g., Kenya) can create opportunities for trade that put pressure on domestic prices (Benson, 2008). Moreover, some regions within a country—especially rural regions—may be more isolated from international price rises than urban areas because of high transport costs (Codjoe et al., 2008; Ulimwengu et al., 2008). All of these complexities point to the need for research that combines both detailed macro- and microeconomic analysis (e.g., Arndt et al., 2008).

3.2. Microeconomic vulnerability to rising food prices

Given that we know so little, at a cross-country level at least, about the extent of food price changes or the costliness of policies aimed at mitigating price rises, it should be no surprise that we know even less about the impacts of rising prices on poverty. What we do know from the cross-country poverty simulations so far—namely, Ivanic and Martin's (2008) nine-country study, Zezza et al.'s (2008) 11-country study, Wodon et al.'s (2008) study of 12 West African countries, and Dessus et al.'s (2008) study of the urban sector of 73 developing countries—is what the likely impacts on poverty would be, *given* price changes. In effect, then, these simulations tell us who *would* be vulnerable to rising prices, but not which populations are *actually* experiencing hardship as a result of rising food prices, because none of these experiments incorporate actual price changes. As we saw above, changes in food prices are likely to vary substantially across countries, whereas these studies assume common price changes across countries. Nevertheless, these studies are methodologically insightful, and empirically useful for identifying vulnerability to price changes across countries and subnational groups (e.g., rural and urban). All three studies can also tell us about the incidence of poverty changes (poverty headcounts) as well the extent of changes (e.g., poverty gaps). Indeed, the Wodon et al. (2008) and Ivanic and Martin (2008) studies have been particularly influential in framing World Bank responses to the crisis (World Bank, 2008) and catalyzing support from other institutions.

These four studies also make a useful comparison because all three use quite recent microeconomic surveys, as well as similar simulation methods. These similarities are as follows. First, all four papers look at real food price changes, but not at oil or fertilizer prices, even though rising oil prices, in particular, could have a larger effect on poverty than food prices.[19] Second, each study only looks at the short-run impacts by precluding significant behavioral responses by producers and consumers of food, or significant partial or general equilibrium effects on prices in other sectors. All four studies explicitly acknowledge this, and the Martin and Ivanic and Zezza et al. (2008) studies also calculate some partial equilibrium effects on household income as robustness tests, although neither find significantly different findings, except some redistribution of negative impacts from rural to urban households in the case of Ivanic and Martin's unskilled wage effects. Nevertheless, there could be other behavioral responses to rising food prices, even in the short run. For example, many poor households have diversified income sources and may have substantial scope to increase farm-based activities as food prices rise.

Finally, the main methodological framework of each study is relatively similar in following Deaton's (1989) approach. Essentially, the welfare effect of rising food prices at the urban, rural, or country level depends upon the number of people who are poor and vulnerable (just above the poverty line), whether those people are net buyers or net sellers of food, and whether they are marginal net sellers/buyers or significantly so. Such a calculus leads to some nuanced expectations of which groups might be expected to suffer most from rising prices. On the one hand urban populations have large numbers of net buyers of food, but they also tend to be better off than the rural population. Moreover, rural populations might also contain surprisingly large numbers of net food buyers because of the prevalence of nonfarm workers, cash crop production, low productivity food production, or landlessness (Ahmed et al., 2007). A somewhat surprising insight of Ivanic and Martin's study, for example, is that rural poverty increases by more than urban poverty in two of the three African countries surveyed. In Zambia rural poverty increases by three times as much as urban poverty, even though initial poverty rates were roughly the same in rural and urban areas (of course, poverty rates do not capture the number of people who are vulnerable).

The large effects on rural poverty that result from these simulations seem somewhat at odds both with prior intuitions and other evidence on these issues. Aksoy and Isik-Dikmelik (2008), for example, analyze some of the same surveys as Ivanic and Martin, but conclude that: (a) although most poor households are net food buyers, almost 50% are marginal net buyers; and (b) net buyers typically have higher average incomes than net food sellers in eight of the nine countries. Another partial explanation of large changes in rural poverty may be that household surveys have some tendency to underestimate the degree to which households are net sellers of food because the consumption side of household accounts is generally better measured than the production side.[20] For similar reasons,

[19] Arndt et al.'s (2008) study of Mozambique, for example, finds that rising fuel prices lead much larger increases in poverty than rising food prices, and Passa Orio and Wodon (2008) estimate the longer term impact of specific commodity price spikes on the price of other commodities through a social accounting matrix multiplier approach, and find that indirect effects are significantly larger for oil than for food in three of eight countries sampled.

[20] We thank Xinshen Diao for this astute comment. The specific argument is that the consumption side of micro surveys is more regularly updated, whereas production, being largely seasonal, is only measured at distant intervals. It

household income in rural regions may not be as well measured as it is urban regions. So it is possible that certain survey biases are also influencing the outcomes of these simulations, although we do not have any clear idea of the strength of these biases.

A final issue relates to the diversity of microeconomic vulnerability across countries. Clearly there are a range of factors that influence the vulnerability of households to rising food prices within and across countries (Fig. 4). Zezza et al. (2008) go further than the other simulation studies by disaggregating vulnerability across groups and explaining vulnerability measures with OLS regressions. Across 13 developing countries from across the developing world, they find that the most vulnerable households are: urban or rural nonfarm, larger, less educated, more dependent on female labor, less well served by infrastructure, and, within the rural sector, households with limited access to land and modern agricultural inputs. All of these findings are fairly intuitive, but it is still useful to see microeconomic evidence confirming these intuitions and offering orders of magnitude as to which household attributes matter most.

To summarize, these studies suggest that poverty would generally increase in the short run if food prices were to rise substantially, including rural poverty, and Zezza et al.'s (2008) study also offers insights into which types of households are most vulnerable to rising food prices. At the same time, it is important to remember the limitations of these simulations. Ultimately, we still need to learn much more both about actual price changes, the additional impacts of increased fuel and fertilizer prices, the short term behavioral responses to rising food prices, and about how government policies can influence these outcomes.

4. Knowledge of the past and expectations of the future

The recent surge in food prices has been widely termed a crisis, and not without justification. A conflagration of factors caused food prices to rise much more quickly than is desirable (Section 2), and whatever the precise impacts so far (Section 3), it is clear that many of the world's poor have already experienced the harsh reality of more costly sustenance. Moreover, although food prices have probably already peaked, food prices are, in real terms, expected to stay high for several years to come (USDA, 2008a), especially if oil prices remain high and demand for biofuels persists. On this basis it would be premature to conclude that the crisis is over.

But despite the acute problems that rising food prices have caused, this is a crisis that also presents opportunities for positive change. As was the case in 1974, the current crisis has made the weaknesses of the global food system transparent to a broader audience and focused considerable attention back on to the fundamental roles which food production and food security play in both current welfare and in the longer run process of development. Despite the political constraints of the time, the 1974 crisis produced and bolstered a number of new institutions—the WFP, IFAD, the CGIAR, GEIWS—that have mostly been successful in improving food security and raising agricultural productivity (Headey and Raszap Skorbiansky, 2008). But at the same time international policymakers, then and now, have failed to address the most fundamental deficiencies of the global food system, including low levels of agricultural investment and agricultural aid (Bezemer and Headey, 2008), and excessive reliance on the reserve systems of major grain producers as a distant Second Best alternative to freer trade.

The international policy-making community has an obligation and a mandate to redress a 30-year complacency toward these issues (von Braun et al., 2008), yet so far progress has been uneven, especially with respect to subsidies and trade. One part of the challenge at the national level is to ensure that the poor and vulnerable—namely, nonmarginal net buyers of food—do not slip further into poverty. Macroeconomic policies can buffer the rise in food prices to some extent, while microeconomic social protection programs can more aptly target the most vulnerable populations. A second challenge, however, is to use this crisis to permanently lift poor producers of food—who comprise some 60–70% of the world's poor—out of poverty. Even prior to the current crisis, many development specialists had called for renewed efforts to invoke a Green Revolution in Africa (see Diao et al., 2008), and the recent price surge has clearly brought renewed attention to agricultural development issues. The challenge, however, will be to sustain these efforts once prices have fallen, once grain stocks have been rebuilt, and once the crisis atmosphere has abated.[21] After all, for the 800 million hungry people of the world food crises are not a one-off event, but a daily reality.

Acknowledgments

We would especially like to thank Nurul Islam, Marc Cohen, Dennis Petrie, David Orden, Xinshen Diao, seminar discussants at a seminar given at IFPRI's Washington, DC headquarters, and a wide range of colleagues, for very insightful comments and suggestions.

is sometimes argued that household income is also underestimated in these surveys.

[21] Here we are paraphrasing Valdes and Siamwalla (1981), who came to the following conclusion in the years following the 1972–1974 crisis: "International prices of cereals have fallen in real terms, grain stocks have been rebuilt, and the crisis atmosphere has abated. World food security has ceased to be a major concern for the press and for the general public. Yet, the underlying causes of food crises such as the one in 1972–74 have not disappeared ... on the international scene only limited progress has been made to help them in these efforts."

Appendix A. Additional data

Table A1
Trends in stocks relative to domestic consumption plus exports among major exporters and consumers

Commodity	Country	Major exporter?	Stocks/(cons+exports)		Outcome
			1990–2000	2005–2008	
Maize	Argentina	Yes	6	7	Up, but low
	India	Yes	3	7	Up, but low
	United States	Yes	16	12	Well down
	China		93	24	Well down, but still high
	EU-15		8	14	Up
	World		26	14	Well down
	World, exc. China		12	12	Unchanged
Rice	China	Moderate	70	29	Well down
	India	Yes	18	13	Down
	Pakistan	Yes	19	8	Well down
	Thailand	Yes	7	13	Up
	United States	Yes	15	14	Same
	Vietnam	Yes	2	7	Up, but low
	EU-15		22	37	Up
	World		33	17	Well down
	World, exc. China		14	13	Largely unchanged, but low
Wheat	Pakistan	No	17	11	Down, below "optimum"
	Argentina	Yes	4	3	Always low
	Australia	Yes	20	35	Up
	Canada	Yes	32	24	Down, but still high
	EU-15	Yes	16	11	Down, below "optimum"
	India	Yes	13	6	Down, below "optimum"
	Kazakhstan	Yes	23	14	Down
	Russia	Yes	16	7	Down, below "optimum"
	Ukraine	Yes	23	11	Down
	United States	Yes	27	21	Down, but still high
	China		71	38	Well down, but still very high
	World	Yes	27	18	Down, but still "optimal"
	World, exc. China		19	14	Down, below "optimum"

Source: Authors' calculations based on USDA data (2008d).

Table A2
Dependency on U.S. imports and exchange rate appreciation

Region	U.S. wheat imports (% consumption)	U.S. corn imports (% consumption)	Real appreciation against USD: 2002–2008 (% change)	Foreign reserves, 2008 (months imports)
Middle East & N. Africa	**2**	**15**	**20**	**15.0**
Caribbean	**28**	**36**	**15**	**3.5**
Dominican Rep.	46	49	12	2.6
Haiti	26	n.a.	5[a]	3
Trinidad & Tobago	48	95	18	NA
Jamaica	26	100	15	4.1
Central America	**45**	**24**	**10**	**3.5**
Costa Rica	55	47	10	
El Salvador	31	21	8	3.2
Guatemala	46	20	26	4.1
Honduras	45	21	12	3.5
Mexico	20	13	−2	3.7
Nicaragua	46	9	4	1.7
Panama	44	80	0	4.1
South America	**4**	**1**	**25**	**8.7**
Colombia	23	31	41	6.3
Ecuador	9	23	8	2.5
Peru	9	6	20	15.5
Venezuela	27	22	−12	**NA**

Continued

Table A2
Continued.

Region	U.S. wheat imports (% consumption)	U.S. corn imports (% consumption)	Real appreciation against USD: 2002–2008 (% change)	Foreign reserves, 2008 (months imports)
Sub-Saharan Africa	**10**	**0**	**40**	**7.0**
SSA nonoil				5.0
Ghana	10	0	35	2.2
Nigeria	42	0	42	20.6
East Asia	**2**	**7**	**1**	**NA**
Hong Kong	1	49	−21	**NA**
Japan	26	90	2	**NA**
Korea, Rep.	16	28	15	**NA**
South Asia	**0.3**	**0.4**	**22**	**5.6 (4.0)[b]**
Southeast Asia	**12**	**1**	**25**	**6.0**
Thailand	19	0	30	7.1
Philippines	32	0	29	6.3

Source: Authors' calculations based on USDA data (2008c) for imports and IMF's (2008b) exchange rate data.
[a]Only the nominal exchange rate is reported for Haiti because of missing inflation data.
[b]This is the average after India is excluded.

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