Foreign Aid, Exchange Rate, and Agricultural Trade in Developing Countries [*]

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Abstract

We consider the effects of official development assistance (ODA) from rich donor countries on the agricultural trade in poor recipient countries. We first examine the hypothesis that the ODA, as a foreign-exchange inflow, appreciates the domestic currency of recipient countries. Using the constructed data in the period of 2001–2018 at the country level, we find that the ODA inflows cause appreciation of the real exchange rate in recipient countries, a floating exchange regime countries in particular. We then test whether the ODA inflow influences the agricultural exports from recipient countries through the channel of the exchange rate. Relying on the country-product level trade data, we find that, in the response to greater ODA inflow, the exports of the agricultural sector decline wherein the export in the manufacturing sector still remains. The negative effects of the exchange rate on agricultural exports in those countries are more pronounced in processed food products than raw commodity products. This study highlights the importance of a macroeconomic perspective in which foreign aid is provided, so called *Dutch Disease*.

Keywords: Foreign Aid, Official Development Assistance, Exchange Rate, Agricultural Trade, Exports

JEL codes:

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1 Introduction

The potential impact of foreign aid on economic development in poor recipient countries has been a long controversial and debated issue. Contrary to the conventional wisdom that foreign aid fosters economic growth and development (Dalgaard, Hansen and Tarp, 2004; Mekasha and Tarp, 2013), foreign aid often leads to adverse economic impact in recipient countries, so-called "*Dead Aid*", notably argued by Moyo (2009). Vast empirical studies support a skeptical view on the optimistic narratives on the role of foreign aids for development in the recipient countries: One strand of the existing literature finds that foreign aid is not necessarily linked to economic growth (Hansen and Tarp, 2001; Rajan and Subramanian, 2008). Another strand of literature highlights that provision of foreign aids is more politically considered by donor rich countries' international hegemony over recipient governments (Alesina and Dollar, 2000; Collier and Dollar, 2002; Bermeo, 2011). In turn, the distribution of foreign aid has been often radically different from the poverty-efficient allocation (Collier and Dollar, 2002).

Official development assistance (hereafter ODA) has been considered a multifaceted foreign aid policy. Since late 1960, ODA has widely spread as a primary foreign aid source from the OECD Development Assistance Committee (DAC) in order to promote the economic development and welfare of developing countries. Over the past five decades, the disbursement amount of ODA has remarkably risen, approximately growing four times every year and the annual average of ODA was over 151 billion dollars in the period of 2010-2019. Regarding the effectiveness of ODA, there is a growing consensus that the ODA inflow leads to positive economic growth in recipient countries (Burnside and Dollar, 2000; Yasin, 2005; Karras, 2006; Bhavan, Xu and Zhong, 2011; Driffield and Jones, 2013; Benmamoun and Lehnert, 2013; Anyanwu, 2014). Although the literature on the impacts of ODA on economic development is voluminous, much of the attention is still focused on economic growth.

In this study, we look at the impact of ODA on international trade in recipient countries.

In contrast to previous literature on ODA, we view the ODA as a foreign capital inflow that often interrupts the real exchange rate. The inflow of foreign capital overvalues domestic currency leading to the exchange rate appreciation of recipient countries. In turn, those countries have incentives to reallocate their economic resources whereby the exchange rate appreciation is likely to generate a decline in exports by transforming the economic structure of the labor share and tradable industries, commonly named *Dutch disease*. By looking at ODA as a foreign capital inflow, one expects that ODA, originally designed to foster economic development in developing countries, is likely to overvalue their domestic currency and consequently weaken their trade competitiveness (Rajan and Subramanian, 2005; Djankov, Montalvo and Reynal-Querol, 2008).

Here we investigate how the exchange rate responded to the foreign aid inflow in the form of ODA, as well as whether the foreign aid from rich countries causes Dutch disease by reducing agricultural exports from poor recipient countries through the channel of exchange rate appreciation. The answers to these questions are of great importance in agrarian developing countries. While almost every modern nation runs a flexible exchange rate regime since advocated by Friedman et al. (1953), most developing agrarian countries still continue to have a fixed exchange rate regime to protect food security from foreign export market fluctuations in open economies (Schuh, 1974).[1] Understanding how the ODA inflow potentially interrupts their trade and how their exchange rate regimes operate as a mechanism provide a unique opportunity to rethink existing policies on ODA and exchange rate regimes.

To do so, we begin by assessing whether the ODA inflow from donor countries leads to an appreciation of the real exchange rate in recipient countries. Using panel data consisting of 47 ODA countries combined with the real exchange rate data collected from multiple administrated databases, we find that the ODA inflow is positively and significantly associated with the exchange rate appreciation in recipient countries. Given that

[1]Dating back to the early 1970s, a strand of literature developed a theoretical mechanism through which exchange-rate stability influences trade flows (Clark, 1973; Cushman, 1983; Baldwin and Krugman, 1989; Bacchetta and Van Wincoop, 2000; Gali and Monacelli, 2005)

many agrarian developing countries have a fixed exchange rate regime, we further investigate whether the association between ODA and exchange rate shows a different pattern by exchange rate regime. Our empirical results suggest that the effect of the ODA inflow on exchange rate appreciation is primarily driven by floating exchange rate regime countries than fixed exchange regime countries.

We then analyze whether the ODA inflow ultimately influences agricultural exports of those recipient countries. By incorporating the product-country level bilateral trade data (two-digit HS codes), we find that, unlike manufacturing export, the exports in the agricultural sector–a primary export sector in the ODA recipient countries–declines in the response to greater ODA inflow, particularly in the floating exchange rate regimes. The negative export effects of the ODA inflow are more pronounced in the processed food sector than in the raw commodities and livestock sector. Taken together, our findings suggest that the ODA inflow from rich countries to recipient agrarian countries unexpectedly leads to a decrease in the export of their main industry through the channel of the exchange rate appreciation.

The rest of the paper is organized as follows. Section 2 presents the data and discusses the descriptive statistics. Section 3 presents the empirical framework and the estimation results of the effects of the ODA inflow on the real exchange rate. Section 4 assesses whether the ODA inflow influences export in recipient countries through the channel of the exchange rate. In section 5 concludes with policy implications.

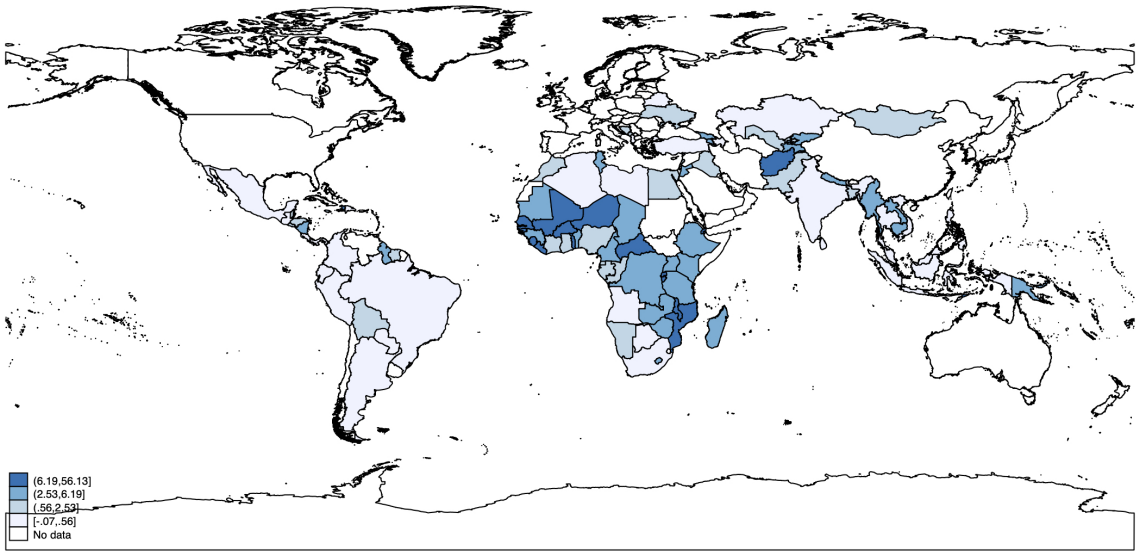
2 Data and Descriptive Statistics

ODA The data used for the empirical analysis is an unbalance panel that consists of 47 countries. Not all ODA recipient countries are included, instead, countries that fulfill either ODA-GNI ratio (%) is greater than 6.34 (upper 75%) or ODA per capita is greater than 79.639 U.S. dollars a year (upper 75%). ODA(total net) is the main explanatory variable of our interest. ODA includes grants, capital subscriptions, total net loans, and other long-

term capital. This is measured by the constant US Dollar(2017 prices). The source of ODA is OECD.

Figure 1 shows the ODA-GNI ratio in 2019 across the world. The darker the blue color, the higher the ODA-GNI ratio. Most recipient countries are the nations of South and South-east Asia, Africa and Latin America.

FIGURE 1: ODA-GNI Ratio(%) in 2019



Source: OECD

Real Exchange Rate The dependent variable is the real exchange rate. This measures the real value of a country's currency against the basket of the trading partners of the country. The source of this variable is Darvas (2021). This dataset covers an extensive number of countries collecting from various sources such as the World Bank, the Eurostat, the BIS, and the OECD. Two versions of the exchange rate are available: a broad and narrow index that considers 172 and 67 trading partners, respectively (increase in the index represents appreciation). The narrow index is used in the current study for data availability.

Exchange Rate Regime The exchange rate regime classification is from Shambaugh

TABLE 1: ODA Recipient Country List

Country	Sample Period		LDICs (Yes=1)	Ex. Regime (Floating=1)	Floating ratio (%)
Afghanistan	2006	2017	1	1	77.7
Albania	2001	2018	0	1	55.5
Antigua & Barbuda	2001	2018	0	0	0
Armenia	2001	2018	0	1	77.7
Bhutan	2001	2018	1	0	0
Bosnia & Herzegovina	2004	2018	0	0	0
Burkina Faso	2005	2017	1	0	0
Burundi	2001	2018	1	1	83.3
Cape Verde	2006	2018	1	1	16.6
Dem. Rep. of Congo	2006	2018	1	1	72.2
Dominica	2001	2018	0	0	0
Fiji	2001	2018	0	1	100
Gambia	2001	2018	1	1	100
Georgia	2003	2018	0	1	100
Grenada	2001	2018	0	0	0
Guinea-Bissau	2005	2017	1	0	0
Guyana	2001	2018	0	0	0
Haiti	2001	2018	1	1	83.3
Iraq	2010	2016	0	0	27.7
Jordan	2014	2018	0	0	0
Kyrgyz Republic	2001	2018	1	1	77.7
Liberia	2007	2017	1	1	100
Madagascar	2005	2018	1	1	100
Maldives	2001	2018	0	1	5.5
Mali	2005	2017	1	0	0
Mauritania	2012	2017	1	1	88.8
Moldova	2001	2018	1	1	88.8
Mongolia	2001	2018	1	1	88.8
Mozambique	2001	2018	1	1	88.8
Namibia	2001	2018	0	0	0
Nicaragua	2001	2018	1	1	100
Niger	2005	2017	1	0	0
Rwanda	2001	2018	1	1	55.5
Saint Kitts and Nevis	2001	2013	0	0	0
Saint Lucia	2001	2018	0	0	0
Saint Vincent & Grenadines	2004	2018	0	0	0
Samoa	2001	2018	0	1	100
Sao Tome & Principe	2002	2018	1	1	50
Seychelles	2001	2017	0	1	72.2
Sierra Leone	2001	2018	1	1	66.6
Solomon Islands	2001	2018	1	1	44.4
Suriname	2001	2018	0	1	16.6
Tanzania	2001	2018	1	1	72.2
Tonga	2012	2018	0	1	100
Uganda	2001	2018	1	1	100
Vanuatu	2001	2018	1	1	100
Zambia	2001	2018	1	1	100

Notes:

(2004) and Shambaugh (2010). Countries that continue to adopt fixed exchange rate regimes from 2001 to 2018 are classified as fixed regime countries. If countries adopt the floating exchange rate regime at least once during the sample period, those countries are regarded as floating regime countries. There is one exception, which is Iraq. According to this regime classification, Iraq should be identified as a floating regime country (Table 1). However, Iraq had never opted for the floating regime during the sample period used for the analysis, it is regarded as a fixed regime country.[2] We will conduct the robustness test on this dummy variable by using a time-varying variable of the regime classification.

Control Variables in the Baseline Model A set of other control variables that affect the real exchange rate is ODA, central bank's net foreign asset, VIX index, and real interest rate difference. Since the foreign exchange intervention has a significant impact on the exchange rate, we take that into account by including the central bank's net foreign asset, which is a good proxy variable for the foreign exchange intervention. The source of the central bank's net foreign asset is the IFS (IMF). The VIX index and real interest rate difference (vis-a-vis the U.S.) are included to capture the global financial market uncertainty and UIP condition, respectively. The source of the VIX index is the Chicago Board Options Exchange and that of real interest rate is the World Bank.

Control Variables in the Extended Model In addition to those four explanatory variables in the baseline model, we include five additional control variables in the extended model to check the robustness of the baseline result. Those control variables are GDP per capita, expected GDP growth, trade balance, trade openness, and net foreign asset. The expected GDP growth is calculated by the GDP growth realized minus the forecast of the GDP growth rate. The first two are values of difference with respect to the center country, the U.S., and the last three variables are all expressed as a percentage of GDP. All additional explanatory variables are taken from the World Bank except for the forecasts of the

[2]The measure of exchange rate regime, the peg is classified based on the classification used in Shambaugh (2004). Peg countries should meet the following two: 1. staying within 2% bands against the base currency or zero volatility in all months except for a one-off devaluation; 2. Countries must be pegged for 2 consecutive years to be counted as a peg to avoid spuriously classifying observations as pegs due to random lack of volatility.

GDP growth. This is from the World Economic Outlook (IMF).

3 ODA and Exchange Rates: Through the lens of Exchange Rate Regime

We now turn to our empirical estimation. Recall that our two key hypotheses are: (i) whether the ODA inflow from donor countries leads to an appreciation of the real exchange rate in recipient countries; (ii) whether the ODA inflow further affects agricultural exports from recipient countries through the channel of the exchange rate, in particular types of exchange rate regimes. In section 3, we empirically test our first hypothesis. In section 3.1, we test whether the inflow of ODA affects the real exchange rate appreciation in the recipient country. We then look at whether types of exchange rate regimes in recipient countries operate as a mechanism where the ODA inflow is associated with exchange rate in section 3.2. We further check if our results are robust to alternative specifications and measures in section 3.3.

3.1 The Effects of ODA on Exchange Rates

In order to test our first hypothesis, relying on Adler, Lisack and Mano (2019*b*), we set up the following regression specification and estimate using Arellano-Bond estimation. [3]

$$\ln(REER_{it}) = \alpha + \beta \ln(REER_{i,t-1}) + \gamma \ln(ODA_{it}) + \Gamma' X_{it} + \varepsilon_{it} \tag{1}$$

where $REER_{it}$ is the index of real effective exchange rate (REER) in county i in year t; ODA_{it} is the total value of ODA inflow to country i from all donor countries; X_{it} is a set of control Variables; it is an error term with mean zero.

[3] Adler, Lisack and Mano (2019*b*) use a two-stage least squares approach with instrumental Variables to deal with the endogeneity problem. Since explanatory variables in Adler, Lisack and Mano (2019*b*) are included as control Variables in the current study, we use a simple regression focusing on the relationship between ODA and exchange rate.

A REER is a trade-weighted multilateral index by averaging the bilateral real exchange rates between a country and each of its trading partners. The REER adjusts a nominal effective exchange rate by the appropriate foreign price level and deflates by the home country price level. Instead of a real exchange rate, REER is suited to our analysis because REER focuses on overall price competitiveness of the country's export (McGuirk, 1986; Catão, 2007).

We include a broad set of country-level covariates (X_{it}), guided by the considerable empirical literature on determinants of exchange rate (Phillips et al., 2013; Adler, Lisack and Mano, 2019*a*). To control for foreign exchange intervention (FXI), we include the Central Bank's net foreign asset (% of GDP, differential). To control for global risk aversion, we include the level of the Chicago Board Options Exchange Market Volatility Index (VIX). To control for the effect of simultaneous changes in the interest rate on the exchange rate, we include interest rate differential. In addition, the expanded set of controls includes exchange rate determinants including GDP per capita (log, differential), Expected GDP growth differential, Net foreign asset (% of GDP) as well as trade covariates including trade balance (% of GDP) and Trade openness (% of GDP).

Table 2 presents the estimation results. In Column (1), we start by checking our estimation result aligns with the existing literature on exchange rate determinants excluding the ODA inflow. In turn, we confirm that the sign of our coefficient of the lagged real exchange rate is consistent with Adler, Lisack and Mano (2019*b*). In addition, the foreign exchange market intervention, that is measured by the % change in central bank's net foreign asset to GDP ratio, is negatively associated with exchange rate meaning that as the central bank intervenes more in the foreign exchange market, the local currency values is more likely to depreciate. The VIX index is included to reflect the global financial condition. The difference between domestic and the U.S. real interest rate is also included to consider the channel through which interest rates affect exchange rate based on the UIP condition.

Column (2) reports our main interest parameter, γ. A positive value of γ would indicate that ODA inflow appreciates the domestic currency of recipient country. The coeffi-

cient is 1.861 and is statistically significant at the 5 percent level. This result means that ODA is positively associated with real exchange rate. That said, ODA inflow from rich donor countries is likely to appreciate the domestic currency in poor recipient countries on average. In Columns (3) and (4), we repeat the analysis extending the set of our control Variables. The positive effect of ODA inflow, however, no longer holds while the lagged exchange rate is still valid to explain the exchange rate.

TABLE 2: The Effects of ODA on Exchange Rate

Variables	Real Effective Exchange Rate (REER, log)			
	(1)	(2)	(3)	(4)
REER (lagged, log)	0.680***	0.674***	0.501***	0.510***
	(0.064)	(0.067)	(0.104)	(0.103)
ODA (log)		1.861**		0.307
		(0.762)		(0.987)
Foreign exchange intervention (diff.)	-0.002***	-0.002***	-0.173	-0.183*
	(0.001)	(0.001)	(0.107)	(0.109)
Volatility Index (VIX)	0.005	-0.002	0.031	0.025
	(0.032)	(0.034)	(0.047)	(0.048)
Real interest rate (diff.)	0.065	0.074	0.135**	0.133**
	(0.062)	(0.061)	(0.064)	(0.064)
GDP per capita (diff.)			10.849	10.458
			(8.264)	(8.345)
Expected GDP growth (diff.)			0.103	0.104
			(0.097)	(0.097)
Trade balance (% of GDP)			-0.114	-0.121*
			(0.069)	(0.069)
Trade openness (% of GDP)			-0.062	-0.067
			(0.044)	(0.046)
Net foreign asset (% of GDP)			0.243***	0.252***
			(0.084)	(0.088)
Constant	33.878***	-0.977	78.531***	70.905**
	(6.111)	(14.948)	(29.381)	(35.813)
Obs.	648	642	495	493
Number of countries	47	47	40	40

Notes: $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

It is noteworthy that a number of recipient countries employ fixed exchange rate regimes in which a domestic currency's value is fixed (or pegged) by a monetary authority against the value of trading partner currency. A natural question is then "Is an exchange rate regime a mechanism where the ODA inflow leads exchange rate appreciation in those countries." To answer to this question, Section 3.2 looks at the role of exchange rate regimes

in recipient countries.

3.2 Mechanism: Do Exchange Rate Regimes Matter?

Building on our findings from Section 2, we next test whether recipient countries' exchange rate regimes play a mechanism where the ODA inflow leads the exchange rate appreciation. To do so, we estimate the equation:

$$\ln(REER_{it}) = \alpha + \beta \ln(REER_{i,t-1}) + \gamma \ln(ODA_{it}) + \delta \ln(ODA_{it}) \cdot Floating_{it} + \Gamma' X_{it} + \varepsilon_{it} \tag{2}$$

where $Floating_{it}$ denotes an indicator variable for whether a recipient country i's exchange rate regime employs a floating exchange regime in year i (i.e., a floating exchange regime = 1; a fixed exchange rate regime = 0). The δ interaction term represents the marginal effect of ODA inflow on export when the country i adopts a floating regime.

Table 3 presents estimation results similar to Table 2. Estimation results for Equation 2, where the first column shows results for the interaction term, whereas the next two columns respectively show results for floating exchange rate regime and fixed exchange rate regime. In sum, the results in Table 3 show that an increase of ODA inflow is positively associated with the exchange rate appreciation in recipient countries with floating exchange rate regime, and that this association is significant at less than the 1 percent level (see columns (1) and (2)). Yet, no exchange rate effects of ODA inflow found in fixed exchange rate regime countries in column (3). This result holds in the extended model including a broader set of control variables in columns (4)–(6).

3.3 Robustness Checks

We conduct additional robustness checks and report the results in Table 4. First, we consider time-varying exchange rate regime classification by including an indicator variable. As some recipient countries changed their exchange rate regimes over years, this alterna-

TABLE 3: Effects of ODA on Exchange Rate: Floating vs. Fixed Regime

Variables	Real Effective Exchange Rate (REER, log)					
	All	Floating	Fixed	All	Floating	Fixed
	(1)	(2)	(3)	(4)	(5)	(6)
REER (lagged, log)	0.670***	0.723***	0.632***	0.502***	0.595***	0.472***
	(0.070)	(0.062)	(0.058)	(0.107)	(0.085)	(0.043)
ODA (log)	-0.197	5.651***	-0.412	-4.627**	3.538***	-2.014*
	(0.436)	(1.230)	(0.475)	(2.281)	(1.334)	(1.132)
ODA $\times Floating$	5.555***			7.379***		
	(1.194)			(2.418)		
Foreign exchange intervention (diff.)	-0.002***	-0.002***	0.059	-0.222**	-0.267*	-0.115
	(0.001)	(0.001)	(0.108)	(0.108)	(0.138)	(0.126)
Volatility Index (VIX)	-0.000	-0.041	0.067	0.032	-0.008	0.190*
	(0.034)	(0.042)	(0.054)	(0.047)	(0.048)	(0.101)
Real interest rate (diff.)	0.069	0.020	0.079	0.128**	0.062	0.256***
	(0.062)	(0.066)	(0.090)	(0.065)	(0.058)	(0.098)
GDP per capita (diff.)				8.709	3.992	-2.414
				(8.120)	(8.743)	(4.199)
Expected GDP growth (diff.)				0.088	0.156*	-0.148
				(0.099)	(0.081)	(0.195)
Trade balance (% of GDP)				-0.110	-0.070	0.042
				(0.069)	(0.081)	(0.063)
Trade openness (% of GDP)				-0.066	-0.080	-0.135***
				(0.048)	(0.061)	(0.037)
Net foreign asset (% of GDP)				0.245***	0.254***	0.097**
				(0.081)	(0.096)	(0.044)
Constant	-35.514**	-79.384***	44.255***	55.445	-14.565	93.027***
	(17.575)	(24.160)	(10.215)	(35.561)	(40.237)	(21.408)
Obs.	642	443	199	493	370	123
Number of countries	47	31	16	40	28	12

Notes: $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

tive specification checks our results are still robust to time-vary exchange rate regimes in a subset of our sample in Columns (1)-(3). Second, we test whether our specification in Equation 2 is still valid when extending our lags of dependent variable in the set of explanatory variables up to two years in Columns (4)-(5). In all cases, our results are robust to a host of both alternative specifications. The coefficient of the interation term between ODA inflow and floating exchange rate regime, (δ in Equation 2), is positively significant at less than the 1 percent level in both columns (1) and (4). The results are pronounced in floating exchange rate regimes, which aligns with the results from Table 3 (see columns (2) and (4)).

As a further robustness check, we test whether our results are robust to alternative

TABLE 4: Robustness: Alternative Specifications

Variables	Real Effective Exchange Rate (REER, log)					
	Time-varying Exchange Rate Regime			Alternative Exchange Rate		
		Floating	Fixed		Floating	Fixed
	(1)	(2)	(3)	(4)	(5)	(6)
REER (lagged, log)	0.497***	0.443***	0.402***	0.618***	0.727***	0.606***
	(0.106)	(0.088)	(0.060)	(0.121)	(0.112)	(0.057)
REER (lagged 2, log)				-0.153***	-0.178***	-0.196***
				(0.052)	(0.062)	(0.066)
ODA (log)	-4.568**	3.621**	-1.369	-4.058**	3.770***	-1.819
	(2.248)	(1.561)	(1.019)	(1.885)	(1.362)	(1.113)
floating	0.869					
	(1.914)					
ODA $\times$ *Floating*	7.304***			7.042***		
	(2.383)			(2.131)		
Foreign exchange intervention (diff.)	-0.222**	-0.091	-0.212*	-0.214**	-0.240	-0.132
	(0.107)	(0.169)	(0.111)	(0.108)	(0.147)	(0.115)
Volatility Index (VIX)	0.028	0.070	0.111	0.005	-0.044	0.185*
	(0.050)	(0.063)	(0.082)	(0.046)	(0.045)	(0.098)
Real interest rate (diff.)	0.131**	0.114	0.226**	0.049	-0.025	0.184*
	(0.065)	(0.089)	(0.106)	(0.070)	(0.061)	(0.100)
GDP per capita (diff.)	9.115	10.160	3.849	11.669	8.793	-2.560
	(8.135)	(8.551)	(8.670)	(8.515)	(8.821)	(4.185)
Expected GDP growth (diff.)	0.094	0.123	0.120*	0.035	0.119	-0.203
	(0.107)	(0.214)	(0.067)	(0.115)	(0.085)	(0.213)
Trade balance (% of GDP)	-0.114	-0.140	0.030	-0.083	-0.024	0.050
	(0.072)	(0.110)	(0.065)	(0.068)	(0.092)	(0.053)
Trade openness (% of GDP)	-0.069	-0.088	-0.160***	-0.066	-0.088	-0.101***
	(0.048)	(0.091)	(0.034)	(0.049)	(0.063)	(0.039)
Net foreign asset (% of GDP)	0.248***	0.047	0.188***	0.201***	0.172*	0.092**
	(0.082)	(0.085)	(0.060)	(0.073)	(0.093)	(0.046)
Constant	56.666	16.686	105.882***	63.131*	2.687	92.802***
	(35.167)	(38.783)	(34.732)	(35.982)	(40.884)	(21.694)
Obs.	493	290	203	482	362	120
Number of countries	40	26	28	40	28	12

Notes:$^{***}p < 0.01; ^{**}p < 0.05; ^{*}p < 0.1$

measures of two key variables, the ODA inflow and the exchange rate. Instead using the constant price of ODA, we use the current price of ODA and report the results in Columns (1)-(3) of Table 4. Also, in order to check if our results are robust to a different source of ODA, we measure the ODA inflow using data from the World Bank need to add the detailed description and report the results in Columns (4)-(6). Our core relationship between $ODA \times Floating$ and $REER$ appear remarkably stable. In sum, our core results are largely robust to the additional specifications and alternative measures indicating that

the ODA inflow from donor countries to recipient developing countries leads the domestic currency appreciation, primarily in floating exchange rate regime countries.

TABLE 5: Robustness: Alternative Measures

	Real Effective Exchange Rate (REER, log)					
	Alternative ODA Measure			Alternative Exchange Rate		
Variables		Floating	Fixed		Floating	Fixed
	(1)	(2)	(3)	(4)	(5)	(6)
REER (lagged, log)	0.499***	0.588***	0.477***	0.530***	0.543***	0.669***
	(0.108)	(0.088)	(0.039)	(0.112)	(0.108)	(0.020)
ODA (log)	-2.434	5.381***	-1.222**	-1.109	2.821	-1.723***
	(1.752)	(1.541)	(0.623)	(0.781)	(2.033)	(0.212)
ODA $\times Floating$	6.701***			4.472**		
	(2.150)			(2.013)		
Foreign exchange intervention (diff.)	-0.214**	-0.290**	-0.103	-0.061	-0.130	0.010
	(0.107)	(0.140)	(0.127)	(0.174)	(0.211)	(0.130)
Volatility Index (VIX)	0.027	-0.026	0.190*	-0.008	-0.022	0.180***
	(0.049)	(0.050)	(0.099)	(0.070)	(0.082)	(0.044)
Real interest rate (diff.)	0.120*	0.052	0.253**	0.052	0.050	-0.206***
	(0.067)	(0.060)	(0.100)	(0.045)	(0.043)	(0.013)
GDP per capita (diff.)	6.158	0.408	-2.227	8.853	8.610	-10.452***
	(8.069)	(8.727)	(4.332)	(8.696)	(11.507)	(2.798)
Expected GDP growth (diff.)	0.081	0.150*	-0.140	0.287***	0.302***	-0.596***
	(0.097)	(0.082)	(0.180)	(0.079)	(0.077)	(0.160)
Trade balance (% of GDP)	-0.093	-0.064	0.041	-0.020	-0.098	0.085
	(0.068)	(0.082)	(0.062)	(0.082)	(0.099)	(0.069)
Trade openness (% of GDP)	-0.076	-0.101	-0.144***	-0.056	-0.076	-0.098***
	(0.048)	(0.063)	(0.032)	(0.066)	(0.066)	(0.032)
Net foreign asset (% of GDP)	0.227***	0.238***	0.104**	0.249**	0.412**	0.120***
	(0.074)	(0.089)	(0.046)	(0.127)	(0.192)	(0.033)
Constant	18.035	-57.005	78.492***	14.644	13.825	54.954***
	(37.716)	(43.680)	(13.354)	(49.775)	(57.399)	(16.170)
Obs.	495	370	125	215	191	24
Number of countries	40	28	12	16	13	3

Notes: $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

4 ODA and Agricultural Exports

In this section, we turn our attention to our hypothesis that test whether the ODA inflow, which leads the exchange rate appreciation in floating exchange rate regime countries, ultimately affects the agricultural exports from the recipient countries.

Following Silva and Tenreyro (2006), we use a Poisson pseudo-maximum-likelihood estimator. The equation of interest is

$$Export_{ijkt} = \alpha + \beta \ln(GDP_{it}) + \gamma \ln(ODA_{it}) + \delta \ln(ODA_{it}) \cdot Floating_{it} + A_i + A_{jt} + A_{kt} + \varepsilon_{it} \tag{3}$$

where $Export_{ijkt}$ is the value of export of product k from country i to country j in year t; GDP_{it} is the GDP per capita of exporting country; ODA_{it} is the total value of ODA inflow to country i from all donor countries; $Floating_{it}$ denotes a dummy variable indicating recipient country i's exchange rate regime classification in year t (i.e., a floating exchange regime = 1; a fixed exchange rate regime = 0). The interaction term represents the marginal effect of ODA inflow on export when the country i adopts a floating regime. To control for all the country-invariant unobserved heterogeneity within each year, we include recipient country fixed effects (A_i). We also include importing country-year fixed effects (A_{jt}) and product-year fixed effects (A_{kt}). it is an error term with mean zero.

Table 6 reports the estimation results by product classification. We begin by estimating the ODA inflow effects on the total export in recipient countries. Looking at our core coefficient of interest (δ) in Column (1), we find the negative association between the ODA inflow in floating exchange rate regimes and the exchange rate. The negative coefficient (-0.266) on the interaction term indicates the ODA inflow to recipient countries whose exchange rate is floating reduces the total exports. As shown in section 3, the result is consistent to our hypothesis that the ODA inflow is likely to lead a decrease in export which is driven by the domestic currency appreciated from the ODA inflow in floating exchange rate regime countries. In other words, the ODA flows in more, export decreases

more though which exchange rate channel.

TABLE 6: Effect of ODA on Export: Agricultural products(processed and non-processed) and Others

	Value of Export (log, %)				
	Total Export (1)	Total Agriculture (2)	Raw commodities & livestock (3)	Processed Foods (4)	Total Non-agriculture (5)
GDP per capita (log)	0.484***	0.199	0.342***	0.081	0.480***
	(0.117)	(0.153)	(0.130)	(0.248)	(0.135)
ODA (log)	0.101	0.407*	0.149	0.676**	0.024
	(0.142)	(0.232)	(0.120)	(0.294)	(0.114)
ODA $\times Floating$	-0.266*	-0.413*	-0.088	-0.856**	-0.177
	(0.154)	(0.236)	(0.123)	(0.345)	(0.127)
Constant	17.201***	12.595***	11.884***	14.073***	17.690***
	(1.645)	(1.687)	(1.290)	(3.132)	(1.784)
Recipient country FEs	yes	yes	yes	yes	yes
Donor country-year FEs	yes	yes	yes	yes	yes
Commodity-year FEs	yes	yes	yes	yes	yes
Obs.	85,620	50,765	40,524	32,833	78,911
Pseudo R-squared	0.661	0.460	0.478	0.508	0.700

Notes: $^{***}p < 0.01; ^{**}p < 0.05; ^{*}p < 0.1$

We then slice our sample into the agricultural sector and non-agricultural sector (i.e., manufacturing) to see whether the ODA effects on exports varied with exports by sectors. As reported in column (2) of Table 6, the agricultural exports declines in the response to a greater ODA inflow (-0.413) in the floating exchange rate regimes. In contrast, we find no statistical significant relationship between the ODA inflow and the non-agricultural exports. We further zoom in on the ODA effect on the agricultural exports. Using the classification of the HS code, we categorize the total agriculture into (i) raw commodities & livestock and (ii) processed foods.[4] Interestingly, the effects on the agricultural trade is driven from the processed food sector rather than the raw commodities & livestock sector. In column (4), the coefficient of $ODA \times Floating$ is -0.856 and statistically significant at the five percent level whereas no effect is found for raw commodities & live stock in column (3). The results suggest that the negative effects of the ODA inflow on the exports

[4]As noted in Appnedix Table A.1, we define the two digits HS code from 1 to 14 as raw commodities & livestock and from 15 to 24 as processed foods.

in recipient countries is primarily pronounced in the process food sector in the recipient countries with a floating exchange rate regime.

5 Conclusion

In spite of a long debate on the potential impact of foreign aid on economic development in poor recipient countries, the relationship between foreign aid and trade is still unanswered. Looking through the lens of ODA as a unique foreign capital inflow, we have studied the question of whether ODA foreign capital inflow from rich countries to poor countries is responsible for a decrease in agricultural exports in recipient countries in the channel of the exchange rate.

Using the constructed data from 47 ODA countries in the period of 2001–2018 at the country level combined with the product-country level bilateral trade data, the core of our analysis documents two primary findings: First, we find that the ODA inflows affect the currency appreciation in recipient countries with a floating exchange regime. Our finding confirms anecdotal accounts that foreign exchange inflow is likely to overvalue the domestic currency. Second, we find that the ODA inflow leads to a decline in the agricultural exports of the recipient countries, resulting in a reduction of their primary export in the international trade market.

Our findings shed light on a long-lasting debate around the negative effects of foreign aid–ODA in particular. Further, we contribute to the literature on agricultural trade and development by providing unexpected effects of foreign aid driven by exchange rate appreciation on agricultural export. Taken as a whole, our findings highlight the importance of understanding the foreign aid and exchange rate context when recipient countries take a floating exchange rate regime.

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Appendix

TABLE A.1: Product Classification

Product	HS code	Ratio to GDP (%) (mean)	(s.d)	Product Description
1	01-05	2.51	1.05	Live animals; animal products
2	06-14	2.02	.87	Vegetable products
3	15	.25	.26	Animal or vegetable fats and oils and their cleavage products,; prepared edible fats; animal or vegetable waxes
4	16-24	2.57	2.56	Prepared foodstuffs, beverages, spirits and vinegar; tobacco and manufactured tobacco substitutes
5	25-27	4.97	2.88	Mineral products
6	28-38	1.22	.77	Products of the chemical or allied industries
7	39-40	.56	.38	Plastics and articles thereof; rubber and articles thereof
8	41-43	.12	.09	Raw hides and skins, leather, furskins and articles thereof; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silk-worm gut)
9	44-46	1.24	.74	Wood and articles of wood; wood charcoal; cork and articles of cork; manufactures of straw, of esparto or of other plaiting materials; basketware and wickerwork
10	47-49	.22	.20	Pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard; paper and paperboard and articles thereof
11	50-63	1.73	.97	Textiles and textile articles
12	64-67	.16	.07	Footwear, headgear, umbrellas, sun umbrellas, walking-sticks, seat-sticks, whips, riding-crops and parts thereof; prepared feathers and articles made therewith; artificial flowers; articles of human hair
13	68-70	.08	.08	Articles of stone, plaster, cement, asbestos, mica or similar materials; ceramic products; glass and glassware
14	71	3.11	1.93	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal and articles thereof; imitation jewellery; coin
15	72-83	2.41	1.19	Base metals and articles of base metal
16	84-85	1.42	1.15	Machinery and mechanical appliances; electrical equipment; parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles
17	86-89	3.73	3.34	Vehicles, aircraft, vessels and associated transport equipment
18	90-92	.17	.15	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; clocks and watches; musical instruments; parts and accessories thereof
19	93	.02	.06	Arms and ammunition; parts and accessories thereof
20	94-96	.16	.11	Miscellaneous manufactured articles
21	97-98	.02	.03	Works of art, collectors' pieces and antiques

Notes:

TABLE A.2: Descriptive Statistics

	N	Mean	Std. Dev.	min	max	1st Perc.	p5	p25	p75	p95	99th Perc.
ODA (log)	732	19.12	1.71	10.6	22.61	14.86	16.21	17.99	20.47	21.59	22.31
lnoda cd total	732	19.09	1.71	11.41	22.63	14.98	16.17	17.87	20.42	21.56	22.32
REER (log, zsolt)	732	4.65	0.14	4.02	5.33	4.25	4.45	4.59	4.73	4.89	5.06
REER (log, wb)	340	4.61	0.12	4.13	5.07	4.22	4.39	4.56	4.67	4.8	4.88
Foreign exchange intervention	732	9.72	162.72	-2869.92	629.28	-22.55	-2.65	7.73	19.83	38.96	162.91
VIXCLS	732	19.28	6.38	11.09	32.7	11.09	11.09	14.23	24.2	32.7	32.7
Real interest rate (diff.)	732	5.78	9.34	-63.11	58.59	-17.87	-5.58	1.4	9.58	19.41	41.04
GDP per capita (log, diff.)	732	-2.46	0.97	-4.39	-.79	-4.23	-4.04	-3.34	-1.63	-1.05	-.86
Expected GDP growth (diff.)	684	2.37	3.15	-5.9	49.64	-3.2	-1.4	.61	3.78	6.69	11.4
Trade balance (% of GDP)	582	-14.67	11.65	-52.78	21.75	-49.53	-34.04	-21.42	-7.26	3.55	16.61
Trade openness (% of GDP)	582	83.15	37.78	20.96	225.02	27.63	35.11	54.37	101.99	163.25	200.73
Net foreign asset (% of GDP)	732	17.94	16.46	-37.98	96.18	-19.23	-5.25	8.25	26.96	47.21	68.31

Notes:$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$