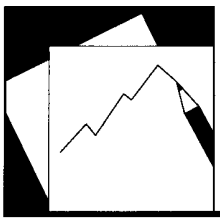
WP/12/67



IMF Working Paper

Are Foreign Aid and Remittance Inflows a Hedge against Food Price Shocks?

Jean-Louis Combes, Christian Ebeke, Mireille Ntsama Etoundi, and Thierry Yogo

INTERNATIONAL MONETARY FUND

 WP/12/67

IMF Working Paper

Strategy, Policy, and Review

Are Foreign Aid and Remittance Inflows a Hedge against Food Price Shocks?[1]

Prepared by Jean-Louis Combes, Christian Ebeke, Mireille Ntsama Etoundi, and Thierry Yogo

Authorized for distribution by Christian Mumssen

March 2012

Abstract

This paper explores the role of foreign aid and remittance inflows in the mitigation of the effects of food price shocks. Using a large sample of developing countries and mobilising dynamic panel data specifications, the econometric results yield two important findings. First, remittance and aid inflows significantly dampen the effect of food price shocks in the most vulnerable countries. Second, a lower remittance-to-GDP ratio is required in order to fully absorb the effects of food price shocks compared to the corresponding aid-to-GDP ratio.

JEL Classification Numbers: E2, E3, F24, F35, O24

Keywords: Household consumption; food price shocks; vulnerability; aid; remittances

Author's E-Mail Address: cebeke@imf.org; j-l.combes@u-clermont1.fr;
mireille.ntsama_etoundi@u-clermont1.fr ; yogout@gmail.com

[1] We would like to thank Gerard Chambas, Patrick Guillaumont, Sylviane Guillaumont, Serpil Bouza, and all the participants at the Cerdi-ANR seminar. Christian Ebeke is affiliated with IMF. Jean-Louis Combes and Mireille Ntsama Etoundi are affiliated with Cerdi-University of Auvergne (France). Thierry Yogo is affiliated with University of Yaounde II-Soa (Cameroon).

Contents Page

Figures

Tables

Appendix

I. INTRODUCTION

The recent increase in food prices over previous years has raised concerns about the risk of the resurgence of undernourishment and hunger around the world, and mainly in poor countries. According to the World Bank (2011), global food prices remain high, partly due to increasing fuel prices as well as speculative behaviours in the commodity markets, and the World Bank's food price index has once again reached its peak from 2008.[2] Moreover, the World Bank study stressed that, since June 2010, an additional 44 million people have fallen below the $1.25 poverty line as a result of higher food prices. Simulations show that a further 10% increase in the food price index could lead to an additional 10 million people falling into poverty, and a 30% increase could plunge 34 million people into poverty.

Notwithstanding the recognised damaging effects of food price shocks on poverty and welfare in developing food-importing countries, little is known about the role that international remittances and foreign aid flows can play in dampening the effects of food price shocks. There are several reasons behind the interest in the effect of these flows.[3]

First, developing countries are among the top recipients of official development assistance (ODA) and remittances (World Bank Migration and Remittances Factbook, 2011) and there are existing studies on the countercyclical responsiveness of aid and remittances when countries are facing various types of shock, such as exchange rate shocks, natural disasters, conflict, oil shocks and financial crises (Ratha, 2005; Yang, 2008; Lueth and Ruiz-Arranz, 2007; Mohapatra et al., 2009; Dabla-Norris et al., 2010; David, 2010).

Second, there are very few papers which examine the role of international capital flows as shock absorbers in developing countries (Collier and Dehn, 2001; Chami et al., 2009; Craigwell et al., 2010; Combes and Ebeke, 2011). These papers essentially focus on the contribution of international capital inflows to macroeconomic stabilisation and coping with various types of shock. Collier and Dehn (2001) found that the adverse effects of negative export price shocks can be mitigated by broadly contemporaneous increases in aid. Combes and Ebeke (2011) showed that remittance inflows help to reduce the destabilising effects of natural disasters, agricultural shocks, financial and banking crises, discretionary fiscal policies and exchange rate volatility on household consumption per capita. One principal limitation of these studies is that they have neglected to compare the effectiveness of remittances and

[2] Several factors lie behind the recurrent rises in food prices. These drivers include severe weather events in key grain-exporting countries, the broad-based increase in agricultural commodity prices in 2010, which increased the competition for land and other inputs; and the link between higher oil prices and biofuels. Moreover, some export bans policies adopted by some of the large food exporters also amplified the initial rises.

[3] According to the World Bank's (2011) recent report, "Migration and Remittances Factbook" the total amount of remittances received by developing countries is three times the level of foreign aid, which positions remittances among the top external sources of finance in the developing world.

foreign aid following a shock, and especially food price shocks in developing countries. This issue is important, since there is a fear that foreign aid will be crowded out by the large remittance flows observed nowadays.[4] Hence, it seems worthwhile to compare the effectiveness of these two flows in times of shock before making any judgments.

Third, there are very few macroeconomic papers which examine the effects of the rise in food prices by distinguishing between the potential effects on the most exposed countries (the vulnerable ones) and those in which there are not necessarily any negative effects on welfare (the less vulnerable ones). One exception is Kamgnia (2011), who addressed the effects of the level of food prices on various outcomes (undernourishment, agricultural production, current account and government spending), and differentiated the effects according to the level of vulnerability to food price shocks in Sub-Saharan African countries.

This paper measures the effects of food price shocks on both the level of household consumption per capita and the volatility of the household consumption per capita growth rate in developing countries. In this vein, this paper explores the role of aid and remittance inflows in the mitigation of the effects of food price shocks in the recipient economies.

Using a large sample of developing countries observed over the period 1980-2009 and after mobilising dynamic panel data specifications, the econometric results yield three important findings. First, food price shocks significantly affect both the level and the volatility of household consumption in highly vulnerable countries. Based on the previous work of de Janvry and Sadoulet (2008), the vulnerability of countries to food price shocks was assessed by computing a continuous index which aggregates three main dimensions: the level of underdevelopment; high food dependency and a high food import burden. Second, remittance and aid inflows significantly dampen the effect of food price shocks in the most vulnerable countries. Third, a lower remittance-to-GDP ratio is required in order to fully absorb the effects of food price shocks compared to the corresponding aid-to-GDP ratio which is required.

The remainder of the paper is as follows. Section 2 computes the vulnerability index, the food price shocks and provides some stylised facts about the vulnerable countries. Section 3 presents the econometric models and discusses the main results. This paper concludes in Section 4 with policy implications.

[4] According to Grabel (2009), skeptics regarding ODA and international aid bureaucracies have embraced remittances as part of what Adelman (2003) approvingly calls the new "privatized foreign aid" and what the *Financial Times* (cited in Adelman) terms the "diaspora that fuels development." In this view, remittances are superior to traditional (public) ODA, because they have little to no overhead, they are not subject to misuse by state officials and they efficiently and directly meet human needs in developing countries.

II. DIFFERENTIAL EFFECTS OF FOOD PRICE SHOCKS ACCORDING TO THE LEVEL OF VULNERABILITY: SOME STYLISED FACTS

A. Identifying vulnerable countries

According to de Janvry and Sadoulet (2008), countries are vulnerable if they meet the following three criteria: (1) high food dependency; (2) a high food import burden and (3) low income.

The first criterion highlights the importance of food in the basket of goods consumed by the representative household in a given country. Hence, the larger the share of food items in the basket, the harder the household will be hit by an increase in food prices. We approximate food dependency by the share of total food imports in the total household consumption. The second criterion stresses the strong dependency of a country on the rest of the world, including for its supply of food items. Thus, net food-importing countries would be naturally more vulnerable to increases in food prices because such increases would cause their current account to deteriorate considerably. In this paper, we measure this variable by the ratio of food imports to total imports. Finally, the third criterion underlines the capacity of a country to constitute food safety nets for domestic consumers, should price shocks be prejudicial to them. We measure this capacity by the level of income as approximated by GDP per capita.

Using the criteria of de Janvry and Sadoulet (2008), we resorted to principal component analysis (PCA) in order to build our vulnerability index. Thus, the vulnerability index is a combination of the following variables: the ratio of food imports to total household consumption; the ratio of total food imports to total imports of goods and services and the inverse of the level of GDP per capita. The latter transformation is achieved in order to ensure that the level of development is negatively correlated to the degree of vulnerability to food price shocks. Finally, the vulnerability index is rescaled so that it ranges between 0 and 10, with higher values corresponding to high levels of vulnerability. The calculation of the vulnerability index is made for the period 1980-2009. The statistical summary of the PCA is presented in the appendices (see Tables A1 and A2 in Appendix A.).

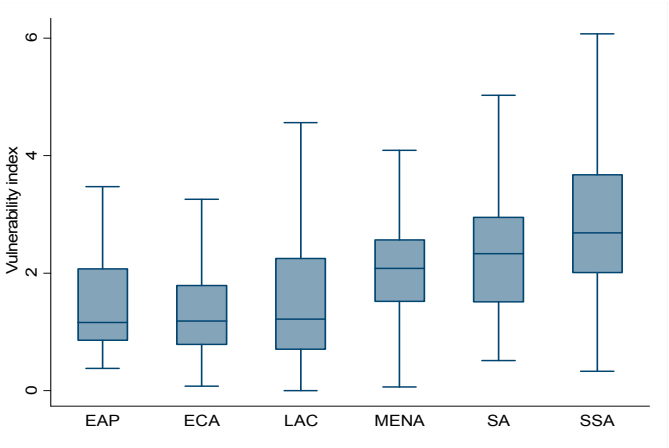
Overall, the first two principal components explain more than 89% of the total variance and are significantly correlated with the three main variables used to build the vulnerability index.

Once the vulnerability index is built, it is useful to see how it is distributed among income groups and regions worldwide.

Figure 1 presents the distribution of vulnerability to price shocks among developing regions. The figure shows that the vulnerability index is greater for Sub-Saharan African countries. This result is, however, intuitive. In fact, most of these countries are highly dependent on food imports and do not have enough income to build safety nets to cope with food price shocks.

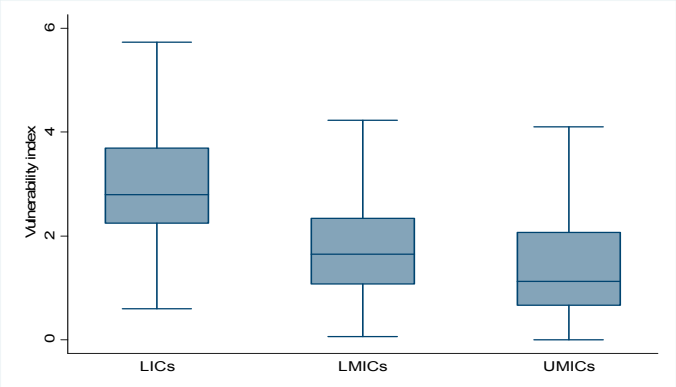
Looking at income groups, it appears that low-income countries are the most vulnerable, as shown in Figure 2. This is due mainly to their inability to build a safety net, such as buffer stocks, as underlined above.

Figure 1. Vulnerability to food price shocks among developing regions (1980 – 2009)



Note : The vulnerability to food price shocks index is the aggregation of three variables: the inverse of GDP per capita, the level of food imports as percentage of total imports of goods and the level of food imports as percentage of total household final consumption. The principal component analysis has been used as the technology of aggregation and the resulting vulnerability index has been rescaled to be between 0 and 10 with higher value indicating a strong level of vulnerability.
In box plots, the lower and upper hinges of each box show the 25th and 75th percentiles of the samples, the line in the box indicates the respective medians, and the end-points of whiskers mark next adjacent values.
EAP: East Asia and Pacific, ECA: Europe and Central Asia, LAC: Latin America and Caribbean, MENA: Middle East and North Africa, SA: South Asia, SSA: Sub-Saharan Africa.
Source : FAO-Stats, World Bank Development Indicators and authors' construction.

Figure 2. Vulnerability to food price shocks among income groups (1980 – 2009)



Note : LICs: Low Income Countries, LMICs: Lower Middle Income Countries, UMICs: Upper Middle Income Countries.
Source : FAO-Stats, World Bank Development Indicators and authors' construction.

Overall, the distribution of the vulnerability index among the developing regions and income groups shows that low-income countries are the most vulnerable. However, among this group, Sub-Saharan African countries are the least secure.

B. Computing the food price shock variable

In order to compute the food price shock variable, we follow the methodology developed by Deaton and Miller (1995) and used by Dehn (2000) and Collier and Dehn (2001). Specifically, we follow two steps: (1) the food price index is computed following the work of Deaton and Miller (1995) and (2) food price shocks are identified using the basic forecast model of Collier and Dehn (2001).

Let $FP_{i,t}$ be the food price index in country i for the year t; $P_{j,t}$ be the world price of food item j at time t and $w_{i,j\bullet}$ be the country-specific weighting of the food item at the base year, so that we have the following geometrically-weighted structure of the commodity price index:

$$FP_{i,t} = \prod_{j=1}^{6} P_{j,t}^{w_{i,j\bullet}}$$

where $w_{i,j\bullet}$ is the value of food item j in the total value of all commodities $n=6$ for the constant base period. In this paper, the basket of goods is made up of six commodities: maize; milled rice; soybean oil; soybeans; refined sugar and wheat. These commodities are considered as the most commonly imported foods in the world (FAO, 2011).[5] The weighting item is obtained using the following formula:

$$w_{i,j\bullet} = \frac{P_{j\bullet} Q_{i,j\bullet}}{\sum_{j=1}^{6} P_{j\bullet} Q_{i,j\bullet}}$$

where $Q_{i,j,\bullet}$ represents the import value of commodity j at the base year. The year 1995 was chosen as the year for which to construct country-specific commodity import weights, because it allows the inclusion of the former Soviet Union countries and it maximises the number of observations of food imports disaggregated by the products in the sample (Burke and Leigh, 2010). Global food prices by product are drawn from the International Monetary Fund World Economic Outlook database, and the data on food imports are drawn from FAO TradeStats online.[6]

[5] FAO (2011) Women in agriculture, closing the gender gap for development: The state of food and agriculture report.

[6] The constructed country-specific food price index has the additional advantage to be free from exchange rates fluctuations that would bias the estimation results if some countries adjusted the exchange rate in order to cope with the international food price shocks.

The second step consists of computing the shock variable. Following Collier and Dehn (2001), shocks are located by differencing each country's aggregate real commodity price index series in order to make it stationary, removing predictable elements from the stationary process and normalising the residuals. The forecasting model used to identify shocks is estimated for each country separately, as follows:

$$\Delta FP_{i,t} = \alpha_0 + \alpha_1 t + \theta_1 \Delta FP_{i,t-1} + \theta_2 FP_{i,t-2} + \varepsilon_{i,t}$$

with *i* denotes the country and *t* the year. The residuals from the equation above ($\widehat{\varepsilon}_{i,t}$) are normalised by subtracting their mean value and dividing by their standard deviation. Food price shocks are the positive observations of the residuals $\widehat{\varepsilon}_{i,t}$. In other words, the negative observations of the normalised residuals $\widehat{\varepsilon}_{i,t}$ are replaced by zeroes in the database. More formally, the food price shock $S_{i,t}$ is written as follows:

$$S_{i,t} = 1[\widehat{\varepsilon}_{i,t} > 0]$$

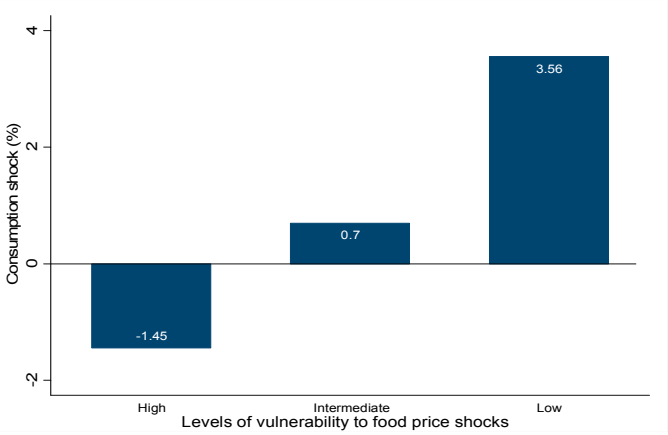
C. Household consumption in times of shocks

This subsection compares the effects of shocks on household consumption between vulnerable and non-vulnerable countries. For this purpose, the relative deviation of the real household consumption per capita during food price shocks compared to a situation without a food price shock is computed.

Figure 3 depicts the consumption deviation during food price shocks over the period 1980-2009 according to the level of vulnerability. The x-axis represents the range of vulnerability. High refers to a level of vulnerability which exceeds the 75th percentile of the vulnerability variable, intermediate refers to a level of vulnerability between the median value and the 75th percentile of the vulnerability variable, and low refers to a level of vulnerability below the median value of the vulnerability variable in the sample.

One may notice that the household consumption deviation value is negative for the most vulnerable countries, slightly positive for the intermediates and fairly high for the less vulnerable countries. In other words, countries which are highly vulnerable exhibit a decrease in consumption in times of shock. Those which are less vulnerable enjoy an increase in consumption relative to times when no shock has occurred. This is due mainly to the fact that most of these countries are net food exporters, and therefore benefit from the increase in prices.

Figure 3. Consumption deviations in time of food price shocks (1980-2009)



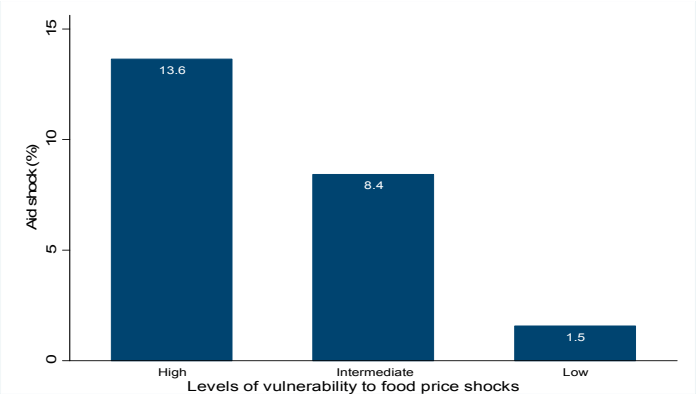
Note : The consumption shock records the relative deviation (in percentage) of the real household consumption per capita in the time of food price shocks compared to a situation without a food price shock in each country.
High: refers to a level of vulnerability exceeding the 75th percentile of the vulnerability variable, Intermediate: refers to a level of vulnerability comprising between the median value and the 75th percentile of the vulnerability variable, Lows: refers to a level of vulnerability below the median value of the vulnerability variable in the sample.
Source : FAO-Stats, World Bank Development Indicators and authors' construction.

It is worth seeing how official development assistance (ODA) and remittances respond to shocks. Figures 4 and 5 present the deviation in ODA and remittances during food price shocks over the period 1980-2009, respectively.

Figure 4 shows that in times of shock, the most vulnerable countries receive more ODA than the other groups of vulnerable countries. The increase in ODA relative to times of an absence of shocks stands at 13.6%, while this figure is 8.4% for the "intermediate" and 1.5% for the "low" group of countries.

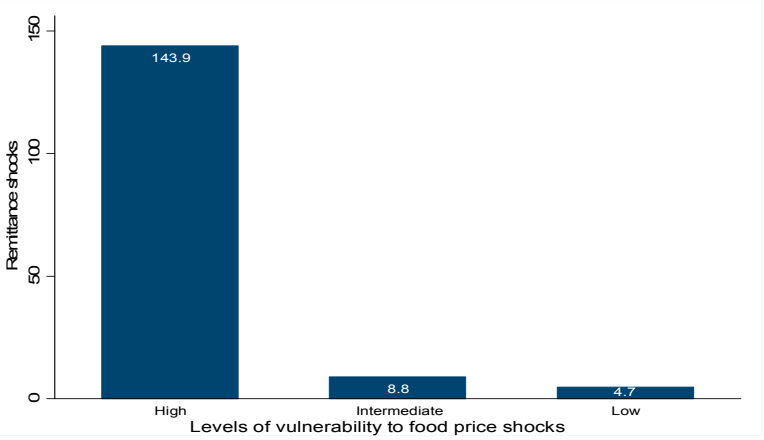
In the same vein, Figure 5 presents the deviation in remittances relative to the absence of shocks. This figure suggests that in the event of shocks, the highly vulnerable countries once again receive more remittances than the "intermediate" and "low" group of countries. However, what is striking in this case is the fact that the increase in the amount received is extremely high, standing at 143.9% relative to situation without shocks.

Figure 4. Official Development Assistance deviations in time of food price shocks (1980-2009)



Note : The foreign aid shock records the relative deviation (in percentage) of the aid-to-GDP ratio in the time of food price shocks compared to a situation without a food price shock in each country.
High: refers to a level of vulnerability exceeding the 75th percentile of the vulnerability variable, Intermediate: refers to a level of vulnerability comprising between the median value and the 75th percentile of the vulnerability variable, Lows: refers to a level of vulnerability below the median value of the vulnerability variable in the sample.
Source : FAO-Stats, World Bank Development Indicators and authors' construction.

Figure 5. Remittance deviations in time of food price shocks (1980-2009)



Note : The remittance shock records the relative deviation (in percentage) of the remittance-to-GDP ratio in the time of food price shocks compared to a situation without a food price shock in each country. High: refers to a level of vulnerability exceeding the 75th percentile of the vulnerability variable, Intermediate: refers to a level of vulnerability comprising between the median value and the 75th percentile of the vulnerability variable, Lows: refers to a level of vulnerability below the median value of the vulnerability variable in the sample.
Source : FAO-Stats, World Bank Development Indicators and authors' construction.

III. DO AID AND REMITTANCES DAMPEN THE EFFECT OF FOOD PRICE SHOCKS? ECONOMETRIC MODELS

The following models are specified in order to test the impact of food price shocks on household consumption.

A. Models of the effects of food price shocks on household consumption

The first models describe the effect of food price shocks on the level and the volatility of the real household consumption per capita.

$$c_{i,\tau} = \rho c_{i,\tau-1} + \mathbf{X}'_{i,\tau}\beta + \theta_1 S_{i,\tau} + u_i + \eta_\tau + \varepsilon_{i,\tau} \qquad \textbf{(1)}$$

$$\sigma_{i,\tau} = \varphi \sigma_{i,\tau-1} + \mathbf{Z}'_{i,\tau}\gamma + \phi_1 S_{i,\tau} + u_i + \eta_\tau + \varepsilon_{i,\tau} \qquad \textbf{(2)}$$

with $c_{i,\tau}$ and $\sigma_{i,\tau}$ representing the level of real consumption per capita and the volatility of the real household consumption per capita growth rate (both expressed in logarithmic terms), respectively. **X** and **Z** represent the vectors of the control variables. *S* represents the average number of positive food price shocks in each country during each period. There may be a concern that households anticipate food price shocks and increase their consumption (if households tend to build buffer stocks in order to cope with future shocks). This can lead to biased estimates of the effects of food price shocks on consumption. However, this is less likely to occur, due to the fact that we are using data averaged over several years. Indeed, this overshooting with regard to consumption would be easily observed with high-frequency data (especially monthly data).

u_i represents the country fixed effects and η_τ are the period dummies. i and τ are the country and the non-overlapping sub-periods spanning from 1980 to 2009, respectively,[7] while $\varepsilon_{i,\tau}$ is the idiosyncratic error term.

Two hypotheses are tested: $\theta_1 = 0$ and $\phi_1 = 0$. In other words, food price shocks, on average, have no significant effect on the level of household consumption, except in a context of high vulnerability to food price shocks. In order to account for this heterogeneity, models 1 and 2 are modified to include a nonlinear effect. In formal terms, the following models are estimated:

$$c_{i,\tau} = \rho c_{i,\tau-1} + X'_{i,\tau}\beta + \theta_1 S_{i,\tau} + \theta_2 S_{i,\tau} * Vul_{i,\tau-1} + \theta_3 Vul_{i,\tau-1} + u_i + \eta_\tau + \varepsilon_{i,\tau} \qquad \textbf{(3)}$$

$$\sigma_{i,\tau} = \phi \sigma_{i,\tau-1} + Z'_{i,\tau}\gamma + \phi_1 S_{i,\tau} + \phi_2 S_{i,\tau} * Vul_{i,\tau-1} + \phi_3 Vul_{i,\tau-1} + u_i + \eta_\tau + \varepsilon_{i,\tau} \qquad \textbf{(4)}$$

[7] For equation 1, data are averaged over eight four-year sub-periods. For equation 2, data are computed over six sub-periods of five years each.

The hypotheses tested are: $\theta_1 \geq 0$, $\theta_2 < 0$ and $\phi_1 \leq 0$, $\phi_2 > 0$. Models 3 and 4 allow the computation of the threshold of vulnerability to food price shocks, beyond which the detrimental effects of the shocks on welfare can be observed. From model 3, the vulnerability threshold is given as:

$$\frac{\partial c_{i,\tau}}{\partial S_{i,\tau}} = \theta_1 + \theta_2 Vul_{i,\tau-1} = 0 \Rightarrow Vul^* = -\frac{\theta_1}{\theta_2}$$

From model 4, we can see:

$$\frac{\partial \sigma_{i,\tau}}{\partial S_{i,\tau}} = \phi_1 + \phi_2 Vul_{i,\tau-1} = 0 \Rightarrow Vul^* = -\frac{\phi_1}{\phi_2}$$

For the model of the level of household consumption (model 1), the basic set of control variables includes the lagged dependent variable, per capita income, the volatility of the growth in per capita income, the age dependency ratio and the rural population. Positive signs are expected for the lagged dependent variable and per capita income. The volatility of the per capita income is expected to decrease the level of consumption, owing to the accumulation of precautionary savings, the decrease in private investment and the unavailability of jobs. The age dependency ratio is also expected to lower the level of consumption per capita when active people take care of less active individuals. Finally, in rural areas which are characterised by a low level of financial development and higher poverty rates, the share of consumption in household budgets would be higher. One could therefore expect a positive correlation between the rural population and the level of household consumption.

The equation for the volatility of household consumption per capita is similar to those proposed by Herrera and Vincent (2008), Craigwell et al. (2010) and Combes and Ebeke (2011). The variables that are expected to be positively correlated with the volatility of household consumption are: the volatility of the GDP per capita growth rate; government size and trade openness. The private credit ratio, the level of economic development and financial openness are expected to be negatively correlated with the volatility of consumption in developing countries.

B. Models of the stabilising effects of foreign aid and remittances

Several specifications are adopted in order to test the hypothesis that foreign aid and remittances act as food price shock absorbers in the recipient economies. If this hypothesis is proven to be true, one would observe a decreasing marginal effect of food price shocks on household consumption as remittance and aid inflows rise. This would be the case specifically in the most vulnerable countries. In order to test this hypothesis empirically, this paper proceeds in two steps. First, the stabilising role of aid and remittances is evaluated using the

entire sample of countries. We expect a non-significant effect of aid and remittance inflows. Next, the sample of countries above the previously computed threshold of vulnerability (*Vul**) is used to identify the stabilising effects of aid and remittances during food price shocks. As previously noted, the outcome variables are the level and the volatility of household consumption per capita. The same matrix of control variables is also retained, along with the identification strategy through system-GMM. In formal terms, this appears as:

$$c_{i,\tau} = \rho c_{i,\tau-1} + X'_{i,\tau}\beta + \theta_4 S_{i,\tau} + \theta_5 S_{i,\tau} * R_{i,\tau} + \theta_6 R_{i,\tau} + u_i + \eta_\tau + \varepsilon_{i,\tau} \quad \textbf{(5)}$$

$$c_{i,\tau} = \rho c_{i,\tau-1} + X'_{i,\tau}\beta + \theta_7 S_{i,\tau} + \theta_8 S_{i,\tau} * A_{i,\tau} + \theta_9 A_{i,\tau} + u_i + \eta_\tau + \varepsilon_{i,\tau} \quad \textbf{(6)}$$

$$c_{i,\tau} = \rho c_{i,\tau-1} + X'_{i,\tau}\beta + \theta_{10} S_{i,\tau} + \theta_{11} S_{i,\tau} * A_{i,\tau} + \theta_{12} S_{i,\tau} * R_{i,\tau} + \theta_{13} A_{i,\tau} + \theta_{14} R_{i,\tau} + u_i + \eta_\tau + \varepsilon_{i,\tau} \quad \textbf{(7)}$$

For the consumption volatility model, the following equations are estimated:

$$\sigma_{i,\tau} = \phi \sigma_{i,\tau-1} + Z'_{i,\tau}\gamma + \phi_4 S_{i,\tau} + \phi_5 S_{i,\tau} * R_{i,\tau} + \phi_6 R_{i,\tau} + u_i + \eta_\tau + \varepsilon_{i,\tau} \quad \textbf{(8)}$$

$$\sigma_{i,\tau} = \phi \sigma_{i,\tau-1} + Z'_{i,\tau}\gamma + \phi_7 S_{i,\tau} + \phi_8 S_{i,\tau} * A_{i,\tau} + \phi_9 A_{i,\tau} + u_i + \eta_\tau + \varepsilon_{i,\tau} \quad \textbf{(9)}$$

$$\sigma_{i,\tau} = \phi \sigma_{i,\tau-1} + Z'_{i,\tau}\gamma + \phi_{10} S_{i,\tau} + \phi_{11} S_{i,\tau} * A_{i,\tau} + \phi_{12} S_{i,\tau} * R_{i,\tau} + \phi_{13} A_{i,\tau} + \phi_{14} R_{i,\tau} + u_i + \eta_\tau + \varepsilon_{i,\tau} \quad \textbf{(10)}$$

with *R* and *A* representing the remittance-to-GDP and aid-to-GDP ratios, respectively.

When models 5 to 10 are estimated with the restricted sample of countries exhibiting a vulnerability index above the critical threshold of *Vul** (the most vulnerable countries in the sample), the following hypotheses hold: $(\theta_4, \theta_7, \theta_{10}) < 0$; $(\theta_5, \theta_8, \theta_{11}, \theta_{12}) > 0$ and $(\phi_4, \phi_7, \phi_{10}) > 0$, $(\phi_5, \phi_8, \phi_{11}, \phi_{12}) < 0$.

From models 5, 6, 8 and 9, the thresholds of the aid and remittance-to-GDP ratios which allow the full absorption of food price shocks in the group of the most vulnerable countries are given as:

$$\frac{\partial c_{i,\tau}}{\partial S_{i,\tau}} = \theta_4 + \theta_5 R_{i,\tau} = 0 \Rightarrow R^* = -\frac{\theta_4}{\theta_5}$$

$$\frac{\partial \sigma_{i,\tau}}{\partial S_{i,\tau}} = \phi_4 + \phi_5 R_{i,\tau} = 0 \Rightarrow R^* = -\frac{\phi_4}{\phi_5}$$

$$\frac{\partial c_{i,\tau}}{\partial S_{i,\tau}} = \theta_7 + \theta_8 A_{i,\tau} = 0 \Rightarrow A^* = -\frac{\theta_7}{\theta_8}$$

$$\frac{\partial \sigma_{i,\tau}}{\partial S_{i,\tau}} = \phi_7 + \phi_8 A_{i,\tau} = 0 \Rightarrow A^* = -\frac{\phi_7}{\phi_8}$$

C. Data and methodology

Data for the control variables are drawn from the World Development Indicators Online, except for the financial openness series, which are drawn from Chinn and Ito's publicly-available dataset.[8] The narrow definition of remittance is employed to record remittances. In other words, the remittance variable only records the money sent back by migrants who have been residing in the host country for at least one year.[9] Remittance data are normalised by country GDP series. The foreign aid variable records the total amount of the official development assistance (ODA) to developing countries as a percentage of GDP.[10]

The estimation of the dynamic panel models 1 to 10 presented above with the use of the OLS estimator is inconsistent, since the lagged dependent variables are introduced alongside country fixed effects. This bias is a particular concern here owing to the short temporal dimension of the dataset used. The system-GMM estimator must therefore be implemented. The equations in levels and the equations in first differences are combined in a system and estimated with an extended system-GMM estimator which allows for the use of lagged differences and lagged levels of the explanatory variables as instruments (Blundell and Bond, 1998).[11] The GMM estimations control for the endogeneity of some explanatory variables.[12]

[8] The original series in Chinn and Ito's (2008) dataset, named KAOPEN, contains both positive and negative values between -2 and 2. We added the value of 2 to all of the observations in order to get only positive values.

[9] For a detailed discussion of the reasons why the narrower definition is suitable in empirical macroeconomic studies, see Chami et al. (2009).

[10] The reader may wonder whether it would not be more appropriate to use disaggregated data on foreign aid, such as food aid or agricultural aid, instead of total aid. At least two reasons justify this choice. First, one objective of this paper is to compare the effects of remittances and foreign aid in the absorption of food price shocks in developing countries. Given that there are no disaggregated data on remittances according to their uses, resorting to total aid allows the comparison with remittances. Second, disaggregated data regarding foreign aid are relatively scarce and are only available for a few countries over a short period of time.

[11] This paper uses the one-step system-GMM estimator developed by Blundell and Bond (1998) for dynamic panel data.

[12] In all specifications, food price shocks, the lagged vulnerability index, period dummies, initial GDP per capita, initial private credit, financial openness, output growth volatility, the rural population ratio and the age dependency ratio are taken as strictly exogenous. The other variables are supposed endogenous.

Two specification tests are used to check the validity of the instruments. The first is the standard Sargan/Hansen test of over-identifying restrictions. The second test examines the hypothesis that there is no second-order serial correlation in the first-differenced residuals.[13]

IV. ECONOMETRIC RESULTS

This section begins by discussing the effect of food price shocks on the level and the volatility of household consumption. Next, the analysis turns to the econometric results of the mitigating role played by aid and remittances.

A. Heterogeneity in the effect of food price shocks

Tables 1 and 2 present the results of the effect of food price shocks on both the level and the volatility of household consumption per capita. In each table, the first columns describe the impact of food price shocks on the corresponding outcome variable. Regardless of the dependent variable that is retained (the level or the volatility of consumption), the hypothesis that food price shocks do not exert a statistically significant effect on consumption is not rejected (column 1 of Tables 1 and 2).[14]

Column 2 of Tables 1 and 2 presents the results of the nonlinear effect of food price shocks on the two outcomes, depending upon the level of vulnerability to food price shocks. The results suggest that food price shocks become statistically significant in explaining both the level and the volatility of consumption once the models allow for interaction with the vulnerability index. In other words, the results reveal a marginal decreasing and significant effect of food price shocks on the level of household consumption per capita as the level of vulnerability increases. Regarding the model of consumption volatility, the results highlight a marginal positive effect of food price shocks on the volatility of consumption, which increases with the extent of vulnerability.

From the results presented in column 2 of Tables 1 and 2, one can compute the threshold of vulnerability to food price shocks beyond which their effect becomes critical for household consumption. The results of Tables 1 and 2 indicate that the values of these thresholds do not differ between the two tables. Indeed, the threshold of the vulnerability index stands at 1.75 (Table 1) and 1.64 (Table 2). The percentage of countries above this threshold stands between 53% and 58%. This suggests that countries that are located precisely above the median value of the vulnerability index are particularly concerned by the damaging consequences of food price shocks on consumption. For the rest of the countries in the sample (those which are non-vulnerable and especially those with a vulnerability index close to 0), food price shocks are

[13] To deal with the well-known problem of instrument proliferation raised by the system-GMM estimator (Roodman, 2009), the matrix of instruments is collapsed and the number of lags is always limited to a fix order.

[14] The specification tests associated with the system-GMM specifications give satisfactory results and do not invalidate the dynamic panel specifications.

likely to increase the level of household consumption, but not necessarily its volatility (according to the value and the significance of the coefficient associated with the additive term of food price shocks in Tables 1 and 2).

Table 1. Food Price Shocks Vulnerability and household consumption, GMM Dynamic Panel Data results

Dependent Variable: *log* real household consumption per capita	(1)	(2)
Food price shocks	-0.000761	0.0201*
	(0.00452)	(0.0109)
Food price shocks*Vulnerability index		-0.0114**
		(0.00567)
Vulnerability index		0.0230
		(0.0320)
lag dependent variable	0.704***	0.698***
	(0.155)	(0.205)
log (GDP per capita)	0.370***	0.385**
	(0.110)	(0.179)
Age dependency ratio	-0.00298**	-0.00311*
	(0.00133)	(0.00166)
Rural population (%)	0.00333	0.00374*
	(0.00243)	(0.00197)
GDP per capita growth volatility	-0.00830***	-0.00539
	(0.00271)	(0.00393)
Foreign Aid-to-GDP	0.00937*	0.0108*
	(0.00550)	(0.00639)
Remittances-to-GDP ratio	0.00635	0.00707*
	(0.00480)	(0.00363)
Intercept	-0.579	-0.706
	(0.543)	(0.455)
Observations	446	386
Number of countries	82	81
Joint test of Aid*food price shocks, *P*-value		0.13
Vulnerability index threshold		1.75
Percentage of countries concerned		53%
Arellano-Bond Test of AR(1) *P*-value	0.03	0.05
Arellano-Bond Test of AR(2) *P*-value	0.32	0.42
Hansen OID test, *P*-value	0.2	0.1
Number of Instruments	19	27

Notes: The estimation method is the one-step System-GMM. Robust *T*-statistics are below the coefficients. Data are averaged over eight nonoverlapping 4-year periods between 1980 and 2009. *** p<0.01, ** p<0.05, * p<0.1.

Table 2. Food price shocks, vulnerability and the volatility of household consumption

Dependent variable:		
log of *sd* of real household consumption per capita growth	(1)	(2)
Food price shocks	0.105	-0.156
	(1.429)	(-1.184)
Food price shocks*Vulnerability		0.0954**
		(2.141)
Vulnerability to food price shocks		-0.129
		(-0.987)
lag of dependent variable	0.208**	0.113
	(2.324)	(1.030)
GDP per capita growth volatility	0.489***	0.453***
	(7.877)	(6.813)
Government final consumption ratio	0.00258	0.0448*
	(0.119)	(1.727)
Initial GDP per capita (*log*)	-0.0672	-0.0669
	(-1.327)	(-0.719)
Initial private credit-to-GDP ratio	-0.00429**	-0.00542**
	(-2.469)	(-2.236)
Trade openness	0.00633***	0.00568*
	(3.800)	(1.759)
Financial openness index	-0.322	-0.509
	(-1.126)	(-1.450)
Financial openness ²	0.0489	0.0905
	(0.867)	(1.332)
Intercept	0.892**	0.965
	(2.156)	(1.571)
Observations	367	330
Number of countries	90	89
Joint significance of food price shocks coeff.,*P*-value		0.087
Threshold level of the vulnerability index		1.64
Number of countries above the threshold		52
Percentage of countries above the threshold		58%
AR(1), *P*-value	0.000	0.000
AR(2), *P*-value	0.672	0.539
Hansen OID, *P*-value	0.219	0.157
Nb of instruments	22	26

Notes: The estimation method is the one-step System-GMM. Time effects are included in all the regressions. Robust *T*-statistics are below the coefficients. Volatility is the 5-year standard deviation of the growth rate of the real household consumption per capita. Data are averaged over six nonoverlapping 5-year periods between 1980 and 2009. *** p<0.01, ** p<0.05, * p<0.1.

To sum up, the preliminary econometric investigations highlight the heterogeneity in the response of household consumption to food price shocks, which depends upon the extent of the country's vulnerability to food price shocks. The next task consists of examining the role played by foreign aid and remittance inflows in absorbing food price shocks.

B. The mitigating role of aid and remittance inflows

Tables 3 and 4 present the results of the econometric specifications, allowing a nonlinear effect of food price shocks conditional on the level of foreign aid and remittance inflows. For each dependent variable, the econometric models are first estimated using the whole sample (columns 1, 3 and 5 of Table 3 and columns 1 and 4 of Table 4). As expected, when the entire sample of countries (a mix of vulnerable and non-vulnerable countries) is used, aid and remittances have no statistically significant effect in dampening the impact of food price shocks, except in the model of the level of household consumption. However, this specification should be taken with a pinch of salt, given that the GMM specification tests are not satisfactory (column 1 of Table 3 and column 1 of Table 4).

The next task consists of estimating the models with the restricted sample of vulnerable countries, and especially the sample of countries with a vulnerability index above the median value of the variable. The results in Table 3 suggest that when countries exhibit a degree of vulnerability above the sample median, remittance and foreign aid inflows have a strong dampening effect on the negative impact of food price shocks on the level of household consumption (columns 2, 4 and 6). Indeed, as expected, the coefficient of the additive term of food price shocks is negative and statistically significant, whereas the coefficients of the interaction between shocks and aid and remittance inflows are positive and significant. The results also highlight the fact that the remittance and aid-to-GDP ratios required for full absorption of the effects of food price shocks on the level of household consumption are 5% and 13%, respectively. For the remittance threshold, approximately 30% of countries are concerned. For the aid-to-GDP threshold, 24% of countries are concerned. This result reveals that a comparatively low ratio of remittances is needed in order to cope with food price shocks.

Regarding the model of consumption volatility, the results of Table 4 suggest that when countries exhibit a vulnerability index above the sample median, foreign aid inflows have a powerful dampening effect on the negative impact of food price shocks on the volatility of the household consumption growth rate (columns 5, 6, 7 and 8 of Table 4). For remittance inflows, countries must be highly vulnerable (above the 75^{th} percentile of the distribution of the vulnerability index) in order to identify a significant stabilising effect of remittance inflows (columns 3 and 8). In other words, the volatility of household consumption is affected to a lesser extent by food price shocks thanks to remittance inflows in countries that

Table 3. Remittances, Foreign Aid, Food prices shocks and household consumption, GMM Dynamic Panel Data results

Dependent Variable: *log* real household consumption per capita	Full sample	Vul>median	Full sample	Vul>median	Full sample	Vul>median
	(1)	(2)	(3)	(4)	(5)	(6)
Food price shocks	-0.0118	-0.0237**	-0.00401	-0.0395**	-0.00696	-0.0543**
	(0.00777)	(0.0110)	(0.00682)	(0.0183)	(0.0110)	(0.0239)
Food price shocks*Remittance-to-GDP ratio	0.00495**	0.00531***			0.00229	0.00446*
	(0.00218)	(0.00178)			(0.00210)	(0.00251)
Remittance-to-GDP ratio	0.00258	-0.000716			0.00411	-0.000161
	(0.00349)	(0.00354)			(0.00338)	(0.00291)
Food price shocks*Aid-to-GDP ratio			0.000457	0.00304**	0.000300	0.00340**
			(0.000819)	(0.00137)	(0.000898)	(0.00155)
Aid-to-GDP ratio			-0.00117	-0.00507	0.00373	-0.00395
			(0.00341)	(0.00378)	(0.00503)	(0.00407)
lag dependent variable	0.592***	0.491***	0.488***	0.521***	0.474***	0.495***
	(0.151)	(0.138)	(0.0995)	(0.129)	(0.115)	(0.143)
log (GDP per capita)	0.440***	0.517***	0.555***	0.514***	0.528***	0.485***
	(0.100)	(0.126)	(0.0813)	(0.115)	(0.0916)	(0.141)
Total population of 65 years old (%)	0.0132***	0.0176	0.00806**	0.0107	0.0128***	0.0192*
	(0.00327)	(0.0109)	(0.00378)	(0.0104)	(0.00362)	(0.0115)
Rural population (%)	0.00300	0.00276	0.00353	0.00333*	0.00142	0.00146
	(0.00266)	(0.00284)	(0.00224)	(0.00200)	(0.00242)	(0.00265)
GDP per capita growth volatility	-0.00624**	-0.00364	-0.00737**	-0.00435	-0.00553**	-0.00478
	(0.00255)	(0.00279)	(0.00316)	(0.00323)	(0.00240)	(0.00298)
Observations	455	213	524	254	446	211
Number of countries	83	54	92	64	82	53
Joint test of shocks, shocks*remittances, *P*-value		0.01		0.07		0.09
Wald test of shocks*Aid= shocks*remittances, *P*-value						0.68
Remittance ratio required for a full absorption of food price shocks		4.45%				
Aid ratio required for a full absorption of food price shocks				13%		
Number of countries concerned		16		15		
Percentage of of countries concerned		30%		24%		
Arellano-Bond Test of AR(2), *P*-value	0.049	0.112	0.16	0.239	0.25	0.112
Hansen OID test, *P*-value	0.06	0.46	0.02	0.34	0.02	0.36
Number of Instruments	16	16	22	22	26	26

Notes: The estimation method is the one-step System-GMM. Robust *T*-statistics are below the coefficients. Data are averaged over eight nonoverlapping 4-year periods between 1980 and 2009. An intercept is included in each model but is not shown *** p<0.01, ** p<0.05, * p<0.1.

Table 4. Remittances, aid, food price shocks and consumption volatility

Dependent variable:	Full sample	Vul>median	Vul>75th per.	Full sample	Vul>median	Vul>75th per.	Vul>median	Vul>75th per.
log of *sd* of real household consumption per capita growth	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Food price shocks	0.114	0.367**	0.818***	0.108	0.461**	0.614***	0.736**	0.991***
	(-1.023)	(-2.119)	(-2.868)	(-1.147)	(-2.461)	(2.722)	(-2.492)	(-3.300)
Food price shocks*Remittance	0.000832	-0.0132	-0.0915**				-0.0198	-0.0504*
	(-0.0901)	(-1.010)	(-2.309)				(-1.222)	(-1.851)
Remittance-to-GDP ratio	-0.0473**	-0.0456*	-0.0189				-0.00864	-0.0273
	(-2.379)	(-1.660)	(-0.497)				(-0.193)	(-0.989)
Food price shocks*Aid				-0.00519	-0.0167**	-0.0213**	-0.0254***	-0.0243**
				(-0.570)	(-2.192)	(-2.306)	(-2.815)	(-2.506)
Aid-to-GDP ratio				0.0346	0.0317	0.0344	0.0477*	0.0480***
				(-1.576)	(-1.596)	(1.104)	(-1.762)	(-2.690)
lag of dependent variable	0.0698	-0.0173	-0.0284	0.153*	0.164	0.384*	0.211	0.294*
	(-0.692)	(-0.108)	(-0.116)	(-1.889)	(-0.992)	(1.701)	(-1.110)	(-1.787)
GDP per capita growth volatility	0.479***	0.298***	0.257*	0.453***	0.332***	0.278	0.337***	0.377***
	(-7.386)	(-4.580)	(-1.905)	(-8.156)	(-4.573)	(1.610)	(-4.801)	(-3.349)
Government final consumption	0.0506	0.0671	0.108	0.0107	0.0494	0.0377**	0.0318	0.0493**
	(-1.378)	(-1.572)	(-1.350)	(-0.466)	(-1.174)	(2.018)	(-0.724)	(-2.052)
Initial GDP per capita (*log*)	-0.128	-0.318	-0.550*	0.0129	-0.128	-0.173	-0.142	-0.225
	(-1.212)	(-1.434)	(-1.849)	(-0.122)	(-0.856)	(-1.203)	(-0.787)	(-0.892)
Initial private credit-to-GDP ratio	-0.00409	0.00157	0.0105	-0.00377**	-0.00806**	-0.00292	0.00191	-0.0014
	(-1.232)	(-0.291)	(-0.883)	(-2.222)	(-2.311)	(-0.713)	(-0.335)	(-0.146)
Trade openness	0.00588	0.0119*	0.0168**	0.00476***	0.00375	0.00432	0.00562	0.00852
	(-0.960)	(-1.725)	(-1.981)	(-3.537)	(-1.368)	(1.295)	(-1.148)	(-1.409)
Financial openness index	-0.148	-0.433	-1.103	-0.142	-0.148	-0.0980	-0.287	0.0788
	(-0.487)	(-0.910)	(-1.271)	(-0.869)	(-0.552)	(-0.249)	(-0.974)	(-0.219)
Financial openness ²	0.0134	0.0879	0.269	0.0241	0.0474	0.0339	0.0888	-0.0131
	(-0.220)	(-0.849)	(-1.386)	(-0.701)	(-0.850)	(0.329)	(-1.476)	(-0.135)
Observations	328	155	92	360	171	103	155	92
Number of countries	86	51	38	90	54	40	51	38
Joint significance of food price shocks coeff., *P*-value	0.488	0.084	0.015	0.514	0.048	0.024	0.046	0.009
Remittance ratio required for a full absorption of the shock			9%					
Aid ratio required for a full absorption of the shock					27.5%	29%		
Number of countries above the threshold			5		1	2		
AR(2), *P*-value	0.672	0.435	0.681	0.656	0.784	0.765	0.714	0.55
Hansen OID, *P*-value	0.035	0.279	0.488	0.627	0.787	0.416	0.647	0.837
Nb of instruments	30	30	30	24	24	24	32	32

Notes: The estimation method is the one-step System-GMM. Time effects are included in all the regressions. Robust *T*-statistics are below the coefficients. Volatility is the 5-year standard deviation of the growth rate of the real household consumption per capita. Data are averaged over six nonoverlapping 5-year periods between 1980 and 2009. *** p<0.01, ** p<0.05, * p<0.1. Intercept is not shown.

are highly exposed to food price shocks. A tentative explanation for this result could be that countries differ in their use of remittances according to their location on the distribution of the vulnerability index. Remittances may be more likely to be devoted to the financing of consumption in countries that are highly dependent upon food imports compared to other countries. This argument is also supported by the fact that the destabilising effect of food price shocks increases significantly when the sample is restricted to the countries above the 75th percentile of the vulnerability index. Indeed, the coefficient associated with the food price shock variable introduced additively increases from 0.37 to 0.82 between columns 2 and 3, and from 0.74 to 1 between columns 7 and 8 of Table 4.

The results also highlight that the remittance and aid-to-GDP ratios required for full absorption of the effects of food price shocks in countries located above the 75th percentile of the vulnerability index are approximately 9% and 29%, respectively. For the remittance threshold, around 13% of countries are concerned. The percentage decreases to only 5% for the corresponding aid threshold.[15] As has been shown previously, a comparatively low ratio of remittances is in fact necessary in order to cope with food price shocks. Several explanations for this remittances' comparative advantage can be evoked. First, many studies have documented a countercyclical behavior of remittance inflows to developing countries while the evidence for foreign aid is actually mixed (Gupta et al., 2009; Frankel, 2011, Ebeke, 2011). Second, micro studies broadly emphasize that remittances are primarily devoted to consumption and recent cross-country evidence shows a stabilizing effect of these flows on household consumption (Combes and Ebeke, 2011). Third, the relative strong effectiveness of remittances to dampen the effects of food price shocks could be also justified by comparative delays in mobilizing remittances vis-a-vis foreign aid. Indeed, remittances are less sensitive to delays in the aftermath of a shock, while mobilizing humanitarian or food aid to help countries facing food insecurity takes a certain time (internal delay) and the foreign aid effectiveness is often limited by countries' administrative and institutional quality.

V. CONCLUDING REMARKS

The dramatic increase in food prices over previous years has revived an increasing concern about food security, mainly for the most vulnerable countries. This paper examines the impact of food price shocks on household consumption according to each country's level of vulnerability to food price shocks. It also addresses the ability of foreign aid and remittances to mitigate the impact of food price shocks.

Based on a large sample of developing countries, observed over the period 1980-2009, two main results are derived. First, food price shocks significantly affect both the level and the volatility of household consumption, especially in the most vulnerable countries. In the context of a high level of vulnerability, food price shocks reduce the level of real household

[15] Indeed, Mozambique and Nicaragua are the sole countries for which the average aid-to-GDP ratio is above the threshold of 29% for the period 1980-2009.

consumption per capita, while fostering the volatility of household consumption. Second, the results highlight that when countries exhibit a high degree of vulnerability, remittance and foreign aid inflows have a strong dampening effect on the impact of food price shocks on household consumption. Finally, the results suggest that a lower remittance-to-GDP ratio is required in order to fully absorb the damaging effects of food price shocks on consumption compared to what is required in terms of foreign aid.

This paper has clear policy implications. The results outlined above suggest that remittances and aid should be increased in order to mitigate the dramatic effects of food price shocks in the most vulnerable countries. Donors should find ways to ensure that their aid can be scaled in the event of food shocks, and remittances should be encouraged by governments in particular during such shocks, e.g. by removing possible constraints and raising public awareness. However, this could be a short-term policy. Indeed, in the long term, one should address the issue of the underlying vulnerability. One way in which to deal with this issue is to invest in agriculture, while increasing the level of diversification. Foreign aid and remittances could also support this process.

References

Adelman, C. (2003) The privatization of foreign aid: Reassessing national largess. Foreign Affairs, 8(6), November–December, 9 – 14.

Blundell, R., and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models, Journal of econometrics, 87(1), 115 – 143.

Burke, P., and Leigh, A. (2010) Do output contractions trigger democratic change? American Economic Journal: Macroeconomics, 2(4), 124 – 157.

Chami, R, Fullenkamp, C., and Gapen, M. (2009) Measuring Workers' Remittances: What Should Be Kept in and What Should Be Left Out, International Monetary Fund, Mimeo.

Chami, R., Hakura, D. and Montiel, P. (2009) Remittances: An automatic output stabilizer?, IMF Working Paper No. 09/91.

Chinn, M., and Ito, H. (2008). A new measure of financial openness, Journal of Comparative Policy Analysis: Research and Practice, 10(3), 309 – 322.

Collier, P. and Dehn, J. (2001) Aid, shocks, and growth, World Bank Policy Research Working Paper Series n° 2688. The World Bank.

Combes, J-L., Ebeke, C. (2011) Remittances and household consumption instability in developing countries, World Development, 39(7), 1076 – 1089.

Craigwell, R., Jackman, M. and Moore, W. (2010) Economic volatility and remittances, International Journal of Development Issues, 9, 25 – 42.

Dabla-Norris, E.; Minoiu, C. and Zanna, L.-F. (2010) Business Cycle Fluctuations, Large Shocks, and Development Aid: New Evidence, IMF Working Papers 10/240, International Monetary Fund.

David, A. (2010) How do international financial flows to developing countries respond to natural disasters?, IMF Working Papers 10/166, International Monetary Fund.

Ebeke, C. (2011) Remittances, Countercyclicality, Openness, and Government Size, Louvain Economic Review, 77, 89-114.

de Janvry, A. and Sadoulet, E. (2008) The global food crisis: Identification of the vulnerable and policy responses. Agricultural and Research Economics Update, Special Issue: Causes and Consequences of the Food Price Crisis, 18 – 21.

Deaton, A. J., and Miller, R. I. (1995) International Commodity Prices, Macroeconomic Performance, and Politics in Sub-Saharan Africa, Princeton Studies in International Finance (79).

Dehn, J. (2000) Commodity price uncertainty and shocks: implications for economic growth. The Centre for the Study of African Economies Working Paper Series.

FAO (2011) Women in Agriculture, Closing the Gender Gap for Development, The state of food and agriculture report.

Frankel, J. (2011) Are Bilateral Remittances Countercyclical? Open Economies Review, 22, 1-16.

Grabel, I. (2009) Remittances: Political Economy and Developmental Implications. International Journal of Political Economy, 38(4), 86 – 106.

Gupta, S., Patillo, C., and Wagh, S. (2009) Effects of remittances on poverty and financial development in Sub-Saharan Africa, World Development, 37, 104-115.

Herrera, S., and Vincent, B. (2008). Public expenditure and consumption volatility, Policy Research Working Paper Series 4633, The World Bank.

Kamgnia, D. (2011) Political Economy of Recent Global Food Price Shocks: Gainers, Losers and Compensatory Mechanism, Journal of African Economies, 20 (suppl 1), i142 – i210.

Lueth, E. and Ruiz-Arranz, M. (2007) Are Workers' Remittances a Hedge Against Macroeconomic Shocks? The Case of Sri Lanka, Asia-Pacific Development Journal, 14, 25 – 39.

Mohapatra, S., Joseph, G. and Ratha, D. (2009) Remittances and natural disasters : ex-post response and contribution to ex-ante preparedness, Policy Research Working Paper Series 4972, The World Bank.

Ratha, D. (2005) Workers' remittances: an important and stable source of external development finance, Remittances: Development Impact and Future Prospects.

Roodman, D. (2009). A note on the theme of too many instruments, Oxford Bulletin of Economics and Statistics, 71, 135 – 158.

World Bank (2011) Food price watch, April 2011.

World Bank (2011) Migration and Remittances Factbook 2nd Edition, The World Bank Group.

Yang, D. (2008) Coping with disaster: The impact of hurricanes on international financial flows, 1970-2002, Advances in Economic Analysis & Policy, 8, 1903 – 1903.

Appendix A: Principal component analysis results

Table A1. Eigen value and cumulative relative frequencies

Principal component	Eigen Values	Proportion	Cumulative relative frequencies
1	1.61	0.53	0.53
2	1.07	0.35	0.89
3	0.314	0.1	1

Table A2. Eigen Vectors

Variable	*P*1	*P*2	*P*3
Food imports-to-household consumption	0.69	-0.26	0.03
Food imports-to-total imports	0.71	0.1	0.14
10,000/GDP per capita	0.05	0.94	0.13

Note : $Vul_i = (0.53/0.89)\times P_1 + (0.35/0.89)\times P_2$

Appendix B: Descriptive statistics and list of countries

Table B1: Descriptive statistics of variables included in the model of consumption

Variables	Obs	Mean	Sd Dev	Min	Max
log (Household Consumption per capita)	674	6.635	1.009	4.353	8.786
Number of price shocks	1088	1.347	1.036	0	4
Vulnerability index	666	2.129	1.286	0.0516	10
Aid-to-GDP	966	8.438	11.04	-0.128	103
Remittance-to-GDP ratio	806	3.235	5.48	0	42.21
log (GDP per capita)	979	6.863	1.097	4.381	9.199
Total population of 65 years old (%)	1046	4.951	3.045	1.848	17.38
GDP per capita growth volatility	953	3.644	4.049	0.0873	47.4
Rural population-to-total population	1086	56.4	20.57	6.51	95.43
Age dependency ratio	1046	75.69	17.92	38.77	116.01

TableB2 : Descriptive statistics of the variables included in the model of consumption volatility

Variable	Obs	Mean	Std. Dev.	Min	Max
Volatility of real household consumption per capita growth (*log*)	476	1.45	0.91	-1.69	5.09
Number of food price shocks	816	1.66	1.11	0	4
Remittance-to-GDP ratio	609	3.09	5.29	0	37.21
Aid-to-GDP ratio	718	8.61	10.87	-0.12	77.16
Volatility of real GDP per capita growth rate (*log*)	734	1.09	0.81	-1.38	3.76
Government consumption-to-GDP	697	15.78	7.10	2.34	53.41
Initial real GDP per capita (*log*)	704	6.83	1.09	4.13	9.00
Private credit-to-GDP ratio	654	26.42	22.54	0	139.83
Trade openness	721	76.55	39.33	0.67	310.58
Financial openness	705	1.62	1.29	0.16	4.48

Table B3 : List of countries in the sample

Vul<Median		Median<=Vul<Vul_{75}	Vul>Vul_{75}
Argentina	Kenya	Albania	Benin
Azerbaijan	Latvia	Algeria	Burkina Faso
Belarus	Lithuania	Armenia	Cape Verde
Bolivia	Malaysia	Belize	Chad
Botswana	Mauritius	Central African Republic	Egypt, Arab Rep.
Brazil	Mexico	Congo, Dem. Rep.	Eritrea
Bulgaria	Morocco	Cote d'Ivoire	Ethiopia
Cambodia	Namibia	Guinea	Gambia, The
Cameroon	Panama	Jordan	Lao PDR
Chile	Paraguay	Kyrgyz Republic	Lesotho
China	Peru	Lebanon	Malawi
Colombia	Philippines	Madagascar	Maldives
Costa Rica	Poland	Mauritania	Mali
Croatia	Romania	Nicaragua	Mozambique
Cuba	Russia	Pakistan	Senegal
Dominican Rep.	Serbia	Papua New Guinea	St Vincent and the Grenadines
Ecuador	South Africa	Sudan	Tajikistan
El Salvador	Thailand	Swaziland	Timor-Leste
Gabon	Tunisia	Syrian Arab Rep.	Togo
Guatemala	Turkey	Tanzania	Yemen, Rep.
Honduras	Ukraine	Uganda	
India	Uruguay		
Indonesia	Venezuela		
Iran, Islamic Rep.	Vietnam		
Kazakhstan	Zambia		

Note: Vul refers to the country specific mean of vulnerability, Median is the median of the distribution of countries according to their level of vulnerability, and Vul_{75} is the 75 percentile of the distribution of the vulnerability index.