Agricultural official development assistance: an assessment of empirical aid determinants

Trends and shocks of aid activity to agriculture from 2002 to 2018

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Abstract

This thesis uses an event approach to understand some under-researched aspects of bilateral development assistance (ODA) in the agricultural sector. The empirical findings on ODA analysis largely agree on some historical explanatory determinants, both political and economic, driving bilateral ODA. Despite being statistically and economically significant, they have never been used to describe agricultural bilateral ODA. Given that, the purpose of our thesis work is to generate new evidence on the possible shocks in donor countries from the OECD Development Assistance Committee (DAC) in bilateral agricultural ODA. We investigated whether exogenous phenomena and shocks such as governance and financial crisis, can globally impact donor allocation decisions. By using a sample of 140 recipient countries worldwide and 29 DAC donors from 2002 to 2018, we found out that ODA for agriculture responds better to ODA's main empirical determinants, being more substantial than the ones specific to the agricultural sector. These exogenous phenomena mirror the increasing trends in ODA transfers. Methodologically, we constructed and analysed a panel dataset using a Tobit censored model. Data unavailability however constrained the analysis, emphasising the need for future research.

Keywords: Official development assistance, agriculture, bilateral aid, Tobit, panel data.

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Abbreviations

CRS	Creditor Reporting System
DAC	OECD Development Assistance Committee
EU	European Union
GDP	Gross domestic product
GNI	Gross national income
LDCs	Least developed countries
ODA	Official development assistance
SDG	Sustainable Development Goals
SSA	Sub-Saharan African countries
US	United States of America

1. Introduction

Official development assistance (ODA) is a category widely used as an indicator of international aid flows. This thesis uses an event approach to understand some under-researched aspects of bilateral ODA in the agricultural sector. Empirical findings on bilateral ODA largely agree on some historical explanatory determinants characterising bilateral ODA. We will further explore whether global macro events impact donor countries' decisions in the aforementioned bilateral allocation. By taking advantage of different typologies of determinants, both classical and sectoral-specific, we want to test whether an aid flow shift towards agricultural-related activities exists and reflects exogenous phenomena and shocks, such as governance and financial crisis. We will focus on the following main research question: are classical empirical drivers reliably describing bilateral agricultural ODA when including agricultural sector indicators as well as exogenous shocks? This can allow further studies to develop several policy implications.

The resource flows to developing countries – namely global aid flows – have been measured since 1961. In 1969 the OECD Development Assistance Committee (DAC) adopted the ODA as the "gold standard" of foreign aid and ODA still nowadays represents the main source of financing for development aid. The OECD defines ODA as "government aid that promotes and specifically targets the economic development and welfare of developing countries" (OECD, 2021, p.1). Historically, European countries and EU institutions (i.e. European Commission), the US, and Japan have always been the biggest donors worldwide. However, today the scenario has changed: at the beginning of the XXI century, we experienced the introduction of the term "emerging donor" referring to a country that often does not belong to the DAC's list and that began to provide ODA later than historical donors, as read in Kim and Oh (2012) and Lee (2012).

Above all, the DAC has extensively contributed to support aid activities, resulting in material resources given by donor countries as a tool to facilitate the growth of developing countries. While ODA flows have been extensively studied, more detailed research still needs to take place on geographic and sectoral breakdowns. Empirical findings identified major development drivers related to bilateral disbursements. In detail, we will extend existing empirical research by focusing on agricultural bilateral ODA, given that most people in developing and least-developed (LDCs) countries live in rural areas and pursue agriculture-related

activities. There is a lack of in-depth assessment of these major drivers' relevance when including both agricultural sector specifications and global exogenous shocks, such as the aftermath of the financial crisis and the consequent food crisis (economic shock), as well as the adoption of Agenda 2030 (governance shock).

Therefore, by using a sample of 140 LDCs and low-middle-income recipient countries worldwide (hereafter, recipients) and 29 DAC donors (hereafter, donors) from 2002 to 2018, we test if empirical determinants are substantially relevant to describe bilateral agricultural ODA. We augment the total number of explanatory variables, including variables characterizing the agricultural sector and exogenous phenomena. We posit that the latter had likely widened financing gaps as countries were – and still are – struggling to recover from economic downturns. As a result, this international scenario raised the need for more substantial aid, as shown by increasing global aid flows in select sectors. To answer our research question, we constructed and analysed a dataset using a Tobit censored model.

This thesis contributes to multiple areas of research. First, the paper contributes to the aid literature by recalling key empirical findings that attempt to describe ODA drivers. Second, an attempt has been made to define a tailored research question about the agricultural ODA, explicitly touching on the ability of these classic determinants to explain whether they are relevant enough when accounting for sector-specific characteristics, and global exogenous shocks. Based on our literature review, only one article in the existing literature has empirically addressed this topic so far. This thesis would then approach this paucity and examine whether the empirical aid framework can be used to explain donors' behaviour after two exogenous shocks. The following thesis, therefore, complements the empirical findings so far embedding an agricultural dimension.

The remainder of this thesis is organized as follows: in section 2 we set the development and ODA theoretical framework, scrutinizing the main drivers appearing in the existing scientific literature review. We provide a contextual framework of some characteristics of the agricultural sector as well. In section 3 we specify the data and the methodology used. In section 4 we discuss the estimated results and draw main policy implication, followed by concluding remarks in section 5.

2. Literature review and aid activity background

Agriculture represents a driver of economic growth in many LDCs and low-middle-income countries, where a large portion of the population subsists thanks to the agricultural sector. Besides the new technologies spread and implemented by the Green Revolution (‘50s -’60s) led to rapid growth in Third World countries' agricultural outputs, which are not yet sufficient. Therefore, the role of ODA is still relevant in the promotion of economic development and welfare.

Formally, ODA is reported by donors in the Creditor Reporting System (CRS) under seven main headings. The CRS originated in 1973 to collect detailed information about “aid loans, and later grants, to complement the recording of aggregate flows” (Hudson, 2013, p.112). Therefore, aid flows result in material resources differentiated by purposes and sectors. Aid activities are financed through grants and loans. To this extent, it is worth noting that two main sets of data appear: one related to commitments and the other to disbursements. However, observing OECD annual Summary Notes we sense that the definition of ODA is constantly under revision. In this regard, a better and more inclusive definition of what ODA means should be “the total cost for some specific activities by richer countries’ governments in their ambition to aid poorer and developing economies in their development in terms of either bilateral or multilateral support”. The definition we provide thoroughly embeds financial flows, technical assistance, and commodities given by wealthier governments to another country for development purposes, either as grants or subsidised loans. Also, these several types of bilateral financial support might include projects, and core funding to local institutions while tackling specific aid activity dimensions in recipient countries. This is linked to the fact that multiple components of aid, such as the foreign political agenda of the donors other than development motives, should figure in, as well. On these premises, and given the framework of this thesis, when referring to bilateral ODA, we are explicitly referring to the bilateral disbursement dimension, as “the release of funds to or the purchase of goods or services for a recipient; by extension, the amount thus spent” (Hudson, 2013).

Briefly analysing the structure of the Gross bilateral ODA 2019-2020 as in Figure 1 for all DAC countries, we can see some structural characteristics: the DAC

Recipient list presents countries and territories in groups, consisting of all low-and-middle-income countries based on gross national income (GNI) per capita. Overall, ODA from official donors totalized USD 162.2 billion in 2020: an increase of 6.9% in real terms since 2018, our final year. Breaking down the analysis by income group and region, we see that 30% of ODA goes towards both LDCs and low-middle-income countries, especially located in Sub-Saharan Africa (SSA) and South and Central Asia. The sectoral breakdown, instead, emphasizes a larger ODA ratio for education and health, followed by social infrastructure and services, and humanitarian aid. In detail, we note that production – aid activity including agriculture – results in only 6,7% of the total bilateral ODA amount.

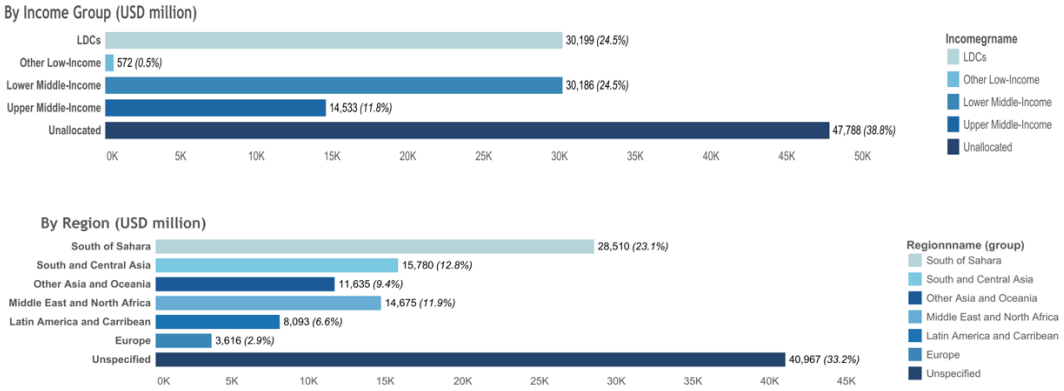

Figure 1. Gross bilateral ODA 2019-2020 by total DAC donors. Top: break down share by income group, bottom: break down share by region
Source: OECD – DAC

This section proposes a literature background embedding the empirical findings on ODA literature. Selected studies are categorized into two sections: (i) a general ODA background, focusing on studies describing the "classical" explanatory drivers, and (ii) studies which explored the role of ODA in the agricultural sector.

2.1 Empirical determinants of bilateral ODA: classical drivers and main trends

When analyzing ODA, existing literature relies on several empirical findings coming from various research fields such as political science, development, and applied economics. Scholars have been identifying and addressing the main drivers explaining donors' bilateral aid allocations. However, there is no unified development theory on aid drivers, rather a broad debate around those empirical findings. We read in Brück and Xu (2012, p. 594) that the "main criteria of aid allocation can be divided into political and economic factors".

On the one hand, the socio-political approach commonly used to analyse ODA in the past decades has succeeded in identifying the major aid determinants of the bilateral allocation choices, including - among others - colonial ties, democratic regimes, common language, "good institutions", and corruption level. Asatullaeva et al. (2021) show primary clusters of research in aid allocation. Most of the studies have been devoted to examining how aid affects recipients, focusing on the geostrategic, security, and political dimensions. To this extent, we read that Schraeder, Hook, and Taylor (1998) include the socio-political dimension of multilateral order as a good driver to be considered. Following up, we read in Alesina and Dollar (2000) that position on world order, strategic interests, and relationship with former colonies (as known as past colonial history) are to be included. In other cases, however, the analysis prioritized the role of democracy, the colonial past, and the level of governance. Merging all these dimensions, through time series, evidence about the role played by democracy has been found: democratic countries do get substantially higher ODA transfers. Other dimensions, such as voting patterns in the United Nations (UN) better explain the distribution of aid rather than the economic policy of recipients, as originally thought (see for instance Alesina & Dollar, 2000). This is in line with our underlying assumption that bilateral ODA is indeed a politicised phenomenon, following a clear political agenda.

On the other hand, economic factors, such as GNI per capita, income level, and trade participation helped understand the quantitative dimension of ODA. The economic stream initialized by Alesina and Dollar (2000) introduced the concept of the recipient's needs and merits. They not only accounted for donors' main needs but also for receiving countries' self-interests, as well. This understanding derives from the fact that positive outcomes can be reached when development is more efficiently allocated. To this end, when looking at recipients' merits, aid has been found to be more effective when given to developing countries with sound institutions, good economic policies, and good trade policies (see for instance Burnside & Dollar, 2000). The focus on donors' attitudes toward rewarding economic and social performances can be found in other studies. Taking advantage of a panel structure (recipient–year–donor), we can read in Berthélemy and Tichit (2004) that both the self-interest of donors and recipient's needs variables are introduced. To this extent, Misha et al. (2012) showed in a panel data analysis that both recipients' needs and donors' interests are significant determinants of bilateral ODA. However, as we will further articulate, we do not stand for this narrative: our assumption prioritizes the donors' interests above all.

Moreover, multiple findings arise from other studies: both Balla and Reinhard (2008), and Ji and Lim (2018) agree that donor countries act following their national interests and goals, as well as their historical and cultural relations with the recipient countries. Through their findings, they argue that political factors prevail in aid flows allocation. Looking at world order, Balla and Reinhardt (2008) argue that the

nature of aid allocation grows further in the presence of conflicts. Differently, Ball & Johnson (1996) came up with a strategic business-oriented dimension. Using a study case, they showed that geopolitical interests and surpluses of American agricultural commodities appear to have been the most influential determinants in the allocation of U.S. food aid among African recipients, much more than merely humanitarian considerations.

Huge emphasis has been put on the relationship between aid, poverty, and growth by a consistent branch of the existing literature. Doucouliagos and Paldam (2011) demonstrated that throughout the last decades, the aid-to-growth causality assumption dominated the world of data-driven research. However, findings show that aid activity does not always present a straightforward clear causal direction about how and to what extent ODA helps countries to grow. This is the reason why Mahembe and Odhiambo (2021) argue that the ODA allocation model has been challenged both theoretically and empirically. Besides, literature often presents the debate surrounding aid's effectiveness in fighting poverty. In this regard, ODA flows as a tool to sustain and support long-lasting growth failed at lifting people out of poverty: despite the generous DAC efforts, poverty still represents a global threat (see for instance Mosley & Suleiman, 2007; Cervantes-Godoy & Dewbre, 2010; Mahembe & Odhiambo, 2021). All in all, we must say that the relationship between bilateral aid flows and effectiveness is complex and difficult to establish casual paths.

To conclude, economists have identified in the past several determinant clusters describing bilateral ODA, which can be roughly summarised as follows:

1. Political and governance focus: state of the governance and institutions, democratic regime, corruption and terrorism, rule of law, and colonial ties;
2. International arena focus: multilateral order, UN voting schemes, international conflicts;
3. Economic and trade focus: GNI per capita, income level, participation in trade agreements;
4. Cultural focus: indicators for cultural proximity, such as common language, religion, legal system;
5. Geographical and sectoral country-level focus: distance, share of the rural population.

2.2 Empirical findings on agriculture and agricultural aid activity

In the upcoming paragraph, we try to provide a summary of the existing empirical findings, embedding a specific focus on the agricultural sector. While historically the role of agriculture in shaping national economies, both in terms of economic

development and poverty reduction, has been widely tested, a recent branch of the literature – especially from the Global South – is investigating aid contribution to agriculture. According to Asiedu et al. (2020), the scientific literature has provided us with a general understanding of the impact of aid at the national and sub-national levels since the beginning of the century (see for instance Alesina & Dollar, 2000). However, only a minor assessment has been devoted to understanding quantitatively sector-specific aid, as in the case of agricultural ODA. Their results suggest that agricultural ODA is necessary to accelerate agricultural investments and achieve food security and sustainable long-lasting growth.

Moreover, we read in Jim and Li (2018) that agricultural aid directed towards alleviating rural poverty has a positive implication in promoting agricultural growth and general development in the recipient country. This is enforced by Kaya and Kaya (2019). By disaggregating data into sub-categories, the two researchers explained how ODA, with an emphasis on agriculture, played an important and successful role in contributing to the development of low-income countries. However, not all literature is unanimous in this regard. Djokoto et al. (2022) show that ODA to agriculture independently has been ineffective in promoting agricultural development.

All in all, a strongly empirical lack of analysis still characterizes agricultural ODA. Our thesis aims not only to come up with quantitative analysis but to test major macro-level phenomena using the agriculture sector's main characteristics. Diaz-Bonilla et al. (2010) explain that, despite the heterogeneity of countries, there are regional cluster characteristics describing the agriculture sector worldwide. The main characteristics of agriculture in developing countries are the large share of GDP and the consequent large share of the agricultural labour force. They experience high dependency on agricultural imports as well (food insecurity). Agricultural production depends on weather and seasonality. Agricultural output is often consumed by producers, given the lack of transformation of agricultural products. In this respect, they used the 2008 World Bank Development Report on "agriculture-based" countries – namely the ones where agriculture is fundamental for growth and poverty – adding additional indicators to describe structural differences among regions when it comes to considering agricultural production and related infrastructures. Agricultural production and rural population result in having a larger presence in sub-Saharan Africa (SSA) and South Asia. These are only two major drivers used to analyse the developing regions. In fact, other interesting indicators are represented by the ratio of agricultural exports and agricultural machinery, as in the case of Latin America and the Caribbean (LAC) region. The presence of roads and available arable land per capita are used as good indicators to estimate agriculture and value-added (% of GNI) in both Africa and Asia, as well.

3. Materials and methods

3.1 Data and descriptive statistics

The dataset of this thesis consists of a panel dataset and we used a Tobit model to analyse it. This thesis combines the value of the ODA transfers from a donor country (j) to a recipient country (i) in a specific year (t), including several explanatory variables. The upcoming analysis considers 29 donors, and 140 recipients covering the 2002-2018 timeframe. Given the quality and nature of the data, we crafted a data filtering system, as shown in Appendix A. The original dataset, in fact, consisted of 92916 observations derived from the ODA flows between the donor-recipient pair in the period 2002-2019. However, several countries and explanatory variables resulted in more than 60 percent missing observations (NA's). Through our filter, we were thus able to derive a more solid dataset excluding the whole year of 2019 from the analysis, and some other variables. In addition, some countries were deliberately excluded from the analysis, since the focus of this thesis is on low-and-middle-income countries and LDCs. Hence, unlike other studies, we excluded South Korea from the DAC donor' list as the country is an emerging donor. Table 1 provides the names, definitions, units for variables, and sources of data.

The main database we refer to is the OECD Creditor Reporting System (CRS) publicly available on the DAC website and built on the FAOStat-Development Flows to Agriculture data. The OECD DAC gathers statistics[1] on ODA and other resource flows towards developing countries from bilateral and multilateral donor agencies on an annual basis, accounting for both ODA commitments and effective disbursements. As previously mentioned, there is no unanimous consensus in the literature on whether to use disbursement or commitment data when dealing with bilateral donor decisions. This thesis will use disbursements data (Value ODA) as the dependent variable, expressed in ln form, to get straightforward elasticities. This is in line with the robust findings from Nunnenkamp and Thiele (2006). They argued that disbursement does represent the "transfer made" as the result of a complex "decisional process" (2006, p. 1181).

[1] OECD statistics are by far the only source of official, verified, and comparable data on ODA.

Table 1. **Names, definitions and units for Variables and sources of data**

Variable	Classification	Definition	Source	Unit
Value of agricultural ODA	Dependent	Agriculture sector aggregate DAC aid, expressed in ln form	FAO/OECD (CRS)	US$ (million)
landlocked	Independent	Dummy variable set equal to 1 for landlocked countries	CEPII	0 or 1
Common language	Independent	Dummy variable indicating whether the two countries share a common language	CEPII	0 or 1
colony	Independent	Dummy variable indicating whether the two countries have ever had a colonial link	CEPII	0 or 1
distance	Independent	Distances between country i and j, accounting for the parameter measuring the sensitivity of trade flows to bilateral distance, expressed in ln form	CEPII	km
Rural population	Independent	Rural population refers to people living in rural areas as defined by national statistical office	WDI/FAO	% of total pop
GDP per capita	Independent	Real GDP per capita at constant 2015 prices, expressed in ln form	WDI/FAO	US$ million (constant 2015 US$)
agricultural land	Independent	Agricultural land refers to the share of land area that is arable, under permanent crops, and under permanent pastures.	WDI/FAO	% of land area
Corruption*	Independent	Control of corruption captures perceptions of the extent to which public power is exercised for private gain	World Bank Development - WDI	ranging from -2.5 to 2.5.
Government* effectiveness	Independent	Government effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies	World Bank	ranging from -2.5 to 2.5.
Rule of law*	Independent	Rule of Law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence	World Bank	ranging from -2.5 to 2.5.
Political* stability	Independent	Political stability and absence of Violence/Terrorism measures perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism	World Bank	ranging from -2.5 to 2.5.
financial	Independent	Dummy variable set equal to 1 for years after 2008	/	0 or 1
SDGs	Independent	Dummy variable set equal to 1 for years after 2015	/	0 or 1

* These variables must be intended as lagged (-1) to avoid endogeneity. Source: own elaboration

For this purpose, we decided to start our analysis from 2002 onwards, given the fact that the data on disbursements are only available in a reliable form since 2002. We read in Hudson (2013) that OECD warns about using earlier data for sectors of analysis since it might result in unreliable estimates. To this extent, we took into consideration code 311, namely the agricultural production. Appendix B provides a breakdown description of the DAC 311 Purpose Code.

Following the previous empirical findings as per Section 2, we included a total of 13 explanatory independent variables, both continuous and dummies. In detail, distance-related measures come from the 2011 Mayer and Zignago's CEPII dataset. We decided to include the landlocked dimension as well as the geographical distance corrected by a parameter accounting for the openness to trade and expressed in ln form (distance). The dummies explaining the former colonial tie (colony), and the common language (common language) between donor and recipient also come from this dataset. Hence, agricultural-related determinants come from FAOStat, namely the percentage of the rural population, and the agricultural land, as well as the GDP per capita in constant 2015 prices, expressed in ln form. The variables relative to the political dimensions, such as the level of corruption, the rule of law, government effectiveness, and political stability have been extracted from the World Development Indicators (WDI) by the World Bank. We then created two time-dummies to account for the exogenous phenomena under analysis, i.e. the financial and food crisis (financial), and the adoption of the 17 SDGs by the UN (SDGs).

Ultimately, Table 2 shows the statistical data on the explanatory variables. The sample size is represented by 69,020 observations. The regression accounts for 60,904 observations of which 46,691 are left-censored data at zero, and 14,213 are properly observed. Ultimately, the Tobit model drops out 8,116 missing values (NA's) as per construction.

Table 2. **Summary statistics** (n = 69,020)

	mean	sd	var	min	q1	mdian	var.1	q3	max	IQR
Value ODA	2.5195	9.0976	82.7671	0	0.0724	0.3816	82.7671	1.7484	412.3253	1.6760
landlocked	0.2047	0.4035	0.1628	0	0	0	0.1628	0	1	0
common language	0.1164	0.3208	0.1029	0	0	0	0.1029	0	1	0
colonial ties	0.0335	0.1799	0.0324	0	0	0	0.0324	0	1	0
rural population	49.8166	22.0624	486.7509	0	33.6290	51.3220	486.7509	67.7430	91.3180	34.1140
agricultural land	39.4177	22.0883	487.8948	0.4487	20.6258	38.5602	487.8948	58.0579	85.2874	37.4322
SDGs	0.2353	0.4242	0.1799	0	0	0	0.1799	0	1	0
financial	0.6471	0.4779	0.2284	0	0	1	0.2284	1	1	1
GDP per capita (ln)	7.9957	1.1497	1.3218	5.5554	7.1294	8.0452	1.3218	8.7500	11.7657	1.6205
corruption	-0.4077	0.7197	0.5180	-1.8687	-0.9120	-0.5033	0.5180	-0.0434	1.7246	0.8686
gov effectiveness	-0.4283	0.6998	0.4898	-2.4467	-0.8870	-0.5032	0.4898	0.0163	1.5722	0.9033
rule of law	-0.4179	0.7416	0.5500	-2.6064	-0.9232	-0.4942	0.5500	0.0517	1.6296	0.9749
political stability	-0.2751	0.9539	0.9099	-3.3149	-0.8561	-0.2210	0.9099	0.4058	1.5994	1.2619
Value ODA (ln)	-1.3269	2.9449	8.6727	-13.8155	-2.6160	-0.9566	8.6727	0.5620	6.0218	3.1780
Distance (ln)	8.8395	0.5831	0.3400	5.7459	8.5150	8.9453	0.3400	9.2303	9.8814	0.7154

Source: own elaboration

3.2 Methodology

Since the dependent variable is left-censored[2], we use a Tobit model as the main estimation technique. Following Balla and Reinhard (2008), our strategy does not prioritize time-invariant or slowly changing ODA drivers. We want to study the full effects of both agricultural sectoral characteristics, as well as exogenous shocks – e.g., the aftermath of the 2008 financial crisis and the consequent food crisis (2008-2011), and the governance shock due to the adoption of the UN SDGs Agenda (2015) –, in low-and-middle-income countries on donors' allocation decision worldwide. We hypothesize that such phenomena had likely widened financing gaps as countries were – and still are – struggling to recover from economic downturns. Therefore, our dependent variable is represented by the amount of agricultural ODA to each recipient for each year measured by gross disbursement (constant 2015 US dollars).

We decided not to use cross-country approach, given the argument in Nunnenkamp and Thiele (2006) about the risk of misspecification. However, it is challenging to test the determinants describing ODA allocation, and the choice of the more robust method is not straightforward due to the logic governing bilateral ODA, as well as the presence of missing values (NA's). First, not all donors provide aid to all countries for several reasons. Second, the issue originates from the potential selection bias linked to the nature of the dependent variable (Value), indicating either that the $flow_{ijt}$ does not exist in several observed years (truncated) or that the $flow_{ijt}$ is not recorded if it is below some threshold value (censored). This results in a large presence of NA's. Besides, in many publicly accessible datasets, it is not always clear whether NA represents a perfect substitute for zeros or lack in the observation. Methodologically, we read in Sigelman and Zeng (1999) that confusion still reigns when it comes to choosing what model better captures censored and truncated (sample-selected) data in the context of decisions, as in political phenomena. To account and correct for the selection bias, the economics methodology suggests the Heckman 2-steps sample selection (1979), also known as a "Tobis-2 model". Several generalizations of Heckman's solution are present in the empirical literature and the model has been previously applied to flows and aid studies given its capacity to capture the intensity of aid in the selection model through a probit, and the quantity in the semantic model using a corrected OLS (see for instance Ji and Lim, 2018). However, economists often highlight that, while acknowledging that Heckman method's estimators are estimated with high precision, those estimators are subject to bias (Hudson, 2013). Heckman's correction considers the missingness in the dependent variable – in our case, the value of agricultural ODA transfer. As shown in Appendix C, we carried out the model merely as a robust check. Moreover, in our regression, we incorporated all

[2] In the framework of this thesis, left-censored and censored from below are to be considered synonymous.

donor-recipient pairs, including those who received and who did not, to avoid a selection bias issue. That is why our analysis faces censored data, and that is why Heckman's solution suggested by the literature is not ideal. In addition, we notice that data censoring may arise from a question of data observability – not associated with selection bias. On the one hand, if zeros are true zeros, there is not selection bias. On the other hand, if the zeros are not true zeros they represent a code and it is hard to distinguish between true and false. In this scenario, Amore and Murtinu (2021) showed that the use of Tobit is appropriate.

Furthermore, we read in Amore and Murtinu (2021) that OLS is potentially unsuitable in this context, while Tobit model represents a valid solution. To estimate the causal effect describing the ODA flow as well as to understand what part of the observable outcome is linked to the causal relationship for each donor-recipient pair, the OLS regression would not be enough. It is inconsistent and can provide over-estimated results, creating a correlation with the error term (see for instance Ji & Lim, 2018; Toomet & Henningsen, 2008). In detail, OLS is not suitable because it ignores the fact that the conditional expectation cannot be negative and it can be very misleading.

Despite borrowing part of the theoretical framework from Balla and Reinhardt (2008), and Ji and Lim (2018), nevertheless we opt for a Tobit model. This model captures the "values of the dependent variable clustered at zero irrespective of whether any censoring has occurred" (Sigelman & Zeng, 1999, p. 167). Tobit accounts for the probabilities that some observations are censored and accordingly adjusts the estimation results. This is in line with the Tobit model used by Berthélemy and Tichit (2004), accounting for the truncated nature of the aid variable. The standard Tobit model is defined as follows, as per Sigelman and Zeng (1999):

$$y_i^* = x_i\beta + \epsilon_i \qquad \begin{cases} y_i = y_i^* \text{ if } y_i^* > 0 & (1) \\ y_i = 0 \text{ if } y_i^* \leq 0 & (2) \end{cases}$$

where y_i^* is the latent dependent variable, y_i is the observed dependent variable, $x_i$is the vector of the independent variables, β is the vector of coefficients, and the unobserved part ϵ_i is assumed to be independently normally distributed: $\epsilon_i \sim N(0, \sigma)$, therefore $y_i \sim N(x_i\beta, \sigma)$. There are various types of Tobit models because the cutoff condition can be generalized ($y_i > z$, with z being some prespecified constant, or even a variable, instead of $y>0$). As we argued before, the observed 0's on y_i can mean either a "true" 0 value or censored data. Differently from Heckman's two-steps, the Tobit model results in only one equation representing one causal mechanism and one decision process – i.e. the amount disbursed.

Tailoring down this theoretical framework to our analysis, this thesis considers three underlying cases:

1. there is aid disbursed, and the data contain the value (Value ODA > 0);

2. there is aid disbursed, but the amount is so small that it has been rounded down to zero by construction;
3. there is no flow transferred, hence a NA/missing is in the data.

We know that if the dependent variable contains many zeros, as in our research, it is suggested to use Tobit. In detail, we assume that in the third case, NA's mean indeed zero, and we replace them with zero. This is in line with the assumptions made by Kim & Oh (2012), arguing that the Tobit model considers the zero value in the dependent variable not simply as a number but as a "code", which represents a censored random variable as a lower limit. This assumption allows Tobit to treat these observations as censored instead of throwing the data and lowering the sample size. Besides, we also noted that the dependent variable has a relatively small number of negative values (27 out of 69,020 observations). We interpret those as in Yung and Moon (2014), namely as the repayments made for past loans. Therefore, we censor those negative values at zero.

All in all, most of the zeros still stem from case 2. This enforces the possible critique – based on the Tobit nature – implying that only case one and two are present, and leads us to conclude that the Tobit regression is indeed the best alternative. Therefore, we reduce these multiple frameworks to the first two and we generate the Tobit y_i using the following independent variables, as described in equation 3. Our Tobit has been estimated with the standard parametric maximum-likelihood method. We do not account for panel structure in the model we estimate, due to the massive presence of NA's and some observations which are time-invariant. Therefore, we opt for a pooled model.

$$y^{*}_{jit} = \beta_0 + \beta_1 \text{landlocked}_i + \beta_2 \text{comlang}_{ij} + \beta_3 \text{colony}_{ij} + \beta_4 \log(\text{distance})_{ij} + \beta_5 \text{rur\_pop}_i + \beta_6 \text{agri\_land}_i + \beta_7 \log(\text{GDP}_{2015})_{it} + \beta_8 \text{corr}_{it-1} + \beta_9 \text{gov\_eff}_{it-1} + \beta_{10} \text{RoL}_{it-1} + \beta_{11} \text{stability}_{it-1} + \beta_{12} \text{SDGs}_t + \beta_{13} \text{financial}_t + \varepsilon_{ijt} \quad (3)$$

The political determinants present a one-year lag (t-1) to avoid endogeneity. Following Yoon and Moon (2014), we know that ODA disbursement decisions are based on the donor's economic interests as well as the foreseen potential conditions of the recipient before the year under analysis. In addition, as a further check, we excluded some explanatory variables due to the high missingness of observations, as advised by Hudson (2013).

4. Results and discussion

The following section describes the estimated results and contains a general discussion, including caveats and limitations.

4.1 Results

Table 3 provides the results of the Tobit, embedding the significant factor loadings. When analysing the upcoming results, it is fundamental to bear in mind the importance and difference between the statistical significance and the economic one, which is very useful in the context of development economics.

Table 3. Estimated results for ODA to the agricultural production sector: Tobit regression

	Censored regression (Tobit1)
	Dependent variable: **Value ODA** (ln)
Landlocked	0.2040 *** (0.0576)
Common language	2.0989 *** (0.0685)
Colonial tie	3.5153 *** (0.1229)
Distance (ln)	0.2897 *** (0.0387)
GDP_2015 (ln)	- 1.3649 *** (0.0349)
Rural population (%)	- 0.0141*** (0.0013)
Agricultural land (%)	- 0.0079 *** (0.0011)
Corruption (t-1)	- 0.9093 *** (0.0712)
Government effectiveness (t-1)	2.2762 *** (0.0687)
Rule of law (t-1)	- 0.3633 *** (0.0730)
Political stability (t-1)	- 0.6414 *** (0.0339)
SDGs	0.2305 *** (0.0534)
financial	0.6735 *** (0.0482)
logSigma	1.6349*** (0.0029)
Constant	- 2.8065 *** (0.4764)
Observations	60,904
Log Likelihood	-185,989.0000
Akaike Inf. Crit.	372,007.9000
Bayesian Inf. Crit.	372,143.2000

Notes: Tobit. Normal distribution, cutoff at -13.815511. Standard errors in parentheses.
* p < 0.1; ** p < 0.05; *** p < 0.01. Many coefficients without asterisks are significant at the 10% level.

Donor interests represented by both colonial past and common language are statistically significant. In detail, sharing the same language tends to affect bilateral ODA positively. The existence of a past colonial tie (dummy) among a donor-recipient pair of countries shows an even higher economic significance.
Looking at geographical specifications, we see that the percentage change in ODA transfer associated with switching landlocked from 0 to 1 is 22.68%. Hence, the positive and statistically significant coefficient for the geographical distance suggests that the farther away the donor-recipient pair, the higher the flow of agricultural ODA. This is in line with the nature of bilateral political aid, which prefers sending money to a country far away rather than to neighbours, who can be influenced by other matters. This empirical evidence is interesting considering that ODA is less precisely predicted since it is based on short-political decisions.

When it comes to the agricultural sector-specific determinants, we see that they are both significant and not economically neglectable, presenting a negative coefficient. Firstly, the agricultural land variable represents an example of negative causal mechanism: if a recipient country presents a large agricultural sector, there is no intention to engage in bilateral agricultural ODA. The donor-recipient pair for big agricultural-related projects opts for multilateral ODA, such as the one provided through multilateral and sectorial organizations like the World Bank and the FAO. They commit a higher amount and bring professionals and technicians to work. Secondly, the percentage of the rural population has an analogous effect in the same direction: the size of the rural population in the recipient countries has a negative impact on the ODA amounts. This might suggest that more agricultural aid goes to relatively smaller agriculture-oriented countries, contrasting with the previous findings from Ji and Lim (2018).

Hence, a symmetrical interpretation can apply to the estimates of the recipient country's GDP per capita. Understandably and in line with previous studies (Ji & Lim, 2018; Alesina & Dollar, 2000), agricultural ODA appears to respond negatively to an increase in GDP per capita. This is concurrent with the theoretical purpose and nature of ODA, which should go toward LDCs and lower-income countries. Therefore, the political variables show statistical significance: however, some variables do not carry the same sign, thus shedding a light on different characteristics. The underlying setup is that higher levels of democratization in a recipient country leads to likely higher agricultural aid. In detail, the coefficient of corruption is understandably negative. The higher the independence from political pressures, as well as the quality of policy formulation and the credibility of the government's commitment to such policies, the higher the value of agricultural ODA, as explained by the positive coefficient of government effectiveness. However, political stability and rule of law do not carry the expected signs and are therefore inconsistent with our assumption. Since the higher the political stability, the higher the international accountability, therefore we would expect higher ODA. Fundamentally, the coefficient of rule of law captures the

perceptions of the extent to which agents have confidence in and abide by the rules of society. Again, our hypothesis expects a positive sign, given that adopting several rules of law, reforms, and adhering to more western society standards would imply more aid disbursed.

Moreover, a noteworthy result is represented by both time dummies – financial and SDGs – that are both statistically significant, and positively correlated. This validates our hypothesis that after these exogenous phenomena, ODA towards low-and-middle-income countries increased, trying to support the sustainable growth of the agricultural production sector. All in all, we note that the sigma (also known as the ancillary statistics) is equivalent to the square root of the residual variance in OLS regression.

Finally, Appendix C provides similar results besides the use of a different methodology. The Heckman's solution has been computed as a robust check; nevertheless, it represents a less statistically relevant result. In spite of the discrepancies in some cases with the logical setup, these variables demonstrate their relevance in explaining the politicization of bilateral ODA.

4.2 Discussion

The significant rise in bilateral ODA towards low-and-middle-income countries by DAC donors generated much interest in scholars in its motives – whether they be economically, politically, or sectoral specific. However, this thesis represents the second attempt to cluster the analysis on a fragment of the whole ODA, i.e. the agricultural production. To this extent, possible limitations or different approaches could ameliorate our findings. The following paragraph critically discusses this issue.

Since the 90s, the existing findings tested aid classical drivers and aid activity in general, using the specification of regression analysis. We did take advantage of the same methodology, examining the impact of external macro events on donor countries' decisions. First, we must bear in mind that bilateral ODA, unlike other types of aid (see for instance multilateral aid) represents a very politically polarised type of aid. These ODA transfers are often used as soft-power tools and represent both a clear policy direction and geopolitical implication, with multifaceted effectiveness and extents across donor-recipient pairs, as we read in Blair et al. (2021). Granted this, we deliberately decided not to use the "recipient needs" label, often recalled in the literature (see for instance Alesina & Dollar, 2000; Ji and Lim, 2018). These would not represent reliable determinants of aid allocation since this typology of aid, by definition, is mainly driven by donors' interests. The positive and highly significant coefficients for both past colonial ties,

and common language sustain this assumption. In other words, this also means that agricultural bilateral ODA is closely aligned with our assumption on donor countries' preferences rather than recipient needs. However, the Post September 2001 era needs to be our analysis lens: a higher amount of ODA goes through multilateral rather bilateral since it is more efficient.

In addition, the focus choice on bilateral rather than multilateral ODA can represent one of the biggest limitations of this thesis. A high proportion of agricultural support passes through sectoral agencies that manage the portfolios of agricultural projects worldwide. We are mainly referring to UN sectoral agencies (WFP, FAO), as well as the World Bank. These agencies can provide governments and local realities with experts and resources necessary for the smooth run and implementation of projects. Again, bilateral ODA represents a political decision with short-run results – such as the influence on the next UN vote – or creating a regional influence zone. Furthermore, we must confess that sometimes the line between multilateral and bilateral can be blurry: for example, France and Japan offer disbursements for specific projects, but then these projects are truly implemented by FAO.

However, we see that our results are not always aligned with empirical findings. Given the nature of bilateral agricultural ODA, we did not consider the idea of having a lagged - by one period only - GDP per capita. As we read in Nunnenkamp and Thiele (2006), GDP per capita might rather depend on ODA, rather than driving it. This is in contrast with the smaller amount compared to other typologies of ODA (e.g., humanitarian, infrastructure, etc). On the contrary, we prefer focusing on the government level, namely international accountability, and political stability, rather than including other political parameters such as human rights. This dimension of human rights protection is more apparent and controversial as it can be easily challenged by civil society and create popular discontent leading to the loss of votes within donor countries. Also, one additional criticism might come from the fact that people depending on agriculture to make a living not necessarily correspond to rural people: some, in fact, might live in urban areas but still being employed in the agricultural sector. We initially argued that agricultural ODA is showing an increasing trend. Following the main international aid analysis, however, we must keep in mind that the financial crisis that engulfed the wealthiest countries post-2008 played a non-negligible role in the downsizing of aid flows in general.

As we mentioned in the setup of this thesis, we wanted to diversify our research since recent studies analysing the role of ODA towards agriculture are likely direct to poverty reduction per se. Hence, data unavailability only allowed selected measures on some agricultural variables. When it comes to the analysis and comparisons across the datasets used, some problems arise. More specifically, they differ not only in terms of how a sector is defined (all the minor agro-implications, whether they include forestry or other activities as in Appendix B) but

as well as time and country covered. One possible explanation can be linked to the fact that during the time span some countries moved from being recipients to being donors. To this extent, we argue that other possible dimensions, such as climate change impacting agriculture, should be considered (see for instance Asiedu et al., 2020). Moreover, it can be relevant, in the context of rural-driven economies, to account for other social explanatory variables, such as the access to agricultural land resources, the presence of farmer associations, the degree of education of the household, as well as the general outreach of international agri-projects. To this extent, rather than microcosm, we would rather suggest taking national averages. Also, endogenous aggregated data would have likely given more accurate information on considered variables capturing local and regional decision-making and mainly household characteristics.

Methodologically – as shown in detail in Appendix C – we developed a tailored Heckman's 2-step model, as well, to better capture the two stages characterizing aid allocation. This has been run as a robustness check and our results are partially in line with Ji and Lim (2018). The second stage (semantic or outcome model) is a linear regression accounting for X+1 set of independent variables. The Heckman two-step model is commonly specified with an additional explanatory variable in the selection model as we read in Baltagi (2013), arguing that, including the same independent variables in the selection and outcome models, results in large standard errors and over or under-estimated results due to introduced bias. In the context of this thesis and to avoid a possible non-linearity of the model, we suggest the use of the agricultural land variable as the categorical variable. The used implementation[3] is designed to analyze cross-sectional datasets; however, it would not fit our dataset. This is due to the fact that we would apply it to a panel dataset with likely cross-sectional dependence so that the iid – independent and identically distributed - assumption of the error term(s) is likely not fulfilled. Lastly, another methodological argumentation could arise from the panel structure of the dataset, given that economists could argue against our approach highlighting that a better estimation could be obtained using panel data random effect estimators, since fixed effects are not consistent in the context of Tobit model, and use Mundlak's (1978) to correct for the potential bias raised from the random effect. The key idea underlying Mundlak's approach is to add a group-mean of variables to relax the random-effects estimators' assumption of the uncorrelation between the observed and unobserved variables. This approach is useful to test whether such assumption holds for individual regressors, and it can provide a straightforward interpretation: these variables can be interpreted as long-term effects since they are not intertemporal. However, in our context, we could assume that u_{ijt} – the error term of the original random-effects model – are all zeros, meaning that all unobserved factors for each donor-recipient pair are identical or, even homogenous. This leads

[3] See Toomet, O., & Henningsen, A. (2008). "sampleSelection" package in R

us to conclude not to take advantage of the panel data estimates, given the absence of random effects; therefore, Mundlak's approach is not necessary.

Finally, analysing the key dynamic regulating ODA determinants and their impacts on recipients is fundamental to understand decision-makers' disbursements. Therefore, the straightforward policy implications that we derive is that this kind of sectoral ODA, perfectly responds to donors' interests and policy outcomes in the short run. The influence – i.e. higher ODA disbursed – is stronger, the farther away the two countries are geographically from each other since the only viable intervention is an economic one. As a result, the amount is higher after both typologies of exogenous shocks affecting these developing economies. Surprisingly, however, the ODA towards agricultural production responds better to classic ODA determinants, which are more substantial than the ones specific to the agricultural sector.

Conclusions

In this study, we examined whether empirical determinants can reliably explain DAC donor countries' trends when it comes to bilateral agricultural ODA, using a Tobit model. 29 DAC donor countries were tested to study the impact of classical determinants and agricultural characteristics (namely agricultural land, and the share of rural population) and their impact in 140 LDCs and low-middle-income countries from 2002 to 2018, with an emphasis on the effect of two exogenous global shocks. On the one hand, our analysis surprisingly shows that the coefficients of ODA's main classical determinants can reliably help understand bilateral agricultural aid. On the other hand, agricultural-related characteristics fail at providing us with a better explanation of the direction of agricultural ODA transfers. Moreover, the large statistically significant positive effects of the financial crisis (financial shock), and the adoption of the UN SDGs (governance shock) suggest that after these phenomena, bilateral agricultural ODA increased, trying to support the sustainable growth of the agricultural sector. We must bear in mind the political nature of bilateral ODA, which can be used as a soft-power tool. Donors' interests, and political agenda, therefore, must always be taken into consideration.

Although fluctuations in results are dependent on emerging findings of more specific and detailed data, this thesis remains unicum in the existing literature due to its embedding of a statistically significant Tobit Model in comparison to existing research. Nevertheless, future research efforts could endeavour towards involving more explanatory variables, not simply from the agricultural sector – e.g., access to agricultural land, resources, and agricultural education – but also originating from climate as a determinant of agriculture. In closing, by contributing to the ODA literature given the significant rise in bilateral ODA trends to agriculture by DAC donors, this thesis represents a unicum in scholarly literature thus far unexplored.

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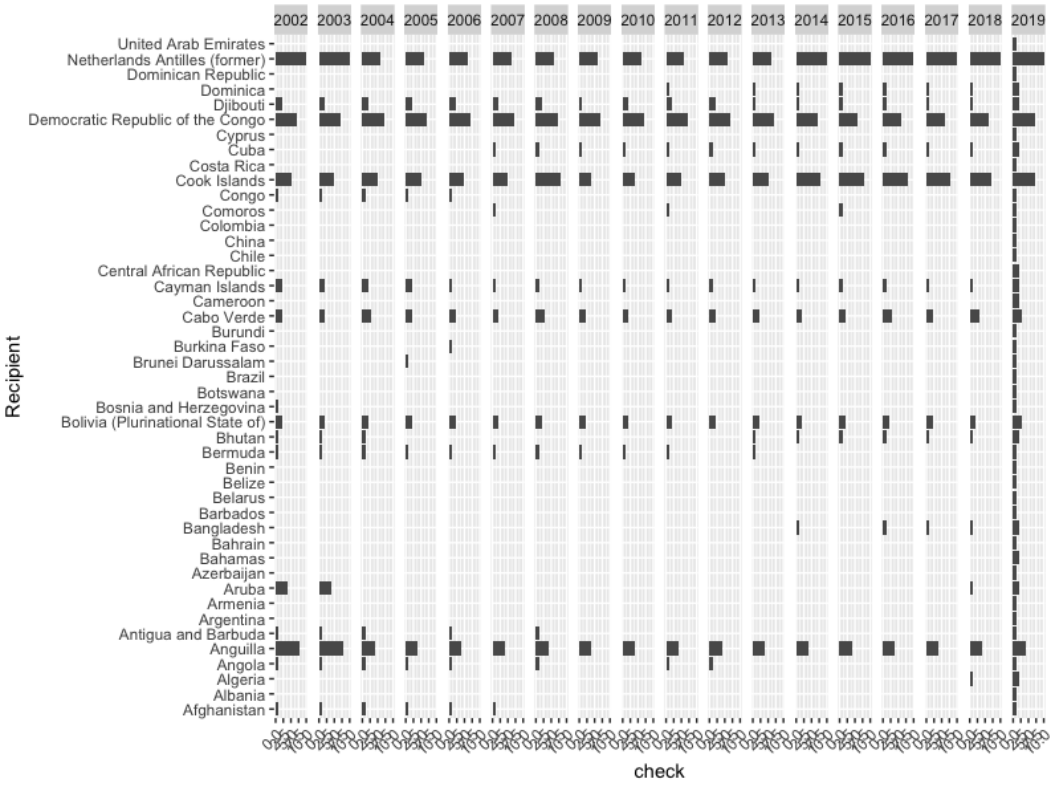
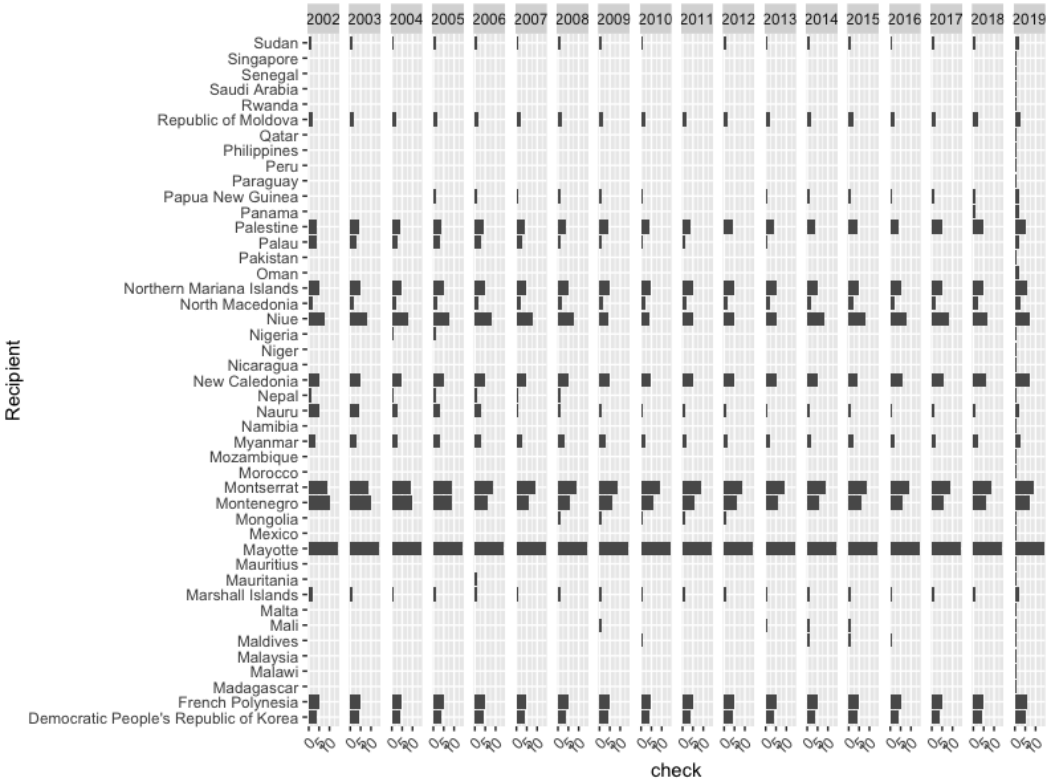
Appendices

Appendix 1. Analysis of missing data (NA's)

Below is the plotting of the filter used to select the explanatory variables and the recipient countries to include in the analysis, given the high presence of missing data (NA's) in both categories. The baseline of each quadrant represents the percentage of missing data.

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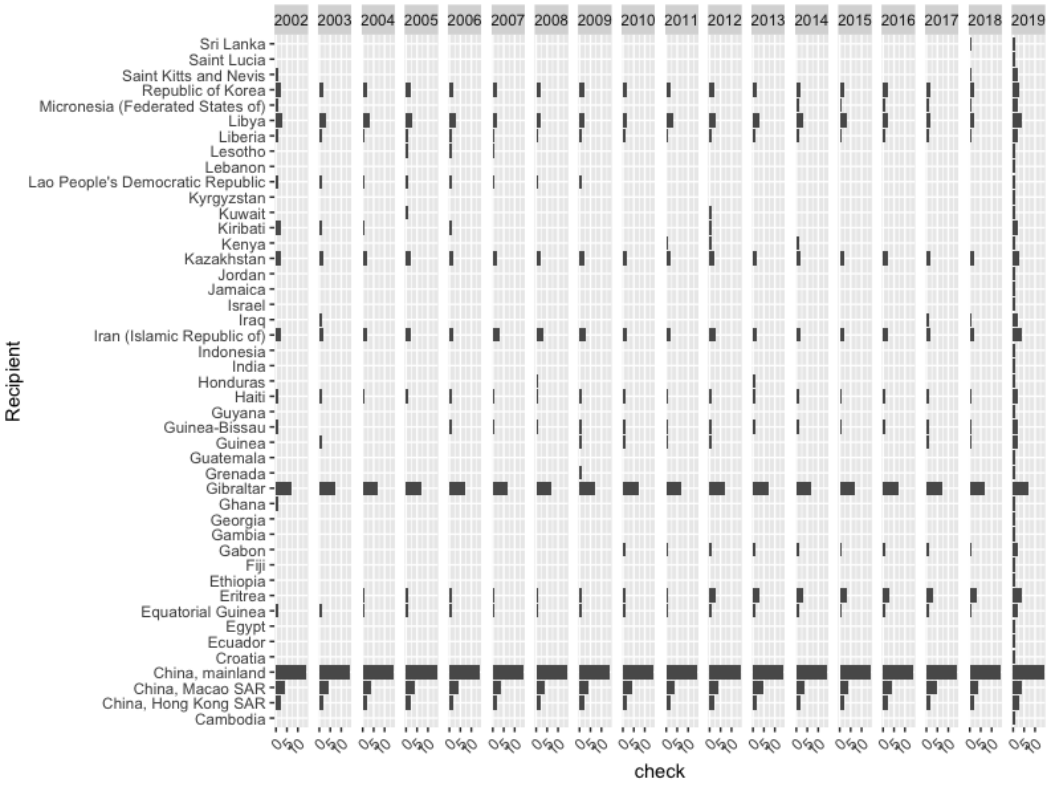
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Kuwait
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Kenya
Kazakhstan
Jordan
Jamaica
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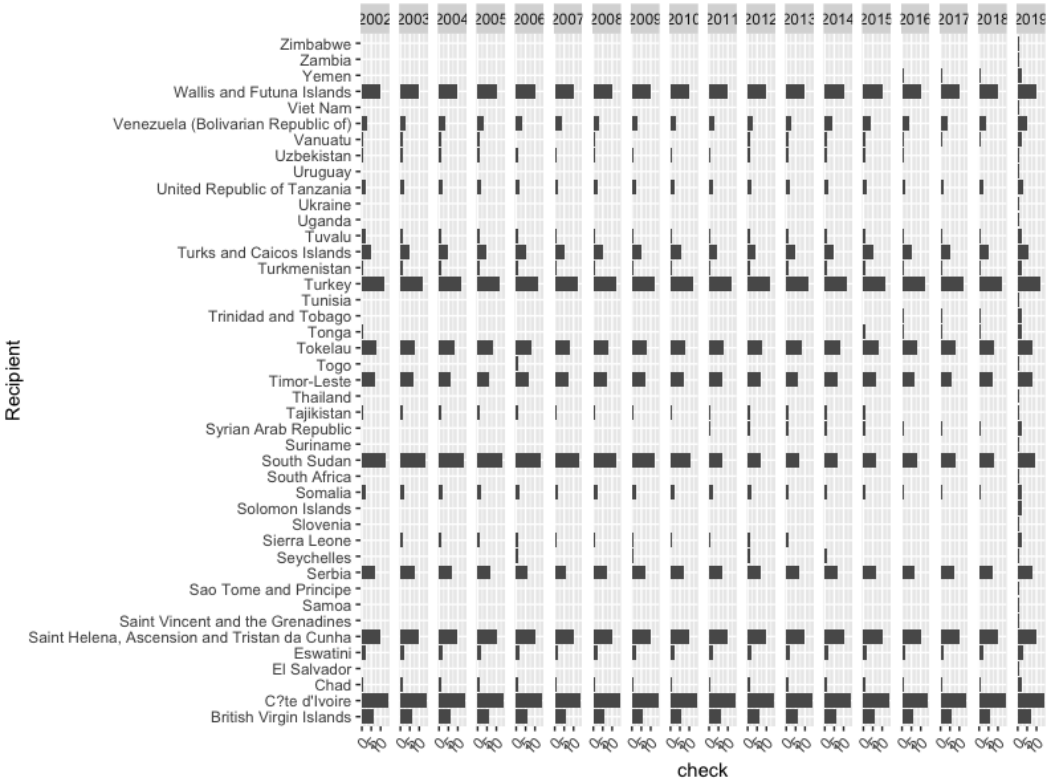
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Uruguay
United Republic of Tanzania
Ukraine
Uganda
Tuvalu
Turks and Caicos Islands
Turkmenistan
Turkey
Tunisia
Trinidad and Tobago
Tonga
Tokelau
Togo
Timor-Leste
Thailand
Tajikistan
Syrian Arab Republic
Suriname
South Sudan
South Africa
Somalia
Solomon Islands
Slovenia
Sierra Leone
Seychelles
Serbia
Sao Tome and Principe
Samoa
Saint Vincent and the Grenadines
Saint Helena, Ascension and Tristan da Cunha
Eswatini
El Salvador
Chad
C?te d'Ivoire
British Virgin Islands
Recipient
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Appendix 2. Break down description of the DAC 311 Purpose Code

Code	Subcode	Definition	Description
310		**Agriculture, Forestry, Fishing**	
311		**Agriculture**	
	31110	Agricultural policy and administrative management	Agricultural sector policy, planning and programmes; aid to agricultural ministries; institution capacity building and advice; unspecified agriculture.
	31120	Agricultural development	Integrated projects; farm development.
	31130	Agricultural land resources	Including soil degradation control; soil improvement; drainage of waterlogged areas; soil desalination; agricultural land surveys; land reclamation; erosion control, desertification control.
	31140	Agricultural water resources	Irrigation, reservoirs, hydraulic structures, ground water exploitation for agricultural use.
	31150	Agricultural inputs	Supply of seeds, fertilizers, agricultural machinery/equipment.
	31161	Food crop production	Including grains (wheat, rice, barley, maize, rye, oats, millet, sorghum); horticulture; vegetables; fruit and berries; other annual and perennial crops. [Use code 32161 for agro-industries.]
	31162	Industrial crops/export crops	Including sugar; coffee, cocoa, tea; oil seeds, nuts, kernels; fibre crops; tobacco; rubber. [Use code 32161 for agro-industries.]
	31163	Livestock	Animal husbandry; animal feed aid.
	31164	Agrarian reform	Including agricultural sector adjustment.
	31165	Agricultural alternative development	Projects to reduce illicit drug cultivation through other agricultural marketing and production opportunities (see code 43050 for non-

		agricultural alternative development).
31166	Agricultural extension	Non-formal training in agriculture.
31181	Agricultural education/training	
31182	Agricultural research	Plant breeding, physiology, genetic resources, ecology, taxonomy, disease control, agricultural biotechnology; including livestock research (animal health, breeding and genetics, nutrition, physiology).
31191	Agricultural services	Marketing policies & organisation; storage and transportation, creation of strategic reserves.
31192	Plant and post-harvest protection and pest control	Including integrated plant protection, biological plant protection activities, supply and management of agrochemicals, supply of pesticides, plant protection policy and legislation.
31193	Agricultural financial services	Financial intermediaries for the agricultural sector including credit schemes; crop insurance.
31194	Agricultural co-operatives	Including farmers' organizations.
31195	Livestock/veterinary services	Animal health and management, genetic resources, feed resources.

Source: own elaboration, based on FAOStat and OECDStat ODA Description, Code 311.

Appendix 3. Robustness check: Heckman's and Tobit comparison

Below is the "Estimated results for ODA to the agriculture production sector: Heckman vs Tobit", namely the comparison between Heckman's two-step selection model and the censored Tobit. The former has been computed using the heckit() function in the package sampleSelection in R, whilst the latter uses the censReg() function.

In our analysis, the first stage is represented by equation 1. This so-called selection model explains the dependent variable (AID) being equal to 0 when Value is equal to 0, and the first stage dependent variable equal to 1 when Value greater than 0.

$$\begin{cases} \mathrm{Y}_{\mathrm{AID}_{\mathrm{ij}}} = 1 \text{ if } \mathrm{Y}_{\mathrm{Value}_{\mathrm{ijt}}} > 0 \\ \mathrm{Y}_{\mathrm{AID}_{\mathrm{ijt}}} = 0 \text{ if } \mathrm{Y}_{\mathrm{Value}_{\mathrm{ijt}}} \leq 0 \end{cases}$$

The dummy variable AID is observed if the ODA transfer (Value) is greater than zero. This is because the donor country first decides whether to allocate aid at all. An unobserved part (μ_{ijt}) normally distributed correlates with the probit model.

$$\begin{aligned} \Pr(\mathrm{AID}_{\mathrm{ijt}} = 1) = \Phi \Big\{ & \alpha_0 + \alpha_1 \mathrm{landlocked}_{\mathrm{ij}} + \alpha_2 \mathrm{comlang}_{\mathrm{off}_{\mathrm{ij}}} + \alpha_3 \mathrm{colony}_{\mathrm{ij}} + \\ & \alpha_4 ln(\mathrm{distance})_{\mathrm{ij}} + \alpha_5 rural_{pop_{it}} + \alpha_6 ln(\mathrm{GDP\_percapita})_{it} + \alpha_7 \mathrm{agri}_{\mathrm{land}_{it}} + \\ & \alpha_8 \mathrm{corr}_{\mathrm{it}-1} + \alpha_9 \mathrm{gov\_eff}_{\mathrm{it}-1} + \alpha_{10} \mathrm{RoL}_{\mathrm{it}-1} + \alpha_{11} \mathrm{stability}_{\mathrm{it}-1} + \alpha_{12} \mathrm{SDGs}_{\mathrm{t}} + \\ & \alpha_{13} \mathrm{financial}_{\mathrm{t}} + \mu_{\mathrm{ijt}} \Big\} \end{aligned} \quad (1)$$

In the second stage (outcome model), the OLS linear regression considers the amount disbursed by using empirical determinants as explanatory variables. In equation 2, we included the presence of the so-called Inverse Mills ratio (IMR), used as a correction term. Recalling Ji and Lim (2018), the IMR indicates the probability that a donor transfers ODA "over the cumulative probability of a country's decision, which addresses potential selection bias when using OLS (2018, p.211). The error term ($\varepsilon_{\mathrm{ijt}}$) is iid with a N(0, 1) distribution.

$$\begin{aligned} (\ln(\mathrm{Value})_{\mathrm{ijt}} | \mathrm{AID}_{\mathrm{ijt}} = 1) = {} & \beta_0 + \beta_1 \mathrm{landlocked}_{\mathrm{i}} + \beta_2 \mathrm{comlang}_{\mathrm{off}_{\mathrm{i}}} + \beta_3 \mathrm{colony}_{\mathrm{i}} + \\ & \beta_4 ln(\mathrm{distance})_{\mathrm{ij}} + \beta_5 rural_{pop_{it}} + \beta_6 ln(\mathrm{GDP\_percapita})_{it} + \beta_7 \mathrm{corr}_{\mathrm{it}-1} + \\ & \beta_8 \mathrm{gov}_{\mathrm{eff}_{\mathrm{it}-1}} + \beta_9 \mathrm{RoL}_{\mathrm{it}-1} + \beta_{10} \mathrm{stability}_{\mathrm{it}-1} + \beta_{11} \mathrm{SDGs}_{\mathrm{t}} + \beta_{12} \mathrm{financial}_{\mathrm{t}} + \varepsilon_{\mathrm{ijt}} \end{aligned} \quad (2)$$

Results for ODA to the agriculture production sector: Heckman vs Tobit

	Dependent variable: Value ODA (ln)	
	Heckman selection (1)	censored regression (2)
landlocked	0.0865	0.2040***
	(0.0685)	(0.0576)
common language	1.2213***	2.0989***
	(0.2121)	(0.0685)
colonial tie	1.9461***	3.5153***
	(0.2946)	(0.1229)
distance (ln)	0.2515***	0.2897***
	(0.0578)	(0.0387)
GDP_2015 (ln)	-1.4788***	-1.3649***
	(0.1945)	(0.0349)
rural population (%)	-0.0146***	-0.0141***
	(0.0036)	(0.0013)
agricultural land (%)		0.0079***
		(0.0011)
corruption (t-1)	-0.8268***	-0.9093***
	(0.1593)	(0.0674)
government efficiency (t-1)	2.1085***	2.2762***
	(0.3320)	(0.0687)
rule of law (t-1)	-0.5591***	-0.3633***
	(0.1394)	(0.0730)
political stability (t-1)	-0.4642***	-0.6414***
	(0.0737)	(0.0339)
SDGs	0.0822	0.2305***
	(0.0744)	(0.0534)
financial	0.7153***	0.6735***
	(0.0985)	(0.0482)
logSigma		1.6349***
		(0.0029)
Constant	4.3250***	-2.8065***
	(0.8321)	(0.4764)
Observations	60,904	60,904
R^2	0.0451	
Adjusted R^2	0.0442	
Log Likelihood		-185,989.0000
Akaike Inf. Crit.		372,007.9000
Bayesian Inf. Crit.		372,143.2000
rho	0.7410	
Inverse Mills Ratio	2.7206*** (0.5563)	

Note: standard errors in parentheses * p < 0.1; ** p < 0.05; *** p < 0.01.

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