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Agri-investments and public spending in selected vulnerable countries – will they contribute to reduce food insecurity?

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Abstract

Using a panel data set for about 70 countries, this paper jointly analyzes agri-investment trends and food security developments in vulnerable countries. This work empirically connects two mainly independent debates about impacts of agri-investments on food security and on the proposed responsible investment policy frameworks and its contribution to achieve food security. The results indicate the special relevance of private investments, domestic or foreign. The domestic situation in target countries in terms of governance is relevant: Good governance supports food security. The findings underline the importance of the recently developed responsible investments guidelines as they shall contribute that investments maintain their potential positive influence on economic development and food security.

Keywords: Agri-investments, food security, determinants, responsible investment

JEL classification: F53, F21, O13, O16

1 Introduction

The need for more capital inflow into the agricultural sector is often stated: The Food and Agricultural Organization (FAO) estimates that globally an additional 83 billion dollar private money per year is required in developing countries' agriculture to meet the constantly increasing food demand in 2050 (FAO 2009, p. 4, Heumesser and Schmidt 2012 p. 4). Agricultural capital – capital inflow into the agricultural sector - is regarded as especially effective: It is not only seen as the

most effective strategy for reducing poverty and food insecurity¹ in rural areas of developing countries (FAO 2013a), but is also often considered to generate higher returns compared to investments in other sectors (FAO 2012a).

However, the past empiric spending patterns contradict these findings: Globally, agricultural development aid lost importance as its share in overall development aid declined from nearly 20% in the 1980s to 6% in the year 2011 (OECD 2013a). The same happened to domestic public budgets dedicated to agriculture: They diminished slightly from 4.6% of all national public expenditures in 1995 to 4.2% in 2007 (IFPRI 2010, p. 8). Foreign private investment offset this declining trend as inflows quintupled in size in recent years especially in developing countries (Rudloff 2012, p. 8). However, foreign private investments in the agricultural sector only address a negligible part of 0.1 % of all private investments (Rudloff 2012, p. 7ff) in agriculture as the main capital results from the capital invested by the farmers themselves and related domestic agribusiness partners (FAO 2012a).

With rising food prices it can be expected that investments will become more attractive in the years to come. One could then hypothesize that resilience towards food insecurity will also benefit from these positive agri-investment developments and that national and global food security indicators will thus improve. This hypothesis is underlined by FAO's observation that in countries that made insufficient progress towards achieving the Millennium Development Goals, the average on-farm investment per worker has declined by about 1 per cent annually (FAO 2012b, p. 5f). Simultaneously, several initiatives have been started in recent years to draft accompanying guidelines on how to make investments more responsible so that negative repercussions are avoided. Such negative

¹ We follow the conventional definition of food security as introduced by the World Food Summit in the year 1996 (FAO 1996). In recent years, the term "Food and Nutrition Security" became common practice combining the aspects of foods security and nutrition security (Pangaribowo et al. 2013, p.5).

consequences often became public in the context of large scale land investments in developing countries. Examples of these initiatives on responsible investments include the 2011 UNCTAD/ FAO/ IFAD/ World Bank Principles for Responsible Agricultural Investments (PRAI, UNCTAD 2013a), the 2012 FAO principles for Responsible Agricultural Investments (RAI, FAO 2012c) or the 2013 OECD Policy Framework for Investment in Agriculture (PFIA, OECD 2013b).

Building on a panel data set for about 80 vulnerable countries containing information on different types of agri-investments and public spending, food security developments, and other country characteristics, the objective of this paper is to jointly analyze agri-investment trends and food security developments in vulnerable countries. We use a broad understanding of the term “spending” encompassing both traditionally productive companies’ investments and public expenditures. This follows the FAO’s categories of *public domestic capital* (via agricultural budgets), *public international aid* (agricultural development assistance), *private domestic capital* (capital stock) and *private international investments* (inflows of foreign direct investments, specified for land investments) (FAO 2012 b).² The empirical findings are then discussed against the background of the proposed policy frameworks on responsible investments. This work empirically connects two until now mainly independent debates about first, importance and second, impacts of agri-investments on food security and reflects

² In economic theory, a distinction of capital according to the time path of capital returns is made with an investment being defined as one where one abstains from today’s consumption to generate income in the future. Therefore the costs and benefits of the investment are not taking place in the same period whereas for an investment considered an (public or private) expenditure the return happens in the same period (FAO 2012b, p. 9). Expenditures often focus on public spending like subsidies or state aid for which budgets periods are defined administratively. For investments it usually holds that some productive impact must occur, which excludes any speculative transaction that is taken with the mere purpose to await only monetary returns. However, in some cases, the line between investment and expenditure is not clear-cut.

on the proposed responsible investment policy frameworks and its contribution to achieve food security.

In section two, we debate the (two-edged) role of investments for food security and discuss recent initiatives for responsible investments in developing countries. In section three, an empirical analysis of food security trends, determinants and agri-investment patterns is conducted for selected vulnerable countries, followed by a discussion of the results in section four. Section five concludes and provides recommendations for investors and policy makers to improve investments.

2 Agri-investments and food security

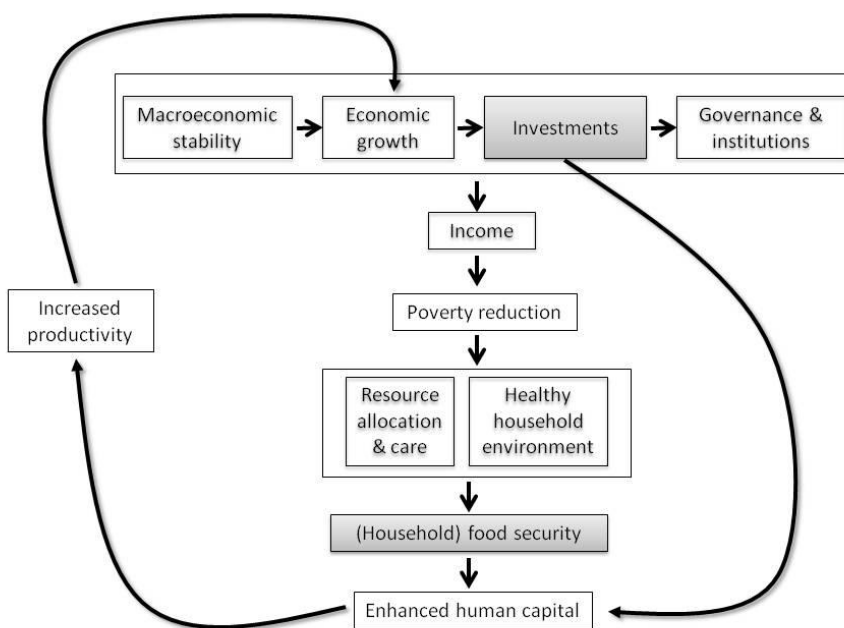
2.1 How do agri-investments affect food security?

A unified conceptual framework on causes of malnutrition was presented by UNICEF (1991) where basic, underlying and immediate causes of malnutrition were distinguished: (1) basic causes of malnutrition relate to the availability of natural resources and the control of resources, (2) underlying causes are defined by inadequate care for children and women, inadequate household food security, insufficient health services and an unhealthy environment and (3) immediate causes of malnutrition relate to inadequate dietary intake resulting from the underlying levels of malnutrition determinants and diseases as a consequence of insufficient health services.

Smith et al. (2000, Fig. 1) extend this framework by focusing on the two basic causes: insufficient national food availability and insufficient access to food by households and individuals. This fits with the FAO'S definition of food security along the two pillars of availability and access (FAO 2003). As a consequence, a potential positive influence on food security may arise at different levels – global, national, local, household or individual level (Smith et al. 2000). In more recent contributions, the importance of socio-economic (Black et al. 2008) and macro-economic (Ecker and Breisinger 2012, Fig. 2.1) factors that impact on malnutrition

with its short- and long-term consequences is highlighted (Black et al. 2008, Fig. 1). Income poverty resulting from lack of financial, human, physical, social and natural capital is an important determinant of lack of household food security, care and healthy living environments at the individual and household (micro) level. At the same time macro-level factors are also important: Factors such as economic stability and growth and its distribution across the society, the integration into and stability of the world economy, public expenditure and governance drive the basic causes of food insecurity and have consequences on all levels and time-dimensions (Pangaribowo et al. 2013, p. 7).

Figure 1. From macroeconomic stability to investments to food security and beyond



Source: Author’s own representation based on UNICEF (1998, Fig.3), Black et al. (2008, Fig.1) and Ecker and Breisinger (2012, Fig. 2.1).

(Agri-) investments as a measure to alleviate food security may be applied at these different levels (see Figure 1): investing in the agricultural sector could mean giving a poor person a field job and raising his income; it could also mean enhancing agricultural productivity through investments in technology and therefore increasing food availability for a country as a whole (Mogues et al. 2012). Investments in the non-agricultural sector, into education or infrastructure may improve the food security “equation” by either promoting economic growth and development, raising individual income, enhancing human capital or increasing the access to food and market integration. This improved food security situation combined with economic and governmental stability may also stimulate further investment in a country. However, the literature and case studies do not reveal an unambiguous causality of capital and food security. Most relevant are the following impact factors:

(1) *The addressed actor*: Agricultural development seems especially effective when it comes to the poorest members of a society who live on less than 1\$-a-day (Christiaensen et al. 2010: 1). When looking at the so-called “better-off” poor as measured by the \$2-a-day count, the non-agricultural sector is assumed to be more effective in reducing poverty. In addition, there is some indication of sectoral spillovers - each dollar of additional value added in the agricultural sector can lead to 30-80 cents in “second round income gains” in other sectors of the economy (FAO 2012a: 35). Growth in the agricultural sector and an increase of agricultural productivity therefore can play a role in reducing poverty among the poorest. Additionally, agricultural growth can be most effective in lessening extreme poverty and hunger when it includes smallholders – especially if they are women (FAO 2012a: Key Messages). With regard to private investments, the Committee on World Food Security (CFS) demands that corporate investments should be smallholder-sensitive. This includes inter alia that corporate investments should neither undermine smallholders’ rights or their assets base nor discourage them from investing in their own farms (CFS 2011: 9). Better integrating smallholders’ needs into investment strategies is decisive for improving food security and

nutrition as well as reducing rural poverty, as most smallholders are situated in rural areas (CFS 2011: 3).

(2) *The investing actor/investment's source*: Farmers and especially smallholders themselves are important investors in the agricultural sector. They can be categorized as *private/domestic* investors. As smallholders are – on an aggregated level – very important investors in the agricultural sector, special attention should be given to them. Smallholders invest in four different types of capital: human, intellectual, natural and physical (CFS 2011: 5). It is crucial to ensure that smallholders can invest in their farms and enhance their productivity. To do so, they need to be able to profit from other investments – be it public or private (FAO 2013:9). Other investments can come from a state itself (*public/domestic*): agricultural expenditure is seen as one of the most important instruments a developing country government has to support economic growth and reduce poverty – especially in rural areas (Mogues et al. 2012: 25). Investments can also come in the form of Official Development Assistance (ODA) by countries belonging e.g. to the OECD's Donor Assistance Committee (DAC) (*public/foreign*).

The importance of different sources of revenue can vary from country to country, but often, domestic investments in the agricultural sector – public or private – are the dominant category (FAO 2012b). Especially Foreign Direct Investments (FDI) (as *private/foreign* investments) have received high public attention: Foreign investors are seen to target very poor countries where a large part of the population is suffering hunger and (land) institutions are weak (FAO 2013a: 7). Therefore, large scale land investments (“land grabs”) are often criticized as being irresponsible.

Currently, private foreign agricultural investments can be characterized neither as fully positive nor be rejected as a matter of principle (Lay, Nolte 2011: 1). Vis-à-vis the budget pressures developing countries face and declining development assistance, private investments could in general close funding gaps and provide much needed revenue flows. Thereby, they may be positive for food

security. Furthermore, given certain conditions greater factor returns from foreign investment can exceed the danger of a diminished domestic food sector (Rakotoarisoa 2011: 14).³

(3) *The investment's objective:* Although the literature gives a lot of different answers where investors should invest there is some general agreement whereas investments in public goods for agriculture are seen as especially influential in enhancing agricultural productivity and in reducing poverty, thereby contributing to food security. First and foremost, investments in agricultural research and development (R&D), in education and in rural infrastructure are seen as crucial (FAO 2012b: xiii). R&D investments have stronger and more stable returns than other types of investments (Mogues et al. 2012: 3). For example, research on how to avoid production losses has been quite successful and helped increase cassava production in Africa (OECD 2012a: 6).

While R&D investments are generally considered to have highly positive effects, the impact of other investment measures on agricultural productivity growth differs on a country-by-country basis. For example, spending on road infrastructure generated high returns in Uganda and India, while in Thailand investments in rural electrification played an important role (Mogues et al. 2012: 27). For smallholder farmers especially, the rural infrastructure is important (Oxfam 2012: 44). Furthermore, short food chains and local channels of distribution can be relevant (Council of the European Union 2013: 3) as for instance smallholders profit when they are able to get their agricultural products to markets quickly.

³ A mixed category between private and public are public-private-partnerships, often used in financing projects. With the given public information, these investments are difficult to classify as the share of public and private money is often unknown as well as the share resulting from domestic or foreign sources.

Investments in all of these areas are necessary so that agriculture can act as an “engine of overall economic growth” (Morris et al. 2003: 135). With regard to improving food security, the best results were achieved when different sub-objectives like infrastructure and research were combined and when synergy effects between multiple factors evolved (OECD 2012a: 1ff).

2.2 *Which initiatives exist to support responsible investments?*

Several connotations of responsible political and business’ behavior exist, limited to economic sustainability as financial responsibility, or focusing on extended dimensions like stakeholder inclusion and environmental stability.

The first initiatives that made spending dependent on certain criteria were started by private actors as voluntary principles: In the eighteenth century Methodists rejected investments in breweries, gambling and prostitution (Brot für die Welt 2012, p.10). The civil rights movement in the 1960ies defined rules on investing only in companies not being discriminatory against Black people (Ibid.). Recently, there are several new incentives intending to make investments in general more responsible without having defined what is meant exactly by “responsible” investments or having identified exact criteria. We refer to responsibility in terms of food security in the sense that responsible spending increases food security. Such initiatives continuously developed in the very recent past caused by the food price crises of 2008 and 2011 which raised the awareness for food insecurity. One major reason was that these price crises induced political crises and that subsequently, especially foreign land investments were seen more critical with respect to their local food security dimension.

Existing rules differ significantly regarding the legal status of the initiatives, the actors addressed (public or private) and regarding the actor to be hold accountable for an improvement of investment responsibility (private actor or the state, investing or host country).

(1) Public and binding initiatives. A basic and in principle legally binding rule is the Human Right to Food which recognizes the "right to an adequate standard of

living, including adequate food" (International Covenant on Economic, Social and Cultural Right 1966, Art. 12). This right had been introduced in several public and private guidelines (Ruggie 2011). However, only the WTO's Trade-related Investment Agreement (TRIMS) and Bilateral Treaties (BITs) can be seen as legally enforceable framework for any and not only for agricultural types of investment. Both have their origin in protecting investor rights: TRIMs focuses on pre-establishment situations i.e. market access by limiting requirements for investing (e.g. no local content-criterion allowed like requiring the use of domestic labor force). BITs address post-establishment situations (after an investment is made). They guarantee access to relevant infrastructure for the investor, protect him against expropriation without compensation and allow the investor to export. BITs may require that social and environmental impact assessments of investment projects should be done and they may permit limiting exports for some exceptional situations like a national crisis. The option to limit exports is supported by the GATT and the WTO-Agreement on Agriculture (AoA) as well, allowing even for export bans in times of food insecurity (GATT XI. 2 and AoA Article 12). However, no ruling on the specific design of an investment as such is laid down. This has been proposed by UNCTAD via a new general model on international investment policy (multilateral or bilateral) according to which sustainable dimensions should be especially encouraged and public interests and risks in host countries more acknowledged (UNCTAD 2013b).

(2) *Public and voluntary initiatives.* Based on the human right to food the FAO developed the voluntary guidelines on responsible tenure of land. This set of rules addresses all actors involved, investor and host states, private and public. A specific chapter on investments suggests ensuring food security by supporting small farmers' rights in host countries and making use of safeguards clauses (FAO 2012d). Recently the FAO is developing principles explicitly targeted at investments not only in land but in the general agri-food system (RAI); food security is stated here as overarching principle for responsible investments. This initiative follows the precedent work led by the World Bank which had lacked

support by developing countries (PRAI). The OECD on the other hand defined several guidelines for multinationals (OECD 2012b). One is focused especially on fragile states and acknowledges the investors' responsibility of sustainably exploiting resources due to the risk of political instability (OECD 2006). A specific set of rules refers to agricultural investments in particular and aim at attracting foreign investors. However; they define some principles for considering food security within the host country itself at the same time. They have been applied and monitored in Burkina Faso, Indonesia, Myanmar and Tanzania (OECD 2013b: 4).

(3) Private and voluntary initiatives. Several international initiatives, have been trying to define guidelines for private sector engagement in the agricultural sector to bring forward generally positive effects and by that food security as well. But it's not just how a foreign investor acts; it's also about the host country itself. The UN Global Compact for example requires information duties on food security as far as related to general UN principles like human rights. The Equator principles for finance address social and environmental risk issues already from the starting phase of deciding on a loan. Additionally, several certification schemes exist for specific products which also address food security indirectly by for example requiring national protection of land tenure rights (Roundtable on Sustainable Palm Oil).

3 Empirical analysis of the impact of agri-investments on food security

3.1 Empirical framework

A political objective like food security may be considered as the resulting output of a number of input factors (Figure 1). To analyze the contribution of different input factors for a certain output such as for example agricultural productivity or poverty reduction, the use of an inter-country aggregate production function approach has become standard: Thirtle et al. (2003) and Lio and Liu (2008) for example analyzed the importance of governance and research and development for agricultural productivity growth and poverty reduction. Strauss and Thomas (2007)

used it to analyze people's health outcomes as a function of health inputs. This aggregate production function concept may be transferred to the food security (FS) domain with food security for country i and year t being considered an outcome of a function of different input factors related to macro- (M) and micro- (I) level input factors and production resource constraints (C):⁴

$$FS_{it} = f(M_{it}, I_{it}, C_{it}).$$

These input factors may be further differentiated in factors related to macroeconomic stability, economic growth, investments, governance, income development, resource allocation and care and health as outlined in Figure 1. These factors change over time and interact with each other causing potential endogeneity and path dependency. As mentioned before, investments may enter this equation at different levels (macro and micro) and through different sources of investments resulting either from domestic or foreign or public or private sources. Different country indicators and variables are used in the following analysis to empirically analyze the impact of the above mentioned factors on food security for a sample of food insecure vulnerable countries.

3.2 *Data: selection of vulnerable countries and relevant variables*

A balanced panel data set for the years 2000-2011 is constructed for all low and low-middle income countries according to the World Bank (WB) classification (WB 2013a). We have experimented with different country selection criteria as for example using a simple country cut-off at a certain rate of undernourishment, the Least Developed Country (LDC) status according to the United Nations (UN 2013), or all countries included in the EU Global Needs Assessment⁵ (EU GNA 2013). In the end, we decided to use income as the relevant criteria as this is an

⁴ An initial production function approach is also broadly outlined in Pangaribowo et al. (2013: 9f).

⁵ A political indicator used for the decision to initiate humanitarian aid.

important indicator regarding the ability of countries and households to deal with crisis.⁶

Covering different vulnerability dimensions at the macro- and micro-level and relevant resource constraints, we use the World Development Indicator data set (WB 2013b), the Governance Indicator Set (WB 2013c), the FAO data base (FAOSTAT 2013a) and the related FAO Food Security Indicator data set (FAO 2013c).

In order to capture the different dimensions of agri-investments we use the investment data on capital stock (*private/domestic*) and government expenditure for agriculture (*public/domestic*) provided by FAOSTAT (2013a), the World investment report (UNCTAD 2009)⁷ for inward FDI in agriculture, forestry and fishing, WB data on net financial inflow for private foreign investments (*private/foreign*), the Land matrix information portal for private foreign investments into land (LANDMATRIX 2013)⁸ (*private/foreign*), the Official Development Assistance data base of the OECD (OECD 2013c)⁹ (*public/foreign*) and the WB World Development Indicator data set (WB 2013b) for information on private-public partnership investments in water and energy (*mixed category*). The full list of variables used in the subsequent analysis can be seen in Table 1.

Even though there are well known problems with the completeness of the data (in particular regarding data on private agricultural investments) that led to the exclusion of some countries from the data set, we ended up with 72 countries

⁶ There is also a large overlap between the different criteria with all countries that are part of the WB low and low-middle income classification also being part of the EU GNA and with the exception of Equatorial Guinea also part of the LDC group.

⁷ Only two three-year averages of observation are available (2002-2004, 2005-2007).

⁸ For the land investment data, only land deals with the status “contract signed” were considered. No time series data is available; instead the year the signed contract was signed was used.

⁹ Only data from 2002 onwards was available. This was considered accordingly in the calculations.

forming the balanced panel. The list of countries and an overview according to geographical distribution can be found in Annex 1.

Table 1. Summary statistics for variables in data set.

	Unit	Source	Mean	Standard deviation	Minimum	Maximum
Macroeconomic stability						
Net food importing countries	0=not, 1=yes	WTO	0,56	0,50	0,00	1,00
(Global) Food price index	Annual Food Price Index (2002-2004=100)	FAO	136,39	39,74	0,00	199,81
Total population	Million people	WB	39,91	137,26	0,09	1205,62
Share of rural in total population	% of total population	WB	63,13	15,29	23,00	91,30
Economic growth						
GDP growth	Annual %	WB	4,62	4,64	-32,83	33,63
Investments						
Agricultural capital stock	US \$ per capita	FAO	735,34	611,65	0,00	4219,00
Government expenditure for agriculture	US \$ per capita	FAO	5,44	11,19	0,00	71,86
Net FDI inflow (total)	US \$ per capita		43,78	70,25	-55,98	623,51
Net FDI inflow (agriculture)	US \$ per capita		0,16	1,80	-1,95	32,51
Land investments	1000 ha	Landmatrix	39,11	316,42	0,00	6481,32
Land investments in share of agricultural area	% of agricultural land	Landmatrix, FAO	0,38	3,63	0,00	75,36
ODA Agriculture, water, energy	US \$ per capita	OECD	11,72	17,01	0,00	195,98
ODA Emergency food aid	US \$ per capita	OECD	1,39	3,35	0,00	31,31
Investment in water and sanitation with private participation	US \$ per capita	WB	0,18	3,91	0,00	99,12
Investment in energy with private participation	US \$ per capita		5,57	32,57	0,00	603,53
Governance						
Control of corruption	Indicator scale [-2.5,2.5]	WB	-0,66	0,46	-1,83	0,79

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	Unit	Source	Mean	Standard deviation	Minimum	Maximum
Rule of law	Indicator scale [-2.5,2.5]	WB	-0,70	0,55	-1,91	1,08
Income						
GDP per capita	US \$ per capita	WB	948,81	779,10	0,00	3916,73
Agricultural producer price index	Annual Producer Price Index (2004-2006 = 100)	FAO	27,32	52,49	0,00	331,30
Consumer price index	Annual Consumer Price Index (2000 = 100)	FAO	150,51	358,99	0,00	8600,07
Ressource allocation & care						
Arable land per capita	Hectare per capita	WB	0,21	0,16	0,00	1,18
Cereal yield	Kilogram per hectare	WB	1821,79	1267,33	0,00	7556,20
Food production	Food production index (2004-2006 = 100)	WB	103,82	13,79	67,70	156,77
Access to electricity	% of population	WB	3,31	14,28	0,00	99,60
Total area equipped for irrigation	% of agricultural land	FAO	8,71	17,79	0,00	101,64
Healthy environment						
Improved rural water source	% of rural population with access	WB	63,07	20,76	0,00	99,00
(Household) food security						
Average dietary energy supply adequacy	% percentage of the Average Dietary Energy Requirement	FAO	107,90	13,98	70,00	146,00
Prevalence of undernourishment	% of population	FAO	24,13	14,83	5,00	75,60

Source: Own calculations.

3.3 *Classification of countries according to food security status*

Next, the chosen countries were classified according to their food security status. Different indicators are available (the most recent overview to be found in Pangaribowo et al. 2013, Fig. 3 and Fig. 4) focusing on different aspects of the multi-dimensional complex of food security. For the purpose of our analysis, a composite index such as the Global Hunger Index (IFPRI 2013) or the Global Food Security Index (Economist Intelligence Unit 2013) is not useful as the time-series is not available and the composite nature of the index may cover too many dimensions so that the impact of agri-investments on food security may become blurred. We decided to use the food security “outcome” indicator “Prevalence of undernourishment” (PoU) that covers the food security dimension of “access to food” as this indicator is widely used and accepted. Implicitly, the PoU is also a composite indicator as it is based on household consumption surveys that provide information about the “habitual daily dietary energy consumption” and about “Minimum Dietary Energy Requirements” for a normal human activity levels. (FAOSTAT 2013b: V_7.1 Metadata). It integrates information from household surveys with macro data sources, such as food balances, censuses and demographic surveys and “focuses on the likely proportion of people that are undernourished in the population” (FAO 2013b: Annex 2). The PoU is strongly negatively correlated with the “Average dietary energy supply adequacy” (FAO 2013b: 24) where this is an indicator for the availability of food (contrary to the PoU focusing on the distribution of food across the population). The data for the PoU is calculated as three-year-averages around each year of the sample and is displayed as percent of the population.

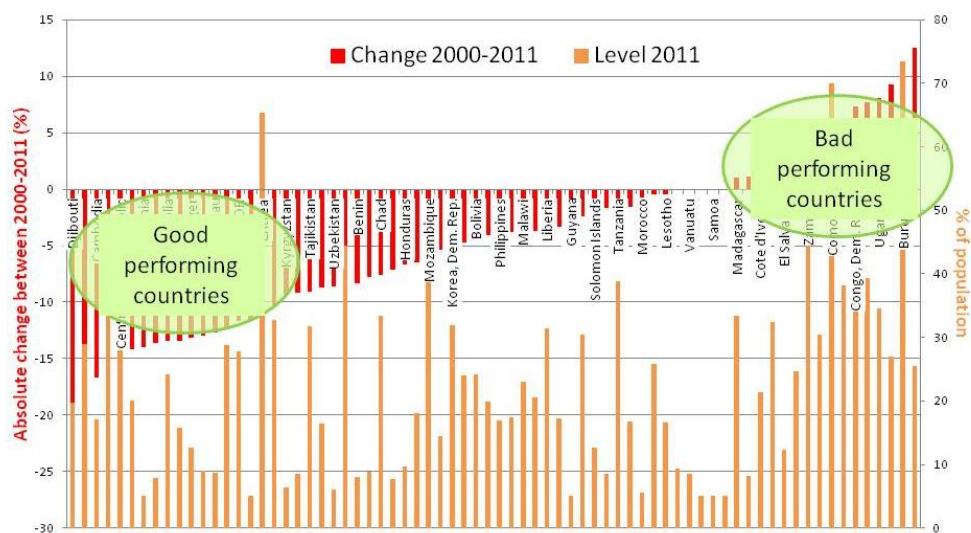
Using the PoU, we order the countries according to their level of food insecurity, i.e. prevalence of undernourishment, in the year 2011 and by calculating the change of PoU between the years 2000-2011 (see Figure 2).

The five countries with the highest level of food insecurity in the sample are Burundi (73%), Comoros (70%), Eritrea (65%), Zambia (47%) and Haiti (45%);

the five countries with the lowest level are Armenia, Egypt, Ghana, Samoa, and Syrian Arab Republic (all with levels less or equal to 5%). The five countries with the largest improvement (i.e. reduction) in the rate of undernourishment are Djibouti (from 47% to 20%, i.e. a reduction of -27%points), Rwanda (-18), Cambodia (-17), Ethiopia (-15) and the Central African Republic (-15) and the five countries with the worst development (an increase in the rate) consist of Sudan (+8), Uganda (+8), Swaziland (+9), Burundi (+10) and Paraguay (+13).

For the analysis, we have formed different country groups: According to the *level of PoU in 2011*, a group consisting of 22 countries with severe problems of food security is created (PoU larger than 30%) and the opposite group with 18 countries displaying the lowest levels of undernourishment in 2011 (PoU smaller than 10%). Based on the *rate of change in PoU* over time, the good and bad (stagnant) performing countries in terms of food security can be classified. The cut-off criteria for the good performing countries (18 countries) is set at an improvement in the PoU of at least 10%-points and the cut-off criteria for the bad performing countries (16 countries) is set at a 0%-point change or even an increase of the rate.

Figure 2. Country classification according to the indicator “prevalence of undernourishment”.



Source: Own compilation based on FAOSTAT 2013b.

3.4 Results

3.4.1 Agri-investment trends in vulnerable countries

Table 2 highlights the different investment patterns for the time period 2000-2011 for the countries with severe and low (i.e. better) levels of food security in the year 2011 (left side of the table) and for the good and bad performing countries (right side).

Table 2. Agri-investment trends in country groups (averages across all countries in groups)

		Country groups according to level of food insecurity		Country groups according to performance	
		Severe	Low	Good perf.	Bad perf.
Prevalence of undernourishment.	Level 2011 (%)	40,60	10,55	28,92	30,98
	<i>Change over period (%)</i>	<i>-1,81</i>	<i>-7,02</i>	<i>-14,22</i>	<i>5,38</i>
Private domestic					
Agricultural capital stock	US \$ per capita	539,76	1040,64	825,93	759,04
	<i>Ann. change in %</i>	<i>1,80</i>	<i>1,61</i>	<i>2,12</i>	<i>1,44</i>
Public domestic					
Governm. exp. for agriculture	US \$ per capita	4,41	13,47	3,33	11,42
	<i>Ann. change in %</i>	<i>4,91</i>	<i>1,29</i>	<i>8,45</i>	<i>1,02</i>
Private foreign					
Net FDI inflow (total)	US \$ per capita	0,30	0,99	45,93	41,03
	<i>Ann. change in %</i>	<i>22,99</i>	<i>66,75</i>	<i>25,49</i>	<i>16,67</i>
Net FDI inflow (agriculture)	US \$ per capita	0,65	5,28	0,82	0,31
Land investments	1000 ha	840,44	1027,34	500,86	471,76
Public foreign					
ODA Agriculture, Water, Energy	US \$ per capita	8,16	19,86	12,47	11,48
	<i>Ann. change in %</i>	<i>10,66</i>	<i>10,87</i>	<i>9,74</i>	<i>12,38</i>
ODA Emergency food aid	US \$ per capita	3,53	0,61	2,24	2,12
	<i>Ann. change in %</i>	<i>12,31</i>	<i>5,39</i>	<i>7,80</i>	<i>10,65</i>
Mixed category					
Investments in water, sanitation	US \$ per capita	1,11	5,18	0,91	34,42
Investments in energy	US \$ per capita	13,85	26,26	40,83	12,44
Other "proxy" variables that indicate investments					
Land equipped for irrigation	% of agric. land	4,60	8,96	4,97	2,79
Access to water in rural areas	% of rural population	53,91	68,61	54,50	60,38
Access to energy	% of population	27,04	66,47	51,54	42,39

Source: Own calculations.

Contrasting agri-investment pattern in the countries with severe and low level of food insecurity, we note that:

- For all investment categories (including mixed and “proxy” variables) with the exception of foreign emergency food aid, the average investments per capita are considerably higher in the group of countries with a better food security status. This finding is in line with the introductory statement that high stocks of agricultural capital come together with good food security levels
- For domestic investments, the annual change over time displays a more dynamic picture in the country group with high levels of food security.
- For private investments, a larger annual increase is observed in the countries with low undernourishment rates.
- Public foreign investment in form of ODA develops more favorably in countries stronger in need of this support which is as expected.

When we focusing on the pattern in good and bad performing countries, the picture with respect to investment per capita is less clear, but the picture about change in investment over time support the findings from above:

- Private investments (per capita and annual change) are larger in the good performing countries. In particular the change over time underlines again the finding that investments are seen as an effective instrument to reduce food insecurity and poverty as these good performing countries show considerable reduction of PoU over time.
- For public domestic money, the expenditure per capita is higher in bad performing countries, but the good performers show a more dynamic development over time. For the bad performing countries, this high per capita expenditure raises questions about the spending effectiveness of the public money at least when focusing on food security indicators.
- For the mixed category and the “proxy” variables, no clear picture emerges.

- For foreign domestic investments, the investments per capita are rather similar but rates of annual change are somewhat higher in bad performing countries.

3.4.2 Determinants of food security

Moving from descriptive trend analysis to more formal econometric analysis of food security determinants, an estimation framework based on the approach outlined in section 3.1 is developed. Using the full sample of 72 vulnerable countries, a fixed-effects panel estimation is performed focusing on a large set of potentially relevant determinants of food security.

Table 3. Estimation results for full sample

Dependent Variable: Prevalence of Undernourishment			
Method: Panel Least Squares			
Sample: 2002 2010			
Cross-sections: 72			
Total panel (balanced) observations: 648			
Variable	Coefficient	t-Statistic	Prob.
Constant	29.79050	117.6801	0.0000
Capital stock	-0.000933	-12.98376	0.0000
Government expenditure for agriculture	0.012181	10.24308	0.0000
Net FDI inflow (agriculture)	-0.003951	-2.194243	0.0286
Land investments in share of agricultural area	-0.002096	-2.303949	0.0216
ODA Agriculture, water, energy	0.001288	7.722025	0.0000
Investment in water	0.006293	19.89005	0.0000
Access to water	0.008002	27.11177	0.0000
Investment in energy	-0.001209	-13.54634	0.0000
Net food importing countries	0.427343	5.016755	0.0000
Share of rural population	0.077996	9.231202	0.0000
GDP growth	-0.007642	-12.24994	0.0000
GDP per capita	0.000855	8.366950	0.0000
GDP p. Capita *Food Price Index	-8.73E-07	-2.021044	0.0438
Control of corruption	0.671098	290.1674	0.0000
Rule of law	-0.174783	-7.352821	0.0000
Agricultural producer price index	-0.003754	-14.80162	0.0000
Consumer price index	6.93E-05	16.88486	0.0000
Cereals yield	-0.000121	-10.11794	0.0000
Food production *Total population	-1.45E-11	-8.623053	0.0000
Average dietary energy supply adequacy	-0.253069	-74.93875	0.0000

Source: Own estimation.

A stepwise approach was used where variables that were not statistically significant were removed from the specification. Potential regressor endogeneity

and cross-section heteroscedasticity in the specification is addressed as (1) panel data implicitly provide internal instruments for endogenous regressors (Verbeek 2000: 312) and (2) White cross section standard errors are used.

In our sample, the main determinants showing a *positive effect* on food security measured by the PoU (i.e. decreasing the PoU) were (Table 3): GDP growth, good governance measured by a “rule of law” index, increasing agricultural producer prices, improving cereals yield (as a proxy for use of technological progress) and an Improvements in the overall calories provided (measured by the average dietary energy supply adequacy that is derived from the FAO Food Balance sheets). The interaction between GDP per capita and global food price development also has a positive impact indicating that if global food prices increases this potentially negative effect for consumers may be offset if GDP per capita also increases. A similar finding holds for the interaction between total population and food production where also here, a joint upward movement seems to be no threat to food security. A *worsening impact* on food security emanates from the net food importing status of a country, control of corruption, GDP per capita, the share of rural population in total population, an increase in the consumer price index and an improvement in access to water for the rural population. The findings for the net food importing status and the impact of the consumer price index are straightforward to interpret whereas for GDP per capita and the corruption control, this is somewhat more difficult.

With respect to the investment variables, the results confirm the findings from the descriptive analysis of investment patterns: Private capital (agricultural capital stock, net FDI inflow) significantly improves food security whereas agricultural government expenditure displays a negative impact on food security probably resulting from the fact that in some countries with worsening PoU rates the average expenditure per capita is rather high.

Land investments (measured by the share of land under investments contracts in overall agricultural area) follow the pattern of private investments displaying a decreasing effect on the PoU rate. This is in line with the findings from the

descriptive analysis as in the countries with lower food insecurity we observe a slightly higher land area of under contract as well as in the good performing countries. Hence, the often two-edged effect of land investments on food security cannot be detected in this analysis but one should also keep in mind that this analysis is with national data whereas the land investment effects on food security are often more relevant on a local level in the region where the investments take place and hence may not be captured in the national analysis. Within the full sample, public foreign investments (ODA) did not provide very satisfying results which was already indicated by the descriptive analysis with the unclear picture when comparing spending on a per capita basis between the country groups. With respect to the “mixed” investment categories, water investments seem to have a negative impact on undernourishment whereas energy investments display a positive effect.

Overall, our findings are in line with results from the literature, as for example the also FAO highlights that agricultural FDI can have an important impact on food security if the host countries have a good functioning governance system (FAO 2013: 329). Similarly, the FAO shows that the PoU decreases when GDP per capita goes up (FAO 2012a: Fig.14). In the interaction with the global food price index this is also confirmed for our sample. Furthermore, the close negative connection between PoU and average dietary energy supply adequacy (FAO 2013b: Fig. 16) is also detected for our sample.

4 Conclusions

The results indicate the special relevance of private investments, domestic or foreign. Even the category of land investments shows a positive influence on food security. This puts the often claimed criticism that these investments raise hunger somewhat into perspective. Nevertheless, the findings underline the importance of the recently developed guidelines for private responsible spending so that these investments can maintain their potential positive influence. In contrast to the public debate agricultural ODA and the need to increase it are not that relevant in average

at least in the medium-term. However, different conclusions may result for good and bad performing - as for the latter a positive impact on food security can be detected.

The domestic situation in target countries in terms of governance is relevant: Good governance supports food security. This issue is addressed in all recent guiding principles. Investing countries and companies should be sensitive of this issue when investing in countries with weak governance. Even though governance issues fall under national sovereignty and should thereby be addressed by the target country, investor countries and companies still have responsibilities. This entails either not investing in these countries or considering carefully the legal and political situation. Thereby negative results for food security e.g. via expropriating local farmers should be avoided.

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Annex 1

Countries included in analysis

Geographical region	Number	List of countries
Sub-Saharan Africa	38	Central African Republic, Chad, Congo Democratic Republic, Liberia, Mali, Sudan, Guinea-Bissau, Madagascar, Cote d'Ivoire, Djibouti, Ethiopia, Mauritania, Uganda, Nigeria, Kenya, Zimbabwe, Mozambique, Benin, Burundi, Niger, Togo, Guinea, Rwanda, Sierra Leone, Comoros, Eritrea, Gambia, Malawi, Tanzania, Zambia, Senegal, Burkina Faso, Cameroon, Lesotho, Swaziland, Cape Verde, Ghana, Sao Tome and Principe
Northern Africa	2	Egypt, Morocco
Caucasus, Central Asia	6	Kyrgyzstan, Georgia, Tajikistan, Armenia, Mongolia, Uzbekistan
Western Asia	2	Yemen, Syrian Arab Republic
Southern Asia	5	India, Pakistan, Bangladesh, Sri Lanka, Nepal
Eastern Asia	1	Democratic People's Republic of Korea
South-Eastern Asia	6	Cambodia, Philippines, Viet Nam, Timor-Leste, Lao Democratic People's Republic, Indonesia,
Oceania	4	Kiribati, Solomon Islands, Vanuatu, Samoa
Latin America	7	Bolivia, Paraguay, Guatemala, Honduras, Nicaragua, El Salvador, Guyana
Caribbean	1	Haiti
Sum	72	

Source: Own compilation.