The Food Price Crisis Monitor[1]

Executive Summary

1. A multisectoral effort led and coordinated by the World Bank's Poverty Global Practice (GPVDR) has developed a proposal for a food price monitoring system. This framework defines, identifies, and monitors food security crises at the national level caused by shocks and factors that are not circumscribed to a given country. The framework will provide critical information for timely responses in the face of food crises.

2. The proposed monitoring system should contribute to the early detection of unfolding food security crises in most vulnerable countries. By doing so, the framework will provide relevant inputs to the Crisis Response Window team and to Bank colleagues participating in fora such as the UN High Level Task on Global Food Security and the Agricultural Market Information System, AMIS. It is also expected to assist Bank country teams engaged in food security work by providing country specific data and regional/global benchmarking.

3. The key concept underlying this monitoring framework is a country's vulnerability to food insecurity. Vulnerability is defined in terms of the degree of exposure to domestic food price spikes and limited macroeconomic capacity to mitigate their effects. The framework consists of two components, the global and domestic stages.

4. This proposal discusses, compares, and calibrates several indicators and triggers in the global and domestic stages. The calibration exercise determines the best performing triggers in terms of identifying past crises peaks; minimizing false positives; early detection of the crisis (that is, the number of months before the price peak is reached); and length of the crisis.

5. Using food, fertilizer, and fuel global price trends from 1960 to 2012 from the World Bank, 46 country specific staple prices data from FAO and macroeconomic indicators for such countries reported by the IMF, the calibration exercise that predicts the 2008 and 2011 price spikes show that the best performing triggers are:
   (i) Global food price index exceeds 3 standard deviations (SD) from the detrended historical mean of 1960–2006 (2005=100).
   (ii) Domestic food staple prices increase at least 15 percent during a period of five months for two or more countries from a same (sub)region.
   (iii) All those countries in the region or subregion that exceed the staple price trigger have at least one macroeconomic vulnerability (as defined by debt, current account, fiscal, and foreign reserves triggers).

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6. The framework will provide red flags or warnings in two ways. In the top-down approach, a warning is issued after global food prices exceed their specific trigger. Then, domestic staple prices and macroeconomic vulnerability variables are analyzed for countries by region to determine the most severe cases. In the bottom-up approach, in the absence of global prices' warnings, a warning or alert may become active when domestic variables in two or more countries within a region exceed their triggers.

7. By no means the tool will or should be used unilaterally by the Bank or any of its departments to declare global or national food crises. There are existing international venues and engagements – in which the Bank is a partner— for such declarations to be collectively made. To be sure, the tool will provide the Bank with analytical inputs for such decisions, but should never be used for unilateral declarations.

8. Several next steps are identified, including the piloting of the system with current data, the need to define the governance of the framework, and data requirements to sharpen the system.

1. Context

This note introduces a **framework to monitor food crises** and includes its basic characteristics; objectives; basic underpinnings; indicators and triggers; its calibration and use; and next steps. This framework responds to the need to design an information tool that effectively identifies and monitors unfolding, multicountry food crises. Ultimately, this framework will contribute to the Bank's ongoing mitigation and prevention efforts in preparation for future crises.

This monitoring framework adds to other World Bank's ongoing operational and financial efforts to improve policies, transparency and monitoring of food related crises. These efforts include partnership with the G20's Agricultural Market Information System and UN High Level Task Force on Global Food Security; the quarterly monitoring report, Food Price Watch, and the knowledge platform, Secure Nutrition; crisis alleviation financing mechanisms such as the Rapid Response Mechanism, the Global Food Price Response Window, and the Crisis Response Window. Medium and long term interventions and advocacy on agriculture, nutrition and food security include the Global Agricultural Food Security Program; participation in the CGIAR; the Critical Commodities Finance Program and novel risk management products against food price volatility.

The monitoring framework is not the only tool currently dealing with food security issues. Other instruments like the FAO-GIEWS (Food and Agriculture Organization—Global Information and Early Warning System on Food and Agriculture), the U.S. Agency for International Development (USAID)'s FEWS NET, or the UN-developed Food Insecurity Severity Scale, IPC, all provide a basis for a very detailed analysis of food crisis vulnerability at the country level. However, they do not provide an integrated global picture. Conversely, the recently launched Agricultural Market Information System, AMIS, and the FAO's Global Food Price Index provide information on global food prices –observed and futures in the case of AMIS– but fail to provide a detailed national angle. Furthermore, none of these frameworks integrate in their monitoring the country's capacity to deal with food related crises. As a result, the proposed monitoring framework strikes a balance between global and domestic food price monitoring, on the one hand, while integrating food price dynamics with macroeconomic space to deal with crises, on the other. As a result of a deliberate decision, the proposed monitoring framework focuses on providing comprehensive data – in terms of number of countries and time series– for domestic and international food prices and for macroeconomic vulnerability, at the cost of a deeper analysis on the

prices of futures, food stocks and selective subnational information. This is believed to maximize the contribution of this framework to existing monitoring tools.

There are three main challenges that the framework must still address. First, there is no consensus on a definition of what a food crisis is (box 1), and, consequently, there is not a generally accepted mechanism to identify the onset of a food crisis until well after it has started. Second, there is typically a lag—to various degrees—in the availability of relevant data. Third, while there is a consensus on the multiple factors driving global and domestic food crises, there is much less consensus on the relative importance of each and their interdependence.

The current framework acknowledges these three challenges. It proposes an empirical definition of food crises that is easy to operationalize and monitor, but is also appropriately flexible for revision as circumstances require or when additional information becomes available. The framework maximizes frequently available relevant data and, when not available, uses annual data. Finally, the framework does not attempt to solve analytical or operational issues (such as, for instance, whether responses should be different in transitory and chronic situations), but focuses instead on single channels clearly conceptualized.

Box 1. Defining a Food Crisis

Although the concept of food security is widely acknowledged, "all people, at all times, have physical and economic access to sufficient, safe and nutritious food for a healthy and active life,"[a] there is not a clear operational definition of what constitutes a food crisis. For example, the World Bank's Global Food Crisis Response Program does not contain an explicit definition of "food crisis."[b] The Bank's Operation Policy 8.00, which lays out the Bank's policy on rapid response to crises and emergencies, does not differentiate between "crises" or "emergencies," and includes the term "disaster" in stating when the Bank can respond to a borrower's request for assistance—which would be when "an event that has caused, or is likely to imminently cause, a major adverse economic and/or social impact associated with natural or man-made crises or disasters."[c]

Both the Food and Agriculture Organization (FAO) and World Food Program (WFP) differentiate transitory from chronic food insecurity and talk specifically of "crisis-induced food insecurity." This includes sudden "shocks" (for example, due to a flood or conflict) and "crises" that develop progressively (for example, due to drought or economic collapse)."[d] The 2008–13 Strategic Plan of the WFP does not once mention "food crisis." It speaks of "emergency," defined as urgent situations in which there is clear evidence that an event or series of events have occurred that cause human suffering or imminently threaten human lives or livelihoods and for which the government has not the means to remedy. "Emergency" is also described as a demonstrably abnormal event or series of events that produces dislocation in the life of a community on an exceptional scale.[e] In monitoring such emergencies, the WFP uses indicators of mortality rates, nutrition, and food security to establish the magnitude of the problem. FAO-GIEWS (Global Information and Early Warning System) does not have a definition for "food crisis" either, but does identify three factors by which to determine whether a region is in a food crisis: (i) lack of food availability; (ii) limited access to food; and (iii) severe and localized problems.[f]

The Integrated Food Security Phase Classification (IPC), originally developed in Somalia under the FAO Food Security Analysis Unit (FSAU) and by a multiagency partnership of eight major United Nations agencies and international nongovernmental organizations (NGOs), defines an "Acute Food and Livelihood Crisis" as "highly stressed and critical lack of food access with high and above usual malnutrition and accelerated depletion of livelihood assets that, if continued, will slide the population into Phase 4 [(i.e. Humanitarian Emergency)] or 5 [(i.e. Famine/ Humanitarian Catastrophe)] and/or likely result in chronic poverty."[g] To determine the level of food insecurity in a given country, the IPC uses indicators such as crude mortality rate, acute malnutrition, stunting, food access/availability, dietary diversity, water access/availability, hazards, civil security, livelihood assets, and structural factors.

In a study prepared for the Strengthening Emergency Needs Assessment Capacity Project, Devereux[h] distinguishes the temporal from the severity aspects of food insecure situations and discusses chronic and transitory food insecurity; predictable versus unpredictable food insecurity; and cyclical and seasonal insecurity. By combining the temporal and severity dimensions,

Devereux defines emergencies as severe transitory food insecurity situations to be distinguished from chronic hunger, that is, moderate chronic food insecurity; however, he does not refer particularly to a definition of crisis.

Source: Authors.
a. "World Food Summit Plan of Action," 1996, http://www.fao.org/docrep/003/w3613e/w3613e00.htm.
b. "Framework Document for Proposed Loans, Credits, and Grants in the Amount of US$1.2 Billion Equivalent for a Global Food Crisis Response Program," June 26, 2008, http://imagebank.worldbank.org/servlet/WDSContentServer/IW3P/IB/2008/06/30/000333038_20080630001046/Rendered/PDF/438410BR0REVIS10and0IDAR20081016212.pdf.
c. World Bank Operations Policy 8.00, Rapid Response to Crises and Emergencies, http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTOPMANUAL/0,,contentMDK:21238942~menuPK:4564185~pagePK:64709096~piPK:64709108~theSitePK:502184,00.html.
d. In contrast, "chronic food insecurity" is a "long-term or persistent inability to meet minimum food consumption requirements (FAO/WFP "Joint Guidelines for Crop and Food Security Assessment Missions [CFSAMs], January 2009, ftp://ftp.fao.org/docrep/fao/011/i0515e/i0515e.pdf).
e. "Definition of Emergencies," WFP/EB.1/2005/4-A, http://documents.wfp.org/stellent/groups/public/documents/communications/wfp228800.pdf.
f. FAO, *Crop Prospects and Food Situation*, No. 4, December 2011, http://www.fao.org/docrep/014/al983e/al983e00.pdf.
g. *IPC in Brief*, http://www.ipcinfo.org/attachments/02_IPCBrief_EN.pdf.
h. Devereux, S., "Desk Review: Distinguishing between Chronic and Transitory Food Insecurity in Emergency Needs Assessments," IDS, Sussex, UK (2006).

2. Conceptualization

Objective: The immediate objective is to develop a simple framework that defines, identifies, and monitors food security crises at the national level caused by shocks and factors that are not circumscribed to a given country. This is not to say that country-specific shocks causing a situation of food insecurity in that given country are not relevant or will not get an adequate World Bank response. However, from a regional and global point of view, the interest is in a shock or set of shocks that are either internationally generated, or, if caused within a specific country, have regional or global repercussions.

The framework will fill a current informational gap by providing timely red flags on unfolding crises before a consensus on the severity of the situation eventually emerges well into the crisis. The ultimate objective is to contribute to helping the Bank become better prepared to deal with mitigation and future prevention of crises. It is not expected, however, that the tool be used for unilateral declarations of food price crises at the global, regional or national level.

Vulnerability to food insecurity: The framework **monitors the vulnerability** of International Development Association (IDA) countries [2] to a food crisis (not circumscribed to a specific country). As such, the framework captures both the *exposure* to a shock and *capacity* to react to its effects.

In addition to monitoring vulnerability, an **early warning system**—such as the Famine Early Warning System Network (FEWSNET) or the Agriculture Market Information System (AMIS)—is critical to bring attention to emergency situations in the making, whether caused by a global shock or by fundamentals (say, stagnant agricultural yields). **Monitoring and early warning systems are not exclusive and can be integrated into one system.** For example, the information on food stocks and futures prices of grains that AMIS monitors provides useful insights on future trends and expectations. However, much of that information is restricted to participating countries and their markets and hence a smaller sample than the one considered in this framework. Hence, the framework outlined in this note focuses on monitoring vulnerability, using as much available and updated information as possible.

Stages: Conceptually, the framework is designed in two stages, a first "global stage" that captures global or regional shocks affecting or expected to affect food security, and a second "domestic stage" (country-specific stage) that zooms into the exposure of each IDA country to the shock and their capacity to manage the shock's impacts.

[2] The domestic calibration, however, uses all countries for which information is available, whether IDA (and blend) countries or not.

The presence of two stages does not imply necessarily that both are closely linked. The pass-through of international prices to domestic prices is not automatic, either because national markets are not internationally integrated or, when they are, price transmission lags several months on average. Rather, the two stages of the framework ensure that specific countries' vulnerabilities to global shocks are carefully analyzed but also that domestically generated alerts are not overlooked when global prices are calm.

Operationally, the monitoring framework will generate two types of alerts: "top-down" and "bottom-up." In the top-down approach, the global stage sets off an alert after either or both global food and fuel prices exceed some predefined threshold. Then, domestic indicators are analyzed to determine the severity of each IDA country's vulnerability to the global alarm. At that point, the framework might include in its domestic analysis if there are ex ante warnings on unfolding disaster and humanitarian crises. The bottom-up approach focuses on domestic vulnerability and sets an alarm—even in the absence of global crisis—when two or more countries in a region or subregion exceed their domestic price and macroeconomic triggers.

Global food and crude oil prices: In principle, the framework should monitor all shocks that may affect food security. In practice, the framework focuses on two direct global shocks, those regarding global food prices and global crude prices. These two factors are expected to affect the food security situation in a country in two ways: directly, by contributing to increases in domestic food prices, the overall cost of living and fertilizer and transport costs, or indirectly, by contributing to policy responses such as export bans that affect access or prices of food.

Global macroeconomic shocks (fiscal, financial, and trade) may also affect food security. To the extent that global macro shocks affect global prices of food and/or fuel, they will be captured in those components of the monitoring system. For example, a huge increase in public debt that will affect the capacity of a country to import food will be considered in the second stage of the framework. The hypothetical resulting reduction in food imports, for example, is not considered a shock, but the effect of the debt shock. As a result, global food and oil prices are considered both shocks and transmission mechanisms from other global shocks into national food insecurity. To the extent that they are country specific, they are covered in the second/domestic stage of the framework. In this sense, the proposed framework seeks to strike a balance between a meaningful account of crises generation and a manageable and prudent framework.

Country-specific monitoring: Simplified by domestic food inflation, the domestic stage will capture the specific exposure of each IDA country to food insecurity. Country capacity to confront such crises is also monitored. The underlying notion is that—more likely than not—the more vulnerable the country is to macroeconomic shocks, the more vulnerable the country is to a severe food insecurity situation. Other domestic factors that may affect the vulnerability of a country, such as their safety nets (or social protection in general)[3] or physical and legal restrictions to access to and distribute food internally within the country, are not included.[4] These factors are omitted because of a lack of technically satisfactory indicators at a sufficiently large scale. To be clear, the omission of these aspects in the monitoring framework does not imply that they should not be considered in the design of crises responses. Issues related to safety nets, trade and logistics – to cite some– are encouraged to be considered country by country in addition to the evidence provided by the framework.

[3] This is not to say that countries with macro stability automatically develop sound safety nets. Macro instability, however, reduces the capacity of a country to effectively react to a food crisis situation.

[4] These restrictions refer to internal communications; geography; logistics; and/or trade and market-related issues that hinder the normal access of food within a country.

3. Framework, Indicators, Thresholds, and Sources

The monitoring framework consists of indicators, triggers, data sources, and the rules for when to alert or provide a warning. Table 1 provides a set of proposed indicators, their sources, and illustrations of triggers. This set is illustrative rather than exhaustive. Section 5 includes the final selection of the indicators and triggers in the monitoring system, which is determined through a calibration exercise.

Table 1. Monitoring System

Variables	Potential Indicators	Potential Triggers	Frequency and source
Global stage: multicountry shocks			
1.1 Global Food Price Index, FOPI	1. Level of FOPI 2. Number of consecutive months of sustained FOPI increases 3. Change in FOPI 4. Unusual deviation from historical trend	1. FOPI exceeds a specific fraction of the June 2008 food crisis peak: fractions considered are 75% and 50% of the 2008 peak 2. At least five consecutive months of FOPI increases 3. FOPI increase exceeds 15% in a five-month period 4. FOPI is beyond 3 SD from historical trend (1960–2006)	World Bank DECPG Daily/monthly information
1.2. Global Grain Price Index, GGPI	1. Level of GGPI 2. Number of consecutive months of sustained GGPI increases 3. Change in GGPI 4. Unusual deviation from historical trend	1. GGPI exceeds a specific fraction of the June 2008 food crisis peak: fractions considered at 75% and 50% of the 2008 peak 2. At least five consecutive months of GGPI increases 3. GGPI increase exceeds 15% in a five-month period 4. GGPI is beyond 3 SD from historical trend (1960–2006)	World Bank DECPG Daily/monthly information
1.3. Fuel Price Index, FUPI	1. Level of FUPI 2. Number of consecutive months of sustained FUPI increases 3. Change in FUPI 4. Unusual deviation from historical trend	1. FUPI exceeds a specific fraction of the June 2008 food crisis peak: fractions considered at 75% and 50% of the 2008 peak 2. At least five consecutive months of FUPI increases 3. FUPI increase exceeds 15% in a five-month period 4. FUPI is beyond 3 SD from historical trend	World Bank DECPG Daily/monthly information
1.4. Prices of crude oil	1.International price of crude oil barrel (average price of Brent, Dubai, and West Texas intermediate equally weighted in US$/barrel)	1. Price of barrel of crude oil exceeds US$100	World Bank DECPG Daily/monthly information
Domestic stage: country-specific vulnerability			
Exposure **2.1 Domestic food price increases**	1. Cumulative domestic inflation of any key staple 2. Number of consecutive months of sustained price increases of a key food staple 3. Unusual deviation from IDA sample	1. Increased price of food staple exceeds 15% in a period of five months 2. At least five months of consecutive price increases 3. Key food staple price increases exceed 3 SD around the mean of food price inflation for the IDA sample	FAO monthly data series and/or national statistical office information; either option would provide an incomplete picture for the entire IDA sample Typically updated with some months' lag, depending on country
2.2. Risk of food insecurity emergency	3. Integrated Food Security Phase Classification (IPC)	1. IPC of 3 to 5	FAO-FSAU provides reports on outlook for next 3 to 6 months and updated alerts as situations change
Capacity to react **2.3. Macro space**	1. Fiscal balance as % of GDP 2. Public debt as % of GDP 3. FX reserves to imports (in months) 4. CA as % of GDP	1. Fiscal deficit > 3% of GDP 2. Public debt > 60% of GDP 3. FX/M < 3 months 4. CA > 3% of GDP	Annual data updated from IMF's World Economic Outlook

Source: Authors' compilation.

Note: CA = current account; FX = foreign exchange; GDP = gross domestic product; IPC = Integrated Food Security Phase Classification; SD = standard deviation(s); M = imports. Once again, initial fiscal deficit triggers are selected arbitrarily, but trying to follow conventions of what constitute a macroeconomic imbalance. FOPI, the global food price index reported by the World Bank's Commodity Price Historical Series, the Pink Sheet, weighs the international prices of three sets of commodities: cereals (which include maize, rice, wheat, and barley) at 28%; fats and oils (coconut oil, groundnut oil, palm oil, soybeans, soybean meal, and soybean oil) at 41%; and other foods (bananas, fishmeal, beef, chicken, oranges, and sugar) at 31%. GCPI is the subset of cereals within the FOPI, with relative weights of 41% for maize, 25% for wheat, 30% for rice, and 4% for barley.

Trigger calibration: The calibration exercise considers several triggers for the indicators reported in table 1 and compares them against some desirable features. Trigger "properties" refers to the individual trigger's capacity to identify the global food price hikes of June 2008 and February 2011; the length of the alert (that is, how long the trigger is activated); the anticipation with which the trigger is activated before the price peak; and the incidence of false positives, that is, periods not considered to be "in crisis," but for which the triggers were activated. For the calibration exercise, specific starting dates are assumed for the 2008 and 2011 price hikes based on the onset of the trend leading to the price hike (figure 1). This helps identify "false positives," although there is not a generalized consensus on when the crises specifically started.

It is worth noting that even if informed, **the initial choice of triggers is arbitrary.** The calibration, however, aims at understanding how setting the bar too high or too low for an indicator affects the framework monitoring. The objective is to find a "bar" that is neither so low that every seasonal spike is registered as a potential crisis, nor so high that a potential crisis goes undetected until it is a full-fledged crisis. **This is an empirical exercise because there is no theory that determines which level with respect to a peak should be considered as a crisis level.**

The first trigger corresponds to the World Bank's Global Food Price Index (FOPI) and is activated when a certain threshold value of the June 2008 peak is surpassed. The analysis looks at 75 percent and 50 percent of the value of the FOPI at its June 2008 peak. For other indicators, the analysis focuses on instances in which there have been five consecutive months of price increases. Again, this is an arbitrary notion of protracted price increases. But, the choice of five months is long enough to transcend a typical crop cycle, which allows distinguishing price movements that may be purely seasonal from those that may be more serious. It is also consistent with the empirical fact that the series of global food price crises do not record any price increase streak longer than five months in the period 2000–2012. The calibration exercise also checks three months of sustained increases in food prices.

With regards to price levels defining a crisis, there is no analytical work that relates price increases to food insecurity deterioration.[5] This then becomes an empirical question; to answer it, the analysis focuses on price increases of 15 percent or more. The justification for this figure is that the average annual increase for years in which the global food price index increased since 1960 is 12 percent; the average price changes for years without price spikes is 8 percent. The average increase among the five years in the series with serious price spikes is 42 percent. Arguably, a 15 percent increase in five months implies a 3 percent monthly increase in prices, which is close to the increase for those years with price spikes. The monthly price increase that is considered unusually high is adjusted to a five-month period consistent with the consecutive period criterion discussed above. Then, the 15 percent food price increase is analyzed for five consecutive months, and for five months relaxing the condition of consecutive price increases observed in all five months.

Finally, unusual prices are defined statistically as levels exceeding 3 standard deviations (SD) with respect to the historical trend before the increasing price trend since January 2000. It is important to caveat this choice with the fact that the standard deviation of a nominal series over a four decade period is simplistic, not least because each of the series considered may have undergone structural breaks. However, this crude tool is an initial starting point. One step further is to replicate the exercise after detrending the series in an attempt to get rid of potential seasonality effects, that is, of predictable,

[6] In the same way that there are analyses determining when inflation becomes deleterious for economic growth, see for example R. Espinoza, H. Leon, and A. Prasad ("When Should We Worry about Inflation?" *World Bank Economic Review* 26 [1] 100–127, 2012).

recurrent and transitory effects.[6] In addition, the benchmark period of 1960–2006 is determined by the fact that available food and fuel price series go all the way back to 1960. Furthermore, the year 2007 marks the onset of a price increase sustained trend after two disparate periods, 1960–72, and 1973–2006, of stable and volatile global prices, respectively (figure 1).

Frequency: Information on the first stage, global food and crude prices, is available daily and monthly. Information on domestic food prices from Food and Agriculture Organization (FAO, see next section) is also available monthly, but does not include all food consumption, just a handful of key staples that vary across countries and regions. National statistical offices and central banks report food (and beverage) indices, but for only about half of the sample (see next section). Macro information is publicly available on a yearly basis with some lag, which may in fact be needed to avoid endogeneity, that is, to avoid the fact that the current account deficit already takes into account food price increases. This implies that an integrated framework will be updated as new data are available, with global information updated monthly and country-specific information monitored quarterly.

Food inflation versus price of key staples: Ideally, it is domestic food price inflation that should be monitored at the country level. However, **there are not sufficiently large sets of domestic prices for the purposes of this exercise**. FAO GIEWS database has 1,175 monthly domestic retail and wholesale price series of major staples consumed in 84 countries and 36 international cereal export price series, covering a total of 20 different food commodity categories as of July 2012. However, the data we use in the analysis here is subset of this whole. Selected countries have data as far back as January 2005 and only one commodity and market is chosen per country. The chosen commodity is always the most important staple for each of the countries in terms of consumption and the chosen price series is most often either the national average price or the price that prevailed in the capital city.[7] Table 2 reports the number of countries whose national statistical offices, central banks, or ministries of finance report updated food price inflation (either aggregate and/or disaggregated by products). "Updated information" refers to reporting any 2011 or more recent data; "aggregate" means that the source reports "food and beverage" inflation; "subgroup," some index on cereals and bread, oils and fats, and so on; and "commodity specific" means that the country specifically reports the price of a key staple.

Table 2. Availability of Food Inflation Data
Food Index Available

	Aggregate	Subgroup	Commodity specific	Total IDA countries
SSA	24	5	3	39
EAP	6	2	2	14
ECA	5	1	2	9
LAC	6	…	2	9
MENA	1	…	1	2
SA	6	1	2	8
Total	48	9	12	81

Source: National statistical offices.

[6] The series are detrended by linearly regressing each series on time for the period 1960–2006 and then subtracting the trend, which allows concentrating on the residuals. Then, the mean and standard deviation of the residuals are used to determine the trigger.

[7] By applying these criteria, we end up with an overall sample of 63 countries: 7 from EAP; 9 from ECA; 14 from LAC; 1 from MENA; 7 from SAR; 9 from eastern Africa and 4 from southern Africa

Note: SSA = sub-Saharan Africa; EAP = East Asia and Pacific; ECA = Europe and Central Asia; LAC = Latin America and Caribbean; MENA = Middle East and North Africa; SA = South Asia. Currently, there are 81 IDA countries after the recent inclusion of Micronesia and Marshall Islands. Other countries may add to the list in the future.

Using FAO domestic prices, the analysis is circumscribed to individual staple food prices (rather than domestic food inflation). In principle, the more staple prices considered, the closer the exercise will be to an ideal scenario. It is well known, however, that the consumption of staples is subject to substitution, typically for cheaper staples or for nonstaples, as their prices go up. [8] But setting a specific number of staple prices per country to monitor, or a predetermined mix of particular staples (say wheat, rice and maize), would further restrict the sample size being analyzed. As a result, the key domestic staple for each country for which its prices are reported is considered in the domestic stage of the analysis.

Early warning ex ante variables: The Integrated Food Security Phase Classification (IPC) is an illustration of the use of ex ante variables. Variables considered in the formulation of the IPC include crude mortality rate, acute malnutrition, stunting, food access/availability, dietary diversity, water access/availability, hazards, civil security, livelihood assets, and structural factors. Outlook reports focus on expectations of climatic considerations, markets, civil security, and structural factors to assess risks in the next three to six months. Therefore, the IPC does not follow the price of a particular staple or food in general, but a wider range of variables. However, the IPC rating does not take place for every single country systematically or every period (say, every month), rather, its status changes as circumstances vary. In practice, as of June 2012, IPC is at various stages of implementation in 27 different countries. Of these, only seven are at the consolidation stage, meaning that in these countries, "the IPC has been adopted by the government or by national IPC technical working group since more than 3 seasons."[9] This implies that domestic stage monitoring cannot be currently implemented for a comprehensive sample using this method. If, and when, the IPC system becomes available for a larger sample of countries, the domestic stage could include this ex ante indicator to extend the domestic stage analysis (as discussed above in section 2, stages).

Benchmarking: For each of the triggers, a benchmarking exercise is conducted to examine how soon alerts or warnings would have been issued during the two most recent food price crises. Also, the analysis benchmarks the number of consecutive months that the framework alert would have persisted. In addition to defining the triggers based on the food price index, triggers are also defined based on the global cereal price index, the fuel price index, and the fertilizer price index. The cereal price index is a component of the food price index, while fertilizers and energy are essential complements in the production of food and are likely to carry useful early signals about any impending price shocks.

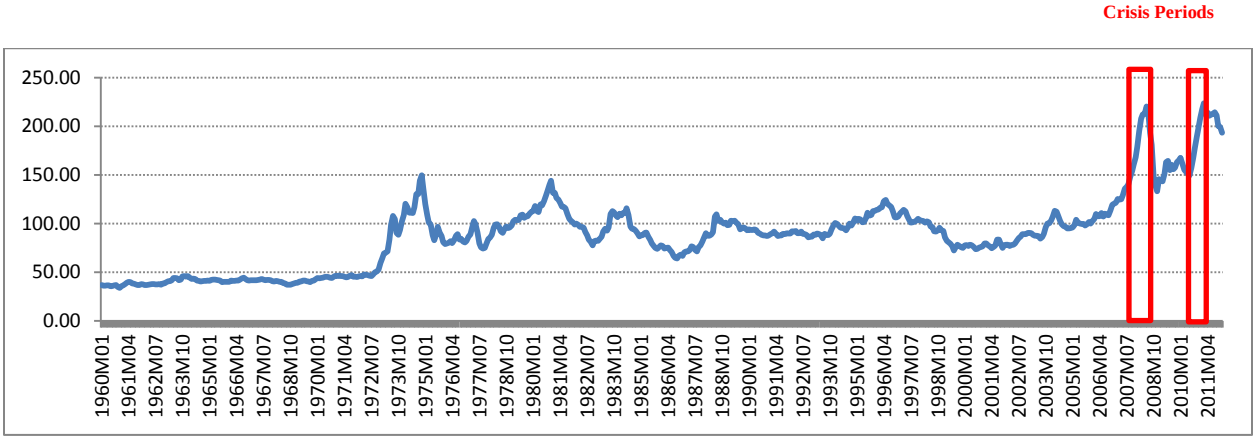
4. The Framework at Work

Activation: The monitoring system will be useful to the extent that is able to red flag (that is, provide a warning or alarm for) crisis situations at the appropriate time. To do this, the system needs potentially three elements: (i) triggers calibrated initially to predict past crises and assessed periodically to ensure a good ability to predict crises; (ii) the *mechanics* to activate the triggers should be flexible enough to capture regional and subregional situations, even when global indicators do not trigger an alert; and (iii) – ideally—include a combination of updated variables (such as monthly global food prices and quarterly domestic food inflation) and ex ante variables (such as food stocks and production projections).

[8] World Bank, Food Price Watch, January 2012.
[9] IPC World Map 2010, http://www.ipcinfo.org/countries.php.

The calibration exercise, presented in section 5, explains how to identify the set of thresholds (of selected indictors) that would have identified the 2008 and 2011 food price crises. The exercise also shows how these thresholds would have fared in previous and in-between periods, where for this analysis it is considered that there were no food price crises. If an alert is activated in those periods, that instance is considered a false positive. For this analysis, "false positive" refers specifically to alerts outside a period of crises defined for this purpose as the first half of 2008 (July 2007–June 2008) and the second half of 2010 until February 2011 (June 2010–February 2011, figure 1). The idea is to have a framework that identifies food crisis situations in the most parsimonious manner. A trigger that is calibrated too low will undoubtedly identify future crises; but it will also generate a lot of false alarms. Conversely, a trigger that is set too high may be unable to detect the crisis until prices have escalated to dangerously high levels. So the ideal framework will need to balance precision with timely identification of a future crisis.

Figure 1. Monthly Global Food Price Index, 1960–2011



Source: World Bank DECPG.
Note: The crisis periods correspond to July 2007–June 2008 and June 2010–February 2011.

The following situations will determine when the warning or alert is issued:

(i) Whenever one or both indicators in the first stage exceed the indicated threshold of the trigger, a warning will be provided, that is, the framework would provide an "alert" valid throughout the month the trigger activated.
(ii) Even when the first stage indicators do not set off a trigger, if either domestic food prices alone or domestic food prices and macroeconomic vulnerability worsen beyond their threshold levels for two or more countries in a given subregion/region, then alerts will be issued.

Ranking: There are two potential ranking possibilities:

(i) Categorization of vulnerability without ranking
(ii) Country ranking

The first possibility, *categorization*, simply looks at the two country-specific dimensions (domestic food inflation and macro vulnerability) and red-flags those dimensions that exceed their respective triggers. The monitoring system provides a comprehensive picture of troublesome indicators across categories; table 3 provides an illustration.

Table 3. Illustration of Categorization of IDA Countries

	Food price inflation	Macro vulnerability Fiscal	Public debt	FX	CA	Categorization
IDA country 1	●	●	●	●	●	Very highly vulnerable
IDA country 2	●	●	●	●	●	Highly vulnerable
IDA country N	●	●	●	●	●	Moderate/low vulnerability

Source: Authors' illustration.
Note: CA = current account; FX = foreign exchange.
A red dot indicates that the given country surpasses the threshold of food price inflation and/or macroeconomic vulnerability. A green dot indicates the opposite.

The second option, *ranking*, will rank countries according to some score system that marks each category and weighs them into a final score. The simplest one is to weigh each of the dimensions equally (say, give 1 point if the respective indicator is triggered) or, alternatively, weigh food inflation and macroeconomic vulnerability equally and –within macro vulnerabilities– weight each macro dimension equally as well. Table 4 provides an illustration of the latter ranking system for the example above.

Table 4. Illustration of Ranking of IDA Countries

	Food price inflation	Macro vulnerability Fiscal	Public debt	FX	CA	Score (assuming equal weights, equal points per dimension)
IDA country 1	1	1/4	1/4	1/4	1/4	2
IDA country 2	1	1/4	1/4	0	0	1.5
…						
IDA country N	0	1/4	1/4	1/4	1/4	1

Source: Authors' illustration.
Note: CA = current account; FX = foreign exchange.

Obviously, a categorization index implicitly leads to a ranking: more red flags imply a more severe situation than one with fewer red flags. It could be determined that those countries with domestic inflation triggered and high macro vulnerability have very high (or high) vulnerability. Those with high food inflation but low or moderate macro vulnerability have low or moderate vulnerability.

The ranking option based on a score necessarily requires a weighting method. It also requires an additional decision: which threshold of the score prompts an alert? Conceptually, it implies that a score of 4 is twice as bad as a score of 2, that is, that there is some lineal comparability.

Section 5 presents a ranking of countries for illustrative purposes.

5. Calibration

Global stage: Appendix 1 reports the results of the calibration exercise for the period 2000–2012, month by month. Table 5 summarizes the key findings of the exercise. It shows the number of months that each trigger would have set off a warning and whether the 2008 and 2011 global food price hikes would have been identified or missed—how early and for how long. Based on the performance of each trigger in these criteria, additional values for the triggers are considered as well.

The comparative exercise shows that the trigger of 3 SD around the mean of the detrended historical series from 1960 up to 2006 is the best performer. This trigger is capable of identifying the two periods of crises in 2008 and 2011 and the Horn of Africa disaster in the summer of 2011, and their peak months (respectively June 2008, February 2011, and July 2011—when Somalia officially reached famine status). It produces relatively short periods of alerts, but sufficiently early (in terms of months of anticipation of the peak). For June 2000–August 2012, the period analyzed in the calibration exercise, the system would have been triggered about 20 percent of the time on account of global food prices and about 30 percent of the time if considering global oil prices. When global food prices and oil prices are considered simultaneously, the triggers would have been activated 14 percent of the time—or 19 out of 138 months. These results do not change much if the global grain price index and the fertilizer price index substitute for global food and oil prices, respectively (although the fertilizer price index tends to increase the length of the activated trigger).

The analysis for other indicators and triggers shows that setting a fraction of the 2008 June peak does not turn out to be very discriminating: if the fraction is set too high and close to the 2008 June peak, then few months would have been activated, while if set at lower levels, many months would be activated. The trigger is easy to understand and may produce few false positives, but it is the criterion that lends itself to the most arbitrariness. Also, it might produce very lengthy periods of active triggers. Similarly, the price of the crude oil barrel exceeding US$100 trigger performs well in terms of identification of the peaks and the periods of crises, but also produces lengthy alert periods: specifically of 32 and 41 months around the 2011 and 2008 crises, which questions the discrimination capacity of the trigger.

Table 5: Incidence of Global Food Price Alerts

	% of 2008 GPI peak	US$ ppb	5 consecutive months		15% price increase in 5 consecutive months		15% price increase over 5 months		3 SD (1960–2000)		Detrended 3 SD (1960–2006)			
	50%	US$ 100	FOPI	GGPI	FOPI	GGPI	FOPI	GGPI	FOPI	GGPI	FOPI	GGPI	FertGPI	FUPI
Incidence, # of	73	79	25	15	13	10	16	22	67	68	13	23	32	28
Incidence, %	48	53	16	10	9	7	11	15	45	45	9	15	21	19
2008 June peaks	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2011 February peak	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
When 2008	Oct-06	Jul-05	Aug-07	Dec-07	Nov-07	Dec-07	Nov-07	Nov-07	Dec-06	Nov 2006	Mar 2008	Feb-08	Jan-08	Dec-07
Length of alert, # of months	69	41	11	5	7	5	7	8	67	68	5	8	15	11
When 2011	Oct-06	May-09	Nov-10	Nov-10	Nov-10	Nov-10	Sep-10	Sep-10	Aug-10	Sep-10	Jan-11	Jan-11	Jan-11	Feb-11
Length of alert, # of months	63	32	4	4	4	4	6	6	67	68	8	11	2	17
False positives	2	0	4	2	1	1	1	4	2	1	0	2	1	0
False positives, # of months	4	0	10	6	2	1	3	8	3	2	0	4	15	0

Source: Authors' compilation.
Note: FertGPI = Fertilizer Global Price Index; GGPI = Grain Global Price Index; FOPI = Global Food Price Index; FUPI=Global Fuel Price Index; ppb = price per barrel.

The length of alerts shortens after introducing the criterion of consecutive months. In effect, five consecutive months of food price increases reduces substantially the incidence of alerts; shortens the average period of the alert; and identifies the crisis periods for 2008 and 2011. However, it still does not trigger an alert right at the peak of the 2008 crisis, because the 2008 June peak was preceded by a minimal decrease in the FOPI in May 2008. This breaks the streak of food price increases and therefore fails to activate an alert for the very peak of the crisis. This is not a problem for crude or fertilizer price triggers, which remain active during the peaks of the crises. However, the analysis shows that the number and length of false positive increase. These findings do not change for a three consecutive month trigger. Because there were no streaks of price increases exceeding five consecutive months, triggers that define six or more consecutive months would have not triggered any alert between 2000 and 2011.

The trigger that combines five consecutive months and at least 15 percent price increases reduces slightly the incidence of alerts and the incidence of false positives for global food prices, but does not solve the problem of identifying the 2008 peak (for the reason explained above). Changes in the length of the consecutive months (from five to three) do not solve the problem either (not shown in table 5).

When considering at least 15 percent increases of food prices over a period of five months (even if price increases are not consecutive throughout that period), the system keeps a relatively low incidence of alerts, low false positives, has short lengths of alerts, and provides "reasonably" early detection, but still does not recognize the peak of 2008. The reason now is that the sharpest price increase during the 2008 crisis took place six months away from the peak, that is, from January to February 2008, which is a month shy of those included in the calculation of the five-month period up to June 2008.

The final trigger considered is an extreme deviation from a historical trend. The trend period considered in this analysis is 1960 to 2000. The trigger will set off an alert when the price index exceeds 3 SD from the historical (1960–2000) mean. Three SD in statistical terms are considered an extreme deviation from a trend. Results show that the trigger solves the identification of the peaks, but at the cost of increasing—moderately—the incidence of alerts, especially for global crude and fertilizer prices. The length of the alerts also rises. However, as indicated above, detrending the historical series and using 3 standard deviations of the detrended series for the 1960-2006 period as the cutoff eliminates much of the caveat

Domestic stage: Appendix 2 reports the results of the calibration exercise for the domestic stage. However, the following analysis focuses only on those cases where two or more countries of the same region or subregions—East, West, and South—in Africa comply with the activation trigger for the domestic price of staples. Not reported in this note, our results show that relaxing the constraint of two or more countries in the same region will duplicate the number of country alerts (beyond 600 cases in the 2000-2012 period).

Three factors to consider for the domestic price calibration exercise include:

(i) The historical series are much shorter for each country's prices and there are relatively few countries monitored any given year.
(ii) As indicated above, the analysis does not work with domestic food inflation series, but with prices of specific food staples in each country. Therefore the 3 SD trigger results must be evaluated cautiously because the periods and countries available may not be representative of a long enough historical trend or a sufficiently meaningful IDA sample.

The analysis uses the IMF World Economic Outlook (WEO) database, which contains annual data—not biannual or quarterly data—for the indicators included. The data on foreign reserves is available only up to 2011 and the source of that information is the World Bank's WDI database. **For domestic prices, the analysis considered the trigger of 15 percent price increases in five months** (regardless of whether or not price increases were sustained over five consecutive months). There were 247 cases in which two or

more countries within the same region or subregion had price increments higher than 15 percent in the last five months. Of those, there were no circumstances in which a country had no macro-vulnerability measured by the criteria described above: many countries had more than one. This criterion was not used as a qualifying restriction (that is, all countries having at least one macroeconomic vulnerability), because that would have disproportionately affected cases with a large number of countries involved (thus biasing against the most troublesome cases) and also, geographically, those regions healthiest in macroeconomic terms.

By regions, East Africa, Latin America, and West Africa had large incidences of alerts, 49, 51, and 54, respectively, distantly followed by southern Africa, 28; Europe and Central Asia (ECA), 26; South Asia, 20; and East Asia and Pacific (EAP), 19. These numbers should be interpreted as follows: there were 47 out of a total of 91 months between January 2005 and July 2012 during which at least two East African countries had price increases exceeding 15 percent in over a 5 month period. (See Appendix 2 for a full list).

Evidence also shows that there are many countries involved in the alerts in the regions of Latin America and East and West Africa (although not all Latin America and Caribbean [LAC] countries are IDA). In other regions, there is a more concentrated sample of countries with alerts. Also, price alerts are triggered largely by wheat in ECA, maize in LAC and Southern Africa, and rice and wheat in East and South Asia. By contrast, multiple staple prices trigger alerts in East and West Africa. The incidence of macro vulnerabilities is similar to the incidence of food price alerts, with more macro vulnerabilities concentrated in the three regions with more food staple price alert cases. Current account imbalances appear more frequent, and, on average, each country in appendix 2 has about two macro vulnerabilities, an average that is uniform across regions.

Table 6 presents the top 30 alerts in terms of highest staple food price increase observed using the suggested trigger as illustration. It also highlights episodes around the peaks of 2008 and 2011. The analysis shows that the proposed triggers seem to perform well, that is, they pick up the peaks in 2008 and 2011. Triggers would have gone off in April, May, June and July of 2008 in South Asia, East Asia, Eastern and Southern Africa corresponding to the period leading up to the 2008 food price crisis. Interestingly, these are all regions where rice is either the main staple food item or where rice is heavily important for consumption, particularly in urban areas. The Horn of Africa crisis during summer 2011 is also well captured as the trigger would have been activated for a large number of countries in the region from as early as April 2011 to August 2011. Note that this analysis further emphasizes the less obvious finding that there are many periods for which domestic triggers would have picked up local price escalations even when global triggers remained inactive. Consider the example of LAC countries in the spring months of March to May of 2009. That was a period when global prices were easing off but there were pockets in LAC where prices of rice and maize had increased quite a bit.

Table 6. Incidence of Domestic Alerts

Region	Countries	Date	Staple	Average staple price increase (%)	Number of countries with macro vulnerabilities	Number of macro vulnerabilities
SSA- Eastern	SDN, ETH, KEN, UGA	July, 2008	S, M, M, M	90	4	12
SSA-Southern	MOZ, MWI, ZMB	March, 2008	M, M, M	83	3	9
SSA- Eastern	TZA, ETH, SOM, UGA, KEN, RWA	July, 2011	M, M, M, M, M, M	81	6	15
LAC	CRI, NIC	March, 2009	R, M	80	2	5
SSA- Eastern	UGA, SDN, KEN, ETH	June, 2008	M, S, M, M	77	4	12
LAC	NIC, HND, CRI	May, 2009	M, M, R	76	3	8
LAC	HND, CRI, NIC	April, 2009	M, R, M	75	3	8
SAR	PAK, AFG, LKA	April, 2008	W, W, R	65	3	6
SSA- Eastern	ETH, TZA, SOM, KEN, UGA, RWA	May, 2011	M, M, M, M, M, M	64	6	15
SSA- Eastern	SOM, KEN, UGA, ETH, RWA, TZA	June, 2011	M, M, M, M, M, M	64	6	15
SSA- Eastern	KEN, SOM, TZA, ETH, RWA, UGA	April, 2011	M, M, M, M, M, M	63	6	15
SSA- Eastern	TZA, MDG	November, 2007	M, R	62	2	6
SSA- Eastern	KEN, SDN, TZA, RWA, ETH, UGA	May, 2008	M, S, M, M, M, M	62	6	18
EAR	THA, KHM, MNG, PHL	April, 2008	R, R, W, R	61	4	9
SSA- Eastern	RWA, UGA, SOM, TZA, MDG	January, 2011	M, M, M, M, R	61	5	13
LAC	NIC, CRI	February, 2009	M, R	60	2	5
SSA- Eastern	SDN, MDG, RWA, BDI, UGA, TZA	January, 2008	S, R, M, B, M, M	57	6	17
SSA-Southern	ZMB, MOZ, MWI	February, 2008	M, M, M	57	3	9
EAR	LAO, MNG, PHL, KHM, THA	May, 2008	R, W, R, R, R	57	5	12
SSA- Eastern	UGA, ETH, MDG, KEN, RWA, SOM	March, 2011	M, M, R, M, M, M	57	6	15
SSA-Southern	ZMB, MWI	April, 2008	M, M	56	2	6
SSA- Eastern	RWA, ETH, SDN, UGA, KEN	August, 2008	M, M, S, M, M	56	5	15
LAC	GTM, HND, NIC, SLV, MEX	April, 2011	M, M, M, M, M	56	5	13
SAR	LKA, NPL, PAK, AFG	January, 2008	R, R, W, W	54	4	8
EAR	KHM, LAO, THA, MNG, PHL	June, 2008	R, R, R, W, R	54	5	12
LAC	SLV, NIC, GTM, HND, MEX	May, 2011	M, M, M, M, M	54	5	13
SSA- Eastern	BDI, TZA, MDG	December, 2007	B, M, R	53	3	9
SSA- Eastern	ETH, UGA, TZA, KEN, RWA, SOM	August, 2011	M, M, M, M, M, M	53	6	15
SSA- Western	MLI, BEN, CPV, MRT, NGA, GHA	November, 2007	Mi, M, W, W, S, M	52	6	17
SSA- Western	SEN, GHA, BEN, MRT, NGA, TGO	February, 2008	R, M, M, W, S, M	52	6	17

Source: Authors' compilation.
Note: C = cassava; M = maize; R = rice; S = sorghum; W = wheat; Mil = millet; B = barley. Macro vulnerabilities: D = public debt; C = current account; F = fiscal deficit; R = reserves. Djibouti is part of the Middle East and North Africa region according to World Bank classification, not part of eastern Africa.

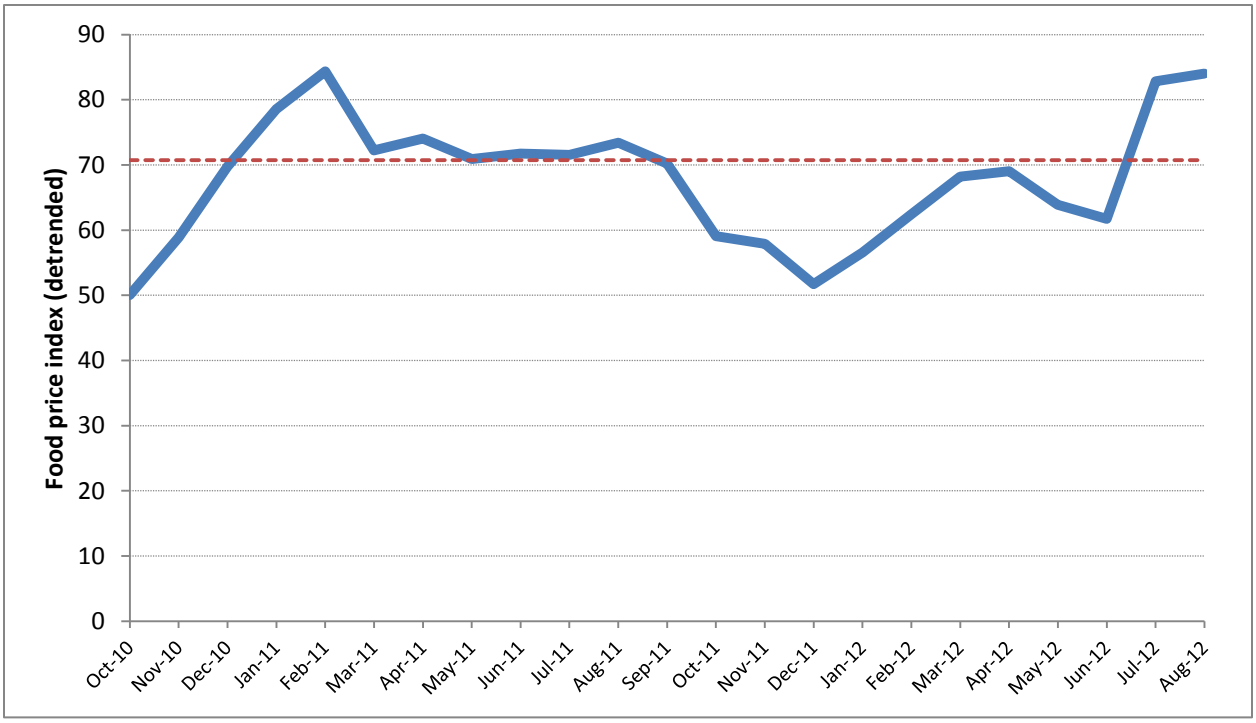
6. The framework at work in 2011 and 2012

We also analyze how this framework would have responded during the period January 2011 until August 2012, latest available data at present. At the global level, using 3 standard deviations of the detrended series spanning 1960–2006 as the threshold, the trigger for global food prices would have been activated in January 2011 until August 2011 and back in July 2012 and August 2012. See Figure 2 below. Alerts based on the global crude oil prices trigger would have been activated on February 2011 and it would have lasted 17 months remaining active until June 2012.

At the domestic level, 55 alerts would have been triggered for two or more countries in a same subregion or region from January 2011 to July 2012. Eighteen of these cases are from East Africa, nineteen from Western Africa, eight from Latin America, six from ECA, four from Eastern Asia and two from Southern Africa. All of these instances are reported in Table 7. Table 7 also highlights that there potential ways to prioritize the triggered episodes. In the simplest case, the analysis can prioritize among episodes within the same month by the number of countries involved or the average staple price increase. In its last two columns, Table 7 reports a score and the ranking resulting from that score. This score is constructed by averaging (with equal weights) the average price increase, the number of countries involved and the average number of macroeconomic vulnerabilities per country (to avoid over-representing the number of countries involved) associated with that episode.

Results reassuringly show that numerous regions in the world would have triggered an alert, which substantiates the global nature of the food price hikes that spiked in February 2011. The system would have also picked the Horn of Africa disaster, involving many countries in the subregion and alerting as early as February 2011. In fact, we see alerts since February to July 2011 for many countries in that subregion. Finally, the framework also peaks signs of alert for the Western Africa for 2012, related with the unfolding crisis in the Sahel region.

Figure 2. Monthly Global Food Prices 2011-2012



Source: Authors' using World Bank (2012) data.

Table 7. Domestic Alerts for the Food Price Crisis in 2011 and 2012

Region	Countries	Date	Staple	Average staple price increase (%)	Number of countries with macro vulnerabilities	Number of macro vulnerabilities	Vulnerability per country	Score	Ranking
ECA	GEO, TJK, KGZ, AZE, UKR	January, 2011	W, W, W, W, W	22	5	13	2.6	10	47
LAC	CRI, BRA, BOL, HND, SLV	January, 2011	R, W, M, M, M	27	5	13	2.6	12	39
SSA- Eastern	RWA, UGA, SOM, TZA, MDG	January, 2011	M, M, M, M, R	61	5	13	2.6	23	5
ECA	KGZ, AZE, TJK, MDA, UKR	February, 2011	W, W, W, W, W	19	5	13	2.6	9	49
LAC	CRI, HND, SLV	February, 2011	R, M, M	39	3	9	3.0	15	23
SSA- Eastern	RWA, TZA, MDG, KEN, SOM, UGA	February, 2011	M, M, R, M, M, M	45	6	16	2.7	18	13
SSA-Southern	ZMB, ZAF	February, 2011	M, M	20	2	5	2.5	8	54
ECA	MDA, UKR, KGZ, AZE	March, 2011	W, W, W, W	31	4	11	2.8	13	33
LAC	GTM, CRI, HND, NIC, SLV	March, 2011	M, R, M, M, M	46	5	14	2.8	18	12
SSA- Eastern	UGA, ETH, MDG, KEN, RWA, SOM	March, 2011	M, M, R, M, M, M	57	6	15	2.5	22	6
SSA- Western	GHA, TGO	March, 2011	M, M	25	2	6	3.0	10	44
ECA	KGZ, UKR, GEO, MDA	April, 2011	W, W, W, W	29	4	12	3.0	12	37
LAC	GTM, HND, NIC, SLV, MEX	April, 2011	M, M, M, M, M	56	5	13	2.6	21	7
SSA- Eastern	KEN, SOM, TZA, ETH, RWA, UGA	April, 2011	M, M, M, M, M, M	63	6	15	2.5	24	4
SSA- Western	TCD, NER, GHA, BEN	April, 2011	M, Mi, M, M	33	4	12	3.0	13	28
ECA	GEO, MDA, UKR, KGZ	May, 2011	W, W, W, W	24	4	12	3.0	10	42
LAC	SLV, NIC, GTM, HND, MEX	May, 2011	M, M, M, M, M	54	5	13	2.6	21	8
SSA- Eastern	ETH, TZA, SOM, KEN, UGA, RWA	May, 2011	M, M, M, M, M, M	64	6	15	2.5	24	2
SSA- Western	TCD, NGA, BEN, GHA, NER	May, 2011	M, S, M, M, Mi	31	5	14	2.8	13	32
ECA	UKR, MDA	June, 2011	W, W	32	2	6	3.0	12	34
LAC	NIC, SLV, HND, GTM	June, 2011	M, M, M, M	51	4	11	2.8	19	10
SSA- Eastern	SOM, KEN, UGA, ETH, RWA, TZA	June, 2011	M, M, M, M, M, M	64	6	15	2.5	24	3
SSA- Western	GHA, NGA, TCD, BEN	June, 2011	M, S, M, M	39	4	11	2.8	15	21
LAC	NIC, SLV, HND, GTM	July, 2011	M, M, M, M	50	4	11	2.8	19	11
SSA- Eastern	TZA, ETH, SOM, UGA, KEN, RWA	July, 2011	M, M, M, M, M, M	81	6	15	2.5	30	1
SSA- Western	GHA, BEN, TCD, NGA	July, 2011	M, M, M, S	37	4	11	2.8	15	24
EAR	KHM, THA	August, 2011	R, R	16	2	5	2.5	7	55
LAC	NIC, GTM, HND, SLV	August, 2011	M, M, M, M	39	4	11	2.8	15	22
SSA- Eastern	ETH, UGA, TZA, KEN, RWA, SOM	August, 2011	M, M, M, M, M, M	53	6	15	2.5	21	9
SSA- Western	BEN, TCD, GHA, NGA	August, 2011	M, M, M, S	44	4	11	2.8	17	14
EAR	KHM, THA	September, 2011	R, R	22	2	5	2.5	9	50
SSA- Western	BFA, TCD, NGA	September, 2011	S, M, S	20	3	8	2.7	9	52
EAR	KHM, THA	October, 2011	R, R	28	2	5	2.5	11	41
SSA- Eastern	ETH, SDN	October, 2011	M, S	42	2	4	2.0	15	19
SSA- Western	BFA, TCD, NGA	October, 2011	S, M, S	21	3	8	2.7	9	48
EAR	KHM, THA	November, 2011	R, R	22	2	5	2.5	9	51
SSA- Eastern	SDN, ETH, MDG	November, 2011	S, M, R	34	3	7	2.3	13	31
SSA- Western	BFA, MLI	November, 2011	S, Mi	32	2	6	3.0	12	35
SSA-Southern	ZAF, ZMB	November, 2011	M, M	30	2	5	2.5	12	40
SSA- Eastern	MDG, SDN	December, 2011	R, S	43	2	5	2.5	16	17
SSA- Western	BFA, NER, MLI	December, 2011	S, Mi, Mi	40	3	9	3.0	15	20
SSA- Eastern	MDG, SDN	January, 2012	R, S	35	2	6	3.0	13	29
SSA- Western	BFA, SEN, MLI, NER	January, 2012	S, R, Mi, Mi	30	4	12	3.0	12	36
SSA- Eastern	TZA, SDN	February, 2012	M, S	44	2	6	3.0	16	15
SSA- Western	NER, GHA, SEN, BFA, MLI	February, 2012	Mi, M, R, S, Mi	35	5	15	3.0	14	25
SSA- Eastern	TZA, SDN, UGA	March, 2012	M, S, M	24	3	9	3.0	10	45
SSA- Western	NER, GHA, BFA, MLI	March, 2012	Mi, M, S, Mi	33	4	12	3.0	13	30
SSA- Eastern	UGA, TZA, SOM, SDN	April, 2012	M, M, M, S	41	4	10	2.5	16	18
SSA- Western	BFA, NER, MLI, GHA, NGA	April, 2012	S, Mi, Mi, M, S	33	5	14	2.8	14	27
SSA- Eastern	SOM, SUD, TZA, UGA	May, 2012	M, S, M, M	43	4	7	1.8	16	16
SSA- Western	CHA, GAB, MAL, NGA, SEN	May, 2012	Mil, C, Mil, S, R	31	3	4	1.3	12	38
SSA- Eastern	ETH, RWA, SUD, UGA	June, 2012	M, M, S, M	36	4	8	2.0	14	26
SSA- Western	CHA, MAL, NIG	June, 2012	Mil, Mil, Mil	26	3	4	2.0	10	43
SSA- Eastern	RWA, SUD	July, 2012	M, S	26	2	4	2.0	10	46
SSA- Western	BUR, MAL, NIG	July, 2012	S, Mil, Mil	20	3	5	2.0	8	53

Source: Authors' compilation.

7. Next Steps

Expand the list of countries for which domestic food prices are available: The analysis was conducted on 63 countries for which FAO data on staples are available. Some regions, like MENA, are very poorly represented. Available information on domestic food prices from FAO covers key staples, but not national food inflation. Online information from national statistical offices is abundant, but not comprehensive enough to run the analysis from headquarters. At the World Bank, this information is reported frequently by Central America and East Asia and Pacific teams, but not for the rest of regions. For this indicator to

be fully operational, country economists (CEs) should report monthly or quarterly food inflation (along with overall and nonfood inflation) into a special and simple database open to all CEs, if appropriate (to be provided by the Poverty Global Practice [GPVDR]).

Inclusion of ex ante variables (variables or assessments that directly alert on future risks): If the framework is to also cover ex ante risks to potential crises, additional variables will be required. One possibility, shown in table 1, is to associate ex ante considerations to already existing mechanisms such as the Famine Early Warning System Network (FEWSNET), or others in preparation such as the Agricultural Market Information System (AMIS). Alternatively, the framework may focus on updated variables that clearly have a bearing on future events, such as stocks-to-use ratios, if data quality is considered appropriate.

It is important to bear in mind, however, that the coverage of these instruments is also limited. For example, using the IPC methodology, alerts would have only been triggered for the period of analysis for Burundi, Côte d'Ivoire, Kenya, Somalia, Sudan, South Sudan, and Uganda.

Piloting: Run the framework for three consecutive months and analyze the incidence of alerts and confirm the selected set of indicators and triggers.

Expand the interactivity of the tool: Additional options on domestic and global price triggers can be offered to the user to increase the interactivity of the tool.

Governance of the system: Articulate the institutional setting of this framework, which will include the allocation of technical roles among established (or new) structures; decisions on communication, coordination and activation of response mechanisms; and other aspects of decision-making processes.

Recalibration: The selected triggers may need to be reviewed with some frequency to ensure that they remain relevant. For example, in the case of the global price trigger discussed for the 3 SD detrended historical mean for 1960–2006, the system may well be revisited (that is, calibrated again) every two years to determine whether that period remains relevant for the setting of the threshold. This recalibration exercise will be conducted in direct collaboration with other units of the Bank, such as the Agriculture Global Practice, DEC, the Social Protection & Labor Global Practice, to cite some.

Further analytical work: The main caveat of the empirical analysis is the arbitrariness of the selected criteria, for example, there is no theoretical reason why 15 percent increase in five months is superior to 20 percent in six months. Additional analysis is needed to try to correlate specific price trends with food insecurity or nutritional outcomes.

Appendix 1. Snapshot of the Master Database for Two Selected Indicators

	Raw Data from DECPG				TRIGGER ACTIVATION			5 Consecutive Months			
	Food	Grain	Fert	Fuel	50% of 2008 peak	75% of 2008 peak	US $100 a barrel for oil	Food	Grain	Fert	Fuel
2000M01	78	84.47	63.14	46.78	0	0	0				
2000M02	78	85.56	65.34	50.03	0	0	0				
2000M03	77	83.58	64.02	50.61	0	0	0				
2000M04	78	82.48	63.57	44.54	0	0	0				
2000M05	78	82.47	65.66	50.76	0	0	0				
2000M06	76	77.46	68.86	55.15	0	0	0	0	0	0	0
2000M07	74	72.23	72.12	52.88	0	0	0	0	0	0	0
2000M08	74	71.85	73.27	54.94	0	0	0	0	0	0	0
2000M09	75	74.50	68.49	60.03	0	0	0	0	0	0	0
2000M10	76	79.19	69.13	59.11	0	0	0	0	0	0	0
2000M11	77	80.81	65.26	61.01	0	0	0	0	0	0	0
2000M12	80	84.43	65.69	52.43	0	0	0	1	0	0	0
2001M01	80	84.20	69.33	53.28	0	0	0	0	0	0	0
2001M02	78	81.98	66.24	53.61	0	0	0	0	0	0	0
2001M03	76	80.64	64.65	49.84	0	0	0	0	0	0	0
2001M04	75	78.50	62.18	50.96	0	0	0	0	0	0	0
2001M05	76	78.00	60.96	53.17	0	0	0	0	0	0	0
2001M06	77	77.01	60.70	51.92	0	0	0	0	0	0	0
2001M07	84	80.34	61.53	47.71	0	0	0	0	0	0	0
2001M08	84	80.39	61.92	49.22	0	0	0	0	0	0	0
2001M09	79	79.65	62.04	47.63	0	0	0	0	0	0	0
2001M10	75	78.24	62.88	40.52	0	0	0	0	0	0	0
2001M11	78	80.07	63.40	36.87	0	0	0	0	0	1	0
2001M12	78	81.26	65.33	36.38	0	0	0	0	0	1	0
2002M01	78	82.95	65.19	37.04	0	0	0	0	0	0	0
2002M02	77	82.50	63.98	38.42	0	0	0	0	0	0	0
2002M03	78	81.20	62.58	44.61	0	0	0	0	0	0	0
2002M04	78	80.38	61.01	47.52	0	0	0	0	0	0	0
2002M05	80	82.14	62.13	47.94	0	0	0	0	0	0	1
2002M06	83	86.27	61.95	45.75	0	0	0	0	0	0	0
2002M07	85	91.11	62.71	47.52	0	0	0	1	0	0	0
2002M08	86	96.62	64.12	49.14	0	0	0	1	0	0	0
2002M09	89	102.74	62.36	51.94	0	0	0	1	1	0	0
2002M10	89	101.31	61.80	51.42	0	0	0	1	0	0	0
2002M11	89	98.88	62.48	46.69	0	0	0	0	0	0	0
2002M12	90	95.45	62.71	52.45	0	0	0	0	0	0	0
2003M01	90	94.35	65.39	57.64	0	0	0	0	0	0	0
2003M02	90	94.24	69.25	62.64	0	0	0	0	0	0	0
2003M03	89	92.44	71.15	57.43	0	0	0	0	0	1	0
2003M04	87	91.67	67.13	49.49	0	0	0	0	0	0	0
2003M05	88	93.42	69.53	50.64	0	0	0	0	0	0	0
2003M06	87	92.00	70.78	53.62	0	0	0	0	0	0	0
2003M07	85	86.60	72.07	54.21	0	0	0	0	0	0	0

2003M08	86	90.32	73.26	55.95	0	0	0	0	0	0	0
2003M09	89	91.60	74.24	51.42	0	0	0	0	0	1	0
2003M10	96	92.45	75.69	54.82	0	0	0	0	0	1	0
2003M11	100	95.88	76.50	55.19	0	0	0	0	0	1	0
2003M12	100	98.32	78.36	58.02	0	0	0	1	1	1	0
2004M01	103	101.67	78.03	60.51	0	0	0	1	1	0	0
2004M02	107	104.11	74.08	60.40	0	0	0	1	1	0	0
2004M03	113	109.59	74.59	64.80	1	0	0	1	1	0	0
2004M04	112	112.66	74.91	65.54	1	0	0	0	1	0	0
2004M05	108	109.04	76.83	72.37	0	0	0	0	0	0	0
2004M06	103	105.30	81.78	69.50	0	0	0	0	0	0	0
2004M07	99	96.76	90.38	73.36	0	0	0	0	0	1	0
2004M08	97	95.13	91.75	79.50	0	0	0	0	0	1	0
2004M09	97	93.69	95.91	78.26	0	0	0	0	0	1	0
2004M10	95	92.88	99.31	87.88	0	0	0	0	0	1	0
2004M11	95	95.82	95.43	79.84	0	0	0	0	0	0	0
2004M12	95	97.93	92.09	75.27	0	0	0	0	0	0	0
2005M01	96	99.11	93.12	81.58	0	0	0	0	0	0	0
2005M02	99	98.02	92.25	84.23	0	0	0	0	0	0	0
2005M03	104	100.92	98.86	94.59	0	0	0	0	0	0	0
2005M04	101	98.20	103.84	94.50	0	0	0	0	0	0	0
2005M05	100	97.71	106.19	89.64	0	0	0	0	0	0	0
2005M06	100	97.42	100.35	99.68	0	0	0	0	0	0	0
2005M07	100	101.32	99.40	104.26	0	0	1	0	0	0	0
2005M08	98	100.49	98.69	114.26	0	0	1	0	0	0	0
2005M09	99	100.26	99.73	115.70	0	0	1	0	0	0	0
2005M10	102	104.07	102.68	110.78	0	0	1	0	0	0	0
2005M11	100	99.33	104.04	103.51	0	0	1	0	0	0	0
2005M12	103	103.14	100.84	107.28	0	0	1	0	0	0	0
2006M01	105	104.96	97.44	114.93	0	0	1	0	0	0	0
2006M02	110	109.90	100.84	110.32	0	0	1	0	0	0	0
2006M03	107	108.41	106.97	112.08	0	0	1	0	0	0	0
2006M04	108	110.35	108.61	123.84	0	0	1	0	0	0	0
2006M05	111	114.50	104.72	124.38	1	0	1	0	0	0	0
2006M06	107	114.77	100.61	123.78	0	0	1	0	0	0	0
2006M07	110	118.38	100.28	130.60	1	0	1	0	0	0	0
2006M08	109	117.19	102.60	130.03	0	0	1	0	0	0	0
2006M09	109	120.00	102.89	113.03	0	0	1	0	0	0	0
2006M10	114	131.08	102.23	106.84	1	0	1	0	0	0	0
2006M11	120	139.89	106.73	108.38	1	0	1	0	0	0	0
2006M12	120	138.31	110.71	112.67	1	0	1	0	0	0	0
2007M01	121	139.66	113.78	100.72	1	0	1	0	0	0	0
2007M02	125	145.68	121.09	108.13	1	0	1	1	0	0	0
2007M03	125	143.32	128.17	112.51	1	0	1	0	0	1	0
2007M04	125	135.61	127.58	119.72	1	0	1	0	0	0	0
2007M05	129	138.58	136.92	119.89	1	0	1	0	0	0	0
2007M06	136	146.67	149.90	125.06	1	0	1	0	0	0	1
2007M07	138	141.93	146.71	133.58	1	0	1	0	0	0	1
2007M08	140	146.37	150.53	128.46	1	0	1	1	0	0	0
2007M09	148	161.62	160.64	139.00	1	0	1	1	0	0	0

2007M10	154	165.93	166.43	148.80	1	0	1	1	0	0	0
2007M11	161	167.63	178.46	165.11	1	0	1	1	0	0	0
2007M12	168	181.53	205.51	162.88	1	1	1	1	1	1	0
2008M01	179	194.63	238.78	166.26	1	1	1	1	1	1	0
2008M02	195	219.01	265.10	174.99	1	1	1	1	1	1	0
2008M03	208	241.47	351.80	187.79	1	1	1	1	1	1	0
2008M04	212	266.99	407.91	200.51	1	1	1	1	1	1	0
2008M05	213	259.68	443.44	224.34	1	1	1	1	0	1	1
2008M06	220	265.86	446.71	242.17	1	1	1	1	0	1	1
2008M07	215	251.09	481.88	246.44	1	1	1	0	0	1	1
2008M08	193	233.30	521.08	213.84	1	1	1	0	0	1	0
2008M09	181	225.30	511.69	189.34	1	1	1	0	0	0	0
2008M10	149	184.97	443.53	142.71	1	0	1	0	0	0	0
2008M11	139	168.68	349.39	111.40	1	0	1	0	0	0	0
2008M12	133	162.58	324.88	89.12	1	0	0	0	0	0	0
2009M01	146	177.08	302.28	91.60	1	0	0	0	0	0	0
2009M02	145	171.56	260.23	85.36	1	0	0	0	0	0	0
2009M03	143	172.92	255.74	90.96	1	0	0	0	0	0	0
2009M04	151	170.76	221.36	94.89	1	0	0	0	0	0	0
2009M05	163	179.05	210.26	107.29	1	0	1	0	0	0	0
2009M06	164	183.24	198.65	125.24	1	0	1	0	0	0	0
2009M07	155	165.81	189.63	117.30	1	0	1	0	0	0	0
2009M08	160	158.04	162.01	128.24	1	0	1	0	0	0	0
2009M09	156	152.67	159.51	122.68	1	0	1	0	0	0	0
2009M10	157	159.31	163.10	133.18	1	0	1	0	0	0	0
2009M11	163	169.33	162.25	139.37	1	0	1	0	0	0	0
2009M12	165	170.51	161.13	136.85	1	1	1	0	0	0	0
2010M01	167	168.31	168.14	142.61	1	1	1	0	0	0	0
2010M02	162	160.91	171.02	138.36	1	0	1	0	0	0	0
2010M03	155	156.21	172.64	144.97	1	0	1	0	0	0	0
2010M04	153	152.06	177.94	152.21	1	0	1	0	0	0	0
2010M05	151	150.91	171.54	138.63	1	0	1	0	0	0	0
2010M06	149	141.46	171.35	137.63	1	0	1	0	0	0	0
2010M07	157	152.94	176.71	137.39	1	0	1	0	0	0	0
2010M08	168	167.54	186.56	138.82	1	1	1	0	0	0	0
2010M09	178	187.08	198.61	139.37	1	1	1	0	0	0	0
2010M10	189	200.48	209.93	148.21	1	1	1	0	0	0	0
2010M11	198	205.27	218.57	153.97	1	1	1	1	1	1	0
2010M12	209	217.96	222.86	164.15	1	1	1	1	1	1	1
2011M01	218	225.92	230.69	170.63	1	1	1	1	1	1	1
2011M02	224	241.88	232.24	178.14	1	1	1	1	1	1	1
2011M03	212	232.64	227.58	194.92	1	1	1	0	0	0	1
2011M04	214	247.10	247.76	207.49	1	1	1	0	0	0	1
2011M05	211	245.27	260.38	194.24	1	1	1	0	0	0	0
2011M06	212	245.06	279.55	191.05	1	1	1	0	0	0	0
2011M07	212	240.05	287.27	195.03	1	1	1	0	0	0	0
2011M08	214	250.36	291.04	182.88	1	1	1	0	0	1	0
2011M09	211	245.91	294.41	183.62	1	1	1	0	0	1	0
2011M10	200	233.02	295.26	181.93	1	1	1	0	0	1	0
2011M11	199	233.30	291.79	189.99	1	1	1	0	0	0	0

2011M12	193	221.72	265.50	187.77	1	1	1	0	0	0	0
2012M01	198	223.89	258.20	192.55	1	1	1	0	0	0	0
2012m02	204	226.74	258.87	200.96	1	1	1	0	0	0	0
2012m03	210	229.74	263.31	208.43	1	1	1	0	0	0	0
2012m04	211	224.59	275.75	201.12	1	1	1	0	0	0	0
2012m05	206	227.87	274.38	185.72	1	1	1	0	0	0	0
2012m06	204	228.84	259.90	163.51	1	1	1	0	0	0	0
2012m07	225	265	256	173	1	1	1	0	0	0	0
2012m08	226	265	257	187	1	1	1	0	1	0	0

Source: Authors' compilation.

Appendix 2. Database for Domestic Triggers

Region	Countries	Date	Staple	Average staple price increase (%)	Number of countries with macro vulnerabilities	Number of macro vulnerabilities
SSA- Eastern	ETH, SDN	June, 2005	M, S	34	2	6
SSA- Western	TCD, BEN, TGO, MLI	June, 2005	M, M, M, Mi	64	4	11
SSA- Eastern	ETH, SDN	July, 2005	M, S	35	2	6
SSA- Western	BEN, MLI, TCD, NGA, TGO	July, 2005	M, Mi, M, S, M	42	5	13
SSA- Eastern	ETH, SDN	August, 2005	M, S	46	2	6
SSA- Western	MLI, TCD, TGO, NGA	August, 2005	Mi, M, M, S	33	4	10
SSA-Southern	MOZ, ZAF	August, 2005	M, M	23	2	6
SSA- Western	NGA, MLI	September, 2005	S, Mi	67	2	5
SSA-Southern	ZAF, ZMB, MOZ	September, 2005	M, M, M	31	3	9
SSA- Western	MLI, NGA	October, 2005	Mi, S	30	2	5
SSA-Southern	ZMB, MOZ, ZAF	October, 2005	M, M, M	39	3	9
SSA-Southern	MOZ, ZAF, ZMB	November, 2005	M, M, M	48	3	9
SSA-Southern	ZMB, ZAF, MOZ	December, 2005	M, M, M	76	3	9
SSA-Southern	MOZ, ZAF, ZMB	January, 2006	M, M, M	64	3	8
SSA-Southern	MOZ, ZAF, ZMB	February, 2006	M, M, M	47	3	8
LAC	HND, URY	March, 2006	M, W	22	2	5
SSA-Southern	ZMB, MOZ, ZAF	March, 2006	M, M, M	29	3	8
SSA- Western	TCD, MLI, BEN	May, 2006	M, Mi, M	26	3	8
LAC	HND, GTM	June, 2006	M, M	23	2	6
SSA- Eastern	RWA, UGA	June, 2006	M, M	30	2	6
SSA- Western	MLI, TCD, BEN	June, 2006	Mi, M, M	33	3	8
LAC	GTM, HND, SLV	July, 2006	M, M, M	21	3	9
SSA- Western	TCD, MLI	July, 2006	M, Mi	28	2	5
ECA	MDA, UKR	December, 2006	W, W	25	2	5
SSA-Southern	MOZ, ZMB	December, 2006	M, M	25	2	5
ECA	MDA, UKR	January, 2007	W, W	25	2	6
LAC	PER, BOL	January, 2007	R, M	26	2	4
SSA- Eastern	MDG, UGA	January, 2007	R, M	29	2	6
SSA-Southern	MOZ, ZMB	January, 2007	M, M	22	2	6
LAC	GTM, BOL, HND	February, 2007	M, M, M	36	3	8
SSA- Eastern	RWA, MDG	February, 2007	M, R	28	2	5
LAC	BOL, HND, GTM, SLV	March, 2007	M, M, M, M	41	4	11
LAC	HND, BOL, GTM, SLV, URY	April, 2007	M, M, M, M, W	37	5	13
SSA- Western	BFA, GHA	April, 2007	S, M	20	2	6
LAC	GTM, SLV, HND, BOL	May, 2007	M, M, M, M	35	4	11
LAC	NIC, SLV, BOL, GTM, HND	June, 2007	M, M, M, M, M	39	5	14
LAC	GTM, SLV, NIC, HND	July, 2007	M, M, M, M	43	4	12
ECA	KGZ, AZE, RUS, UKR	August, 2007	W, W, W, W	26	4	9
LAC	NIC, SLV, HND	August, 2007	M, M, M	48	3	9
ECA	UKR, TJK, KGZ, AZE, RUS	September, 2007	W, W, W, W, W	33	5	12
LAC	SLV, HND	September, 2007	M, M	26	2	6
SAR	NPL, AFG	September, 2007	R, W	21	2	3

SSA- Eastern	TZA, ETH	September, 2007	M, M	51	2	6
SSA- Western	CPV, NGA	September, 2007	W, S	25	2	5
EAR	MNG, KHM	October, 2007	W, R	33	2	3
ECA	KGZ, RUS, AZE, UKR, TJK, ARM, GEO	October, 2007	W, W, W, W, W, W, W	43	7	18
LAC	PAN, DOM, PER	October, 2007	R, R, R	19	3	8
SAR	PAK, AFG, NPL	October, 2007	W, W, R	20	3	6
SSA- Eastern	ETH, BDI, SDN, RWA, TZA	October, 2007	M, B, S, M, M	37	5	14
SSA- Western	MLI, GHA, CPV, NGA, MRT	October, 2007	Mi, M, W, S, W	35	5	14
EAR	KHM, MNG	November, 2007	R, W	40	2	3
ECA	ARM, GEO, AZE, TJK, KGZ, RUS, UKR	November, 2007	W, W, W, W, W, W, W	41	7	18
LAC	PAN, DOM, BOL, PER	November, 2007	R, R, M, R	24	4	10
SAR	NPL, AFG, PAK, LKA	November, 2007	R, W, W, R	23	4	8
SSA- Eastern	TZA, MDG	November, 2007	M, R	62	2	6
SSA- Western	MLI, BEN, CPV, MRT, NGA, GHA	November, 2007	Mi, M, W, W, S, M	52	6	17
SSA-Southern	MOZ, MWI, ZMB	November, 2007	M, M, M	26	3	8
EAR	KHM, MNG	December, 2007	R, W	33	2	3
ECA	AZE, RUS, GEO, KGZ, TJK, UKR, ARM	December, 2007	W, W, W, W, W, W, W	35	7	18
LAC	PAN, DOM, PER	December, 2007	R, R, R	28	3	8
SAR	AFG, PAK, LKA	December, 2007	W, W, R	48	3	6
SSA- Eastern	BDI, TZA, MDG	December, 2007	B, M, R	53	3	9
SSA- Western	NGA, GHA, BEN, MRT, CPV	December, 2007	S, M, M, W, W	46	5	14
SSA-Southern	ZMB, MOZ, MWI	December, 2007	M, M, M	33	3	8
EAR	MNG, KHM	January, 2008	W, R	17	2	5
ECA	GEO, AZE, TJK, KGZ, RUS, ARM, UKR	January, 2008	W, W, W, W, W, W, W	25	7	19
LAC	DOM, PAN, COL, CRI, PER	January, 2008	R, R, R, R, R	25	5	14
SAR	LKA, NPL, PAK, AFG	January, 2008	R, R, W, W	54	4	8
SSA- Eastern	SDN, MDG, RWA, BDI, UGA, TZA	January, 2008	S, R, M, B, M, M	57	6	17
SSA- Western	CPV, MRT, NGA, BEN, GHA, SEN, TGO	January, 2008	W, W, S, M, M, R, M	38	7	20
SSA-Southern	MOZ, ZMB, MWI	January, 2008	M, M, M	38	3	9
EAR	KHM, THA	February, 2008	R, R	25	2	5
ECA	TJK, AZE, RUS, UKR, ARM, GEO	February, 2008	W, W, W, W, W, W	21	6	16
LAC	BOL, CRI, COL, DOM, PER	February, 2008	M, R, R, R, R	25	5	13
SAR	IND, PAK, NPL, AFG, LKA	February, 2008	R, W, R, W, R	40	5	10
SSA- Eastern	BDI, RWA, UGA, TZA, SDN	February, 2008	B, M, M, M, S	41	5	14
SSA- Western	SEN, GHA, BEN, MRT, NGA, TGO	February, 2008	R, M, M, W, S, M	52	6	17
SSA-Southern	ZMB, MOZ, MWI	February, 2008	M, M, M	57	3	9
EAR	KHM, THA, MNG	March, 2008	R, R, W	50	3	7
ECA	AZE, UKR, ARM	March, 2008	W, W, W	22	3	8
LAC	NIC, DOM, CRI, PER, BOL	March, 2008	M, R, R, R, M	29	5	14

SAR	PAK, IND, LKA, AFG	March, 2008	W, R, R, W	37	4	8
SSA- Eastern	TZA, KEN, SDN, UGA, ETH	March, 2008	M, M, S, M, M	41	5	15
SSA- Western	BEN, TCD, GHA, NER, TGO, NGA	March, 2008	M, M, M, Mi, M, S	52	6	16
SSA-Southern	MOZ, MWI, ZMB	March, 2008	M, M, M	83	3	9
EAR	THA, KHM, MNG, PHL	April, 2008	R, R, W, R	61	4	9
ECA	AZE, TJK, RUS, ARM	April, 2008	W, W, W, W	20	4	10
LAC	BRA, SLV, GTM, DOM, PER, NIC, CRI	April, 2008	W, M, M, R, R, M, R	20	7	20
SAR	PAK, AFG, LKA	April, 2008	W, W, R	65	3	6
SSA- Eastern	ETH, KEN, SDN, TZA, UGA	April, 2008	M, M, S, M, M	44	5	15
SSA- Western	BEN, NER, SEN, GHA, TCD, TGO	April, 2008	M, Mi, R, M, M, M	33	6	17
SSA-Southern	ZMB, MWI	April, 2008	M, M	56	2	6
EAR	LAO, MNG, PHL, KHM, THA	May, 2008	R, W, R, R, R	57	5	12
ECA	RUS, TJK, AZE, ARM, KGZ	May, 2008	W, W, W, W, W	23	5	13
LAC	CRI, GTM, BRA, NIC, SLV, PER, HND, URY	May, 2008	R, M, W, M, M, R, M, W	37	8	23
SAR	NPL, LKA, AFG, PAK	May, 2008	R, R, W, W	38	4	8
SSA- Eastern	KEN, SDN, TZA, RWA, ETH, UGA	May, 2008	M, S, M, M, M, M	62	6	18
SSA- Western	GHA, BEN, TCD, BFA, NER, SEN, NGA, TGO	May, 2008	M, M, M, S, Mi, R, S, M	46	8	22
EAR	KHM, LAO, THA, MNG, PHL	June, 2008	R, R, R, W, R	54	5	12
ECA	KGZ, AZE, RUS, TJK, ARM	June, 2008	W, W, W, W, W	26	5	13
LAC	SLV, BRA, NIC, CRI, URY, GTM, HND	June, 2008	M, W, M, R, W, M, M	39	7	20
SAR	LKA, AFG	June, 2008	R, W	21	2	3
SSA- Eastern	UGA, SDN, KEN, ETH	June, 2008	M, S, M, M	77	4	12
SSA- Western	NGA, BFA, NER, MLI, GHA, TGO, COD, BEN, TCD	June, 2008	S, S, Mi, Mi, M, M, C, M, M	41	9	25
EAR	MNG, LAO, PHL, KHM, THA	July, 2008	W, R, R, R, R	41	5	12
ECA	TJK, AZE, MDA, KGZ, ARM	July, 2008	W, W, W, W, W	23	5	14
LAC	BRA, CRI, NIC, PAN, HND, SLV, URY, GTM	July, 2008	W, R, M, R, M, M, W, M	34	8	23
SSA- Eastern	SDN, ETH, KEN, UGA	July, 2008	S, M, M, M	90	4	12
SSA- Western	SEN, NER, MLI, NGA, GHA, TGO, COD, BFA, BEN, TCD	July, 2008	R, Mi, Mi, S, M, M, C, S, M, M	47	10	28
EAR	PHL, MNG, THA	August, 2008	R, W, R	22	3	6
ECA	MDA, TJK, RUS, AZE	August, 2008	W, W, W, W	16	4	10
LAC	NIC, BRA, HND, CRI, URY	August, 2008	M, W, M, R, W	39	5	14
SAR	PAK, NPL, AFG	August, 2008	W, R, W	34	3	6
SSA- Eastern	RWA, ETH, SDN, UGA, KEN	August, 2008	M, M, S, M, M	56	5	15

SSA- Western	COD, GHA, NGA, TGO, TCD, SEN, BFA, MLI, BEN	August, 2008	C, M, S, M, M, R, S, Mi, M	40	9	25
LAC	HND, CRI, COL, URY, GTM	September, 2008	M, R, R, W, M	45	5	14
SAR	IND, PAK, NPL	September, 2008	R, W, R	24	3	7
SSA- Eastern	KEN, ETH, SDN, RWA, UGA	September, 2008	M, M, S, M, M	49	5	15
SSA- Western	COD, BFA, TCD, NER, NGA, MLI, SEN	September, 2008	C, S, M, Mi, S, Mi, R	43	7	19
SSA-Southern	MWI, MOZ	September, 2008	M, M	28	2	6
LAC	COL, CRI, GTM, PAN	October, 2008	R, R, M, R	26	4	11
SAR	NPL, PAK, IND	October, 2008	R, W, R	23	3	7
SSA- Eastern	SDN, MDG, RWA	October, 2008	S, R, M	39	3	9
SSA- Western	NGA, TCD, COD, MLI, SEN	October, 2008	S, M, C, Mi, R	33	5	13
SSA-Southern	ZMB, MWI, MOZ	October, 2008	M, M, M	52	3	9
SAR	IND, NPL, PAK	November, 2008	R, R, W	20	3	7
SSA- Eastern	RWA, SDN, MDG	November, 2008	M, S, R	23	3	9
SSA- Western	TCD, SEN	November, 2008	M, R	35	2	5
SSA-Southern	ZMB, MOZ, MWI	November, 2008	M, M, M	47	3	9
LAC	CRI, COL	December, 2008	R, R	45	2	5
SSA-Southern	MOZ, ZMB	December, 2008	M, M	44	2	6
LAC	CRI, COL, NIC	January, 2009	R, R, M	43	3	7
SSA-Southern	ZMB, MWI	January, 2009	M, M	37	2	5
LAC	NIC, CRI	February, 2009	M, R	60	2	5
SSA- Western	TGO, BEN, GHA	February, 2009	M, M, M	22	3	9
SSA-Southern	MWI, ZMB	February, 2009	M, M	38	2	5
LAC	CRI, NIC	March, 2009	R, M	80	2	5
SSA- Western	GHA, NER	March, 2009	M, Mi	19	2	6
SSA-Southern	ZMB, MWI	March, 2009	M, M	31	2	5
LAC	HND, CRI, NIC	April, 2009	M, R, M	75	3	8
SSA- Western	BEN, NER, GHA	April, 2009	M, Mi, M	27	3	9
LAC	NIC, HND, CRI	May, 2009	M, M, R	76	3	8
SSA- Western	BFA, BEN, MLI, GHA, NGA	May, 2009	S, M, Mi, M, S	38	5	14
LAC	NIC, HND	June, 2009	M, M	22	2	6
SSA- Eastern	UGA, KEN, SDN	June, 2009	M, M, S	20	3	9
SSA- Western	TGO, GHA, MLI	June, 2009	M, M, Mi	35	3	9
LAC	COL, HND, NIC	July, 2009	R, M, M	27	3	8
SSA- Western	TCD, TGO	July, 2009	M, M	23	2	6
SSA- Western	NGA, TCD, MLI	August, 2009	S, M, Mi	29	3	8
SSA- Western	NGA, MLI	September, 2009	S, Mi	43	2	5
SSA- Eastern	TZA, RWA	October, 2009	M, M	22	2	6
SSA- Western	MLI, NGA	October, 2009	Mi, S	26	2	5
SSA- Eastern	TZA, BDI, SDN	November, 2009	M, B, S	28	3	9
SSA- Eastern	BDI, SDN, TZA, RWA	December, 2009	B, S, M, M	35	4	12
SSA-Southern	ZMB, ZAF	December, 2009	M, M	23	2	5
LAC	MEX, BOL	January, 2010	M, M	21	2	4
SSA- Eastern	BDI, SOM, TZA, SDN	January, 2010	B, M, M, S	40	4	9
EAR	KHM, IDN	February, 2010	R, R	25	2	5
LAC	BOL, MEX	February, 2010	M, M	22	2	4

SSA- Eastern	TZA, BDI, SDN, SOM	February, 2010	M, B, S, M	41	4	9
SSA-Southern	ZMB, MOZ	February, 2010	M, M	22	2	5
LAC	MEX, BOL	March, 2010	M, M	47	2	4
SSA- Eastern	BDI, SOM	March, 2010	B, M	51	2	4
SSA- Western	BEN, NER	March, 2010	M, Mi	18	2	6
SSA-Southern	MOZ, ZMB	March, 2010	M, M	23	2	5
LAC	NIC, GTM, COL, MEX	April, 2010	M, M, R, M	29	4	10
LAC	GTM, MEX, COL	May, 2010	M, M, R	37	3	7
SSA- Eastern	SDN, SOM	May, 2010	S, M	28	2	3
SSA- Western	NER, BEN	May, 2010	Mi, M	23	2	6
LAC	BOL, MEX	June, 2010	M, M	45	2	4
SSA- Western	TGO, BEN	June, 2010	M, M	23	2	6
LAC	MEX, BOL	July, 2010	M, M	50	2	4
SAR	BTN, BGD, AFG	July, 2010	R, R, W	20	3	5
SSA- Western	TCD, NGA, NER	July, 2010	M, S, Mi	16	3	8
ECA	TJK, KGZ	August, 2010	W, W	19	2	5
SAR	BGD, BTN, AFG	August, 2010	R, R, W	32	3	5
SSA- Western	BEN, GHA	August, 2010	M, M	22	2	6
EAR	LAO, MNG	September, 2010	R, W	22	2	5
ECA	KGZ, TJK, GEO, UKR	September, 2010	W, W, W, W	27	4	10
LAC	HTI, BOL, SLV	September, 2010	R, M, M	37	3	6
SAR	BGD, AFG, BTN	September, 2010	R, W, R	36	3	5
EAR	MNG, LAO	October, 2010	W, R	28	2	5
ECA	GEO, KGZ, TJK, UKR	October, 2010	W, W, W, W	33	4	10
LAC	HTI, SLV, BOL, COL	October, 2010	R, M, M, R	29	4	9
SAR	BGD, BTN, AFG, NPL	October, 2010	R, R, W, R	31	4	7
ECA	AZE, GEO, TJK, UKR, KGZ	November, 2010	W, W, W, W, W	32	5	12
SAR	BTN, AFG	November, 2010	R, W	32	2	4
SSA- Eastern	UGA, RWA	November, 2010	M, M	30	2	6
EAR	MNG, THA	December, 2010	W, R	28	2	4
ECA	AZE, TJK, KGZ, GEO, UKR	December, 2010	W, W, W, W, W	31	5	12
LAC	BOL, BRA, HTI, CRI	December, 2010	M, W, R, R	16	4	9
SAR	LKA, AFG	December, 2010	R, W	20	2	2
SSA- Eastern	KEN, UGA, RWA, BDI, MDG	December, 2010	M, M, M, B, R	36	5	15
ECA	GEO, TJK, KGZ, AZE, UKR	January, 2011	W, W, W, W, W	22	5	13
LAC	CRI, BRA, BOL, HND, SLV	January, 2011	R, W, M, M, M	27	5	13
SSA- Eastern	RWA, UGA, SOM, TZA, MDG	January, 2011	M, M, M, M, R	61	5	13
ECA	KGZ, AZE, TJK, MDA, UKR	February, 2011	W, W, W, W, W	19	5	13
LAC	CRI, HND, SLV	February, 2011	R, M, M	39	3	9
SSA- Eastern	RWA, TZA, MDG, KEN, SOM, UGA	February, 2011	M, M, R, M, M, M	45	6	16
SSA-Southern	ZMB, ZAF	February, 2011	M, M	20	2	5
ECA	MDA, UKR, KGZ, AZE	March, 2011	W, W, W, W	31	4	11
LAC	GTM, CRI, HND, NIC, SLV	March, 2011	M, R, M, M, M	46	5	14

SSA- Eastern	UGA, ETH, MDG, KEN, RWA, SOM	March, 2011	M, M, R, M, M, M	57	6	15
SSA- Western	GHA, TGO	March, 2011	M, M	25	2	6
ECA	KGZ, UKR, GEO, MDA	April, 2011	W, W, W, W	29	4	12
LAC	GTM, HND, NIC, SLV, MEX	April, 2011	M, M, M, M, M	56	5	13
SSA- Eastern	KEN, SOM, TZA, ETH, RWA, UGA	April, 2011	M, M, M, M, M, M	63	6	15
SSA- Western	TCD, NER, GHA, BEN	April, 2011	M, Mi, M, M	33	4	12
ECA	GEO, MDA, UKR, KGZ	May, 2011	W, W, W, W	24	4	12
LAC	SLV, NIC, GTM, HND, MEX	May, 2011	M, M, M, M, M	54	5	13
SSA- Eastern	ETH, TZA, SOM, KEN, UGA, RWA	May, 2011	M, M, M, M, M, M	64	6	15
SSA- Western	TCD, NGA, BEN, GHA, NER	May, 2011	M, S, M, M, Mi	31	5	14
ECA	UKR, MDA	June, 2011	W, W	32	2	6
LAC	NIC, SLV, HND, GTM	June, 2011	M, M, M, M	51	4	11
SSA- Eastern	SOM, KEN, UGA, ETH, RWA, TZA	June, 2011	M, M, M, M, M, M	64	6	15
SSA- Western	GHA, NGA, TCD, BEN	June, 2011	M, S, M, M	39	4	11
LAC	NIC, SLV, HND, GTM	July, 2011	M, M, M, M	50	4	11
SSA- Eastern	TZA, ETH, SOM, UGA, KEN, RWA	July, 2011	M, M, M, M, M, M	81	6	15
SSA- Western	GHA, BEN, TCD, NGA	July, 2011	M, M, M, S	37	4	11
EAR	KHM, THA	August, 2011	R, R	16	2	5
LAC	NIC, GTM, HND, SLV	August, 2011	M, M, M, M	39	4	11
SSA- Eastern	ETH, UGA, TZA, KEN, RWA, SOM	August, 2011	M, M, M, M, M, M	53	6	15
SSA- Western	BEN, TCD, GHA, NGA	August, 2011	M, M, M, S	44	4	11
EAR	KHM, THA	September, 2011	R, R	22	2	5
SSA- Western	BFA, TCD, NGA	September, 2011	S, M, S	20	3	8
EAR	KHM, THA	October, 2011	R, R	28	2	5
SSA- Eastern	ETH, SDN	October, 2011	M, S	42	2	4
SSA- Western	BFA, TCD, NGA	October, 2011	S, M, S	21	3	8
EAR	KHM, THA	November, 2011	R, R	22	2	5
SSA- Eastern	SDN, ETH, MDG	November, 2011	S, M, R	34	3	7
SSA- Western	BFA, MLI	November, 2011	S, Mi	32	2	6
SSA-Southern	ZAF, ZMB	November, 2011	M, M	30	2	5
SSA- Eastern	MDG, SDN	December, 2011	R, S	43	2	5
SSA- Western	BFA, NER, MLI	December, 2011	S, Mi, Mi	40	3	9
SSA- Eastern	MDG, SDN	January, 2012	R, S	35	2	6
SSA- Western	BFA, SEN, MLI, NER	January, 2012	S, R, Mi, Mi	30	4	12
SSA- Eastern	TZA, SDN	February, 2012	M, S	44	2	6
SSA- Western	NER, GHA, SEN, BFA, MLI	February, 2012	Mi, M, R, S, Mi	35	5	15
SSA- Eastern	TZA, SDN, UGA	March, 2012	M, S, M	24	3	9
SSA- Western	NER, GHA, BFA, MLI	March, 2012	Mi, M, S, Mi	33	4	12
SSA- Eastern	UGA, TZA, SOM, SDN	April, 2012	M, M, M, S	41	4	10
SSA- Western	BFA, NER, MLI, GHA, NGA	April, 2012	S, Mi, Mi, M, S	33	5	14
SSA- Eastern	TZA, UGA	May, 2012	M, M	52	2	6
SSA- Eastern	ETH, RWA, SUD, UGA	June, 2012	M, M, S, M	36	4	8

SSA- Western	CHA, MAL, NIG	June, 2012	Mil, Mil, Mil	26	3	4
SSA- Eastern	RWA, SUD	July, 2012	M, S	26	2	4
SSA- Western	BUR, MAL, NIG	July, 2012	S, Mil, Mil	20	3	5

Source: Authors' compilation.