Macro-scale assessment and response to natural disasters An ODA approach[1]

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Abstract. Climate driven disasters are increasing in frequency and intensity due to climate change. These events affect countries causing severe damages and injuries. In rural areas, climate related disasters cause signmificant disruption to lives and livelihoods. A recent FAO study estimated that 25% of all damage and loss due to natural disasters was absorbed by the agriculture sector. In relation to drought, this figure rises to a staggering 84% . Humanitarian aid and other financial flows are mobilised to support those affected by disasters, such flows are intended to reduce the effects of disasters on households. But how responseive are these flows to the occurrence of disasters and what effect or impact do they have on recovery? In order to examine this, we have analysed time series data on significant flooding events, as provided by the Dartmouth Observatory repositories, the FAO land-cover database, and the ODA yearly data. Other demographic and economic variables are also included in the analysis. The responsiveness of donors to floods is measured by looking at the volume of aid comitted and disbursed following a major flood event from 1985 onwards. In addition, the effectiveness of the response in recovery from these shocks is evaluated using outcome variables related to sources of rural livelihood, of thse the most important is the change in land cover and land under different types of crops.

Keywords: Natural disaster, Vulnerability, Land cover, Panel data

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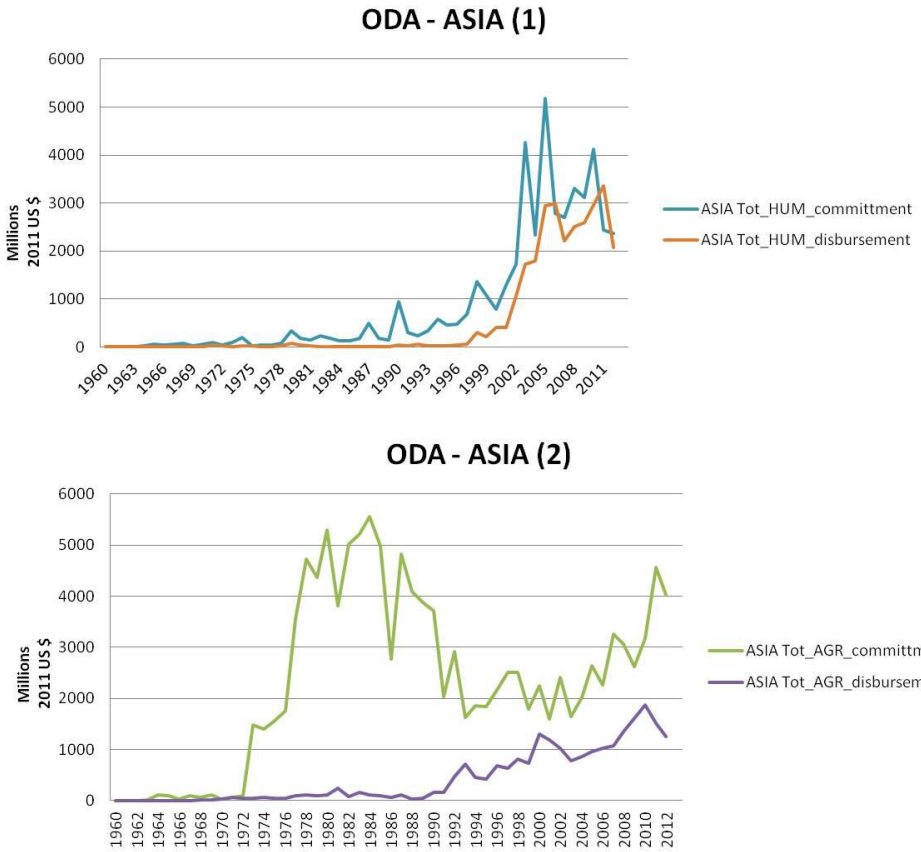
1 Introduction

The relationship between humanitarian aid and need has been the subject of much debate in the past decade and has been one of the main motivating factors behind the so-called *Transformative Agenda* of the Inter-Agency Stranding Committee[4]. The lack of a clear relationship between aid and need was a clear conclusion of a seminal paper by Darcy and Hoffman in 2003 who concluded that *international humanitarian financing is not equitable, and amounts allocated across various contexts do not reflect comparative levels of need*.

Charting the relationship between aid flows and severity and magnitude of disasters is an important tool to inform policy in this field.

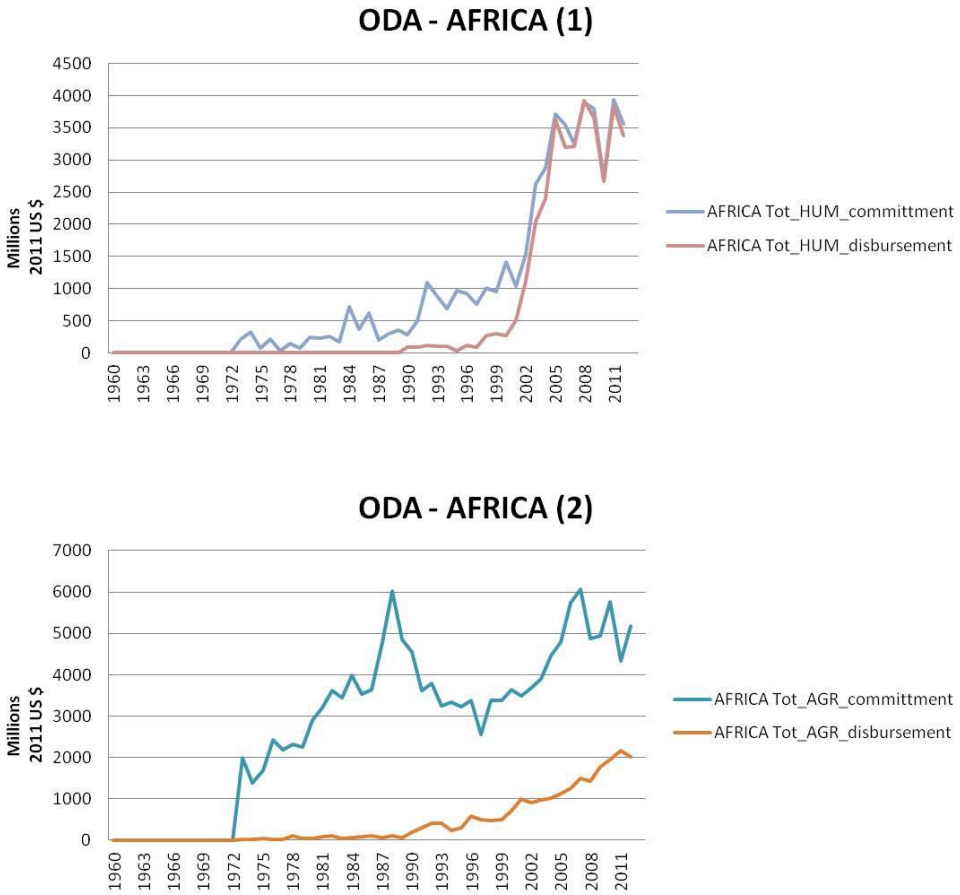
In a similar vein, there has been considerable sceptiscism regarding the impact of humanitarian aid flows on the populations whom they are intended to assist. This is partly due to the inherent difficulties in attributing changes in income and food security after a disaster with particular aid flows. It is also, however, partly due to the absence of commonly accepted measures of impact.

ODA deflated disbursements in Asia



[4] The Inter-Agency Standing Committee (IASC) is the primary mechanism for inter-agency coordination of humanitarian assistance.

ODA deflated disbursements in Africa



Recent studies present a mixed picture of the relationship between aid flows and disasters. Focusing specifically on hurricane responses, Yang (2008) concludes that foreign aid and foreign remittance flows seem to increase, whereas private flows turn negative ("capital flight"). Looking at a broader set of disasters, Stromberg (2007) finds that over a 10 year period (1995 – 2004) DAC donors were more likely to give relief the larger the disaster and the poorer the potential recipient country and if the disaster is in the news. Conversely, David (2010) finds that whilst international aid to low-income countries increases following geological disaster shock, in more general circumstances, the responses of aid flows to natural disaster shocks are not statistically significant. In particular, no relationship was found between aid flows and climatic natural disasters. The lack of aid response to climatic shocks is supported by evidence from Raddatz (2007 and 2009).

As a field of research, the economics of disasters can be best described as nascent. The 1969 book entitled "The Economics of Natural Disasters: Implications for Federal Policy" by Dacy and Kunreuther is often regarded as the fields pioneering work, though there have been relatively few subsequent studies. Cavallo and Noy (2009) state that *compared to the vast amount of research done in natural sciences and other social sciences, economic research on natural disasters and their consequences is fairly limited*.

Whilst the field is limited, a few important strands can be identified.

One strand looks at the effects of disasters on economic growth. Within this some studies consider the short-run effects on GDP while the second examines the long-run effects of disasters on

economic growth. The short-run studies include: Albala-Bertrand (1993), Kahn (2005), Anbarci et al. (2005), Bluedorn (2005), Raddatz (2007), Strobl (2008), Loayza et al. (2009), Noy (2009), Rodriguez-Oreggia et al. (2009), Leiter et al. (2009), Mechler (2009) and Hochrainer (2009); while long-run studies include: Skidmore and Toya (2002), Noy and Nualsri (2007), Cuaresma et al. (2008), Jaramillo (2009), Raddatz (2009) and Hallegatte and Dumas (2009). Compared to the many short-run studies there have been fewer long-run studies conducted in the literature.

The conclusions of these different studies are variable depending on the data sets and the methodology used, however most studies conclude that disasters have negative consequences on both short and long term growth prospects. Exceptions are Skidmore and Toya (2002) and Kim (2010).

Another strand looks at the responsiveness of different types of capital flows to disasters. Within this group, the most widely cited paper is that of Yang (2008) who uses the incidence of hurricanes to examine the consumption smoothing role of international financial flows and concludes that foreign aid and foreign remittance flows seem to increase following hurricanes, whereas private flows turn negative ("capital flight"). Raddatz (2007) using a panel VAR methodology, finds that aid flows do not respond significantly to the occurrence of natural disasters. Mohapatra, Joseph and Ratha (2009) present micro evidence from household surveys and some macroeconomic results indicating that remittances have a positive role in preparing households against natural disasters and in mitigating economics losses afterwards. These authors find that remittances increase in the aftermath of natural disasters in countries that have a large number of migrants abroad. Of this strand of the literature, the paper with the widest scope is probably that of David (2010) who looks at a range of international financial flows and examines the relationship between these and different types of disasters over the period 1970 – 2005 for a large panel of developing countries. The results show that remittance inflows increase significantly in response to shocks to both climatic and geological disasters. The models suggest a nuanced role for foreign aid. While the responses of aid flows to natural disaster shocks in general tend not to be statistically significant, international assistance to low income countries increases following geological disaster shocks does increase. Furthermore, the results show that typically, other private capital flows (bank lending and equity) do not attenuate the effects of disasters and in some specifications, even amplify the negative economic effects of these events.

The overall conclusion from the literature is that appears to be a large degree of disagreement over (a) whether aid flows respond in a statistically significant way to the incidence of disasters and (b) whether the effects of aid flows on post disaster recovery are statistically significant (positive) or negligible. At one level, our work represents a further study which examines these two questions. What appears to us to be new about our approach is the following

- Greater disaggregation of types of ODA: We distinguish not only between humanitarian aid and non –humanitarian aid, but disaggregate both categories of aid to search for differential responsiveness and impact . Within humanitarian we look at food aid vs general humanitarian aid and within overall development ODA we focus on aid to the agricultural sector.
- Greater disaggregation in terms of impact: We go beyond looking at impacts on GDP growth to focus on the agricultural sector using different measures of impact.
- Temporal disaggregation: We look at the differences between pre – 2005 and post 2005 responsiveness and impact. The choice of 2005 is important as this was the year of major reform in both humanitarian sector (the transformative agenda) and the development sector (the Paris declaration).

This current paper examines similar questions to earlier work, however due to access to extensive and specific data sets, the paper is able to focus explicitly on emergency related aid flows following major flooding events and agriculture. In this sense it allows, for the first time, a very detailed analysis to be undertaken of relationships between a particular type of international aid a particular type of disaster (floods) and a particular productive sector: agriculture.

The study investigates two key questions:

• (a) Is there a statistically robust relationship between the scale and severity of disaster and emergency aid flows to agriculture?

• (b) Is there a relationship between disbursed aid and recovery in the agriculture sector following a disaster?

The paper is organized as follows: after the Introduction containing a short review of the literature, data are illustrated in Section 2. Section 3 contains the model setup and the results. The main conclusions of the research carried out, with strengths and limitations of the approach are briefly discussed in Section 4, which concludes the paper.

2 Data

Several datasets have been merged to build the panel used for the analysis carried out in this paper. Since we focus on flood events, the reference dataset we selected concerns worldwide floods occurred from 1985 on. This repository in made available by the Dartmouth College in the US. The statistics presented in the *Dartmouth Flood Observatory Global Archive of Large Flood Events* are derived from a wide variety of news and governmental sources. The quality and quantity of information available about a particular flood is not always in proportion to its actual magnitude, and the intensity of news coverage varies from nation to nation. In general, news from floods in low-tech countries tend to arrive later and be less detailed than information from 'first world' countries. Here below the list of variables in the dataset.

• DFO# - An archive number is assigned to any flood that appears to be "large", with, for example, significant damage to structures or agriculture, long (decades) reported intervals since the last similar event, and/or fatalities.

• GLIDE# - GLobal IDEntifier Number. A globally common Unique ID code for disasters.

• Country - Primary country of flooding. Other affected countries are listed in three separate fields to the right of the main Country column.

• Locations - Includes names of the states, provinces, counties, towns, and cities.

• Rivers - Names of rivers.

• Begin - Ended - Occasionally there is no specific beginning date mentioned in news reports, only a month; in that case the DFO date will be the middle of that month. Ending dates are often harder to determine - sometimes the news will note when the floods start to recede. An estimate is made on the basis of a qualitative judgment concerning the flood event.

• Duration - Derived from start and end dates.

• Known Dead - News reports are usually specific about this, but occasionally there is only mention of 'hundreds' or 'scores' killed; in this case the estimate is: *hundreds*=300; *scores*=30; *more than a hundred* =110 (number given plus 10%). If there is information on the number of people 'missing', the DFO does not include them in the total of deaths. An exact number is provided for analytical purposes, but those numbers are never more than estimates.

• Number Displaced - This number is sometimes the total number of people left homeless after the incident, and sometimes it is the number evacuated during the flood. News reports will often mention a number of people that are 'affected', but this is not used. If the only information is the number of houses destroyed or damaged, then DFO assumes that 4 people live in each house. If the news report only mentions that "thousands were evacuated", the number is estimated at 3000. If the news reports mention that *more than 10,000* were displaced then the DFO number is 11,000 (number plus 10%). If the only information is the number of families left homeless, then DFO assumes that there are 4 people in each family.

• Damage (US $) - This number is never more than an estimate and no independent criteria are used for determining such. Instead it is retained the latest and apparently most accurate number available in all the relevant sources.

• Main Cause - One of eleven main causes is selected: Heavy rain, Tropical cyclone, Extra-tropical cyclone, Monsoonal rain, Snowmelt, Rain and snowmelt, Ice jam/break-up, Dam/Levy, break or release, Brief torrential rain, Tidal surge, Avalanche related. Information about secondary causes is in the Notes and Comments section of the table.

• Severity Class - Assessment is on 1-2 scale. These floods are then divided into three classes. Class 1: large flood events: significant damage to structures or agriculture; fatalities; and/or 1-2 decades-long reported interval since the last similar event. Class 1.5: very large events: with a greater than 2 decades but less than 100 year estimated recurrence interval, and/or a local recurrence interval of at 1-2 decades and affecting a large geographic region (> 5000 sq. km). Class 2: Extreme events: with an estimated recurrence interval greater than 100 years.

• Geographic Flood Extents (sq km) - This is derived from our global map of news detected floods. Polygons representing the areas affected by flooding are drawn in a GIS program based upon information acquired from news sources. Note: These are not actual flooded areas but rather the extent of geographic regions affected by flooding.

• Magnitude (M) - Flood Magnitude =log(Duration x Severity x Affected Area).

Net Official Development Assistance (ODA) per capita consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients; and is calculated by dividing net ODA received by the midyear population estimate. It includes loans with a grant element of at least 25 percent (calculated at a rate of discount of 10%).

The database is entirely based on OECD-CRS Aid Activity database, which is currently the most comprehensive when considering the allocation of assistance to agriculture, as well as other relevant sectors, by recipient country and region at the activity level. CRS database has drastically increased its coverage on multilateral donors in the last decade. It provides a consolidated methodology when more than one donor is involved on the aid delivery process, which avoids double-counting. It includes both ODA and OOF made by bilateral and multilateral donors to developing countries in terms of commitments and disbursements for the period from 1973 to 2011. The ODA database covers agriculture in the broad sense (agriculture, forestry and fishing) and also all the sectors and purposes that are relevant to FAO's strategic objectives like: food and nutrition security, food aid, agro-industries, rural development, water and environment protections. The amounts are expressed in both current and constant USD millions. The embedded DAC deflators are used. Official Development Assistance (ODA) is defined as:

- flows to the DAC list of aid recipients;
- provided to official agencies, including state and local governments, or by their executive agencies;
- administered with the promotion of the economic development and welfare of developing countries; and
- concessional in nature i.e. it contains an element of grant that is at least 25% Other Official Flows (OOF) are transactions by official donors with the list of aid recipients which do not meet the eligibility criteria as ODA either because they are not primarily aimed at development, or because they have a grant element of less than 25%.

Commitment is a firm written obligation by a government or official agency, backed by the appropriation or availability of the necessary funds, to provide resources of a specified amount under specified financial terms, conditions and for specified purposes for the benefit of the recipient country. Disbursement is the placement of resources at the disposal of a recipient country or agency, or in the case of internal development-related expenditures, the outlay of funds by the official sector. It can take several years to disburse a commitment. ODA is further classified in four categories:

1. ODA Grants are transfers in cash or in kind for which no legal debt is incurred by the recipient. For DAC/CRS reporting purposes, it also includes debt forgiveness, which does not entail new transfers; support to non-governmental organizations; and certain costs incurred in the implementation of aid programmes.
2. ODA Grant-like flows comprise a) loans for which the service payments are to be made into an account in the borrowing country and used in the borrowing country for its own benefit, and b) provision of commodities for sale in the recipient's currency the proceeds of which are used in the recipient country for its own benefit.
3. ODA Loans are transfers for which the recipient incurs a legal debt and repayment is required in convertible currencies or in kind. This includes any loans repayable in the borrower's currency where the lender intends to repatriate the repayments or to use them in the borrowing country for the lender's benefit.
4. Equity investment comprises direct financing of enterprises in a developing country which does not (as opposed to direct investment) imply a lasting interest in the enterprise.

The main indicators used from the ODA database are overall disbursement and commitment flows. Commitments on General Programme Assistance and Humanitarian Aid Grouping are also retained

- development food aid and food security assistance, indicated with *committ_foodsec*

- agriculture, indicated with *agr_committ*
- emergency response, indicated with *emerg_committ*
- disaster prevention and preparedness, indicated with *disast_committ*.

Land cover and Food Aid Shipments are also used (FAOSTAT). Variables retained are displayed on Table 6 in the Appendix.

Our final dataset is obtained merging data from the various sources mentioned previously. As a first step of the work, some correlation analysis is carried out for the most relevant variables to our objectives. From pairwise correlations of ODA flows we notice that they are significantly positive correlated with permanent crops and total agriculture land. In particular, commitments for food security are strongly positively associated to arable land. Moreover, some specific sections of commitments related to emergency, agriculture and disaster prevention are mostly associated with higher levels of agricultural arable land. This can be explained not by the fact that commitment flows boost conversion of land for agricultural use, but also by the dramatic level of need of some countries which are depending mostly on agriculture for their livelihood. This is especially true when those countries are subject to extreme natural events, such as floods, which could drastically reduce the agricultural area, destroy crops and thus enhancing food security issues. This in principle should/could stimulate further commitments not only from the side of the country hit by the disaster, but also from DAC donors. Thus, for those reasons, the direction of causality between disbursement and change in land cover for agriculture cannot be clearly identified at this stage. Therefore any conclusions on the effectiveness of international ODA on recovery from flood disasters cannot be drawn. To this aim, more sophisticated models able to take into account feedback effects are needed. To get some insight on time issues related to the effect of past disbursement and commitment on agricultural areas, the correlation analysis is repeated on the same land cover variables observed at time t with disbursements and commitments at time $t-1$ and $t-2$, i.e. one year and two years before, respectively. Interestingly, there is a persistent positive correlation of past ODA flows with agriculture area, in particular with permanent crops area. Similar pattern is noticed for previous year food aid and security commitments against current arable areas. The list of variables used in the next sections is displayed in Table 1. Note, that the number at the end of the variable name indicates the time lag. For example, variables *all7_commitment_defl1* and *all7_commitment_defl2* are the deflated ODA commitments in Humanitarian Aid at 1-year and 2-year lag, respectively.

Table 1: Variables used in the models

Description	Notation
ODA Deflated committments in Humanitarian Aid (section 7)	all7_commitment_defl
ODA Deflated committments in Humanitarian Aid (section 7) after a disaster	all7_commitment_defl_dis
ODA Deflated committments in Humanitarian Aid (section 7) after a flood	all7_commitment_defl_nfl
ODA Deflated committments in Humanitarian Aid (section 7) after a severe flood	all7_commitment_defl_sev
ODA Deflated disbursements in Agriculture (section 3)	tot_agr_disbursement_defl
ODA Deflated disbursements in Agriculture (section 3) after a disaster	tot_agr_disbursement_defl_dis

ODA Deflated disbursements in Agriculture (section 3) after a flood	tot_agr_disbursement_defl_nfl
ODA Deflated disbursements in Agriculture (section 3) to Asian countries	tot_agr_disbursement_defl_asia
ODA Deflated disbursements in Agriculture (section 3) to African countries	tot_agr_disbursement_defl_afr
ODA Deflated disbursements in Agriculture (section 3) to American countries	tot_agr_disbursement_defl_am
ODA Deflated disbursements in Material Relief Assistance (section 72010)	disbursement_72010_defl
ODA Deflated disbursements in Material Relief Assistance (section 72010) after a disaster	disbursement_72010_defl_dis
ODA Deflated disbursements in Material Relief Assistance (section 72010) after a flood	disbursement_72010_defl_nfl
ODA Deflated disbursements in Emergency Food Aid (section 72040)	food_aid_disb_defl
ODA Deflated disbursements in Emergency Food Aid (section 72040) after a disaster	food_aid_disb_defl_dis
ODA Deflated disbursements in Emergency Food Aid (section 72040) after a flood	food_aid_disb_defl_nfl
ODA Deflated disbursements in Agricultural Development (section 31120)	disbursement_31120_defl
ODA Deflated disbursements in Agricultural Development (section 31120) after a flood	disbursement_31120_defl_nfl
ODA Deflated disbursements in Agricultural Policy (section 31110)	disbursement_31110_defl
ODA Deflated disbursements in Agricultural Policy (section 31110) after a flood	disbursement_31110_defl_nfl
Forest area	forest_area
Forest area (in growth rate)	forest_area_rel
Arable land and Permanent crops	agr_perm_crops
Arable land	agr_arable
Arable land (in growth rate)	agr_arable_rel
Interaction: Arable land * disb in Humanitarian Aid	agr_arable_disb7d
Interaction: Arable land * disb in Humanitarian Aid after disaster	agr_arable_disb7d_dis
Interaction: Arable land * disb in Humanitarian Aid after flood	agr_arable_disb7d_nfl
Interaction: Arable land * disb in Agriculture	agr_arable_disb3d
Interaction: Arable land * disb in Agriculture after disaster	agr_arable_disb3d_dis
Interaction: Arable land * disb in Agriculture after flood	agr_arable_disb3d_nfl
Permanent crops	perm_crops
Permanent crops (in growth rate)	perm_crops_rel
Interaction: Perm crops * disb in Humanitarian Aid	perm_crops_disb7d
Interaction: Perm crops * disb in Humanitarian Aid after disaster	perm_crops_disb7d_dis
Interaction: Perm crops * disb in Humanitarian Aid after flood	perm_crops_disb7d_nfl
Interaction: Perm crops * disb in Agriculture	perm_crops_disb3d
Interaction: Perm crops * disb in Agriculture after disaster	perm_crops_disb3d_dis
Interaction: Perm crops * disb in Agriculture after flood	perm_crops_disb3d_nfl
Rice Total shipped	rice
Cereals Total shipped	cereals
Time dummy indicating decade 2003-2012	dum_0312
Number of disasters in the year (EMDAT)	no_disasters

Number of dead (EMDAT)	deads2
Number of homeless (EMDAT)	no_homeless
Total amount of damages in US$ (EMDAT)	total_dam
Total affected surface (EMDAT)	total_affected
Number of displaced (DARTHMOUTH)	displaced2
Duration in days of flood (DARTHMOUTH)	durationsindays
Number of yearly floods with magnitude > 6(DARTHMOUTH)	max_of_totalannualflood_m61
Number of yearly floods with magnitude > 4(DARTHMOUTH)	max_of_totalannualflood_m41
Population (in logarithms)	lpop
GDP at constant prices (2005)	gdpconstant2005us
GDP yearly growth rate (2005)	gdpgrowthannual
Agricultural value added as % of GDP	va_agr_gdp

3 The econometric models

Three models are considered for assessing three main aspects: responsiveness, impact on livelihoods, impact on the economy based on agriculture. EMDAT dataset has been used in the analysis for including the occurrence of a general disasters.

3.1 ODA Response

As already mentioned in the Introduction, our first objective is to investigate if ODA disbursement levels are significantly increased after a flood event and whether the magnitude and severity of disasters have a positive significant impact on those flows. In this model we assess the response of disbursements in humanitarian aid after a general disaster and after a flood. This model is estimated using two dataset. The first is about general disasters (EMDAT) database, and the second about flood only (DARTMOUTH).

The econometric model is a fixed effects with autoregressive errors and takes into account the effects of

- current and past commitment flows (up to 4 years before),
- the severity and magnitude of disasters possibly occurred in the past year,
- food aid shipments (rice and cereals) in previous period,
- changes in land cover.

The response variable is deflated disbursements in section 7, and the explanatory variables are current and past deflated commitments in humanitarian aid, current and past deflated disbursements in agriculture with and without disaster or flood occurrence, variables related to magnitude and severity of disasters or floods. Control variables are current and $1-$lag agriculture and permanent crops area, forest area, previous area food aid shipment in rice and cereals, time dummy related to the period after 2005. The model is estimated after having tested the stationarity of the time series and against the hypothesis of poolability of the data. Moreover, both time and individual effects result significant and the overall variability of the data is quite well explained by the model specification, as confirmed by the overall R squared. From the coefficient estimates displayed in Table 3.1 we observe that commitments in section 7 are persistent (significant up to $4-$lag

autocorrelations).

Table2: RESPONSIVENESS against general disaster or floods: FE Autoregressive on all countries

Variable	General Disaster		Flood	
	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)
all7_commitment_defl	0.612 **	(0.036)	0.742 **	(0.013)
all7_commitment_defl1_dis1	0.107 **	(0.036)	-	-
all7_commitment_defl1_nfl	-	-	-0.069 **	(0.018)
all7_commitment_defl1	0.216 **	(0.010)	0.233 **	(0.013)
all7_commitment_defl2	0.030 *	(0.012)	0.060 **	(0.014)
tot_agr_disbursement_defl1	0.330 †	(0.198)	-0.081	(0.110)
tot_agr_disbursement_defl1_dis1	-0.203	(0.188)	-	-
tot_agr_disbursement_defl1_nfl1	-	-	0.213 †	(0.109)
tot_agr_disbursement_defl	14.581 **	(5.616)	19.071 **	(5.605)
tot_agr_disbursement_defl_asia	-14.416 *	(5.617)	-18.893 **	(5.605)
tot_agr_disbursement_defl_afr	-14.443 *	(5.616)	-18.912 **	(5.605)
tot_agr_disbursement_defl_am	-14.914 **	(5.618)	-19.013 **	(5.609)
forest_area	-0.035 **	(0.012)	-0.031 *	(0.012)
forest_area1	0.034 **	(0.012)	0.031 *	(0.012)
agr_perm_crops	0.020 **	(0.005)	-	-
agr_perm_crops1	-0.020 **	(0.005)	-	-
agr_arable	-	-	0.026 **	(0.005)
agr_arable1	-	-	-0.025 **	(0.005)
dum_0312	10.931 **	(4.045)	10.487 *	(4.216)
rice1	0.000 *	(0.000)	0.000 *	(0.000)
cereals1	0.000 **	(0.000)	0.000 *	(0.000)
no_disasters	-0.558	(0.759)	-	-
deads2	0.001 **	(0.000)	-	-
no_homeless	0.000	(0.000)	-	-
total_dam	0.000	(0.000)	-	-
total_affected	0.000	(0.000)	-	-
displaced21	-	-	0.000 †	(0.000)
max_of_totalannualflood_m61	-	-	0.445	(0.317)
max_totalannual_flood_m41	-	-	-0.143	(0.102)
Intercept	-23.688 **	(6.175)	-23.218 **	(6.506)
N	686		686	
Log-likelihood	-3334.087		-3346.459	
	$F_{(97,588)}$	229.494	$F_{(95,590)}$	246.268
Significance levels : † : 10% * : 5% ** : 1%				

Table 3: RESPONSIVENESS against flood (DARTMOUTH): FE Autoregressive on ASIAN and AFRICAN countries

Variable	Asia		Africa	
	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)
all7_commitment_defl	0.599 **	(0.034)	0.775 **	(0.020)
all7_commitment_defl1	0.215 **	(0.022)	0.150 **	(0.034)
all7_commitment_defl1_nfl	0.032	(0.033)	0.035	(0.028)
all7_commitment_defl2	0.009	(0.025)	0.067 **	(0.020)
tot_agr_disbursement_defl1	-0.538	(0.473)	0.059	(0.090)
tot_agr_disbursement_defl1_nfl1	0.673	(0.457)	-0.175 †	(0.091)
tot_agr_disbursement_defl	0.238 †	(0.124)	0.077	(0.073)
forest_area	-0.022	(0.020)	-0.033 **	(0.012)
forest_area1	0.021	(0.020)	0.031 **	(0.012)
agr_arable	0.012	(0.009)	0.022 **	(0.005)
agr_arable1	-0.012	(0.009)	-0.018 **	(0.005)
dum_0312	1.275	(11.466)	8.962 *	(4.125)
rice1	0.000	(0.000)	0.000	(0.000)
cereals1	0.000	(0.000)	0.000 **	(0.000)
displaced21	0.000	(0.000)	0.000	(0.000)
durationindays1	0.107	(0.075)	-0.008	(0.048)
max_of_totalannualflood_m61	0.634	(0.730)	0.203	(0.274)
max_totalannual_flood_m41	-0.135	(0.238)	-0.048	(0.087)
Intercept	-15.461	(32.943)	-9.252	(5.841)
N	187	381		
Log-likelihood	-958.78	-1665.866		
	F (40,146)	48.248	F (56,324)	232.861
Significance levels : † : 10% * : 5% ** : 1%				

Concerning the response after a general disaster, as displayed in Table 3.1 in the last two columns, current aid grants are positively affected by past commitments in humanitarian aids (up to 2 years before), particularly when commitments are taken at the time of a disaster. Indeed, this has a positive effect of increasing current disbursements. On the other hand, when the disaster is a flood, past commitments in humanitarian aid seem to decrease their positive correlation with current disbursements. This means that the response in case of floods is less dependent on past commitments. This is related to the severity characterizing flood events on people and land. The most severe the flood is at the time commitment, the lowest the correlation with current disbursement (see Table 6 in the Appendix). Moreover, when flood occurs, to lower commitments taken at that time there will correspond higher disbursements in humanitarian aid the year after.

Grants disbursed for humanitarian and agriculture purpose move generally together, i.e. they vary in the same direction in time. This is especially true for Asian countries with high strength of the

relation, lower for African ones (see Table 1) and very weak association for South-America and Caribbeans.

Disbursements in aid are responsive to past land cover in agriculture and permanent crops, and forest area. Increasing forest areas in the previous year is associated to higher current disbursements in aid, as well as previous year decrease in agriculture and permanent crops land. On the other hand, current increase in agricultural land is associated to higher disbursement, and lower forest area.

Moreover, there is a general deterministic upward trend in humanitarian aid disbursements in the past 10 years (from 2003 on).

In particular, previous year food aid shipments in rice and cereals increase are associated with increasing current aids. This means that on average, there is a continuity of aids in time under various forms. In general disasters, the variable more affecting the current amount of grants disbursed for aid is previous year number of dead, whereas in case of flood, it is the number of displaced people.

When the model is estimated for the various continents, we observe an higher persistence of past commitments on current aid, and a weak association between the various purposes of disbursements in agriculture and humanitarian aid. Moreover, previous year cereals shipments are highly associated with current humanitarian aids. The opposite is observed for Asian countries (see Table 1), where humanitarian aid is associated with past commitments only in the short run (i.e. 1−year lag), whereas current disbursements in agriculture are associated to humanitarian aid, which are not related to previous year food aid shipments. For Southern and Central America, Oceania and Europe, there are not enough observations to be able to extract robust insights from the analysis.

Flood variables included in the model are related to the previous year. The number of displaced people affects positively current disbursements. Concerning food aid shipments related to rice and cereals occurred the previous year, we observe that they both affect positively disbursement flows.

3.2 ODA Impact on Livelihood

However, errors appear to be strongly correlated with the explanatory variables, which is clearly due to still existing feedback effects. We believe that the endogeneity in our model could be explained by the fact that disbursements at time t, if effective, might give impulse to changes in land cover, especially related to land for agriculture. On the other hand, flood events affect the land cover and stimulate both commitments at time t and thus disbursement flows at time $t+1$. Since endogeneity makes coefficient estimates biased and inconsistent, we use dynamic approach to model the feedback effects of disbursement.

First, we try to model the relationship between ODA and land cover changes in a way which enables for causality reasoning. This is achieved when we 'control' for a set of other relevant variables which affect both ODA and the land cover changes.

Next steps of the analysis involve the estimation of the model using Blundell and Bond (1998) linear dynamic panel-data estimator. Linear dynamic panel-data models include p lags of the dependent variable as covariates and contain unobserved panel-level effects, fixed or random. By construction, the unobserved panel-level effects are correlated with the lagged dependent variables, making standard estimators inconsistent. Arellano and Bond (1991) derived a consistent generalized method of moments (GMM) estimator for this model. The Arellano and Bond estimator can perform poorly if the autoregressive parameters are too large or the ratio of the variance of the panel-level

effect to the variance of idiosyncratic error is too large. Building on the work of Arellano and Bover (1995), Blundell and Bond (1998) developed a system estimator that uses additional moment conditions.

This estimator is designed for datasets with many panels and few periods. This method assumes that there is no autocorrelation in the idiosyncratic errors and requires the initial condition that the panel-level effects be uncorrelated with the first difference of the first observation of the dependent variable.

Table 4: IMPACT on LAND : dynamic model for impact of ODA on permanent crops, general disaster vs flood (EMDAT)

Variable	**General Disaster**		**Flood**	
	Coefficient	**(Std. Err.)**	**Coefficient**	**(Std. Err.)**
L.perm_crops_rel	0.106 *	(0.053)	0.110 *	(0.053)
gdpconstant2005us1	0.000	(0.000)	0.000	(0.000)
lpop	0.001	(0.003)	0.000	(0.003)
no_disasters1	0.000	(0.001)	0.000	(0.001)
deads21	0.000	(0.000)	0.000	(0.001)
total_affected1	0.000	(0.000)	0.000	(0.001)
total_dam	0.000	(0.000)	0.000	(0.000)
agr_arable_rel	0.296 †	(0.152)	0.296 †	(0.152)
disbursement_72010_defl1	0.000	(0.000)	0.000	(0.000)
disbursement_72010_defl1_dis1	0.000	(0.000)	-	-
disbursement_72010_defl1_nfl1	-	-	0.000 *	(0.000)
food_aid_disb_defl1	0.000	(0.000)	0.000	(0.000)
food_aid_disb_defl1_dis1	0.000	(0.000)	-	-
food_aid_disb_defl1_nfl1	-	-	0.000 **	(0.000)
dum_0312	-0.009	(0.008)	-0.010	(0.008)
forest_area_rel	-0.588	(1.208)	-0.660	(1.201)
Intercept	0.012	(0.050)	0.020	(0.049)
N	733		733	
$\chi^2_{(12)}$	27.185		48.709	
Significance levels : † : 10% * : 5% ** : 1%				

Table 5: IMPACT on LAND : dynamic model for impact of ODA when flood disaster occurs on permanent crops vs arable land. (EMDAT)

Variable	Permanent Crops		Arable Land	
	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)
L.perm_crops_rel	0.097 *	(0.043)	-	-
L.agr_arable_rel	-	-	0.117 *	(0.053)
lpop	0.000	(0.003)	-0.001	(0.003)
no_disasters1	0.000	(0.001)	0.000	(0.001)
deads21	0.000	(0.000)	0.000 **	(0.000)
total_affected1	0.000	(0.000)	0.000	(0.000)
total_dam	0.000	(0.000)	0.000 **	(0.000)
agr_arable_rel	0.214 †	(0.125)	-	-
perm_crops_rel	-	-	0.166 *	(0.082)
disbursement_72010_defl1	0.000	(0.000)	0.000 *	(0.000)
disbursement_72010_defl1_nfl1	0.000	(0.000)	0.000 **	(0.000)
disbursement_31120_defl1	0.000	(0.000)	-0.002 **	(0.001)
disbursement_31120_defl1_nfl1	0.000	(0.000)	0.001 *	(0.001)
disbursement_31110_defl1	-0.001 *	(0.000)	0.000	(0.001)
disbursement_31110_defl1_nfl1	0.001	(0.000)	0.000	(0.001)
dum_0312	0.001	(0.005)	0.006	(0.005)
forest_area_rel	0.401	(0.617)	0.882 †	(0.454)
Intercept	0.020	(0.056)	0.033	(0.044)
N	943		943	
$\chi^2_{(13)}$	40.388		53.974	
Significance levels : † : 10% * : 5% ** : 1%				

In the model for assessing the impact of disaster and ODA disbursements on livelihoods, we use as response variable the change in the land used for agriculture: from the one hand the arable land, and from the other hand areas for permanent crops. The model is estimated using Arellano-Bover linear dynamic panel data estimator, controlling for the economic and demographic size of countries (1-lag GDP at 2005 prices and population in logs), the magnitude and intensity of the disaster or flood (duration, total people affected, estimated damages, etc.) and for the natural trend of agriculture land growth. The explanatory variables are changes in forest area and arable land (when the dependent variable is the rate of change of permanent crop), changes in permanent crops (when the dependent variable is the rate of change of arable land), deflated disbursements in Material relief assistance (section 72010), with and without disaster/flood occurrence, deflated disbursements in Emergency food aid (section 72040), with and without disaster/flood occurrence. Moreover, two different scenarios are considered: general disaster and flood event (dataset EMDAT

combined with dataset DARTMOUTH). The main results are summarized here below.

• Changes in permanent crops have natural tendency to increase in time (current growth rate depending from previous year growth rate), approximately at 10% pace, and are positively associated with changes in agriculture arable land.

• When a general disaster occurs, it is very difficult to seize the impact of humanitarian aid disbursements on changes in land for permanent crops and agriculture. This could be explained by the extreme heterogeneity of the impact, magnitude and severity of a disaster which could require multiple interventions, of which humanitarian aid ODA grants are only a small fraction. On the other hand, when a flood occurs, the effect of disbursements in both material relief assistance and emergency food aid is to increase future permanent crop area. This figure is confirmed when only flood data are used (see Table 3.2).

Table 6: IMPACT on LAND: dynamic model for impact of ODA on arable land when Flood occurs (EMDAT), ASIA vs AFRICA

Variable	**ASIA**		**AFRICA**	
	Coefficient	**(Std. Err.)**	**Coefficient**	**(Std. Err.)**
L.agr_arable_rel	0.049	(0.063)	0.120 *	(0.056)
lpop	-0.007 **	(0.002)	-0.006	(0.005)
no_disasters1	0.001 †	(0.000)	-0.002	(0.002)
deads21	0.000 **	(0.000)	0.000	(0.000)
total_affected1	0.000	(0.000)	0.000	(0.000)
total_dam	0.000	(0.000)	0.000	(0.000)
perm_crops_rel	0.153	(0.128)	0.084 *	(0.036)
disbursement_72010_defl1	.000 **	(0.000)	0.000	(0.000)
disbursement_72010_defl1_nfl1	.000 **	(0.000)	0.000	(0.000)
disbursement_31110_defl1	-0.003 *	(0.001)	0.000	(0.000)
disbursement_31110_defl1_nfl1	0.003 *	(0.001)	0.001 †	(0.001)
forest_area_rel	-0.335	(0.931)	-0.227	(0.330)
Intercept	0.138 **	(0.040)	0.125	(0.088)
N	281		545	
$\chi^2_{(10)}$	130.979	$\chi^2_{(12)}$	39.029	
Significance levels : † : 10% * : 5% ** : 1%				

To disentangle the effectiveness of ODA in Agriculture with respect to ODA in humanitarian aid, two further versions of the model are estimated when a flood occurs: the first assess the impact of various ODA grants on permanent crops, distinguishing flood events from general disasters (Table

2). The second evaluates the impact on arable land (Table 3). From the estimates it is clear that

• it is not possible to seize and disentangle the effects on permanent crops of the various ODA in Agriculture. In absence of floods, it seems that higher grants disbursed in the previous year in Agricultural policy and administrative management (section 31110) are accompanied with a decrease in permanent crops (Table 2).

• Interestingly, ODA grants in agriculture seem to be more effective on arable land than on permanent crops. Indeed, when a flood occurs, previous year disbursements in Agricultural Development (section 31120) have positive effect on changes in arable land (Table 2). Moreover, material relief and assistance disbursements in the previous year affect positively the growth rate of arable land, and the positive effect is even higher when a flood occurred in the previous year. Interestingly, growth of forest areas moves in the same direction as arable land growth rate.

• When continents are considered separately, we observe that in Asian countries, disbursements in Material relief is effective when a flood occurs on the future growth of permanent crops. Moreover, material relief assistance is effective also on the growth of arable land. ODA grants in Agricultural policy and administrative management are effective in Asia in case of floods acting on the arable land (Table 3).

• As for Africa, effects of ODA on permanent crops is difficult to see in case of general disaster or flood event. The only exception is a general positive effect of Material relief and assistance, regardless flood events on permanent crops land growth . Same as for Asia, in African countries, arable land is more sensitive to increase in disbursements in Agricultural policy and administrative management in case of flood (Table 3).

3.3 ODA Impact on Agriculture

In this model the impact of disaster and the effectiveness of ODA disbursement s is measured on the economy through the value added from agriculture, as % of the country GDP. Thus, a dynamic panel is estimated using as response variable the value added from Agriculture (% of GDP). The model is estimated using GMM (Arellano-Bond linear dynamic panel estimator), where instruments are variables related to the magnitude and severity of the disaster/flood event occurred in the previous year, 1-lag food aid shipments in cereals and rice. Moreover, we control for the growth rate of agriculture value added, irrespectively of extreme events, the GDP growth, the natural growth of land resources (permanent crops, arable land and forest area) and last decade general trend. The explanatory variables are ODA grants disbursed in the previous year in humanitarian aid and agriculture interacted with land used for permanent crops or with agriculture arable land in the previous year. Moreover, the impact of grants disbursed in the past on current valued added from agriculture through permanent crops and arable land is considered separately in case of disaster/flood event.

Table 7: IMPACT on VA through permanent crops vs arable land variation after a general disaster (EMDAT)

Variable	Permanent Crops		Arable land	
	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)
L.va_agr_gdp	0.006	(0.058)	0.009 *	(0.004)
gdpgrowthannual	-0.001	(0.001)	-	-
perm_crops_rel	0.165 †	(0.088)	0.198 **	(0.023)
agr_arable_rel	0.437 *	(0.191)	0.408 **	(0.024)
forest_area_rel	-0.589	(0.364)	-0.680 **	(0.048)
perm_crops1_disb7d1	0.000 *	(0.000)	-	-
agr_arable1_disb7d1	-	-	0.000 **	(0.000)
perm_crops1_disb7d1_dis1	0.000 *	(0.000)	-	-
agr_arable1_disb7d1_dis1	-	-	0.000 *	(0.000)
perm_crops1_disb3d1	0.000 †	(0.000)	-	-
agr_arable1_disb3d1	-	-	0.000 **	(0.000)
perm_crops1_disb3d1_dis1	0.000	(0.000)	-	-
agr_arable1_disb3d1_dis1	-	-	0.000 **	(0.000)
dum_0312	-0.025 †	(0.014)	-0.037 **	(0.005)
Intercept	0.066 **	(0.011)	0.072 **	(0.005)
N	648		630	
$\chi^2_{(10)}$	35.211	$\chi^2_{(8)}$	894.300	
Significance levels : † : 10% * : 5% ** : 1%				

Table 8: IMPACT on VA through arable land variation after a FLOOD (EMDAT)

Variable	All countries		ASIA	
	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)
L.va_agr_gdp	0.002	(0.004)	-0.239 **	(0.078)
gdpgrowthannual	-0.001 **	(0.000)	0.001 **	(0.000)
perm_crops_rel	0.209 **	(0.022)	0.026	(0.036)
agr_arable_rel	0.376 **	(0.026)	0.105 **	(0.024)
forest_area_rel	-0.645 **	(0.061)	-2.817	(2.789)
agr_arable1_disb7d1	0.000 *	(0.000)	0.000	(0.000)
agr_arable1_disb7d1_nfl1	0.000 †	(0.000)	0.000	(0.000)
agr_arable1_disb3d1	0.000	(0.000)	0.000 *	(0.000)
agr_arable1_disb3d1_nfl1	0.000	(0.000)	0.000 *	(0.000)
dum_0312	-0.037 **	(0.005)	-0.023 *	(0.011)
Intercept	0.075 **	(0.004)	0.087 **	(0.019)

N	628		175
$\chi^2_{(9)}$	1036.368	$\chi^2_{(9)}$	367.585
Significance levels : † : 10% * : 5% ** : 1%			

Table 9: IMPACT on VA through arable land vs permanent crops variation after a GENERAL DISASTER (EMDAT): ASIA vs AFRICA

Variable	**ASIA**		**AFRICA**	
	Coefficient	**(Std. Err.)**	**Coefficient**	**(Std. Err.)**
L.va_agr_gdp	-0.240	(0.147)	-0.027	(0.086)
gdpgrowthannual	0.001 *	(0.001)	-0.001	(0.001)
perm_crops_rel	0.021	(0.106)	0.208 †	(0.112)
agr_arable_rel	0.110	(0.067)	0.757 *	(0.325)
forest_area_rel	-2.672	(4.824)	-2.506	(1.645)
agr_arable1_disb7d1	0.000	(0.000)	-	-
perm_crops1_disb7d1	-	-	0.000 **	(0.000)
agr_arable1_disb7d1_dis1	0.000 †	(0.000)	-	-
perm_crops1_disb7d1_dis1	-	-	0.000 †	(0.000)
agr_arable1_disb3d1	0.000	(0.000)	-	-
perm_crops1_disb3d1	-	-	0.000 *	(0.000)
agr_arable1_disb3d1_dis1	0.000 †	(0.000)	-	-
perm_crops1_disb3d1_dis1	-	-	0.000	(0.000)
dum_0312	-0.025	(0.022)	-0.004	(0.023)
Intercept	0.086 *	(0.035)	0.078 **	(0.028)
N	175		353	
$\chi^2_{(10)}$	49.302	$\chi^2_{(10)}$	75.607	
Significance levels : † : 10% * : 5% ** : 1%				

The main findings are briefly summarized here below.

• In the last decade there is a general decreasing trend of agriculture value added.

• ODA grants in agriculture and humanitarian aid/material relief contribute to re-boost the economy through agriculture production in permanent crops and arable land, this regardless the presence of disasters/flood events (Table 3.3).

• If a general disaster occurs, ODA humanitarian/relief grants (section 7) increases future agriculture value added through both arable land and permanent crops, whereas grants disbursed in agriculture are effective in case of general disaster through arable land only (Table 3.3).

• When a flood event occurs, ODA grants in aid and agriculture do not generally affect agriculture value added through permanent crops. However, grants disbursed in humanitarian aid and disaster relief is effective on future agriculture value added increase through arable land, with

additional positive impact in case of flood (Table 4).

• In Asia the contribution of grants to value added is mainly through arable land, whereas in Africa through permanent crops. For Asiatic countries, the impact of grants in section 3 and 7 on value added is positive in case of general disasters (Table 5), whereas for floods it is mainly grants in agriculture which help (Table 4). As for Africa, grants disbursed in reconstruction and humanitarian aid are mostly effective after a general disaster. There is no evidence for Africa of differential impact when the disaster is a flood, nor through the arable land.

• Positive changes in permanent crops or arable land are accompanied by lower growth rate of forest area and vice-versa.

4 Discussion

The objective of this study are to investigate the effectiveness of ODA flows on disaster recovery related to agricultural land. In particular, this is related to the extent of floods in terms of magnitude and severity across countries from 1985 on. To this aim we build an original panel of world countries merging several data from various sources.

Our research comprises the use of dynamic models to take into account existing feedbacks effects between aid response and changes in land cover. Moreover, a new release of ODA data has been made available by FAO and enables us to use more disaggregated data on commitments related to aid and disaster recovery in agriculture. In addition, we extend the analysis to other disaster types, such as droughts, earthquakes and tsunamis.

From the analysis carried out so far we can conclude that there is a persistent positive correlation of past ODA flows with agriculture land cover, in particular with permanent crops area. Moreover, past year commitments are significantly affecting current disbursements, especially commitments taken the year after a disaster significantly increase current disbursements. The latter usually occur with some delay with respect to the commitment taken, which can be possibly quantified about a 1-year period on average.

Moreover, we observe a differential impact of grants disbursed on agriculture value added through permanent crops and arable land. Interacting with arable land, humanitarian aid and disaster relief help to increase future value added in agriculture when there are floods. This is not true for grants in agriculture development, which help more in case of general disasters mainly through arable area.

References

- Adger, W.N. (2006). Vulnerability. *Global Environmental Change* **16**, pp.268-281.

- Arellano, M., Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies* **58**, pp.277–297.

- Arellano, M., Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics* **68**, pp.29–51.

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

- Darcy, J., Hoffman, A. (2003). According to Need? Needs Assessment and Decision – Making in the Humanitarian Sector. *ODI HPG Group Report*.

- David, A.C. (2010).How do International Financial Flows to Developing Countries Respond to Natural Disasters?. *IMF Working Paper* **WP/10/166**.

- Guillaumont, P. (2006). Macro Vulnerability in Low-Income Countries and Aid Responses. In: Bourguignon, F., Pleskovic, B., van der Gaag, J. *Annual World Bank Conference on Development Economics Europe: Securing Development in an Unstable World*. The World bank.

- Stromberg, D. (2007). Natural Disasters, Economic Development and Humanitarian Aid. *Journal of Economic Perspectives*, **21**, pp. 199–222.

- Raddatz, C. (2007). Are external shocks responsible for the instability of output in low income countries? *Journal of Development Economics*, **84**, pp.155–187

- Raddatz, C. (2009). The Wrath of God: Macroeconomic Costs of Natural Disasters. *World Bank Policy Research Working Paper*, World Bank, Washington DC.

- Yang, D. (2008). Coping with Disaster: The impact of hurricanes on International Aid Flows 1970 - 2002. In: *Advances in Economic Analysis and Policy*, Berkeley Electronic Press.

Appendix

Source: FAOSTAT

Food Aid Shipments		Land Cover	
Description	Name	Description	Name
Blended And Mix	blended	Country area	country_area
Bulgur Wheat Total	bulgur	Land area	land_total
Rice Total	rice	Agricultural area	agr_total
Butter Oil Total	butter	Agricultural area organic, total	agr_organic_tot
Cereals	cereals	Agricultural area certified organic	agr_organic_cert
Coarse Grains	coarse_grains	Agricult area in conversion to organic	agr_organic_conv
Dried Fruits Total	dried_fruits	Agricult area irrigated	agr_irrigated
Edible Fat Total	edible_fat	Arable land and Perm crops	arable_perm_crops
Fish & Products	fish	Arable land	arable_land
Meat & Products	meat	Arable land organic, total	arable_organic_tot
Milk Total	milk	Arable land certified organic	arable_organic_cert
Non-Cereals	non_cereals	Arable land converted to organic	arable_organic_conv
OtherDairy Products	other_dairy	Temporary crops	temporary_crops
Other Non-Cereals	Other	Temporary meadows and pastures	temporary_mead_pastur
Pulses Total	pulses	Fallow land	fallow_land
Sugar Total	sugar	Permanent crops	permanent_crops
Vegetable Oils	veget_oils	Permanent crops organic, total	permcrops_organic_tot
Wheat & Wheat Flour	wheat	Permanent crops area certified organic	permcrops_organic_cert
		Permanent crops in conversion to organic	permcrops_organic_conv
		Permanent meadows and pastures	permanent_pastures
		Permanent meadows and pastures organic, total	permpastures_organic_tot
		Permanent meadows and pastures area certified organic	permpastures_organic_cert
		Permanent meadows and pastures area in conversion to organic	permpasture_organic_conv
		Perm. meadows & pastures - Cultivated	permpasture_cultivated
		Perm. meadows & pastures - Nat. grown	permpasture_natgrown
		Forest area	forest_area
		Other land	other_land
		Inland water	inland_water
		Total area equipped for irrigation	totarea_equip_irrigation

RESPONSIVENESS against flood (DARTMOUTH): FE Autoregressive on all countries, adding SEVERITY

Variable	**Coefficient**	**(Std. Err.)**
all7_commitment_defl	0.735	(0.013)

	**	
all7_commitment_defl1	0.219 **	(0.011)
all7_commitment_defl1_sev1	-0.001 **	(0.000)
all7_commitment_defl2	0.035 **	(0.012)
tot_agr_disbursement_defl1	-0.044	(0.106)
tot_agr_disbursement_defl1_nfl1	0.178 †	(0.105)
tot_agr_disbursement_defl	18.084 **	(5.515)
tot_agr_disbursement_defl_asia	-17.862 **	(5.516)
tot_agr_disbursement_defl_afr	-17.838 **	(5.515)
tot_agr_disbursement_defl_am	-17.890 **	(5.520)
forest_area	-0.030 *	(0.012)
forest_area1	0.030 *	(0.012)
agr_arable	0.025 **	(0.005)
agr_arable1	-0.024 **	(0.005)
dum_0312	8.612 *	(4.158)
rice1	0.000 †	(0.000)
cereals1	0.000 **	(0.000)
displaced21	0.000 †	(0.000)
max_of_totalannualflood_m61	0.449	(0.313)
max_totalannual_flood_m41	-0.146	(0.100)
Intercept	-23.151 **	(6.530)
N	686	
Log-likelihood	-3337.223	
$F_{(95,590)}$	254.683	
Significance levels : † : 10% * : 5% ** : 1%		