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DISTRIBUTIONAL IMPACTS OF COMMODITY PRICES IN DEVELOPING COUNTRIES: DRAFT REPORT

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Contact: Jonathan Brooks (Email: jonathan.brooks@oecd.org)

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NOTE BY THE SECRETARIAT

This report was prepared by a consultant, Mateusz Filipski, of the University of California, Davis. It examines the impacts of the recent increase in food prices on economic welfare in nine developing countries, and considers the pressures associated with price changes projected by the AGLINK-COSIMO model through to 2018. The report uses the Rural Income Generating Activities (RIGA) dataset maintained by the FAO. The current report is intended to be published as a consultant's report in the OECD Food, Agriculture and Fisheries Working Papers series.

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DISTRIBUTIONAL IMPACTS OF COMMODITY PRICES IN DEVELOPING COUNTRIES: DRAFT REPORT

Abstract

1. We use household production and consumption data combined with national price data to simulate the welfare effects of increases in staple prices. We focus on the rural sectors of nine developing countries and on six types of staple crops. We find that most rural households are net buyers of staples, and stand to lose from higher staple prices in the short run. However, simulations of the 2007/2008 food price crisis suggests that the magnitude and timing of the welfare shocks depended heavily on the type of crops produced and consumed by each rural household. Simulations up to 2018 suggest higher future prices threatening welfare, but also creating opportunities for those who can increase staple production.

Introduction

2. The years 2007 and 2008 saw an unprecedented rise in food prices worldwide. Internationally traded grains provide a striking illustration: during 2008, the world export prices of maize, rice and wheat all peaked at more than three times their levels of January 2005 (FAO 2009). In that same year, the FAO food price index reached its highest levels ever, and remained over 200 from February to July (2002-04 averages serve as the 100 base). In 2009, prices fell back, but they remained above pre-crisis levels. Looking ahead, the recently-published OECD-FAO Agricultural Outlook provides predictions of real prices over the next ten years: the historical downward trend of world wheat prices will continue, but starting from higher levels. Prices of coarse grains will also eventually resume their historical downward trend, but not before 2015. Rice prices will remain high compared to the past, and rice will gradually become more expensive relative to wheat. Furthermore, the report also warns that "another major price spike like the once recently witnessed cannot be ruled out" (OECD-FAO 2009, chapter 6).

3. Therefore, concern over staple prices in the near future stems from two facets: systematically higher levels, and greater volatility than in the past. These concerns come at a time when hunger statistics are already disquieting. The number of hungry people in the world has just crossed the one-billion line(FAO 2009). The half-century-long declining trend of undernourishment has been reversed: the numbers and proportion of undernourished people rose not only during the crisis, but also in 2009 (FAO 2009). To avoid a worsening of this situation, and possibly turn it around, it is essential to understand the link which exists between prices on commodity markets and world hunger. The aim of this paper is to participate in this effort, by shedding further light on the welfare and distributional impacts of price changes.

4. The focus of this paper is on the rural sectors of a sample of developing countries. While the effects of high food prices are unambiguous for urban populations, they are complex and ambiguous for rural farm households, who stand to gain as producers and lose as consumers. In practice, in the rural sectors of developing countries, net sellers of staple foods are often a minority. For the nine countries we study in this report, the proportion of rural net sellers of staples is lower than that of rural net buyers, except in Vietnam. The 2008 World Development Report, using a different set of countries, reports that a majority of the rural poor are net buyers of tradable staples (World Bank 2008, p.109). Thus, the effects on the rural populations are far from clear cut. Furthermore, three quarters of the world's poor are rural (IFAD

2001 chapter 2, p16) and since the poor tend to spend a high proportion of their income on food (principle known as "Engel's law"), they are naturally the ones most likely to experience hardship in the face of rising food prices, and the most in need of relief policies.

Table 1. Proportions of net buyers and net sellers of staple foods among rural households

Country	Survey year	Urbans (net Buyers)	Rural Net Buyers	Rural Net Sellers
Bangladesh	2000	32%	50%	18%
Ghana	1998	33%	56%	11%
Guatemala	2000	42%	50%	8%
Malawi	2004	12%	82%	6%
Nepal	2003	28%	36%	36%
Nicaragua	2001	53%	37%	10%
Pakistan	2001	37%	52%	11%
Panama	2003	51%	44%	5%
Vietnam	1998	27%	24%	49%

Staples considered included all values of cereals, pulses, roots and tubers and oilseeds produced or consumed. Specific crops differed by survey.
Source: RIGA datasets.

5. Our work seeks to further an analysis performed in the summer of 2008 by an FAO team led by Alberto Zezza (2008). Their paper used the RIGA database (Rural Income Generating Activities[1]) to perform simulations of a rise of food price impacts on various groups of rural households, and to calculate the resulting income shocks at the household level. It then sought to identify the most vulnerable segments of rural populations, categorized by expenditure quintiles, by land ownership, by gender of the household head, among other criteria. Because their goal was to maximize cross-country comparability, they simulated an identical shock in all countries: a hypothetical 10% increase in staple prices (regardless of what the staples were). Written in the midst of the crisis, their work offered a highly informative stylized comparison of the impacts of rising staple prices, with an explicit focus on identifying characteristics of vulnerable households. Their analysis, however, used a composite "staple" category without differentiating between crops, and used no actual price information.

6. We offer two different perspectives: a retrospective look at the effects of the 2007/2008 crisis, and a prospective look into the potential implications of price developments in the next nine years. The former makes use of a disaggregated FAO-compiled dataset of prices made available online recently as part of the Global Information and Early Warning System (henceforth "GIEWS"[2]). The latter uses the 10-year price predictions of the Aglink-Cosimo model[3]. Both datasets provide time series of food prices for various crops or groups of crops, at the country level (though sometimes at the regional or city level). Making use of such price datasets allows us to narrow the focus to specific crops, specific locations and the timing of price shocks. This generates simulations of the market pressures as they are experienced by households with more accuracy. Differentiating between crops is particularly important if we believe that some staples may become more expensive relative to others, as the Agricultural Outlook predicts for rice versus wheat. In the face of changing food prices, which countries suffer most? Which crops are

1. At the time of writing, more information on RIGA datasets could be obtained from *www.fao.org/es/ESA/riga/english/index_en.htm*.

2. At the time of writing, more information on GIEWS could be obtained from *www.fao.org/giews/english/index.htm*.

3. At the time of writing, more information on Aglink-Cosimo could be obtained from *www.oecd.org/document/6/0,3343,en_36774715_36775671_40969158_1_1_1_1,00.html*.

responsible for the strongest pressures on welfare? Are there any "buffer" crops that help mitigate the welfare shock? Does the timing of price increases in different crops play a role? Which countries are hit first? Which suffer the longest food crisis? This works provides elements of answers to all of these questions.

7. The remainder of our study attempts to provide answers to these questions, and is organized as follows. In the next section (Part 1), the methodology and data are described. In Part 2, we simulate a theoretical 10% shock on staple prices, which provides an illustration of the mechanisms at play and a cursory analysis. Part 3 then presents results obtained from the retrospective simulations of actual price shocks on various countries, using the GIEWS historical dataset of prices. Part 4 provides corresponding results from a prospective point of view, using the Aglink-Cosimo price forecasts. Part 5 draws the conclusions.

Part 1: Methodology and data

Methodology

8. Our methodology is based upon Zezza *et al.* (2008). The goal is to estimate, at the household level, the welfare shocks that are induced by price shocks. We value a household's welfare shock as the immediate effect of a price variation on the value of the household's incomes and expenditures. For prices of agricultural commodities, this means we value the welfare effect as the increase in the value of the commodity a household is producing; minus the increase in the amount it spends to consume that same commodity (which is different from "economic surplus" measures). Because we assume the household does not have time to adapt the quantities it will produce or consume, we will call this the "immediate welfare effect" (following Zezza *et al.* [2008]). Formally, this immediate welfare effect for a given household facing an increase in a given crop price (all else being equal) is expressed as:

$$\frac{\Delta w}{x_0} = \frac{\Delta p^p}{p_0^p} P - \frac{\Delta p^c}{p_0^c} C \qquad (1)$$

9. Where Δw is the first order approximation of the change in welfare of the household, and x_0 the household's income before the shock (approximated by total expenditures, hence the letter choice). P and C are, respectively, the values of the household's production and consumption, both as shares of x_0. p^p is the producer price and p^c the consumer price (initial price levels are subscripted by 0). Given the lack of reliable price data, producer price and consumer price are assumed to be equal in our analyses, and denoted by p. This yields the simpler expression:

$$\frac{\Delta w}{x_0} = \frac{\Delta p}{p_0}(P - C) \qquad (2)$$

10. The quantity P-C, net sales of a crop as a percentage of total expenditures, is also called the "net benefit ratio" (henceforth NBR). The immediate welfare effect thus reduces to the NBR of a given crop multiplied by the size of the price shock. This method of modelling a welfare effect is unsophisticated compared to what can be obtained from a behavioural model, such as the Development Policy Evaluation Model (DEVPEM), currently under development. Indeed, we ignore all higher-order effects of the price shock: the household's adjustments in production and consumption patterns, the economy's responses in terms of labour markets, in terms of markets for substitutes and complements of the commodity in question, etc. Our approach, however, requires minimal data and still provides a solid base for cross-

country comparisons[4]. It has been used in several studies (Deaton 1989) (Budd 1993) (Barrett and Dorosh 1996), and more recently applied by Ivanic and Martin (2008) in a working paper similar in spirit to our work, but using aggregated world prices rather than country-level prices.

Data: RIGA, GIEWS and AGLINK-COSIMO datasets

11. As mentioned in the introduction, this work uses three main sources of data: household survey data from RIGA, historic prices from GIEWS and prospective prices from Aglink-Cosimo.

12. The RIGA database is comprised of a series of household-level datasets for a range of developing countries. Each country's dataset is compiled from raw data available from the World Bank Living Standards Measurement Survey (LSMS) archive: the RIGA team cleans the data and standardises it to provide a consistent and comparable set of variables across all countries. For this project, we worked closely with the RIGA team to compile, at the household level, the incomes and expenditures related to each product of interest. The detailed methodology, explaining the compilation of RIGA datasets, can be found in Carletto (2007). Our study focuses on nine countries: four in Asia (Bangladesh, Nepal, Pakistan, Vietnam), two in Africa (Ghana, Malawi), and three in Central America (Guatemala, Nicaragua, Panama). These countries were selected so that various regions of the world were represented, and because comparable data could be found for all of them.

13. The GIEWS database offers a variety of staple price series for a variety of countries, on a monthly basis. All the prices used in the retrospective section of this work were downloaded using the GIEWS data and analysis tool[5]. It should be noted, however, that the commodities for which prices are available vary by country, as does the geographic unit of observation and the available date range. For Vietnam, for example, only the retail price of rice in Hanoi is available. In contrast, Malawi prices for the three major food crops (maize, cassava and rice) and the five largest cities are all available. The starting date of the data is 2005 for most countries, but in some cases it is 2007. In many instances, several prices were available for a single commodity within the same country (either at different locations, or different varieties of the same crop); we then compiled national averages. Retail prices were available in some countries, wholesale prices in others. When both were available, we used retail prices, because the majority of our samples are net buyer households. Finally, all prices were expressed in real terms and in local currency units.

14. The Aglink-Cosimo agricultural outlook modelling system is an OECD-FAO common project that uses a global partial equilibrium model to predict yearly values of agricultural commodity prices in all regions of the world. They use a 10-year moving window. It was used, for example, as the basis for the writing of the most recent OECD-FAO Agricultural Outlook (OECD-FAO 2009). At the time of writing, the most up-to-date available predictions reached 2018, which thus became our outlook year. The Aglink-Cosimo doesn't model all countries of the world individually, such that we had to use regions in some cases. Nicaragua, Panama and Guatemala, for example, were all considered to be part of the Aglink-Cosimo region "CLA - Central Latin America"[6].

4. Zezza *et al.* report computing second-order welfare effects using own-price elasticities of supply and demand, and finding no qualitative differences for their analysis.

5. At the time of writing, GIEWS data was available at *www.fao.org/giews/pricetool/*.

6. We used Giews data to check how valid this approximation was. Correlations between the evolutions of prices (as differences from their mean levels) in Guatemala, Nicaragua, and Panama were 0.42 on average. They were strong for wheat and rice prices. The outstanding exception was for pulse prices in Nicaragua, which were negatively correlated with the two other countries (around -0.4).

15. The household data from RIGA and the two price datasets were merged at the crop level. Since the availability of and definitions of crop data varied between datasets, we created categories of crops (modelled on the Aglink-Cosimo commodity categories). Those categories are detailed in Table 2. Note that only staple crops were included in the study. One reason is that only staple prices are present in the GIEWS dataset, but it is not the only reason. Non-staple foods such as meats or fresh produce are more likely to be quickly cut out of a diet if too expensive. Since we do not allow for changes in consumption patterns in our model, our result would be weaker if we considered non-staple foods. As we have no information on feed prices, adding livestock on the production side would also have been ill-advised. Staple consumption, on the other hand, is fairly inelastic, and we think our method yields fairly robust results in this case. Before presenting those results, we illustrate the method using hypothetical price increases.

Table 2. Commodity categories and codes

Code	Stands for	Comprised of
WT	Wheat	Wheat
RI	Rice	Rice
CG	Coarse Grains	Maize, Sorghum, Millet, Barley, other cereals
OS	Oil Seeds	Flax, Sesame, Palm nut…
HP	High Protein	Soybeans, Dry Beans, Peas…
RT	Roots and Tubers	Potatoes, Sweet potatoes, Cassava, Taro…

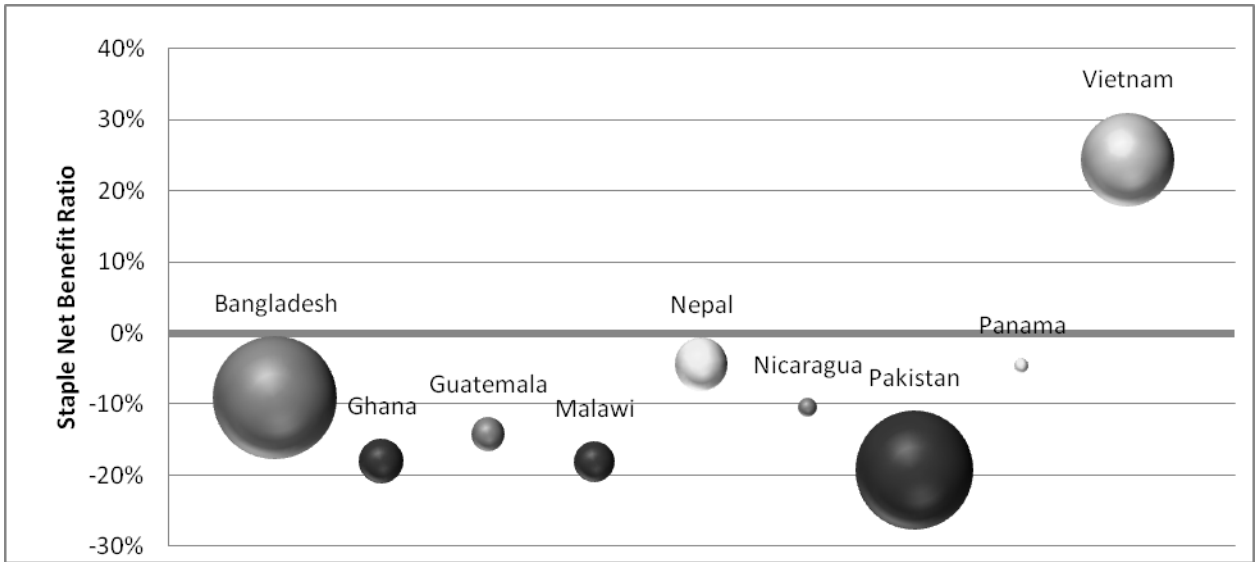
Part 2: Hypothetical price shocks and illustrative results

16. In this subsection we will illustrate the method using a theoretical 10% shock to the price of staples, precisely like the one modelled in Zezza (2008). This allows us to illustrate our method and identify the relevant questions one needs to ask when analyzing price shocks.

17. As explained earlier, if the price of a commodity changes, the sign and size of the immediate welfare shock for a household ultimately depend on this household's net benefit ratio for that commodity. As noted already, the majority of rural households in many developing countries are actually net buyers of staples. Figure 1 illustrates this fact quite dramatically: of the nine countries selected for the study, only Vietnam displays a positive net benefit ratio for staples in the rural sector.

18. What would be the immediate welfare shocks in the rural sectors of those countries if staple prices were to rise, for example, by 10% in each country? Figure 1 gives us an answer at a glance, without even making calculations. Indeed, if we were to model a 10% price shock and calculate the welfare effect using equation (2), we would simply obtain values equal to a tenth of the value read off the bubbles in Figure 2. Thus, leftmost Bangladesh would display an estimated welfare shock of about -1%, and rightmost Vietnam a positive shock of about 2.5%.

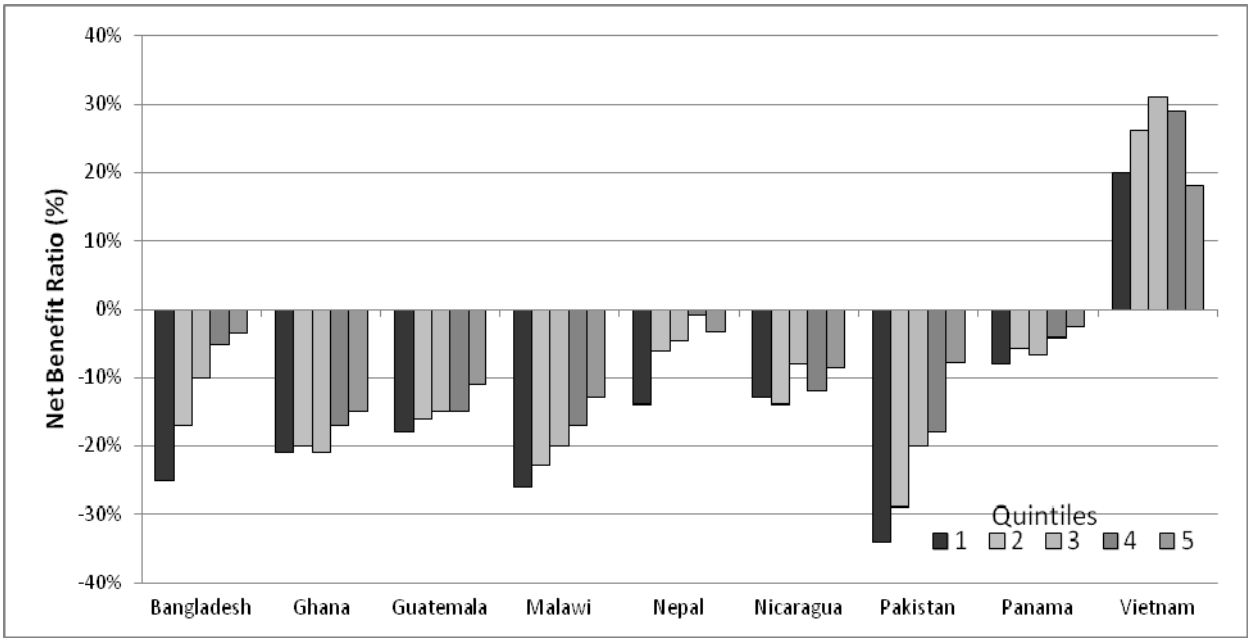
Figure 1. Staple net benefit ratio (NBR) of the rural sector



Bubble size is proportional to the size of the rural population of the countries. Colours are red for values lower than -15%, orange between -15% and -5%, yellow if negative but above -5%, and green if positive.

19. Such figures might seem rather small, but recall that we are using a 10% increase for illustrative purposes only, the actual price shocks which hit during the 2007/08 crisis were of much greater magnitude. The advantage of a single, across-the-board 10% hypothetical increase is that it can help identify vulnerable groups which, all else being equal, stand to be hit hardest by the food crisis. This was the purpose of the Zezza *et al.* (2008) article, that compiles charts similar to Figure 1 for many different groups of households characterized by structural characteristics such as land ownership, fertilizer use, crop diversification, gender of the household head, etc. Findings similar to theirs are presented in Figure 2, which again shows the NBR for staples, only now with households disaggregated by expenditure quintile. The chart reveals that the poorest quintile almost invariably displays the lowest NBR in their country (in two exceptions, it ranks second-lowest by a very small margin). This means that the poorest stand to be hurt most by – or in the case of Vietnam, to benefit least from – a rise in staple prices. Again, welfare shocks from a hypothetical 10% increase will simply equal a tenth of the values read off the bars. Thus, we can tell that, as a group, the twenty per cent poorest rural Bangladeshi households (the leftmost bar of the graph) stand to perceive a welfare shock of about -2.3%, a value significantly larger than what we had estimated for the Bangladeshi rural sector as a whole (about -1%).

Figure 2. Net benefit ratio (NBR) of staples by quintile of total expenditures (1 = poorest, 5 = wealthiest)



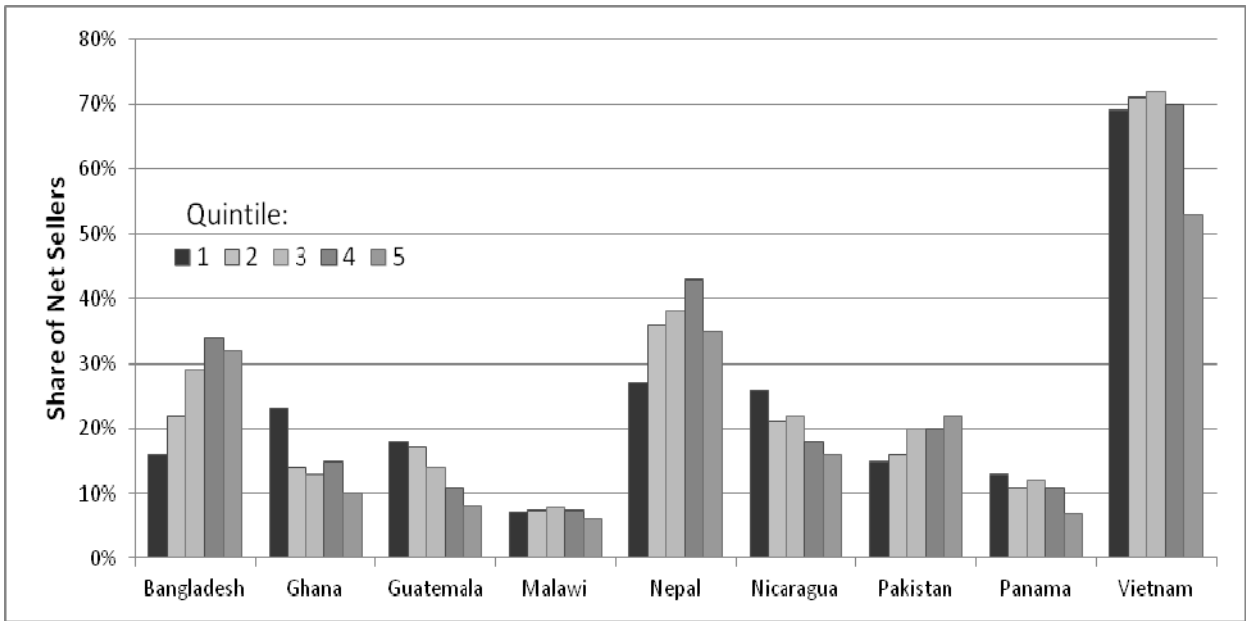
20. With the above-described figures we can already deliver two conclusions: first, that the rural populations of developing countries are predominantly net staple buyers who will be hurt by high staple prices; second, that among them, the poorest will be hurt most. The work by Zezza *et al.* (2008) starts from the same observation, then pushes the analysis by documenting in depth the characteristics that identify the "poorest" households. Our work takes the analysis along different lines: modelling of actual, rather than hypothetical, price shocks, and the differentiating among various staples. Indeed, once we aggregated all staple foods together and found that all quintiles were net buyers, it should come as no surprise that the poorest quintile spends the most (in proportion) on staples. It may be that the results of Figure 2 do little more than documenting Engel's law[7]. As soon as one digs a little deeper, the results become much less homogenous, and conclusions more equivocal than in this cursory analysis.

21. One striking point needs to be made about Figure 2. In all countries, the sign of the marketed surplus for staples is identical for all quintiles: positive for all Vietnamese, and negative for everybody else. This is surprising because one could think that richer farmers may be net sellers who produce a surplus of food, which then serves to feed the city dwellers and the poorer, net buyer segments of the rural population. Yet this does not appear to be the case in many developing countries. Another study of 15 RIGA datasets showed that the percentage of production that is marketed not only is low (ranging from 30% in Nigeria to 61% in Vietnam), it also remains strikingly low in the largest landholding quintile (Brooks, Dyer *et al.* 2008). Similarly, Figure 3 reveals that the supposed "wealthy net sellers / poor net buyers" pattern is far from systematic. Only in Nepal, Bangladesh and Pakistan do we see the proportion of net sellers clearly rising with expenditure quintile, and even there those proportions stay low. As a general rule, Figure 3 shows that net sellers are a minority in all quintiles of all countries (except Vietnam, where they are the majority in all quintiles). An explanation could be that the "net seller / net buyer" division doesn't exist at the national level but rather at the global level: the entire rural sector of countries like

7. Engel's law originally states that the income elasticity of food (not staples) is less than one. However, staples being inferior goods, the observation is likely to be even more dramatic when focusing on staples alone. This might be the reason why a cursory analysis points so unequivocally at the poor being the biggest losers in a food price crisis.

Vietnam produces staple surpluses and feeds the entire rural sector of net buyer countries like Bangladesh[8]. These considerations, again, beg for more details, and encourage us to ask what roles different crops play in the overall result we observe?

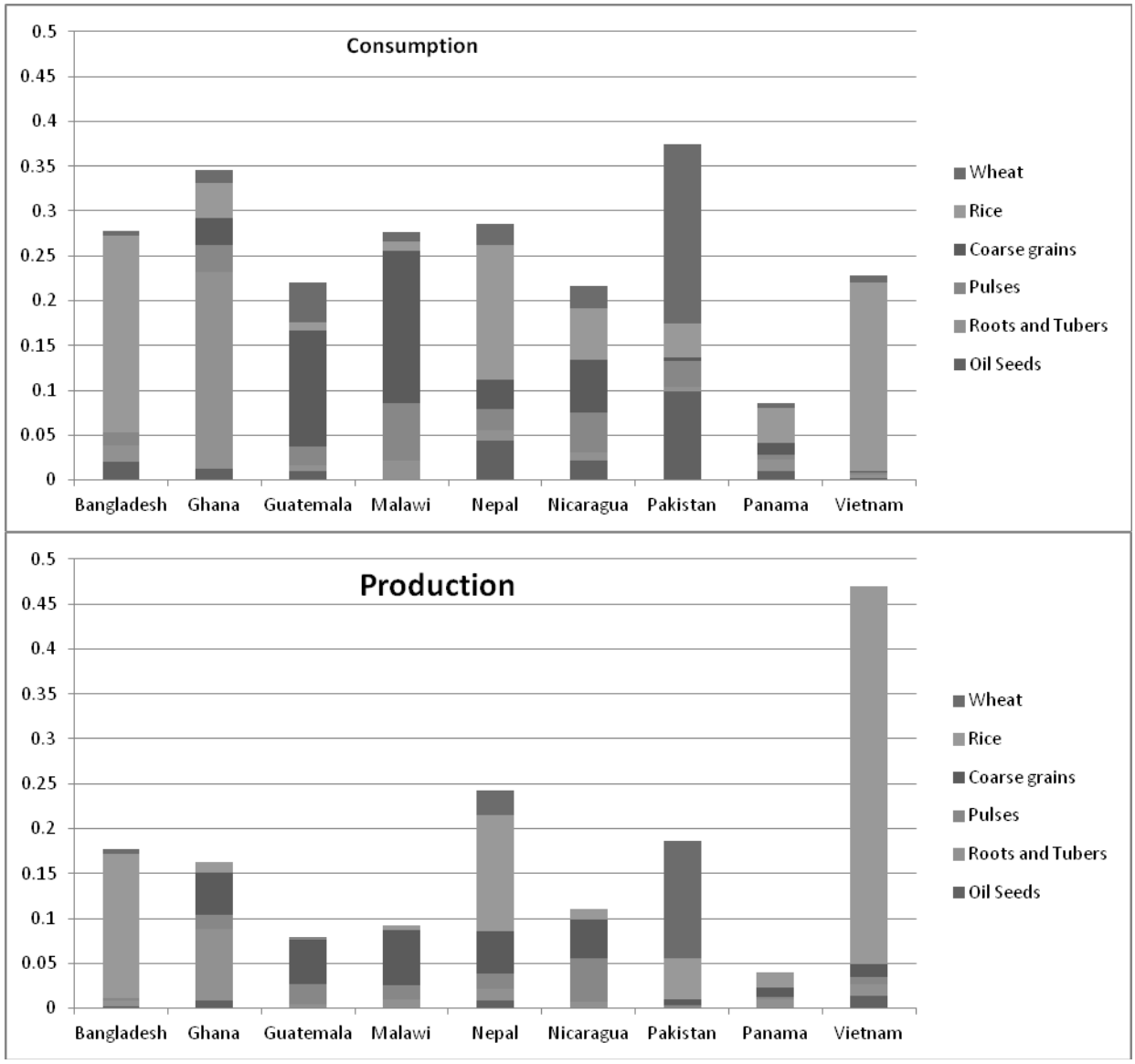
Figure 3. Share of net sellers of staples in each expenditure quintile. Rural households only, weighted by population. (1=poorest, 5=wealthiest)



22. We thus turn the focus to the core of our work: the crop-level analysis of welfare shocks over time series of price data. The methodology in what follows is very similar to what has been presented so far, but we now focus separately on each type of commodity considered. Net benefit ratios (NBR) are obtained from the values of consumption and income related to each type of staple, both of which we present in Figure 4.

8. Other explanations could involve data errors: If respondents chronically over-report their expenditures and under-report their incomes, they will tend to appear as net buyers. It could also be that we over-value home consumption and food gifts (valued at the market price for purchased goods) possibly inducing a sizeable error in our estimation of staple expenditures.

Figure 4. Values of staple consumption (top) and production (bottom) as shares of total expenditures, by type of staple, in the rural sector



23. A few noteworthy observations emerge from the two pictures. First, there is great variation in the importance of staples as a whole (the size of the bars): in Panama, they barely account for 10% of expenditures; in Vietnam, income from staples represents over 45% of total value of expenditures; in Pakistan consumption of staples accounts for 37% of expenditures. Secondly, the dominant staple varies by country (*e.g.* coarse grains in Malawi, rice in Nepal…). Third, the degree of diversification is very different across countries. Bangladesh and Vietnam almost exclusively produce and consume rice. In contrast, Nicaragua shows no clear dominant staple. This last observation in particular seems like it might matter when modelling actual price shocks by commodity. Indeed, a country with a diversified staple basis would be somewhat protected from severe welfare shocks as long as prices of all staples do not soar at once. This introduces our next section, where we use price data in a retrospective analysis.

Part 3: Retrospective look at the 2007/08 food price crisis

24. In this section we confront the LSMS data we compiled to the actual price shocks that happened during the 2007/08 crisis. We first describe and discuss the price data, then simulate the shocks both at the peak of the crisis and as time-series.

GIEWS historical price data shows great diversity

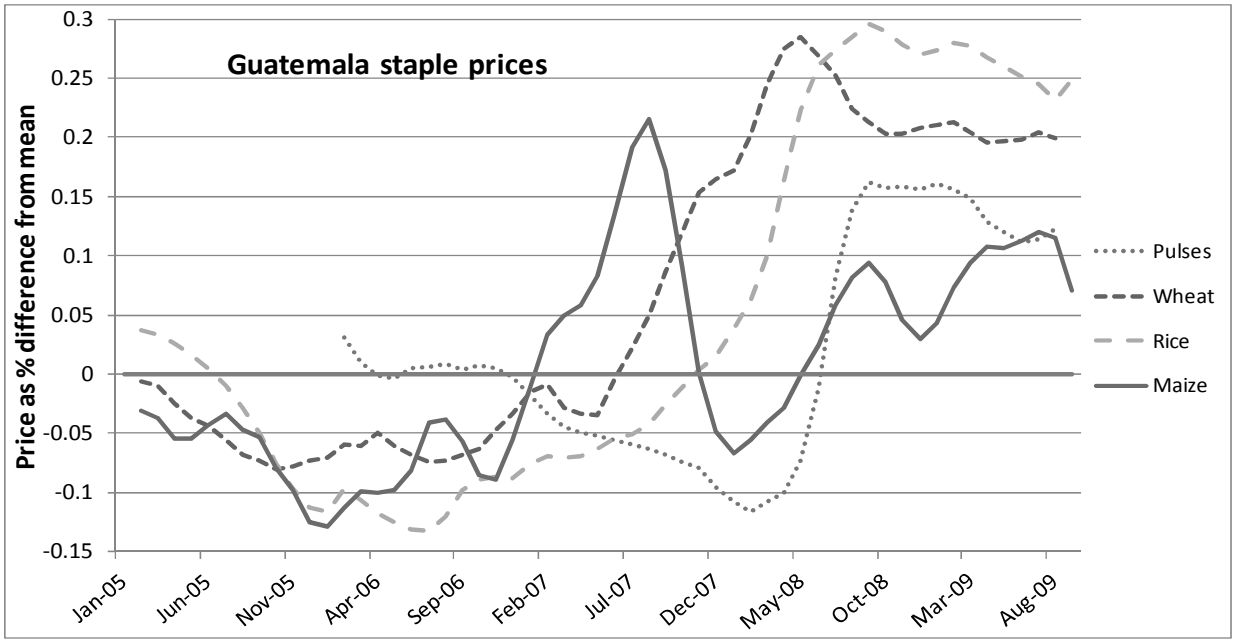
25. The GIEWS database does not provide us with prices for each country and commodity that we wish to model. Table 3 presents the available price data. Despite this issue, comparing Table 3 to Figure 4 reassures us that all major crops are available in the countries where they would seem to matter, with the exception of oilseeds (OS) which would matter somewhat in Pakistan, and pulses (HP) which are the second most important crop in Malawi consumption (although far behind coarse grains). In Vietnam, rice is so clearly dominant, that we need not worry about the lack of other price data.

Table 3. Prices available from the GIEWS database for the countries of interest

Country	Available price series
Bangladesh	Rice (RI), Wheat (WT)
Ghana	Rice (RI), Roots and Tubers (RT), Coarse Grains (CG)
Guatemala	Rice (RI), Wheat (WT), Coarse Grains (CG), Pulses (HP)
Malawi	Rice (RI), Roots and Tubers (RT), Coarse Grains (CG)
Nepal	Rice (RI), Wheat (WT)
Nicaragua	Rice (RI), Wheat (WT), Coarse Grains (CG), Pulses (HP)
Pakistan	Rice (RI), Wheat (WT)
Panama	Rice (RI), Wheat (WT), Coarse Grains (CG), Pulses (HP)
Vietnam	Rice (RI)

26. Presenting the GIEWS price data for each country and each crop would be overwhelming and scarcely informative. Instead, we describe the evolution of staple prices in Guatemala, which provides a telling example. Rather than a single "food price crisis" during which all prices would rise simultaneously then fall together, we observe that prices rose at different times for different crops over a two-year period. During the first observed shock (maize prices in January 2007), prices of pulses were actually falling and kept doing so until March of 2008. At that date, wheat and rice prices were rising sharply, but maize prices had fallen back to below-average levels. After July of 2008, prices of all staples had risen above average levels, and had hardly fallen back down a year later. This first glance suggests a picture which contrasts sharply the one we gather from world prices. While world prices all rose sharply in 2007 and decreased after mid-2008, the Guatemalan economy seems to be undergoing a more durable increase in the level of staple prices.

Figure 5. Staple prices in Guatemala – 2005-09



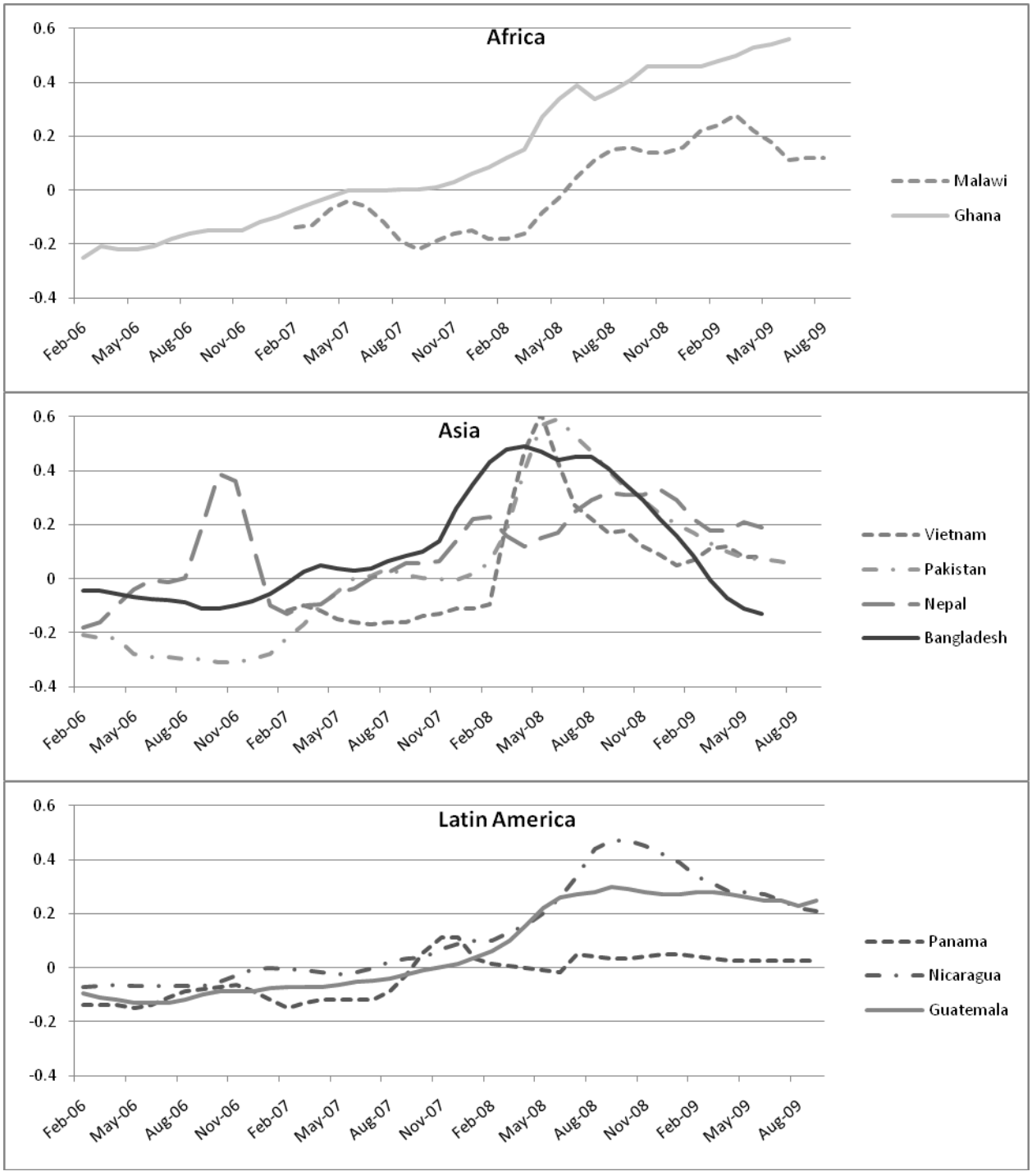
Source: National averages **compiled from** GIEWS database.

27. What are the likely effects of what we see for household welfare? As far as immediate shocks go, for a household that is a net buyer of all of these crops, it is not obvious at what point the decrease in the price of pulses will stop compensating for the increase in the price of other staples. The welfare shock may hit at any point during 2007 or 2008, depending on the relative importance of the crops in the household's budget. Once it hits, however, the negative welfare shock will be quite prolonged if nothing changes. By the middle of 2009 (supposedly after the crisis, as far as world prices are concerned), the four crops are all still 10% to 25% above their average level simultaneously. Our simulations will help discuss how those high prices can translate into welfare pressures.

28. Before we turn to our simulations, however, let us present a quick cross-country comparison. Since the only good for which data is available in all countries is rice, we use it as our example-crop and plot the evolution of the price of rice in all nine countries over the period 2007/09 (Figure 6). The lack of a discernible pattern across the panel is telling: while all countries saw a peak in the price of rice at some point in 2007/08, no two countries display the same evolution. Some countries saw an abrupt spike (Pakistan), others a slower increase (Nicaragua); some spikes were short (Vietnam), others prolonged (Bangladesh); some early (Panama), others late (Malawi). Bangladesh saw a sustained increased price for the entire 2008 year, but the price returned to normal levels in 2009. In contrast, the price of rice in Ghana increased steadily and the available data does not yet show it falling back. In Vietnam, the spike was both sharpest and shortest of all countries. Such differences are bound to induce dramatically different consequences for the various countries. Similar graphs (not presented here) were compiled for the other groups of staples, and similar diversity was observed across countries.

29. The analysis of those price evolutions leads to the question of how transient this "price crisis" really was, since most countries in our sample did not seem to recover. This question is worth keeping in mind, because the consequences of a structural break in commodity markets are quite different from those of a one-off crisis. If the new market conditions are to last, rural economies may need to adjust, and it might be that they will face continued depressed welfare levels until they do so. The policy responses in that case are also very different from the ones necessary to curb a transient crisis.

Figure 6. Evolution of the price of rice in selected countries, expressed as per cent increase or decrease relative to the mean



30. This quick overview of price evolutions in various countries for various crops only reinforces our conjecture made at the end of Part 2: that if we look at differentiated crops rather than staples in general, at actual price shocks rather than hypothetical ones, and at time-series of prices rather than point data, our cursory analysis of welfare shocks may turn out to be greatly insufficient. The diversity of welfare impacts

across countries and household groups is likely to be substantial, not only in terms of magnitude but also in terms of timing and duration. We now explore both of those aspects.

Magnitudes, timing and duration of welfare shocks varied substantially across countries

31. **Magnitude of welfare shocks at the peak of the crisis.** The fact that prices fluctuate is nothing new, and people have always had to deal with it by adapting their behaviour. The word "crisis" connotes a shock of particular brutality: sudden, unforeseen, and of large magnitude. Yet Figure 6 convinced us that the evolution of rice prices did not necessarily fit this description. There is no clear criterion by which to decide whether a peak in prices qualifies as a "crisis". In order to compare the severity of the "price crisis" across countries, Dawe and Morales-Opazo proposed to look for the point of "largest shock", identified as the greatest year-to-year increase in the price of any given staple (Dawe and Morales-Opazo 2009). Using this definition, we can ask the following question: At the point of the largest price shock, how hard of a blow was it in terms of welfare?

32. We identified the largest shock similarly to Dawe and Morales-Opazo (2009), the only difference being that we used a six-month basis[9]. Since the timing of the largest shock for any given country is bound to vary by crop, we decided to sum the differentials across all crops and to choose the date of the largest "crop-cumulative 6-month price differential" as the date of the worst shock. The timelines of cumulative shocks are plotted in Figure 7, which shows that dates of sharpest increases are clearly identifiable for some countries but less obvious for others. Those dates and the corresponding shocks are provided in Table 4.

9. With our sample of countries and goods, year-to-year increases seemed to miss the most dramatic shocks; we thus decided to shorten the time frame. Also, this reduced the loss of data on both ends of the time-series.

Figure 7. Crop-cumulative 6-month price differentials – (per cent increases over value 6-months earlier, summed across all available crop prices)

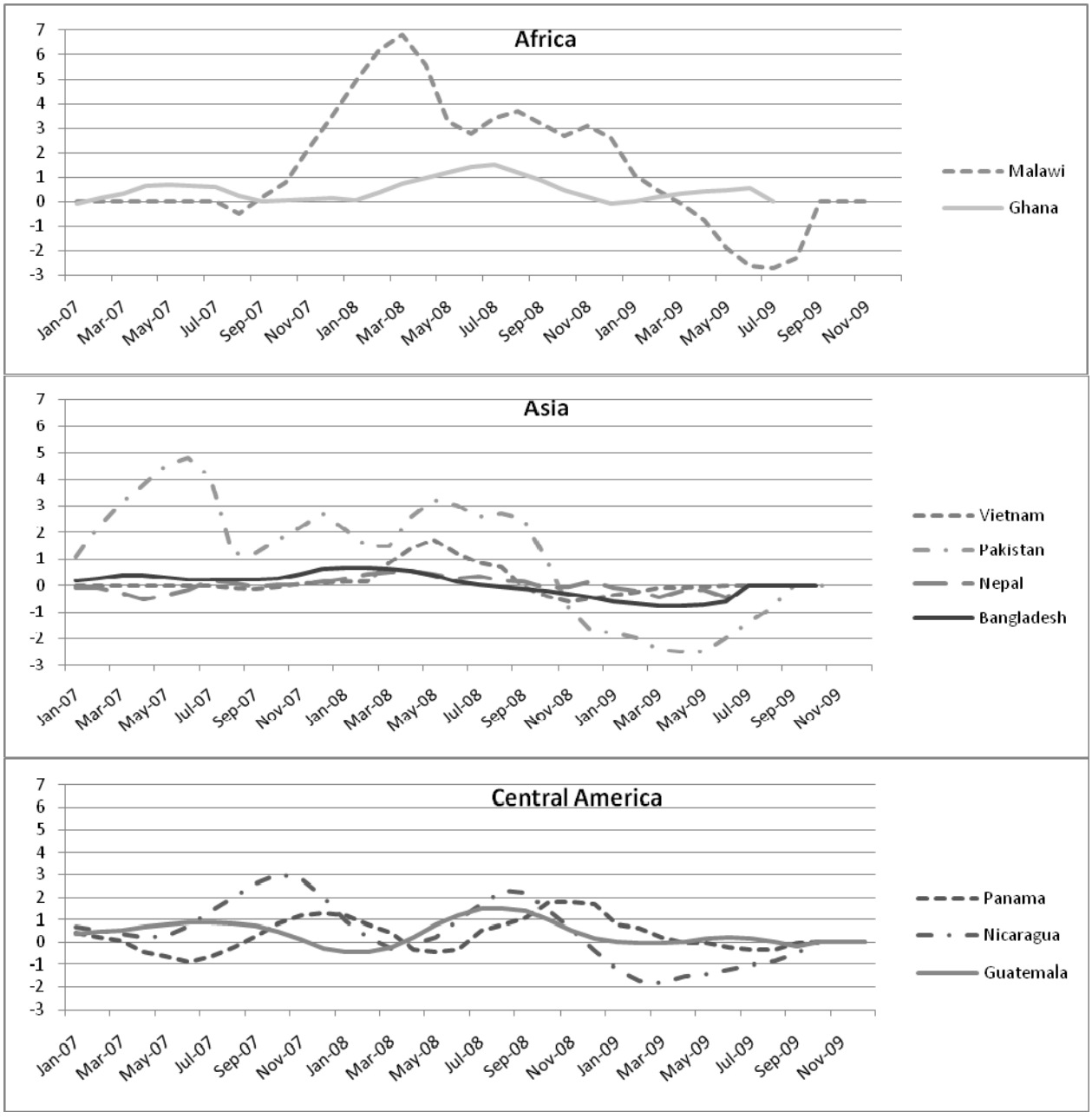


Table 4. Dates of the largest cumulated price shocks by country (shocks over 6-month period), and details by crop

	Date of largest shock (all crops combined)	Size of shock by crop				
		Rice	Wheat	Coarse Grains	High Protein	Roots & Tubers
Bangladesh	Feb 08	34%	32%			
Ghana	Jul 08	24%		80%		42%
Guatemala	Aug 08	21%	2%	15%	29%	
Malawi	Mar 08	8%		110%		-9%
Nepal	Oct 06	55%	18%			
Nicaragua	Oct 07	5%	.	30%	88%	
Pakistan	Jun 07	43%	1%			
Panama	Oct 08	3%	8%	32%	24%	
Vietnam	May 08	85%				

33. Figure 8 presents some of the key findings of our study: they are the result of applying the real price shocks from GIEWS to the household data from RIGA. We present them as a matrix of graphs, where each country graph represents the welfare shock by expenditure quintile, at the date of the sharpest 6-month price shock. Households are disaggregated by expenditure quintiles, and crops are disaggregated as much as data permitted. For each country and each quintile, the fully coloured dots represent the shock due to a particular staple, while the hollow circle represents the overall welfare shock. Analyzing the nine graphs gives us insights into how each country experienced the food price crisis.

34. First, let us focus on the hollow circles and say a word about the magnitudes of shocks. As expected, in some cases the welfare shock is much larger than that of the hypothetical 10% price increase simulation. Some household groups in some countries reveal shocks that are rather severe, such as the poorest quintile in Malawi (25% drop in welfare in six months), or some groups in Bangladesh, Nepal, and Ghana that show a drop of about 7%. On the other hand, Panama, where the most dramatic shock was only -0.6%, stays virtually unaffected. Vietnam stands out as the only country where all rural households gain.

35. The disparities between quintiles are also worth observing. The hollow circles in countries like Bangladesh or Malawi show a clear linear pattern by which the poorest are hit the hardest, and each quintile fares slightly better (less worse) than the previous one. That pattern is virtually identical to the one we could see on the bars of Figure 2. Nepal's poorest quintile also loses most in its country, with a -7% shock, but the linear pattern is less apparent there. In contrast, the poorest Ghanaian quintile fares best in its country, with an overall shock of about zero per cent, while all other quintiles lose around 5% welfare. Meanwhile, the results for Pakistan and Nicaragua exhibit no clear distributional pattern. For those three countries, the shocks predicted by this analysis are very different from the ones of our cursory analysis of Part 2.

36. We now turn to the analysis of the relative importance of each crop in the welfare shocks (the coloured dots). First, we identify a group of countries for which only one crop seems to have mattered, easily identifiable because the "overall shock" hollow circles practically encircle a single dot each. From Figure 4 we already knew that in Bangladesh and Vietnam rice would be the only crop that really matters (and in Vietnam, it is the only crop we have price data on), so it comes as no surprise that overall shocks are fully driven by rice values in those two countries. Malawi and Nepal are more diverse in their foods and production patterns, yet their shocks also seem to be entirely determined by a single crop. The reasons are specific to each country. In Malawi, only one crop matters because at the time of the maximum price shock only one commodity was significantly affected: the price of rice had only gone up 7%, the price of

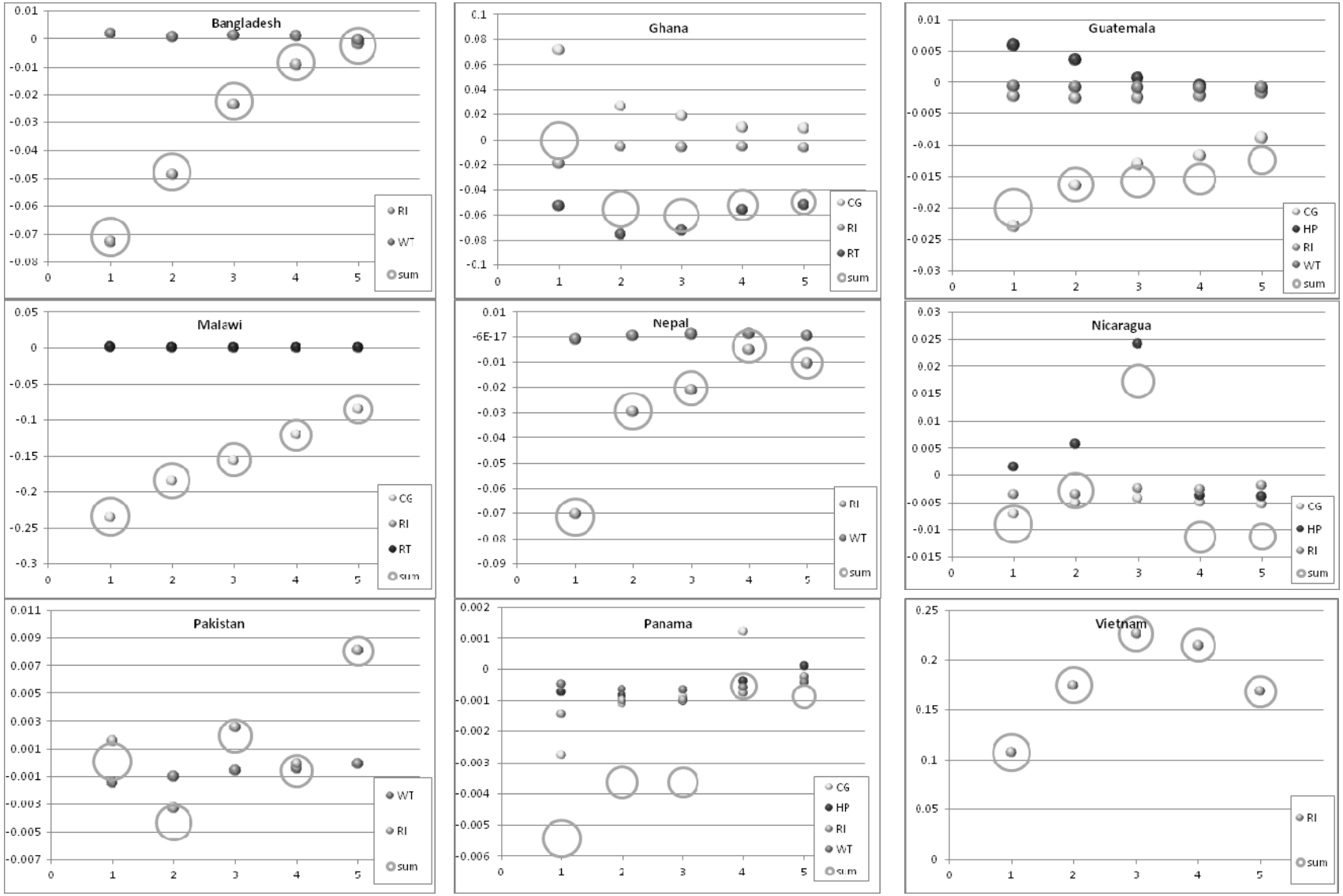
roots and tubers (RT) had actually decreased 8%, while coarse grains had seen a 110% price increase in six months, thus driving the welfare shock. In Nepal, the situation is completely different: rice and wheat both saw relatively large increases in price, and both represent a significant part of consumption and production. However, it turns out (graph not shown) that all five quintiles of the rural population are virtually self-sufficient in wheat, with NBR's approaching zero: even large fluctuations of the wheat price will have little effect.

37. Switching the focus to countries where welfare shocks are determined by several crops, we see that price shocks on different crops can either accumulate or offset each other. Ghana is a clear example of the latter. At the date of maximum shock, prices of coarse grains, rice and RT all increased sharply (respectively by 80%, 42% and 24%). But it also happens that Ghanaian farmers are net sellers of coarse grains, so the 80% price shock had positive welfare effects, and helped to partly offset the negative effects of the rice and RT price shocks. In the case of the poorest quintile, the net effect is close to zero, making them the least ill-affected group. Nicaragua also offers an interesting case. While we had seen that all rural quintiles are net buyers of "staples" in general, this is not the case for pulses in particular. The three poorest quintiles are net sellers of pulses, and the two wealthiest ones are net buyers. Therefore, when prices on pulses increased 88% over six months, this was good news for the three poorest quintiles, helping them offset the negative impact of the simultaneous 30% increase in CG prices. Meanwhile, it made things worse for the two wealthiest quintiles. For the middle-income rural households of the third quintile, this even leads to an unexpected sign reversal, as they perceive a positive overall welfare effect of almost 2%.

38. This subsection leads us to a few conclusions about the magnitudes of welfare shocks. First, we found that even when focusing on each country's most severe price shock over the past 4 years, the magnitude of the actual shocks to welfare shows huge disparities between countries. Second, we found the interplay of different price shocks on different crops that play a different role in the portfolios of different households significantly complicates the picture. The cursory analysis of Part 2 gave incorrect predictions in three cases out of nine. To add even more complexity, we now turn to the analysis of actual time series of welfare shocks during the crisis.

39. **Analyzing welfare over time**. The previous sections showed that the relative importance of crops in the portfolio of households, and the relative size of the price shocks on crops, played a defining role in the welfare shocks induced by the price crisis. With good understanding of the forces involved, we can now add timing into the equation, and analyze welfare timelines in all nine countries.

Figure 8. Welfare shocks by crop, at the time of the "worst" price shock (largest crop-cumulative 6-month price increase). Size of hollow circles proportional to population.)



40. Figure 9 is another matrix of charts. It shows, for the five expenditure quintiles of each country, the evolution of the welfare incidence during the past few years (in percentage difference from the mean level), which we will call the "welfare path". Note that we used as long a time frame as was available for each country, such that some charts span four years, others three, and others only two.

41. Again, the first impression that emerges from the chart matrix is one of diversity. Relative welfare changes varied across all our countries. In our nine-country sample, no two countries show similar welfare paths. The only pair which arguably shows similarity is Malawi and Pakistan, with the important difference that welfare levels in Malawi improve at the end of the period while they stay about 5% below average in Pakistan. Other countries all show very idiosyncratic welfare paths.

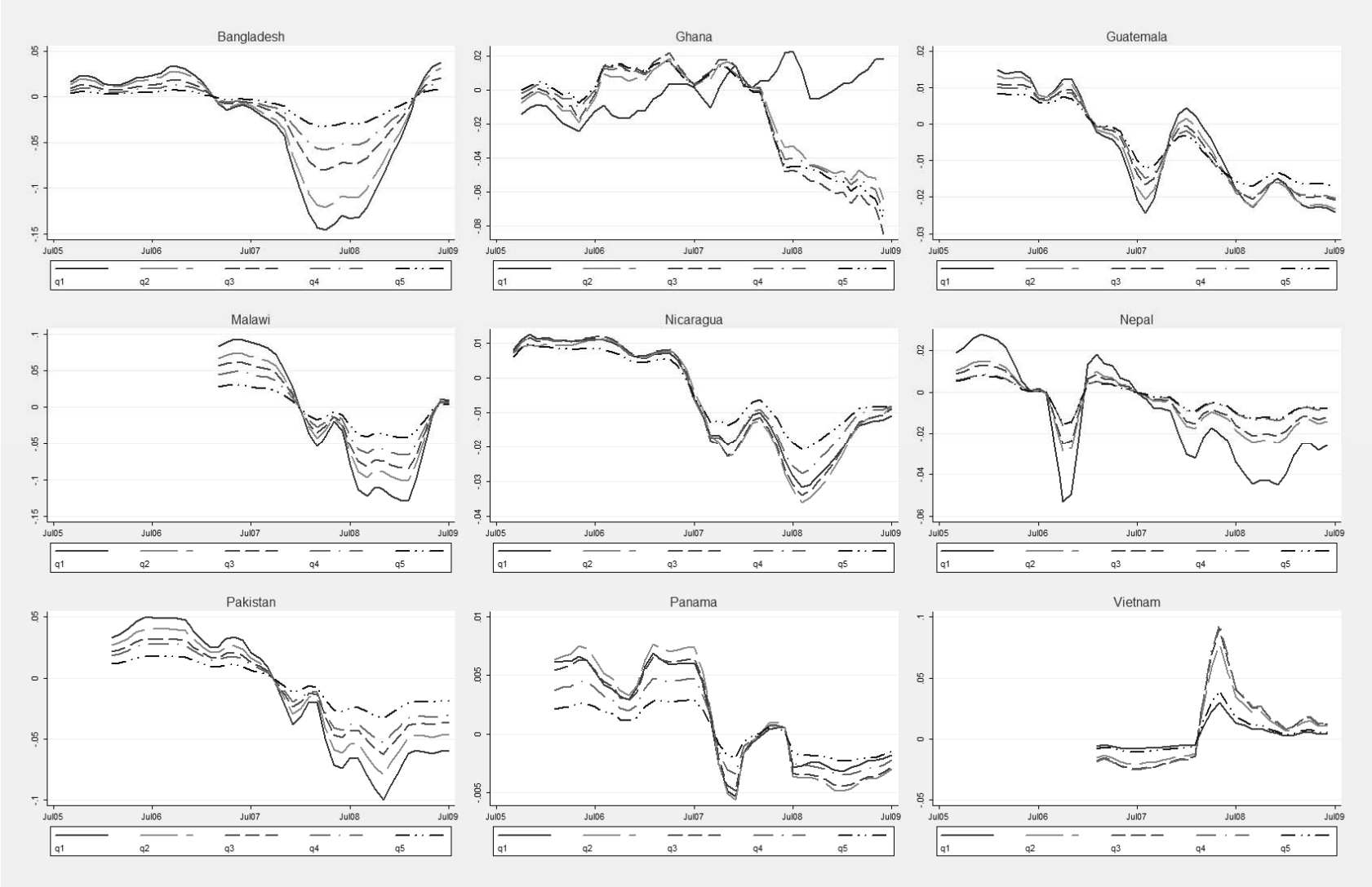
42. The observations about magnitude of welfare outcomes over the period conform to what we observed earlier. Some countries show minimal disturbances (Panama), others sizeable deviations from the mean (Malawi, Vietnam).

43. There are important between-quintiles disparities in terms of welfare shocks. Looking at Guatemala or Nicaragua, we see that all the welfare paths of households are tightly packed together, suggesting that rich and poor all go through equally good or bad times as agricultural prices fluctuate. It is not the case for Malawi and Bangladesh. In those countries, the negative shock was accompanied by a clear widening of welfare disparities. Interestingly, Panama shows the opposite phenomenon (though to a lesser extent): there, the hard times were associated with narrower gaps between quintiles. Looking further at the differences between shocks on various quintiles, we find four countries for which the negative shock was hardest on the poorest quintile (*i.e.* the full line (in red) is the lowest during the negative shock). In three countries the poorest fared no worse than others; in one case they fared best in their country. According to these observations, the food crisis cannot be said to have widened disparities, and it cannot be said to have been hardest on the poor segments of the rural sector. These findings contrast with the predictions of our cursory analysis of Part 2, which led us to think that almost without exception, the poor would be the biggest losers when prices rise. As we mentioned earlier, this result may simply have been an illustration of Engel's law. This is an indication that our earlier analysis was likely *too* cursory.

44. Let us finally make a few remarks about the timing and duration of the "welfare crisis" (rather than just the food crisis). The onset of the sharpest welfare shock varies from late 2006 (Nepal) to mid-2008 (Ghana). This echoes our earlier observations concerning the timing of price shocks. Comparing the duration of the crisis between countries is a difficult task. Bangladesh is the only country that undeniably shows a transient "welfare crisis": welfare drops dramatically and suddenly, and then rises again to average levels. Vietnam shows an equally clear temporary "welfare boom". But recall that those two countries were precisely the two that virtually produce and consume only a single staple (rice). As soon as the production and consumption patterns become more complex, so does the welfare path. Malawi and Nicaragua also display rather identifiable "crises" in 2008/09. Nepal shows a sharp and transient drop in welfare in 2006, a return to normal, then a less obvious "crisis" at the end of 2008. Pakistan seems to be going through a gradual deterioration of welfare, which stays below average during 2009. Panama and Guatemala both show no signs of recovery after the shock, and four out of five Ghanaian quintiles fare worse than ever at the end of the time-series. The welfare paths we observe clearly suggest that in most countries the effects of the rising food crops were prolonged and were not necessarily reversed at the "end" of the crisis.

45. We thus conclude our retrospective part of the study with the observation that the "past" crisis was not necessarily over even by the middle of 2009. This indicates, again, that we may be witnessing some deeper structural change rather than a temporary crisis. As we are about to see, prices are largely predicted to keep rising over the next ten years.

Figure 9. Evolution of welfare over time, in percentage difference from the mean



Part 4: Prospective look at the 2009-18 period

46. In the last section of this study, we switch to a forward-looking analysis. We use the Aglink-Cosimo price predictions to plot out the welfare effects of future price trends. The Aglink-Cosimo price data has the advantage of being very complete, such that we are less limited by data availability than we were with Giews. We now have price predictions for all crops of interest and all countries, with the exception of pulses, which are not modelled in Aglink-Cosimo. This may bias somewhat our results in Nicaragua, but likely will not matter dramatically for most other countries of the sample.

47. The price predictions of Aglink-Cosimo over the next few years show as much complexity and variation as the Giews price data did, and there is no need to discuss them in detail. Each country shows unique price evolutions, which do not simply follow the international prices mentioned in the introduction. In the long-run, however, a clear pattern emerges: in 2018, prices of all commodities in all countries are predicted to have risen substantially (by about 20 to 80% in general, but up to 130% for maize in Malawi).

48. We simulate the effect of those prices on welfare. Because we are using medium-term data, the values of our "immediate welfare shocks" should be interpreted with caution. These results should not be seen as portraying actual welfare outcomes, but rather pressures that commodity markets will exert on welfare – which can provide insights in terms of the direction of likely adjustments. In the long term, for example, some farm households which lose immediately from higher prices may be able to benefit by transforming themselves into net sellers.

49. We chose to disaggregate welfare paths by crop (rather than by household quintiles like earlier), so as to observe which crops will have the strongest impact on household welfare and household behaviour (although we cannot model the latter). Our simulation results are, again, presented in a matrix of charts, Figure 10. The graphs feature the paths of welfare pressures due to each crop, and the overall welfare effect (the orange, thick line). All are calculated using predicted price differentials from their initial 2009 level.

50. We observe three general shapes of graphs. The first, observed in Malawi, Pakistan and Guatemala, shows straight and uninterrupted downward pressure on welfare over the whole period. The second, observed in most other countries, features a more-or-less pronounced welfare increase in the first year, followed by an uninterrupted drop. In those cases, the welfare path drops below the original 2009 level in 2012 at the latest. The outlying shape is that for Vietnam, which shows a mirror image of what we just described: a two-year drop followed by a continuous increase.

51. It immediately comes to mind that the countries which improve from 2009 to 2010 might be the ones that, in our retrospective analysis, had ended on a low level in 2009. Could it be that these countries will finally pick up in 2010? Not systematically. It is the case for Ghana, which ended at its lowest level in 2009, and picks up in 2010. It is barely the case for Panama, with a very mild increase. Guatemala, on the other hand, keeps falling like it was in the past, and so does Pakistan. These results, again, point to the rise in prices as a lasting phenomenon. They also confirm our fear that some rural sectors which have not recovered from the so-called 2007/08 price crisis, are not likely to do so unless livelihood strategies adapt.

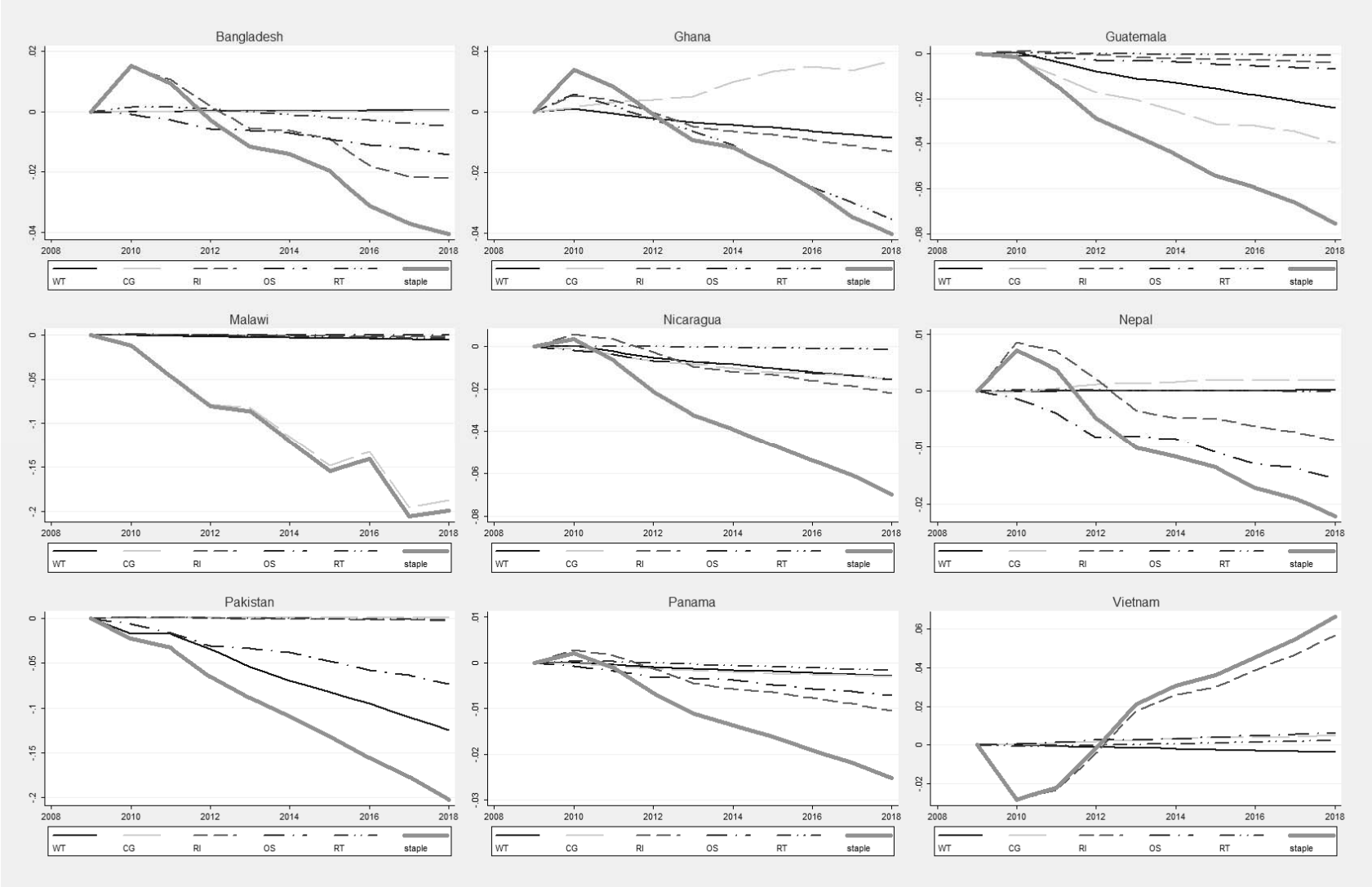
52. The magnitude of the welfare pressures covers a wide range. In Pakistan and Malawi, the welfare paths fall by 25% and 20%, respectively, ranking them among the biggest losers again. The variations in Bangladesh, however, do not exceed 6% in magnitude, whereas they were hit the hardest of our sample in 2008. In contrast, Panama had seen no variation larger than 0.7% which means they had been relatively unaffected, but by 2018 the downward pressure on welfare reaches -2%.

53. The contributions of each staple to the welfare shock are rather similar to those we made using Giews data. Bangladesh, Vietnam and Malawi still seem to be driven by the price of a single crop, while other countries are affected by cumulative effects. In Nepal, we clearly see how the average welfare effect is driven by the prices of rice and oilseeds, which work in opposite directions at first, but then coincide in lowering the overall welfare effect. Interestingly, at the end of the forecast period, in 2018, almost every crop in every net buyer country works to the disadvantage of the overall welfare (coarse grains being an exception in two countries only).

54. In conclusion of this forward-looking analysis, we can say that the staple price predictions seem rather unfavourable to rural households of developing countries. In the long run, we predict downward pressure on welfare for eight out of nine countries.

55. There is no doubt that households will try to adapt to the new commodity markets. They may adapt their consumption habits or production volumes in response to the shifting incentives: the question is how fast they will do so. One might think that households will quickly change their consumption habits to avoid the crisis. However, since we are modelling staples (the cheapest of foods), and since all staple prices rise in the long run, there is actually very little room for households to adapt. On the production side, while adaptation is typically slow in agriculture, we might think that nine years will be enough for households to substitute away from unproductive activities and invest in crop production to benefit from the high prices. This may be a more likely scenario, and a more optimistic one, as it could turn the original negative welfare shock of 2008 into sustained growth opportunities.

Figure 10. Forward-looking shocks – in differences from 2009 level



The orange, thick line represents the overall welfare path, while thinner lines represent one staple each.

Conclusions

56. The world has just witnessed dramatic variations in food prices, which may have been the early sign of structural change in commodity markets. Because the effects of high food prices on rural livelihoods are complex and ambiguous, it is unclear what the welfare impacts of these high prices may have been, and what they may be in the future. We proposed a method to evaluate those welfare impacts, and used it in both a retrospective and a prospective analysis of welfare impacts in nine developing countries.

57. Our approach bridges two kinds of economic studies: those that focus on markets and prices, and those that focus on household data. For example, a study like that of Dawe and Morales-Opazo (2009) documented the extent of the price shocks during the crisis, but could only hypothesize the consequences by stating that "such large price increases almost certainly had severe impacts on the effective purchasing power of the poor". In contrast, a study like that of Zezza and collaborators (2008) simulates a 10% staple price increase, and effectively condenses down to a comparison of staple net benefit ratios along various household characteristics. By bridging the two approaches we provided results that should better portray the likely impacts.

58. The immediate impression that comes out of our results is one of diversity. Far from being problematic, this diversity can help us question certain (mis)conceptions about welfare shocks during food price crises. Part 2 set out with a cursory analysis which produced very general results, similar to those from previous studies, but which failed to hold when detail was added to the picture.

59. We had initially found that rural households in all-but-one of our countries of interest are net buyers of staples in general… but we later showed that they are not net buyers of *all* staples, and that the sign of their net balance for any given crop varies by expenditure quintile. Several households in several countries were shown to be net buyers of one staple and net sellers of another. Those households' welfare impact will depend on the relative size of the prices increases between various staples, and cannot be predicted using a general "staple" category. Using actual price data at the crop level, we identified two households which fared dramatically better than we had originally predicted.

60. Another general result from our cursory analysis was that the households from the poorest quintile fared invariably worst in their country (or second-worse in a single exception). However, once we had disaggregated the analysis by crop and introduced actual price shocks, this was not found to be a general result. We could not document a systematic increase in welfare disparities either, and they were even reduced in one case.

61. Those observations thus reinforce our belief that failing to focus on the crop-level may lead one to overlook non-trivial effects and to oversimplify conclusions. The relative timing of price shocks for various crops and the relative magnitude of those shocks both matter to the analysis and generate substantial diversity in the estimated welfare impacts.

62. Despite this diversity we documented, we can draw a few general conclusions from both our retrospective and prospective analyses. First, we found that the so-called 2007/08 food price crisis carried well into 2009, and may still not be over in some countries. This is particularly worrisome, as households that suffered month after month of depressed welfare may have reached a very dire situation, which could be very difficult to recover from. Second, the conclusions from our forward-looking analysis point to continued increases in staple prices, the consequences of which will depend on whether rural households will be able to turn these high prices to their advantage.

63. The short-run policy implication from the above observations is that pre-emptive action must be taken as early as possible to avoid another food crisis. Retrospective analysis tells us that many countries were still seeing low welfare outcomes as of 2009, and prospective analysis tells us that, in the absence of adjustment, another round of falling welfare is likely in the coming years. Those hit hardest by the first crisis may still be recovering from its long-lasting effects (for example, if they sold assets, took children out of school, developed nutritional deficiencies, sunk into debt, etc.). A few household quintiles of our sample saw welfare drops of over -10% in the first crisis, for several months in a row: safety nets must be put into place before the next crisis strikes.

64. The rise in prices is predicted to be sustained in the long run. This could be seen as a long-term problem, and crisis relief is hardly a sufficient response in that case: protective policies with long-term impacts might also need to be put into place to help struggling households meet their food budget. On the other hand, high food prices also offer opportunities in the rural sector. Notice that Vietnam, a success story of the green revolution, is the outlying country of our sample, the only one that benefits from high food prices. Investments could be made to facilitate adaptation of rural households to the new price conditions. Any household that manages to reach net supplier status will gain rather than lose from the future rise in prices and government policies can help induce this change.

65. We already hinted at a few caveats which could lead to question our conclusions. One is the problem of data quality: it is often believed that households bias their survey answers to appear poorer than they are, in which case we may be overestimating the hardships induced by expensive staples. Another is the absence of second-order effects in our methodology. Higher staple prices could, for example, increase demand for hired labour on net seller farms, increase off-farm income, and thus mitigate the negative welfare shock. In contrast, higher prices on staples could also drive up the prices of other foods. The links between staple markets and feed markets are strong, and meat prices may rise substantially, thus exacerbating the negative welfare shock.

66. To summarise, the recent increase in staple prices created downward pressure on welfare in all but a few cases. The magnitude and timing of those welfare shocks depended on the type of crops produced and consumed by each rural household, and overlooking these details masked important nuances and substantial variation across countries. Price predictions indicate that the rise in prices may not have been a transient incident, but rather may be marking a structural break in commodity markets, with higher future prices threatening welfare while also creating opportunities for those who can increase staple production.

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