

# An empirical analysis of the determinants of agricultural official development assistance

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**Abstract:** The aim of this study was to analyse the determining factors of official development assistance (ODA) provided to the agricultural and food sectors. Lack of empirical research on this type of ODA makes this study stand out from the sea of qualitative approaches. By analysing the agricultural sectors and the views of aid recipient countries, this paper provides evidence-based explanations for the aid flows between donor and recipient countries. Using disbursement ODA data covering 141 countries over 2002–2012, we devise and estimate a gravity model. Heckman's two-step approach is adopted to address a potential bias arising from the selection of aid recipient countries. The estimated results confirm that agricultural aid is mainly governed by the needs of the recipient countries with regard to factors such as undernourishment and food inadequacy rates, depth of food deficits and political circumstances. As expected, the results indicate that food aid is influenced mostly by humanitarian factors.

**Keywords:** agricultural aid, food aid, food security, gravity models

According to the United Nations (UN), approximately one in five persons in developing countries live on less than USD 1.25 per day (UN 2014). Additionally, about 70% of the poor within these countries live in rural areas and rely on agriculture as their predominant source of income. Agriculture is an important industry in terms of its reliability and security as a food source, and by providing a supply of labour and capital accumulation for economic development. Further, agriculture plays a crucial role in satisfying society's basic human needs. In particular, its role in addressing extreme poverty issues in many developing countries has been emphasised. Therefore, the advancement of the agricultural sector is key to overall economic development in developing countries, and is recognised as a facilitator of sustainable development and poverty reduction.

The ultimate purpose of official development assistance (ODA) is to develop the economy of the recipient countries and to promote their social welfare. By providing support through short-term humanitarian efforts, people mired in poverty can meet their basic human needs. Long-term recipients of ODA

are given an opportunity to exit the vicious cycle of poverty through economic development assistance and economic infrastructure reforms.

Donor countries act in accordance to their national interests and goals, as well as their historical and cultural relations with the recipient countries, whose motives and objectives can differ from those of the donors. For example, aid flows may contribute to expanding trade in resources. With regard to ongoing influence in previously colonial countries, ODA may strengthen political ties with established military alliances and foreign policies, the aim being to help the recipient countries earn a place for themselves in the international community.

However, controversy remains over the effectiveness of ODA. Despite the growing development assistance from the international community, the continuation or deepening of poverty prevails in many parts of the world. An exceptional case is South Korea. Despite having been one of the poorest countries in the world in the 1960s, South Korea has achieved a high level of economic growth and entered the ranks of the advanced member countries of the Organisation for Economic

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Co-operation and Development (OECD). In fact, South Korea is the only country to have transformed itself from an aid recipient into a donor country.

The fact that the largest segment of the world's poor lives in rural areas implies that the agricultural sector can play an important role in ensuring economic development and alleviating poverty in developing countries. Therefore, empowering the agricultural industry and rural people through ODA can be a stepping stone towards fighting poverty and underdevelopment. As exemplified in the case of South Korea, agricultural ODA can create an opportunity for developing countries to improve agricultural productivity and growth and to transform their economic systems.

Recognising the essential role that may be played by agricultural ODA, this study aims to identify the determinants of bilateral aid flows from donor to recipient countries. In particular, our study is unique in that it is the first to conduct an empirical analysis of factors affecting agricultural and food ODA under a donor-recipient framework. A gravity model is established to identify the effects of economic interaction and integration and the roles of trade costs on ODA flows. Despite being in an early stage, this approach contributes to explaining agricultural aid patterns between countries.

## AN OVERVIEW OF AGRICULTURAL ODA

As seen in Table 1, the average share of agriculture in the gross domestic product (GDP) of develop-

ing countries is 13%. If agricultural processing and distribution were accounted for, the contribution of agriculture to the GDP would increase to 30%. About 60% of the population in developing countries resides in rural areas and engages in agriculture, that is, the agricultural sector is the largest employer in these economies. Consequently, agricultural growth is regarded as an engine of economic development. Not only income and employment but also stable food provision depend on agriculture (Nkamleu et al. 2003; Kim 2009).

Figure 1 shows agricultural aid received by the least developed countries (LDCs) over the period 1995–2014. Since 2003, agricultural aid has shown an increasing trend, amounting to more than USD 9 billion in 2012. Although the share of agricultural aid in total aid has increased over the same period, it has not recovered to previous levels; the share of 6% in 2012 is lower than the peak level of 8% in 1995.

Figure 2 indicates a steady decrease in the proportion of the undernourished population (the population below a minimum level of dietary energy consumption) in developing countries between 1995 and 2014. The prevalence of undernourishment has improved over time, falling to 11% in 2014. This shows that the food intake of about one in ten people in the world is insufficient to meet their minimum dietary energy requirements. It is not clear whether the increased agricultural aid has contributed to reducing undernourishment. As this topic has been studied rigorously, one may presume that these figures and trends are correlated. In other words, the agricultural aid helps to fight chronic undernourishment and poverty.

Table 1. Agricultural indicators for developing countries

	Latin America and Caribbean	Sub-Saharan Africa	Middle East and North Africa	South Asia	East Asia and the Pacific	All Developing Countries
Agriculture, value added (% of GDP)	7.9	17.9	13.9	28.3	15.4	13.2
Rural population (% of total population)	26.5	68.4	43.6	73.2	67.7	60.6
Agriculture, value added per worker (constant 1995 US\$)	2916.5	349.2	2163.6	376.2	418.4	589.8
Agriculture exports (% merchandise trade)	28.3	23.9	4.7	17.9	11.7	15.3
Land use, arable land (ha per person)	0.27	0.26	0.21	0.16	0.11	0.21
Agricultural machinery (tractors per 100 ha of arable land)	118.2	18.0	117.8	80.9	67.9	102.0
Roads (km per squared km of total area)	0.141	0.052	0.062	0.551	0.139	0.123

Source: Díaz-Bonilla et al. (2010)

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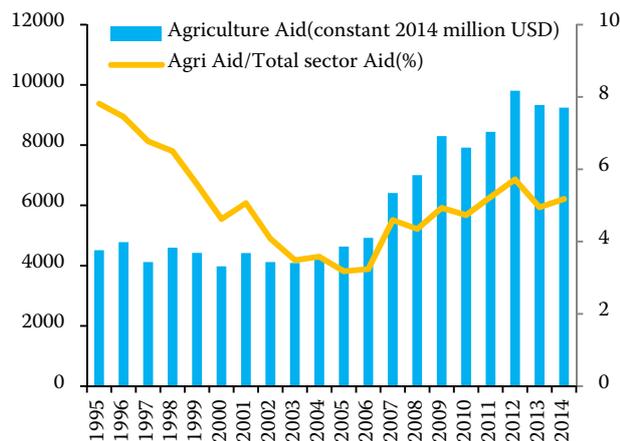


Figure 1. Trend of Agriculture-related Aid for Least Development Countries (LDCs)

Source: OECD/DAC CRS Database (<http://stats.oecd.org>)

## LITERATURE REVIEW

In principle, ODA is supposed to target needy and deserving countries. In particular, agricultural aid must be directed towards alleviating rural poverty and promoting agricultural growth and development in the recipient countries. This study categorises such factors, the so-called “recipient needs,” from the viewpoint of a recipient country. Recipient needs can take many different forms or definitions.

For example, Lumsdaine (1993) suggested that the moral responsibility of countries providing ODA support is guided by recipient polity, past colonial experience and poverty levels in the recipient countries. Alesina and Dollar (2000), Berthélemy and Tichit (2004), Berthélemy (2006) and Park (2011) highlighted humanitarianism, income levels and infant mortality rates as motives behind ODA. By comparing aid patterns in the USA, Japan, France and Sweden, Schaefer et al. (1998) demonstrated that recipients’ humanitarian needs were the principal drivers for providing ODA to aid and welfare states. Finally, Neumayer (2003) argued that compared to bilateral aid, multilateral aid provided by international development banks and UN agencies was more attuned to fulfilling humanitarian needs.

It goes without saying that ODA flows are highly dependent on donor countries’ decisions, also referred to as “donor interests.” Donor interests consist of political and economic factors. The former is based on the realism theory in international relations, which postulates that world politics are in a state of conflict (war) because of clashes between countries pursuing

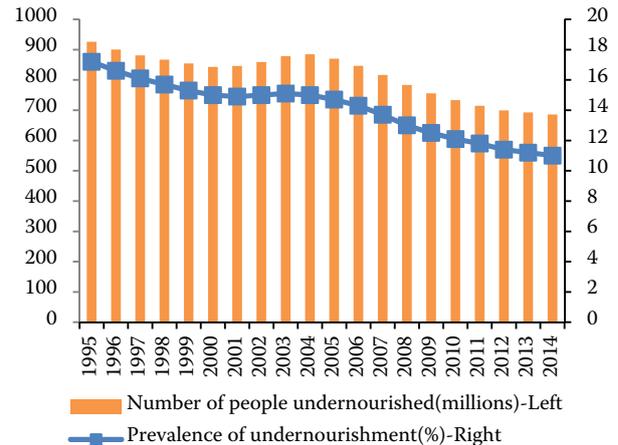


Figure 2. Undernourished People in Developing Countries (1995-2014)

Source: UN Millennium Development Goals (MDGs) Database (<http://mdgs.un.org/unsd/mdg/data.aspx>)

power (Williams 1996). Thus, political factors, including military security and diplomatic relations, play an important role in this decision-making (Conteh-Morgen 1990; Kim et al. 2013).

By contrast, the economic factors are rooted in the liberal theory. Founded on ideas of liberty and equality, liberalism argues that economic aid reduces income inequality and raises purchasing power in the recipient countries, which eventually expands exports for the aid providers. According to this view, providing ODA generates mutual benefits and works as an engine of economic growth.

McKinlay and Little (1977) considered the weighting given to both recipient needs and donor interests in US bilateral aid allocation, and found that political and security reasons play a greater role than humanitarianism. Maizels and Nissanke (1984) also concluded that bilateral aid provided by the USA, France and Germany is closely aligned with donor interests. Studying the case of the UK, McGillivray and Oczkowski (1992) suggested that political interests and colonial relationships were important factors in the country’s aid allocation. Alesina and Dollar (2000) and Hook (1995) argued that pursuit of national interests and political strategies were the main priority in administration of ODA. Lebovic (1998) and Poe (1992) found that US ODA policy is largely governed by its political and military interests.

Nevertheless, one may conclude that both recipient needs and donor interests are relevant, or equally important, for aid allocation. According to Kim et al. (2013), the Korean government has demonstrated a balanced approach in selecting aid recipients. Dividing

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Table 2. Determinants of official development assistance

Studies	Data Periods	Donor Countries	(a) Recipient Needs or (b) Donor Interests or (c) Others	Results
Mckinlay and Little (1977)	1960–1970	U.S.	(a) GDP per capita, calorie consumption per capita, number of doctors per population, real GDP growth rate per capita, gross domestic fixed capital structure (b) International economic relations, security, political interests, political stability, level of democracy	High priority accorded to foreign policy
Maizels and Nissanke (1984)	1969–1970, 1978–1980	Bilateral aid (U.S., France, Germany, Japan, and U.K.) and multilateral aid	(a) Population, gross national product (GNP) per capita, GNP growth, balance of payments (b) Political security, investment, trade	Bilateral aid: donor interests Multilateral aid: needy basis
McGillivray and Oczkowski (1992)	1980–1987	U.K.	(a) GNP per capita, population, status of emerging developing countries and LDCs	All factors are found to be relevant
Neumayer (2003)	1983–1997	International Development Financial Institutions (IDFIs), UN	(a) Population, GDP per capita (c) Polity, human rights, arms, purchase of weapons, corruption, colonial past	IDFIs: economic development UN: recipient needs
Gounder and Sen (1999)	–	Australia	(a) GNP per capita, international deficit, aid per capita (b) Military aid per capita, investment in Indonesia, Indonesian exports to Australia	High priority accorded to donor interests
Berthélemy and Tichit (2004)	1980–1999	OECD/DAC 22 countries	(a) Real GDP per capita, population, growth rate, basic education rate, infant mortality rate (b) Openness, FDI (c) Overall aid performance from other donors, civil liberty, political freedom	High priority accorded to economic benefits

Source: Cooray and Shahiduzzaman (2004) and Lee (2005)

aid types into grants and loans, Lee (2005) found that grants are more oriented toward the needs of the recipients, while loan allocation is largely governed by economic considerations. Table 2 provides a summary of selected empirical studies in terms of their data, variables and outcomes.

## MODEL SPECIFICATION AND DATA

Table 3 provides the definitions of the variables and data sources.

Following the previous literature, specifically that pertaining to agricultural ODA, this study explores the key factors affecting aid allocation in donor-recipient frameworks. Gravity equations are employed for the empirical analysis. Known as a workhorse, the gravity model has been widely used to analyse the determinants of bilateral trade (Feenstra 2003; Canavari and Cantore 2010; Head and Mayer 2014). The gravity model is based on the common empirical evidence that trade flows are proportional to economic sizes

and are inversely proportional to distance. A larger country imports more goods from its trading countries as well as also exporting more goods to the countries that it trades with. However, this trading process is impeded by distance, which is taken as trade costs. In addition to a physical distance term, standard proxies for trade costs include common language, colonial relationships, adjacency, institutions and others.

A fundamental idea behind the gravity model is to identify the effects of economic interactions and integration on trade. Despite its popularity in explaining goods trade, other gravity models have been increasingly adopted to analyse determinants of migration and foreign direct investment. As it is at an early stage, the modelling of agricultural ODA flows is essentially used for the purpose. A key difference between aid transfers and goods trade is their differing treatments of the trade costs. The theoretical gravity model, first developed by Anderson (1979) indicates that the more resistant a country is to trade with all other trading partners, the more this country is driven to trade with a particular bilateral trading

Table 3. Definitions of variables and sources of data

Classification	Variable	Definition	Source	Unit
Dependent	Agriculture production sector ODA	Agricultural production policy, development, land resource, inputs, crop production, research, and service support	OECD/CRS	US\$
	Food ODA	Food aid, free distribution or special supplementary feeding programs, and short-term relief to targeted population groups affected by emergency situations	OECD/CRS	US\$
Recipient needs	Prevalence of undernourishment	Share of undernourished population	FAO STAT	% of population
	Prevalence of food inadequacy	Share of population who suffer from food shortages	FAO STAT	% of population
	Depth of food deficit	Daily calorie deficit	FAO STAT	Kilocalories per person per day
Donor interests	Polity	Concomitant qualities of democratic or autocratic authorities in governing institutions	Center for Systematic Peace	-10 (hereditary monarchy) -10 (consolidated democracy)
	Colony	Historical colonial relationships	CEPII	0 or 1
Others (controls)	Recipient rural population	People living in rural areas as defined by national statistical offices	WDI	Person
	Recipient gross national income (GNI)	GNI per capita or gross national income divided by mid-year population.	WDI	US\$
	Donor GNI	GNI per capita	WDI	US\$
	Distance	Geographical distance between recipient and donor countries	CEPII	Km

partner. Anderson and van Wincoop (2003) termed the average trade barrier “multilateral resistance.” The addition of the multilateral resistance terms in the gravity equation can also correct for the omission of price measures (Baier and Bergtrand 2009; Silva and Nelson 2012). However, since aid transfers between bilateral countries do not depend on the average barrier with all bilateral countries, the gravity model for ODA flows is not required to include the multilateral resistance term. In a gravity context, this paper adopts the Heckman two-step model that incorporates the two distinctive stages of decision-making of aid allocation. In the first stage, also called the selection stage, a donor country determines which recipient countries are eligible for aid. In the second stage, the donor country decides how much aid it should allocate to the selected recipient countries. The Heckman model is useful to address a selection bias problem, which may lead to under- or over-estimated results (Haq et al. 2012; Kim et al. 2013). Besides, the method can deal with the large numbers of zeros typically witnessed in aid flow data.

The first step is to estimate the probit model where the dependent variables,  $Y_{A_{ijt}}$  and  $Y_{F_{ijt}}$ , are binary

indicators, 0 or 1. As shown in Equations (1) and (2), if a recipient country,  $i$ , obtains aid from a donor country,  $j$ , at time  $t$ , the dependent variables take the value of 1. Otherwise, they are 0.

$$\begin{cases} Y_{A_{ijt}} = 1 \text{ if } A_{AID_{ijt}} > 0 \\ Y_{A_{ijt}} = 0 \text{ if } A_{AID_{ijt}} = 0 \end{cases} \quad (1)$$

$$\begin{cases} Y_{F_{ijt}} = 1 \text{ if } F_{AID_{ijt}} > 0 \\ Y_{F_{ijt}} = 0 \text{ if } F_{AID_{ijt}} = 0 \end{cases} \quad (2)$$

where  $A_{AID_{ijt}}$  and  $F_{AID_{ijt}}$  refer to agricultural and food aid flows, respectively.

The probit model for agricultural aid is specified in Equation (3), followed by the Heckman model in Equation (4). The same model specifications can be applied for food aid.

$$\Pr(AID_{ijt} = 1) = \Phi\{\alpha_0 + \alpha_1 Need_{it} + \alpha_2 Polity_{it} + \alpha_3 Colony_{ij} + \alpha_4 \ln(RPOP)_{it} + \alpha_5 \ln(R\_GNI)_{it} + \alpha_6 \ln(D\_GNI)_{it} + \alpha_7 \ln(DIST)_{ij} + \alpha_8 (FOA)_{ijt} + \mu_{ijt}\} \quad (3)$$

$$\ln(AID_{ijt} | AID_{ijt} = 1) = \beta_0 + \beta_1 Need_{it} + \beta_2 Polity_{it} + \beta_3 Colony_{ij} + \beta_4 \ln(RPOP)_{it} + \beta_5 \ln(R\_GNI)_{it} + \beta_6 \ln(D\_GNI)_{it} + \beta_7 \ln(DIST)_{ij} + \beta_8 \ln(IMR)_{it} + \epsilon_{ijt} \quad (4)$$

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where  $\ln$  stands for natural logarithm,  $AID_{ijt}$  refers to aid flows between countries  $i$  and  $j$ ,  $Need_{it}$  refers to country  $i$ 's needs for aid, which comprises the prevalence of the undernourished population, namely  $Under_{it}$ , the prevalence of the food inadequacy rate, namely,  $Shortage_{it}$  and the depth of the food deficit, namely  $Calories_{it}$ .  $Polity_{it}$  is country  $i$ 's democracy index,  $Colony_{ij}$  is a dummy variable indicating the historical colonial relationship between countries  $i$  and  $j$ ,  $RPOP_{it}$  is country  $i$ 's rural population,  $R\_GNI_{it}$  and  $D\_GNI_{jt}$  are the gross national incomes (GNIs) per capita for countries  $i$  and  $j$ , respectively,  $DIST_{ij}$  is the geographical distance between countries  $i$  and  $j$ ,  $FOA_{ijt}$  is the frequency of aid between countries  $i$  and  $j$  and IMR is the inverse Mills ratio. The IMR indicates the probability that a country decides to provide aid over the cumulative probability of a country's decision, which addresses potential selection bias when using OLS (Heckman 1979).

The panel data comprise a total of 141 recipient countries and 25 donor countries in the OECD Development Assistance Committee (DAC) over the period 2002–2012. The agricultural aid data are sub-grouped into agricultural production sector ODA (DAC code 311) and food ODA (DAC code 72040). These data refer to disbursement, not commitment. Naturally, the former can provide more realistic estimates.

As seen in the model specifications, the dependent variables are ODA provisions targeting the agricultural production sector and food. The former includes agricultural production policy, development, land resource, inputs, crop production and research and development (R&D). The latter consists of emergency relief, food transportation costs and other cash grants for food supplies.

The independent variables mainly cover recipient needs and donor interests. The recipient needs are specified by nutrition-related indicators of the Food and Agriculture Organization (FAO), including the prevalence of undernourishment, food inadequacy and the depth of the food deficit. As an estimator of chronic food deprivation, the prevalence of undernourishment refers to the percentage of the popula-

tion whose food intake falls short of dietary energy requirements. Setting the energy need to a higher level than the prevalence of undernourishment, the prevalence of food inadequacy measures insufficient food access as a less conservative measure of food inadequacy in the population (FAO 2012). Finally, the depth of the food deficit is calculated as the gap between the average dietary energy requirement, that is, 2100 kcal, and the average dietary energy consumption of the food-deprived population (World Bank 2015).

Even though all three terms are relevant to recipient needs for aid, they are possibly correlated with one another while describing similar situations. In fact, the estimated Cronbach's alpha of 0.72 does suggest that the three "Needs" variables are correlated. To take advantage of efficient estimation and avoid a potential problem of multicollinearity, principal component analysis (PCA) is adopted. As seen in Table 4, the data for recipient needs for aid in three eigenvectors are reduced to one eigenvector with the biggest eigenvalue, 2.73357. The first principal component, namely "Needs\_pc1" is measured to account for about 91% of the cumulative proportion of variance explained. Therefore, instead of representing recipient needs data in three dimensions, the equation can be simply estimated using only "Needs\_pc1."

The donor interests are reflected in terms of variables related to polity and past colonisation. The polity data are widely used to measure the level of democracy in a country. As Burnside and Dollar (2000) pointed out, polity can be an indicator for potential aid effectiveness. In addition, as almost all the OECD/DAC members are democratic governments, aid provision is likely be contingent on the polity level of the recipient country. The variable *colony* reflects the fact that, *ceteris paribus*, donor-recipient relations under past colonialist rule may promote aid flows between the two countries. A number of trade models suggest that a colonial past is a significant determinant of bilateral trade (Ghosh and Yamrik 2004; Melitz 2007; Zhou 2011).

Finally, the control variables include rural population, GNI per capita, and geographical distance

Table 4. Principal Component Analysis (PCA) for recipient needs for aid

Principal Component	Eigenvalue	Proportion of variance explained	Cumulative proportion of variance explained
Needs_pc1	2.73357	0.9112	0.9112
Needs_pc2	0.250105	0.00834	0.9946
Needs_pc3	0.0163281	0.0054	1.0000

Table 5. Summary statistics

Variables		Obs.	Mean	Std. Dev.	Min	Max
Dependent	ODA to agriculture production (log)	10 283	12.8420	2.1917	1.0986	19.8908
	ODA to food (log)	3 227	13.7142	1.9146	5.2679	20.2257
Recipient needs	Prevalence of undernourishment	30 525	17.7182	12.3491	0	58.2000
	Prevalence of food inadequacy	29 225	26.4347	14.4434	5	64.4000
	Depth of the food deficit (log)	30 500	4.4887	0.9780	0.6931	6.3835
Donor interests	Polity	32 450	1.8644	6.2232	–10	10.0000
	Colony	38 764	0.0372	0.1892	0	1.0000
Controls	Recipient rural population (log)	38 775	14.8075	2.1819	8.0408	20.5555
	Recipient GNI (log)	26 075	8.4532	0.9938	4.7205	10.9024
	Donor GNI (log)	30 315	10.5163	0.2384	9.9661	11.0760
	Distance (log)	38 775	8.8207	0.6254	5.1948	9.8814

between the donor and recipient countries. Rural population in the recipient countries is used to capture the fact that the majority of poor people live in rural areas. GNI per capita and geographical distance are included to highlight common trade patterns observed in a standard gravity model, namely, that bilateral trade has a positive relationship with the economic size of the trading country and that countries located further apart trade less, respectively. However, aid flows are inversely proportional to recipient countries' GNIs per capita.

Table 5 shows the summary statistics of the data. There are 38 775 observations, 28 492 being zero flows. The high number of zero values indicates the need to address potential selection bias properly.

## ESTIMATED RESULTS AND DISCUSSION

Table 6 shows the parameter estimates for ODA provided toward the agriculture production sector. A noteworthy outcome is that the recipient needs are statistically significant, carrying the coefficient value of 0.0572. In other words, agricultural ODA is closely aligned with recipient countries' needs.

Donor interests represented by the variables *polity* and *colony* are also statistically significant. The higher the level of democracy in a recipient country, the more likely a donor country is to provide agricultural aid to the recipient country. Past colonial ties between a particular pair of donor-recipient countries tend to affect bilateral aid flows positively.

The negative and statistically significant coefficient for the distance term suggests that the closer the donor-recipient countries, the higher the flow of agricultural aid. This empirical evidence is very

interesting although it is consistent with the standard gravity model (Mckinley and Little 1977; Maizels and Nissanke 1984; Poe 1992; Lebovic 1998; Alesina and Dollar 2000). As a proxy for the transaction costs of agricultural aid, geographical distance between the two countries demonstrates its relevance in explaining bilateral aid flows.

The size of the rural population in the recipient countries has a positive impact on ODA amounts. This suggests that more agricultural aid goes to relatively larger agriculture-oriented recipients,

Table 6. Estimated results for ODA to the agriculture production sector

Variables	Probit	Heckman
Needs_pc1	0.0550*** (0.00939)	0.0572*** (0.0194)
Polity	0.00260 (0.00229)	0.0159*** (0.00493)
Colony	0.664*** (0.0795)	0.885*** (0.111)
Recipient rural population	0.0607*** (0.00816)	0.115*** (0.0168)
Recipient GNI	–0.114*** (0.0157)	–0.221*** (0.0342)
Donor GNI	0.185*** (0.0589)	0.576*** (0.154)
Distance	0.0603** (0.0251)	–0.199*** (0.0525)
Frequency of aid	0.476*** (0.00661)	
Inverse Mills Ratio		–1.134*** (0.0531)
Constant	–3.884*** (0.691)	9.055*** (1.764)
Observations	17 345	17 345

Standard errors in parentheses, \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

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*ceteris paribus*. Asymmetrical interpretation may apply to the estimated coefficient of the recipient country's GNI per capita. Agricultural aid appears to respond negatively to the recipient's GNI per capita while donor GNI per capita works in the opposite direction. This finding goes against the conventional pattern of commodity trade where both importers' and exporters' incomes move in tandem as promoters of commodity flows. Other studies also provide evidence that more ODA flows into lower-income countries (Alesina and Dollar 2000; Berthélemy 2006; Berthélemy and Tichit 2004; Lebovic 2005). The coefficients for the same income variable do not carry the same positive sign, thus shedding light on different characteristics of profit-oriented trade and humanitarian-based aid flows. In other words, donors provide agricultural ODA to relatively low-income countries.

The variable for geographical distance carries the expected sign, implying an inverse relationship between trade costs and values. The trade costs may include transportation costs as well as tariff and non-tariff measures between the two trading partners.

Table 7 provides similar results for the case of ODA to food. Compared to agricultural sector aid, ODA to food could be thought of as a more immediate and

short-run relief for the needy recipients. It is also broader in scope as it targets not only rural areas or residents but also urban areas or urbanites who suffer from a lack of food. In line with the case of agricultural production aid, the first principal component of recipient needs yields a statistically significant coefficient with 0.0891. This finding suggests that food aid is more responsive to needy situations, that is a greater provision of food aid corresponds to more severe hunger and impoverishment.

Unlike aid for the agricultural production sector, democratic qualities and historical colonial ties are negatively associated with food aid. A plausible interpretation would be that food aid is triggered mostly by humanitarian and special supplementary arrangements, and does not carry any strings. Food aid seems to be immune from political considerations. In addition, it is notable that more food aid flows into countries that are vulnerable to greater political risks and hence are coincidentally prone to food crises. Finally, the positive coefficient for distance indicates that food shortages tend to arise farther away from donor countries; in other words, food aid typically travels large distances.

## CONCLUSIONS

Aid to agriculture rebounded in the early 2000s after a long period of decline from the mid-1980s onwards. Growing awareness in developed countries and international organizations of the need to increase aid can be attributed to the UN's Millennium Development Goals (MDGs), which target extreme poverty reduction and hunger eradication. ODA to the agricultural production sector helps develop the sector by improving its economic sustainability and productivity, as well as boosting food and nutrition security. ODA to the food sector can temporarily enhance the security of nutritional status, albeit to a lesser extent than production sector aid envisioned over the long term.

A general finding of this study is that bilateral flows of agricultural and food ODA are in line with recipient needs and donor interests. The former is described by food insecurity indicators, and the latter is governed by the degree of democratic polity in the recipient countries and past colonial ties between country pairs. It is particularly significant that allocation of aid to agriculture is attributable to an altruistic objective such as food security.

Table 7. Estimated results for ODA to food

Variables	Probit	Heckman
Needs_pc1	0.0675*** (0.0121)	0.0891*** (0.0312)
Polity	0.000491 (0.00344)	-0.0192* (0.00996)
Colony	0.355*** (0.0807)	-0.337* (0.191)
Recipient rural population	0.0768*** (0.0121)	0.169*** (0.0383)
Recipient GNI	-0.186*** (0.0225)	-0.145** (0.0639)
Donor GNI	0.447*** (0.0856)	2.231*** (0.293)
Distance	0.0726* (0.0394)	0.410*** (0.105)
Frequency of aid	0.488*** (0.0110)	
Inverse Mills Ratio		-0.482*** (0.0821)
Constant	-7.084*** (0.998)	-14.65*** (3.319)
Observations	17,345	17,345

Standard errors in parentheses, \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Source: OECD/DAC CRS Database (<http://stats.oecd.org>)

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Unlike the conventional pattern of commodity trade, aid to agriculture appears to respond negatively to the recipient's income level. This suggests that more aid should flow into poorer countries, shedding light on the different characteristics of profit-oriented trade and humanitarian-based aid flows. Further, the negative coefficient for physical distance between donor-recipient pairs in the food ODA equation indicates that trade costs may not impede food aid.

Future research may further decompose the determinants of agricultural aid allocation into altruistic, commercial, national (self-interest) or diplomatic motivations. Aid effectiveness may be another important factor shaping the allocation of agricultural aid. In this regard, it will be necessary to consider not only the magnitude, but also the quality of aid in order to achieve developmental and food security targets. Although the gravity model specification dealing with aid flows is relatively new and hence not that well known, it is worth making an effort to develop more concrete economic foundations.

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