Journal of Infrastructure, Policy and Development 2024, 8(10), 5356.
https://doi.org/10.24294/jipd.v8i10.5356

Article

The aid-corruption paradox in development: An examination of provinces in Indonesia

Donie Kadewandana[1,2,*], Ade Paranata[3,4], Viktória Endrődi-Kovács[5]

[1] Doctoral School of International Relations and Political Science, Corvinus University of Budapest, 1093 Budapest, Hungary
[2] Faculty of Communication Science, Universitas Pancasila, Jakarta Selatan 12640, Indonesia
[3] Doctoral School of Regional Policy and Economic, University of Pécs, 7622 Pécs, Hungary
[4] Faculty of Economics and Business, Mataram University, Mataram 83115, Indonesia
[5] Department of World Economy, Corvinus University of Budapest, 1093 Budapest, Hungary
*** Corresponding author:** Donie Kadewandana, doniekadewandana@univpancasila.ac.id

CITATION

Kadewandana D, Paranata A, Endrődi-Kovács V. (2024). The aid-corruption paradox in development: An examination of provinces in Indonesia. Journal of Infrastructure, Policy and Development. 8(10): 5356.
https://doi.org/10.24294/jipd.v8i10.5356

ARTICLE INFO

Received: 21 March 2024
Accepted: 25 June 2024
Available online: 23 September 2024

Abstract: The relationship between aid and corruption remains ambiguous. On the one hand, aid may benefit a country if the aid management system runs efficiently and transparently. On the other hand, aid tends to create new problems, namely corruption, especially in developing countries. This research examines the aid-corruption paradox in Indonesian provinces from a spatial perspective. The data was obtained from the Indonesian Ministry of Finance, the National Development Planning Agency of Indonesia, the Corruption Eradication Commission of Indonesia, and the Electronic Procurement Service, referring to 34 Indonesian provinces between 2011 and 2019. The research applies the spatial panel method and uses Haversine distance to construct the weighted matrix. The spatial error model (SEM) is the best for Model 1 (Grants) and Model 2 (Loans) and the best corruption model in Model 3 (Gratification). The spatial autoregressive model (SAR) is the best approach for Model 4 (Public Complaints) and Model 5 (Corruption). The findings show that there is no spatial dependence between provinces in Indonesia in terms of grants or loans. However, corruption in Indonesia is widespread.

Keywords: grant; loan; corruption; spatial panel; Indonesia

1. Introduction

According to the aid-corruption paradox, corruption can be viewed as an impediment to aid or as an opportunity for reform supported by aid (Bauhr et al., 2013). Controlling corruption in a country is crucial for maximizing the efficiency of aid (Maqbool and Ali, 2021). Many international organizations have emphasized the significance of anti-corruption efforts as a criterion for aid receipt (Ferry et al., 2020). However, Acht et al. (2015) discovered that the amount of aid distributed by donors is unaffected by the quality of governance in recipient countries. Dávid-Barrett and Fazekas (2020) claimed that there is little evidence about how to control corruption in relation to development assistance. The Paris Declaration on Aid Effectiveness in 2005 and the Accra High Level Forum in 2008 established targets for recipient countries to further improve their aid management systems so that aid operates efficiently (Palagashvili and Williamson, 2021).

Foreign aid can wreak devastation in recipient countries due to corruption. Several scholars in this field have suggested that aid has a positive effect on (i.e., diminishes) corruption in developing countries (Alesina and Dollar, 2000; Charron, 2011; Knack, 2001; Tavares, 2003). The findings of Isaksson and Kotsadam (2018)

for African countries, for instance, indicate that aid induces corruption at the local level despite having little immediate effect. However, Ali et al. (2019) found that foreign aid in Asian countries can reduce corruption, as defined by the corruption perception index, although the authors indicate that aid may also create novel forms of corruption. According to Menard and Weill (2016), there is no consensus regarding the relationship between aid and corruption.

Although the level of corruption in aid in Africa is high, this does not necessarily mean that aid should be stopped. First, there is little evidence that cutting aid reduces corruption in such countries (e.g., Zimbabwe). Second, rampant corruption is a symptom of failing institutions. To reduce it, the latter should be strengthened, which may take a long time and require fairly sustained involvement from external experts. Third, some donors argue that, in countries with high levels of corruption, aid should be "fortified". This means that aid must be given in accordance with donor-specified financial management procedures to ensure that it is not stolen. While this reaction is understandable, there is little evidence that this practice is beneficial in reducing corruption in recipient countries (Devarajan, 2009).

This paper classifies aid distribution into two categories, namely grants, and loans, which differentiation is also employed by Hoeffler and Outram (2011). Indonesia is among the countries that have received aid in the form of grants and loans in a variety of sectors and from multilateral, bilateral, and commercial donor organizations. In this work, the authors illustrate corruption through a variety of indicators, including gratification, signs of corruption marked by public complaints, and the successful revelation of corruption. Furthermore, the authors seek to go beyond the nuances of causality studied by Menard and Weill (2016) by examining whether aid and corruption are spatially contagious in Indonesian provinces in a novel way.

The authors surmise that aid and corruption are contagious between provinces. Indonesian Government Regulation Number 10 of 2011 Concerning Procedures for Procurement of Foreign Loans and Receipt of Grants may serve as a starting point for the investigation, as it regulates the mechanism for legally distributing aid from donors to recipients, the latter which must be registered with the Ministry of Finance as the state treasurer. This paper relies on panel data from 2011 to 2019 using a spatial panel approach (Anselin et al., 2008; Belotti et al., 2017; Elhorst, 2014).

Following the introduction, Section 2 provides a summary of the literature on the relationship between aid and corruption and the methodologies utilized by previous researchers. The third section includes data and methods. Section 4 contains the results and discussion, while Section 5 summarizes the findings.

2. Aid-corruption literature

Before presenting the literature review, the authors first explain theories of corruption. According to Transparency International, corruption is the abuse of public power for private gain (Transparency International, 2024). Another widely used description of corruption is any transaction between private and public sector actors in which collective goods are illegally converted into private goods (Heidenheimer, 1989).

Corruption can occur anywhere: in business, government, the courts, civil society, and in all sectors, from health and education to infrastructure, including in the provision of aid to a country. Corruption adapts to different contexts and can develop according to the dynamics of regulations, laws, and even technology (Transparency International, 2023). Therefore, to prevent corruption, aid must be managed efficiently and transparently.

Corruption is a betrayal of trust (Carvajal, 1999; Rose-Ackerman, 2001). Hence, one way to define corruption and other types of white-collar crime is as an 'implied breach of trust.' This breach of trust can occur in the context of the distribution of aid from donor agencies to a country (Sööt and Rootalu, 2012; Sutherland, 1940). Aid involves a cost-benefit analysis and trade-off between various forms of assistance (Batley, 2005).

According to Knack (2013), if donor agencies are able to create an effective aid management system in collaboration with recipient countries, a positive reputation will emerge. Multilateral and bilateral aid distribution is based not only on the needs of the recipient country but also on the donor's interests (Hoeffler and Outram, 2011), although it may be altruistic (Berthélemy, 2006).

Here, the relationship between aid and corruption is examined through an overview of pre-existing research. The authors build on established methodologies to ensure robust support from the literature while addressing gaps in prior studies.

Eradicating corruption should be seen as part of a broader social effort that touches many aspects of life, such as economic development and the distribution of aid. This approach views legal measures against corruption not just as isolated actions but as part of a wider social framework aimed at building justice within society. This perspective aligns with the scientific approach to legal studies that emphasizes understanding and addressing legal issues within their social contexts.

Based on **Table 1**, there is no consensus about the relationship between corruption and aid. In addition, Menard and Weill (2016) claim that there is no causal relationship between corruption and aid. By using a spatial panel approach, the authors of this paper attempt to fill the literature gap associated with the aid-corruption paradox.

Table 1. List of literature on the aid-corruption nexus.

Author	Relationship of…	Country	Data	Method	Relationship
Alesina and Weder (2002)	Corruption to aid	74	1980–1995	Panel regression	–
Kemp and Long (2009)	Corruption to aid	-	Simulation	Game theory	+
Dreher et al. (2011)	Corruption to aid	Development Assistance Committee (DAC)	2011, AidData	Probit and Tobit	–
Bauhr et al. (2013)	Corruption to aid	-	2009 Eurobarometer	Logit regression	–
De la Croix and Delavallade (2014)	Corruption to aid	159	Simulation and Panel	Generalized method of moments (GMM) panel	+
Acht et al. (2015)	Corruption to aid	151	Panel	2SLS	–
Ferry et al. (2020)	Corruption to aid	140	1998–2013	Tobit	–
Svensson (2000b)	Aid to corruption	-	Simulation	Game theory	+
Knack (2001)	Aid to corruption	Global	1982–1995	Ordinary least squares (OLS) and Two-stage least-squares (2SLS) regression	–
Tavares (2003)	Aid to corruption	Organization for Economic Co-operation and Development (OECD) and non-OECD	Panel	2SLS	–
Sayanak and Lahiri (2009)	Aid to corruption	-	Simulation	Game theory	+
Charron (2011)	Aid to corruption	140	1986–2006	2SLS, GMM panel	–
Okada and Samreth (2012)	Aid to corruption	120	1995–2009	Quantile regression	–
Kangoye (2013)	Aid to corruption	80	1984–2004	Generalized autoregressive conditional heteroskedasticity (GARCH)	–
Isaksson and Kotsadam (2018)	Aid to corruption	29	Survey 449 respondent	Panel regression	+
Dávid-Barrett et al. (2020)	Aid to corruption	100+	Panel	Binary logistic	–
Bahoo et al. (2022)	Aid to corruption	150	1995–2018	Gravity model	–
Menard and Weill (2016)	Causality of Aid-Corruption	71	1996–2009	Granger causality, GMM dynamic panel	no

3. Data and method

3.1. Data for study

This paper relies on secondary data obtained from reliable sources. The aid-related data was obtained from the Ministry of Finance and the Ministry of National Development Planning Indonesia. Foreign aid is represented in this paper using two variables: grants and loans. Grants are calculated based on the amount received by each province from multilateral, bilateral, and commercial donors distributed by the relevant ministries. Loans take the form of a variable that is totaled across all years and provinces, calculated using the amount of aid distributed through ministries by multilateral, bilateral, and commercial donors.

Komisi Pemberantasan Korupsi Indonesia (KPK: Corruption Eradication Commission Indonesia) provided data on corruption in the form of indicators of gratification and corruption by proxy as public complaints, as well as corruption cases. Procurement data for all provinces in Indonesia was obtained from the Layanan Pengadaaan Secara Elektronik (LPSE: Electronic Procurement Service) (Details about Jawa Barat Province—for instance—can be found at https://lpse.jabarprov.go.id/eproc4). Dávid-Barrett and Fazekas (2020) previously described the effect of these variables on corruption. Furthermore, this paper included data from 34 Indonesian provinces from 2011 to 2019. All the variables used in the research described in this paper are explained in **Table 2** below.

Table 2. Description of variables.

Variable name	Variable	Description	Measurement unit	Source
Foreign aid:				
Grants_{it}	Grants	Grants per capita in province i of year t	In US$, 2011–2019	Ministry of Finance and Ministry of National Development Planning
Loans_{it}	Loans	Loans per capita in province i of year t	In US$ 2011–2019	Ministry of Finance and Ministry of National Development Planning
Corruption:				
Grat_{it}	Gratification	Number of incidences of gratification per 5000 of population in province i of year t	Cases, 2011–2019	Commission of Eradication Corruption Indonesia (KPK Indonesia)
PC_{it}	Public Complaints	Number of public complaints per 5000 of population in province i of year t	Cases 2011–2019	Commission of Eradication Corruption Indonesia (KPK Indonesia)
Corr_{it}	Corruption cases	Number of corruption cases per 5000 of population in province i of year t	Cases 2011–2019	Commission of Eradication Corruption Indonesia (KPK Indonesia)
Proc_{it}	Procurement	Number of procurements per 5000 of population in province i of year t	Cases 2011–2019	Electronic Procurement Service in 34 Provinces of Indonesia

This paper relies on the Stata (Statistical software for data science) application for data processing. For data visualization purposes, the authors use Quantum Geographic Information System (QGIS) 3.16.5 for each variable.

3.2. Method

This paper applies the spatial panel method, which is a modified model of spatial regression analysis introduced by Anselin et al. (2008) and Elhorst (2014). Since the authors utilized Stata as a data-processing application, Belotti et al.'s (2017) and Drukker et al.'s (2013) guidance was foundational. Creating the spatial weight matrix and building the model followed (Drukker et al., 2013). Nevertheless, the authors also used multicollinearity and heteroscedasticity tests, in addition to the panel method, since there was no spatial effect.

3.2.1. Spatial weighted matrix

In this model, the weight of the distance between provinces is determined by the central distance between each. The authors ignore the use of queen and rook contiguity matrices, which are commonly used in spatial analysis. The reason for this is that Indonesia is an archipelago with several provinces made up of large islands, such as Jawa, Sumatra, Kalimantan, and Sulawesi. Further, there are several small islands that do not have direct neighbors, including Bali, Nusa Tenggara Barat (NTB), Nusa Tenggara Timur (NTT), Maluku, Maluku Utara, Kepulauan Bangka Belitung, and Kepulauan Riau. As a result, the authors employ a weighted matrix based on the distance between provinces.

This paper uses great-circle distance, also known as Haversine distance, as used by Dang and Le (2022) (weighted) to analyze the spatial effects of corruption. The former preferred to use large circle distances to overcome the disregard for the Earth's curvature when using Euclidean distances. The Haversine formula is as follows—from Drukker et al. (2013):

$$d_{st} = r \times c$$

r is the average radius of Earth (6,371,009 km)

c is $2\arcsin\{\min(1, \sqrt{a})\}$

a is $sin^2\emptyset + \cos(\emptyset_1)\, cos(\emptyset_2) sin^2\lambda$

$\emptyset$ is $\frac{1}{2}(\emptyset_2 - \emptyset_1) = \frac{1}{2}(x_2[t] - x_2[s])$

λ is $\frac{1}{2}(\lambda_2 - \lambda_1) = \frac{1}{2}(x_2[t] - x_2[s])$

$x_1[s]$ and $x_1[t]$ are the longitude points s and t,

$x_2[s]$ and $x_2[t]$ are the longitude points s and t.

3.2.2. Spatial dependency

The authors employ the Pesaran cross-section dependence test to determine spatial dependence. The formula is as follows (Jensen and Schmidt, 2011; Pesaran, 2004):

$$\hat{\rho}_{ij} = \frac{\sum_{t=1}^{T} \hat{u}_{it}\hat{u}_{jt}}{\left(\sum_{t=1}^{T} \hat{u}_{it}^2\right)^{1/2}\left(\sum_{t=1}^{T} \hat{u}_{ij}^2\right)^{1/2}}$$

where $\hat{u}_{it} = \gamma_{it} - \hat{\alpha}_i - \hat{\beta}' x_{it}$; with $\hat{\alpha}_i$ being the estimated fixed effects and $\hat{\beta}$ the ordinary least squares estimator of $\hat{\beta}$. In practice, the within-groups estimator is used. This estimator is constructed by subtracting panel-specific means from both γ_{it} and x_{it}, and the panel regression is carried out by regressing the transformed γ_{it} on the transformed x_{it} . This estimator produces the same residuals as the aforementioned ordinary least squares estimation; see, e.g., Wooldridge (2002).

$$CD_{\text{test}} = \sqrt{\frac{2T}{N(N-1)}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}\right)}$$

Under the null hypothesis, the test asymptotically follows the standard normal distribution, with *N* and *T* tending to infinity in any order. *N* being equal to number of variables. *T* is equal to number of observations. $H_0 > 0.05$ suggests there is no spatial relationship and vice versa.

3.2.3. Selection model

The authors use three criteria to select the best model in the spatial panel: Akaike Information Criteria (AIC), Bayesian Information Criteria (BIC), and log-likelihood. The model with the lowest value is considered the best. The smaller the AIC and BIC values, the better the model (Chakrabarti and Ghosh, 2011; Lee and Ghosh, 2009).

3.2.4. Spatial autoregressive model (SAR)

The response variable in a spatial autoregressive model, also known as a spatial lag model, is dependent on observations of the response variable in neighboring units (Elhorst, 2014). The spatial autoregressive model has the following formula (Anselin et al., 2008; Elhorst, 2014).

$$y_{it} = \delta\sum_{j=1}^{N} W_{ij}y_{it} + X_{it}\beta + \mu_i + \varepsilon_{it}$$

In this research, the authors employ the model which is presented below.

Corruption-Aid:

$$Aid_{it} = \delta\sum_{j=1,i\neq 1}^{N} w_{ij}Aid_{it} + \alpha + \beta_j Grat_{it} + \beta_j PC_{it} + \beta_j Corr_{it} + \mu_i + \varepsilon_{it}$$

Aid-Corruption:

$$Corruption_{it} = \delta\sum_{j=1,i\neq 1}^{N} w_{ij}Corruption_{it} + \alpha + \beta_j Grants_{it} + \beta_j Loans_{it} + \beta_j Proc_{it} + \mu_i + \varepsilon_{it}$$

where δ is the spatial regression coefficient, and w_{ij} is the row i column j element of the spatial weighted matrix. ε is the error term. The spatial-specific effect is explained by the fact that it controls for all space-specific time-invariant variables whose omission may bias estimates in a typical cross-sectional study (Elhorst, 2014).

3.2.5. Spatial error model (SEM)

The key point in this model is to concentrate on the residual (Elhorst, 2014). According to Anselin et al. (2006, p. 7), the specification of spatial errors does not necessitate a theoretical model for spatial or social interaction processes but is instead a subset of non-spherical error covariance matrices. This is the spatial error model.

$$y_{it} = X_{it}\beta + \mu_i + \emptyset_{it}$$

$$\emptyset_{it} = \rho\sum_{j=1,i\neq 1}^{N} w_{ij}\emptyset_{it} + \varepsilon_{it}$$

The equation for this model will be:

$$Aid_{it} = \beta_j Grat_{it} + \beta_j PC_{it} + \beta_j Corr_{it} + \mu_i + \emptyset_{it}$$
$$Corruption_{it} = \beta_j Grants_{it} + \beta_j Loans_{it} + \beta_j Proc_{it} + \mu_i + \emptyset_{it}$$

where ρ is the coefficient of spatial autocorrelation. $\emptyset_{it}$ is a residual form of spatial autocorrelation of province i and year t. w_{ij} is an element of a spatial weighted matrix in a row i and column j.

To make it easier to understand, the authors refer to $Grants_{it}$ as Model 1. Model 2 is the equation $Loans_{it}$, Model 3 is the equation $Grat_{it}$, and Model 4 is equation PC_{it}. Finally, model 5 is the equation $Corr_{it}$.

4. Result and discussion

Prior to examining the spatial model in depth, a map is used to illustrate the data distribution for each variable. In addition, we provide the descriptive statistics. The data distribution consists of 2011–2019 sums for each variable. The following is a summary.

In the context of economic development, the amount of loans and assistance fluctuates and tends to increase. Meanwhile, in the legal context, the number of incidences of gratification, corruption cases, and public complaints increases every year. According to Indonesian Corruption Watch (ICW) data for 2004–2023, the handling of corruption cases by region cannot be used as a basis for determining which regions are the most corrupt. Two indicators lead to the high number of suspected corruption cases in the region. First, there is a high level of public participation in reporting suspected corruption cases and monitoring the handling of corruption cases in the field of law enforcement. Second, law enforcement actively responds to corruption cases and conveys the information to the public (Indonesian Corruption Watch, 2018).

Based on data from the Corruption Eradication Commission, most corruption cases occurred within the central government, namely 482. Many corruption cases also occurred in the West Java and East Java provinces. The number of corruption cases in the two provinces was 142, and most corruption cases occurred in 2018, namely, 32 (Corruption Eradication Commission, 2023). We provide all data visualization for each variable from **Figures 1–6**.

Table 3 below presents summary descriptive statistics for each variable. Based on the table, the average value of grants was US $6.113 million, and the average loan was US $67,500 million. Meanwhile, the average number of cases of gratification, public complaints, and corruption were 46,843, 173,846, and 2375, respectively.

Table 3. Descriptive statistics.

Variable	Mean	Std. Dev	Min	Max
Grants	6,113,558	1,602,343	114,005.8	41,700,000
Loans	67,500,000	63,830,000	30,200,000	321,000,000
Grat	46.843	142.828	1.444	1320
PC	173.846	204.921	11.444	1269
Corr	2.375	3.21309	0	44
Proc	929.585	902.217	184	8525

Tests indicated that no model had issues with multicollinearity or heteroscedasticity.

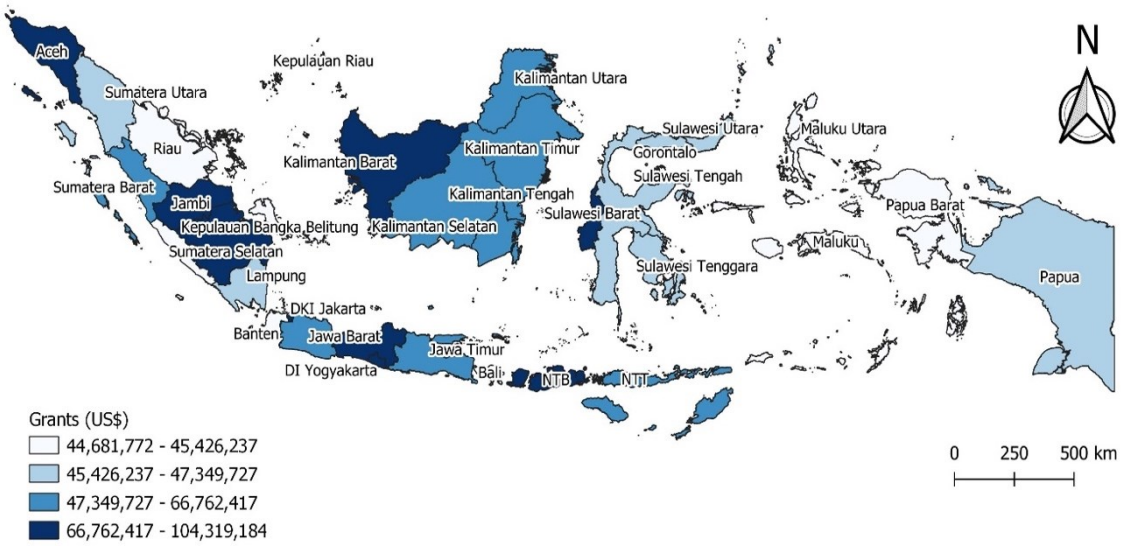

Figure 1. Total grants in provinces of Indonesia, 2011–2019 (USD).

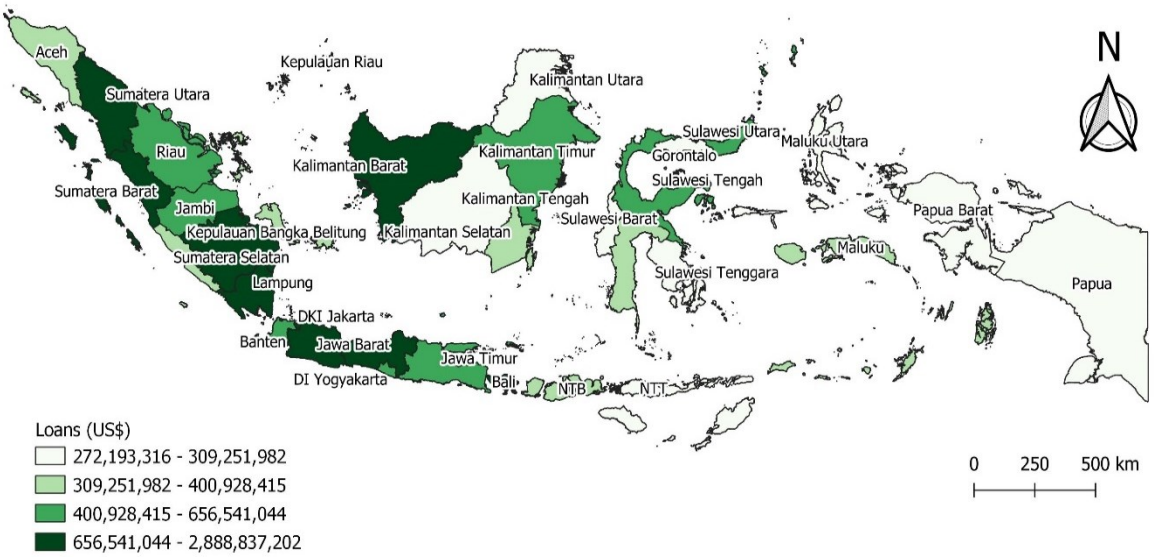

Figure 2. Total loans in provinces of Indonesia, 2011–2019 (USD).

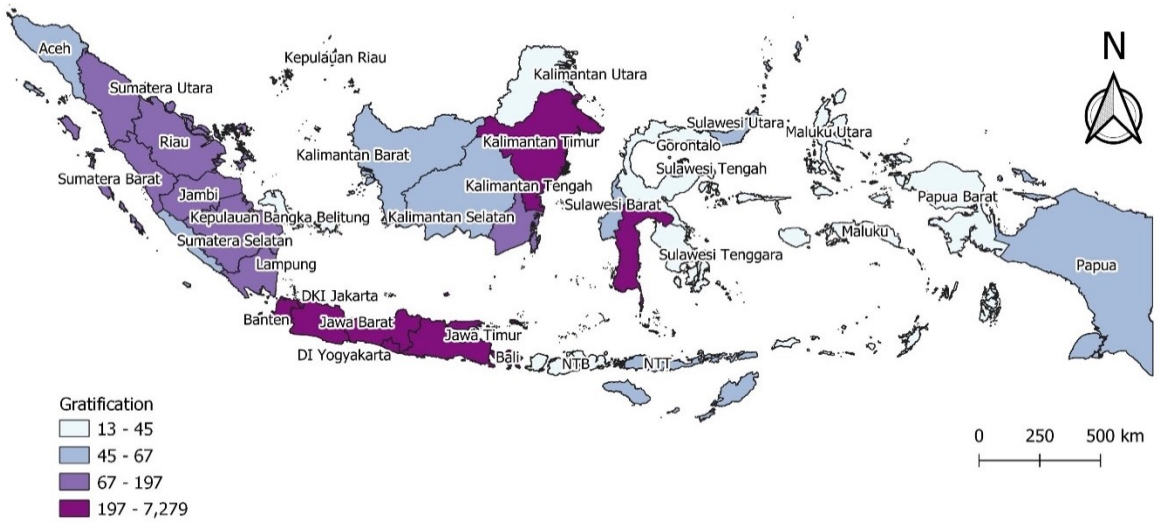

Figure 3. Total gratifications in provinces of Indonesia, 2011–2019 (n).

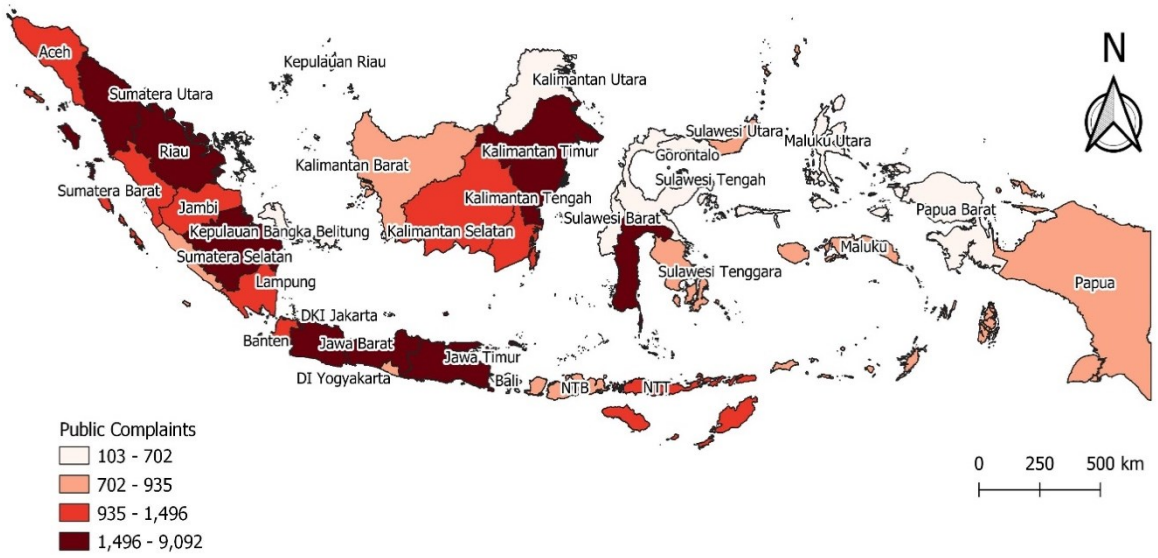

Figure 4. Total public complaints in provinces of Indonesia, 2011–2019 (n).

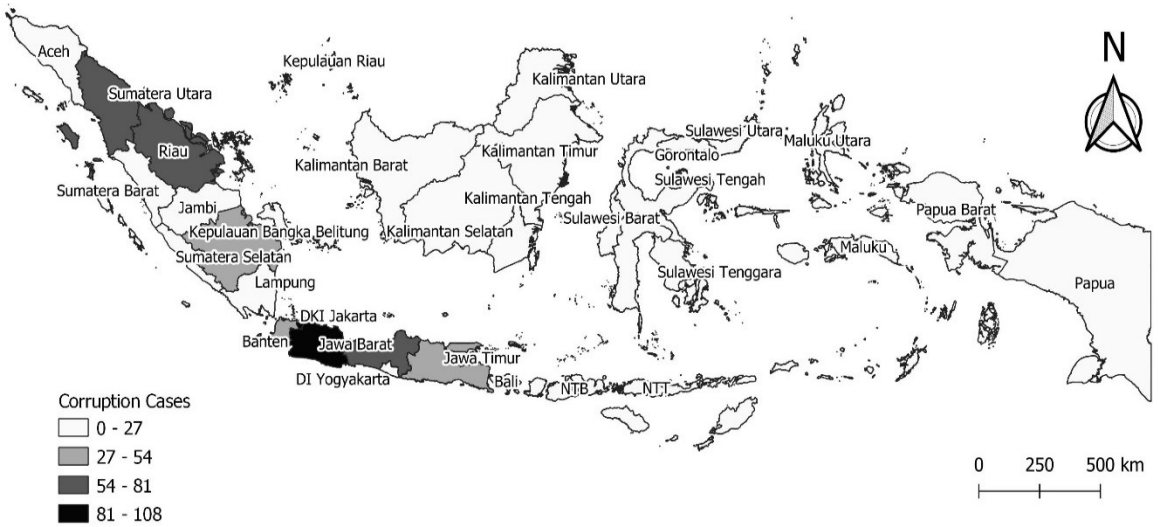

Figure 5. Total corruption cases in provinces of Indonesia, 2011–2019 (n).

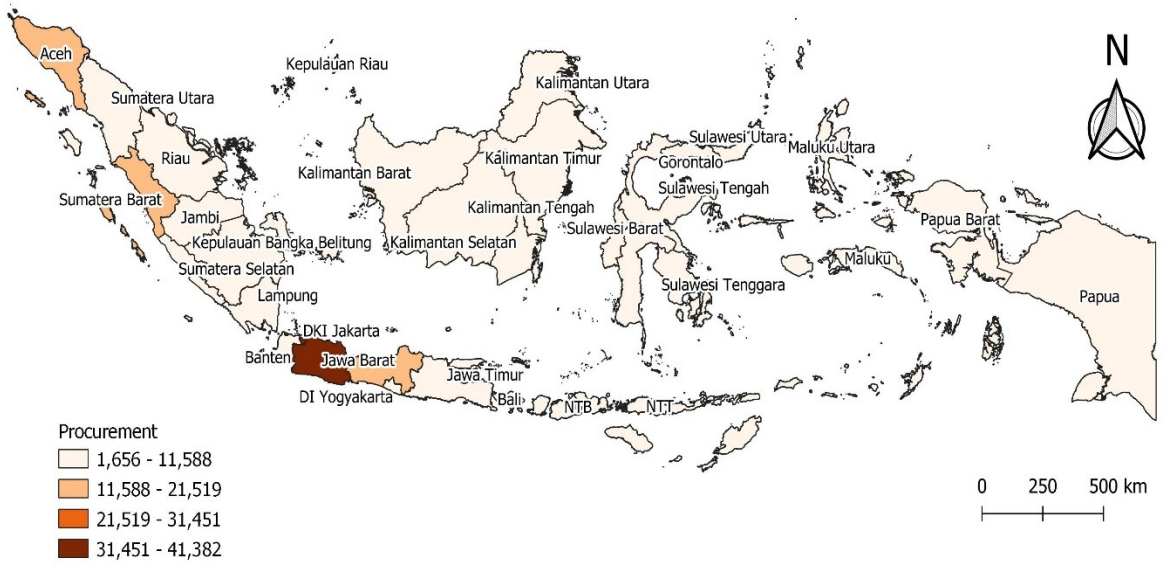

Figure 6. Total procurement in provinces of Indonesia, 2011–2019 (n).

4.1. Spatial weighted matrix and spatial dependency

The weighted matrix is calculated using longitude and latitude positions in the form of the centroid of a specific city or administrative area. The Haversine distance matrix results are shown in **Table 4** below (Detailed calculations can be found in the Appendix).

Table 4. Spatial weighted matrix.

Dimension	Min	Max > 0	Mean	Max
34 × 34	0	0.0001953	0.0011081	0.0128985

The matrix dimension is 34 × 34, based on the number of provinces in Indonesia. The minimum weight value is 0, and the maximum value is 0.0128985. To control for unobservable heterogeneity, the authors use fixed effects by province. The results of spatial dependencies can be seen in **Table 5**.

Table 5. Spatial dependency test of Pesaran's CD.

Dependent variable	Statistics	Average value of Diagonal elements	Decision
$Grants$	47.155***	0.670	H_1 accepted
$Loans$	41.040***	0.617	H_1 accepted
$Grat$	30.789***	0.466	H_1 accepted
PC	11.358***	0.398	H_1 accepted
$Corr$	6.042***	0.424	H_1 accepted

Notes: indicates *** significance at 1% level.

All tests on the five models have a p value < 0.05. This suggests rejecting H_0 that there is spatial dependence between provinces in Indonesia. Since each model is spatially dependent, the authors performed additional tests, namely the spatial autoregressive test and the spatial error test.

To determine the spatial panel regression that we would use, we selected based

on several criteria, including Akaike Information Criteria (AIC), Bayesian Information Criteria (BIC), and log-likelihood. Based on these criteria—adopted from Chakrabarti and Ghosh (2011) and Lee and Ghosh (2009)—we found that the SEM model is the best one for estimating the panel regression.

Table 6. Model criterion selection.

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
SAR					
AIC	664.839	738.173	−1245.693	−969.521	−2736.740
BIC	683.456	756.791	−1227.075	−950.903	−2718.122
Log-likelihood	−327.419	−364.086	627.846	489.760	1358.713
SEM					
AIC	554.689	660.758	−1290.670	−1005.131	−2707.427
BIC	563.307	679.376	−1272.052	−986.513	−2688.809
Log-likelihood	−267.344	−325.379	650.3352	507.565	1373.369

In **Table 6**, SEM is selected as the best model for Model 1 to Model 4 or for Grant, Loan, Grat, and PC Models. The best model for Corr is SAR. After determining the best model, we estimated the spatial effects using the SEM and SAR models. The results of the aid estimation model estimation are shown in **Table 7**.

Table 7. Aid estimation model.

	Model 1 Grant	**Model 2 Loans**	**Model 3 Grant**	**Model 4 Loans**
$Grat$	0.449 (1.100)	−5.450*** (1.359)	−5.016*** (1.065)	−2.133** (0.954)
PC	−1.260* (0.698)	−0.269 (0.855)	5.109*** (0.809)	4.161*** (0.724)
$Corr$	6.259 (12.137)	−6.351 (14.717)	19.924 (19.924)	−10.425 (17.842)
Constant			−0.959*** (0.126)	1.539*** (0.113)
Spatial λ	4.812 (4.010)	−0.719 (4.565)		
Sigma2_e	0.335*** (0.027)	0.491*** (0.039)		
Obs.	306	306	306	306
Fixed effect	Yes	Yes	Yes	Yes
R-square	0.023	0.062	0.517	0.106
AIC	554.689	660.758		
BIC	563.307	679.376		
Log-likelihood	−267.344	−325.379		
F-Stat.			15.54***	11.63***

Notes: Indicates significant * 10%, ** 5%, and *** 1% level. Dependent variable of Models 1 & 3 are grant.

The dependent variable of models 2 and 4 is loans. Models 1 and 2 use SEM.

Models 3 and 4 are fixed-effects models.

We find that in Model 1 and Model 3 in **Table 7**, SEM has no spatial effect. Therefore, we move to the fixed-effects model shown in Models 3 and 4. In Model 3, a one-unit increase in *Grat* decreases 5.016% of *Grant* at alpha < 1%. This result contradicts the effect of PC on *Grat*. A one-unit increase in *PC* causes an increase in *Grant* by 5.109%.

Furthermore, Model 4 shows that the effect of *Grat* and PC on loans is negative and positive (significant), respectively. A one-unit increase in *Grat* contributes to a decrease in *Loans* by 2.133%. Meanwhile, an increase in *PC* of one unit increases *Loans* by 4.161%.

Table 8. Corruption estimation.

	Model 1 **Grant**	**Model 2** **PC**	**Model 3** **Corr**
$Grants$	0.002 (0.003)	0.008** (0.004)	−0.0004*** (0.0001)
$Loans$	−0.010*** (0.002)	−0.003 (0.004)	−0.0004 (0.0001)
$Proc$	0.005*** (0.002)	0.006* (0.004)	0.0007 (0.0002)
Spatial λ	−7.082** (3.675)	−15.704*** (5.543)	
Spatial ρ			9.238*** (2.929)
Sigma2_e	0.008*** (0.006)	0.002*** (0.001)	8.06e−06*** (6.54×10^{-7})
Obs.	306	306	306
Fixed effect	Yes	Yes	Yes
R-square	0.054	0.136	0.107
AIC	−1290.670	−1005.131	−2736.740
BIC	−1272.052	−986.513	−2718.122
Log-likelihood	650.3352	507.565	1358.713

Notes: Indicates significant * 10%, ** 5%, and *** 1% level.

In **Table 8**, in Models 1 and 2, spatial effects are present in the model residuals. This means that residuals in one location are related to residuals in other places. The SEM spatial effect in Model 1 produces a negative result, meaning that if there is an increase in *Grat* that is not explained by the independent variables in a province, then neighboring provinces tend to have an unexplained decrease of 7.082%. It may be that anti-corruption efforts related to foreign grants are beginning to be taken into account by officials at the local level who are trying to avoid graft by those involved in government administrative matters.

In addition, Model 2 also shows a similar trend, which is spatially negative and significant. This confirms that if there is an increase in Loans not explained by the independent variables in one province, then neighboring provinces tend to have an unexplained decrease of 15.704%. In addition, individually, a one-unit increase in Grants can increase PC by 0.008%. Meanwhile, a one-unit increase in Proc can

increase PC by 0.006%. This is also the case in Model 3, where corruption has a spatial and significant effect. An increase of one corruption case ('Corr') in a province is associated with an increase of nine corruption cases in neighboring provinces.

4.2. Impact of corruption on aid

Spatial dependence in terms of grants (Model 1) does not appear to exist between Indonesian provinces. Furthermore, only the public complaint variable has a statistically significant effect on grants. It is possible that the high public pressure on signs of corruption in any region attracts the attention of donors, causing them to reduce the amount of grants. However, gratification and cases of corruption do not appear to be a determining factor in the distribution of grants in Indonesia. This confirms previous research that the issue of corruption is not taken into account in the distribution of international grants (Acht et al., 2015; Alesina and Weder, 2002; Bauhr et al., 2013; Dreher et al., 2011; Ferry et al., 2020). In Indonesia, this could be due to a number of grant components that are inextricably linked to loans.

In Model 2, only gratification has a negative and significant impact on loans, while others are not significant. Several pieces of literature support this result (Bauhr et al., 2013; Dreher et al., 2011; Ferry et al., 2020). Weak governance, characterized by high levels of corruption in various regions, gratification practices, and a heightened public awareness of corruption in central and local government projects, are major considerations for multilateral and bilateral donors.

Donors distribute loans to the central government indirectly, which ministries then distribute to provincial governments. The funds recorded as aid are included in the ministries' budgeted programs and each province's Regional Revenue and Expenditure Budgets. These funds are referred to as budgeted because each amount is included in the respective program or project.

4.3. Impact of aid on corruption

Models 3 to 5 include spatial effects between provinces in Indonesia. The grants variable has no effect on gratification practice. Variable loans have a significant negative impact on the practice of gratification. This indicates that the Indonesian government has made efforts to reform the governance of loan disbursement through Government Regulation Number 10 of 2011. Previous research supports these findings (Bahoo et al., 2022; Charron, 2011; Dávid-Barrett and Fazekas, 2020; Kangoye, 2013; Knack, 2001; Okada and Samreth, 2012; Svensson, 2000a; Tavares, 2003). These efforts are visible in the implementation of a distribution mechanism that necessitates reporting to the Ministry of Finance. As a result, the loan funds are also earmarked for reforming central and local government governance.

In 2012, for instance, the Asian Development Bank (ADB) distributed US $57,750 million in assistance to the Badan Pengawasan Keuangan dan Pembangunan Indonesia (BPKP: Financial and Development Supervisory Agency) through the State Accountability Revitalization Project (STAR). This project aims to support government reform priorities by strengthening the capacity of internal auditors and financial managers at the central and local government levels. Specifically, STAR

aims to 1) increase the capacity of the government's Internal Supervisory Apparatus (ISA) and state financial managers, 2) develop e-learning systems and modules, and 3) accelerate the government's strengthening of its internal control system. Furthermore, one of BPKP's responsibilities is to monitor the progress of development projects throughout Indonesia. This suggests it is critical for such institutions to build capacity and be used in budget oversight.

The Indonesian government also received World Bank (WB) assistance in 2014, which was received directly by the Ministry of Finance. This aid is worth $500 million and will be used to support the Local Government and Decentralization Project Phase II. The primary goal of this project is to improve the Special Allocation Fund (SAF) accountability and reporting system, particularly related to the development of basic infrastructure in the region, such as roads, irrigation, and sanitation. The supervision of SAF is critical, as cases of corruption with the Regional Revenue and Expenditure Budget frequently occur. It was discovered through the corruption model that procurement has a positive and significant effect on gratification and public complaints. However, procurement has a negative and significant impact on the number of cases of corruption. This is consistent with the findings of Dávid-Barrett et al. (2020) that central government aid distributed through tenders can effectively monitor development assistance and reduce corruption.

5. Conclusion

This paper examines the aid-corruption paradox from a spatial perspective in Indonesian provinces. The authors use the spatial panel method. In addition, a spatial weighted matrix is generated using the great-circle distance—Haversine method. Five models were developed to address these issues. The results of the best models indicate that there is no spatial dependence between provinces in Indonesia, either with grants or loans.

In terms of gratification, there is spatial dependence on errors between provinces that may not be caused solely by the factor of aid. There is also spatial dependence on lag in the public complaints model, which suggests a reduction in the number of public complaints in areas when the number of public complaints in neighboring areas increases. This indicates that law enforcement agencies (such as the KPK Indonesia, the Attorney General's Office, Indonesia's BPKP, and the Indonesian Supreme Audit Agency Indonesia) are taking preventive measures to close budget corruption loopholes in various provinces. Meanwhile, corruption cases between provinces are spatially dependent, especially when using the SAR model. This demonstrates that corruption in Indonesia is contagious. However, increased aid, particularly loans, is associated with fewer corruption cases and public complaints about corruption in government projects. We conclude that the relationship between aid and corruption is contagious. However, increasing aid, especially loans, may reduce cases of corruption and public complaints regarding corruption in government projects.

In addition, the study has theoretical implications regarding the relationship between corruption and aid. Using a spatial panel approach, the results theoretically

contribute to filling the literature gap associated with the aid-corruption paradox. Menard and Well (2016) claim that there is no causal relationship between corruption and aid. Based on the results of our selection of the best model, there is no spatial dependence between provinces in Indonesia in terms of grants and loans. However, corrupt practices in Indonesia are contagious.

In addition, this study has limitations related to the use of regional units used due to limited information related to aid channels and grants distributed to the district and city levels. Future studies are expected to expand the scope of the study area to smaller area units and also use more advanced models.

Author contributions: Conceptualization, DK and AP; methodology, DK and AP; software, DK and AP; validation, DK; formal analysis, DK and AP; investigation, DK, AP and VEK; resources, DK, AP and VEK; data curation, DK, AP and VEK; writing—original draft preparation, DK and AP; writing—review and editing, VEK; visualization, DK, AP and VEK; supervision, DK, AP and VEK; project administration, DK and AP; funding acquisition, DK. All authors have read and agreed to the published version of the manuscript.

Acknowledgments: The authors would like to thank the Doctoral School of Regional Policy and Economics, University of Pécs, the Department of World Economy, and the Doctoral School of International Relations and Political Science, Corvinus University of Budapest for facilitating the research.

Conflict of interest: The authors declare no conflict of interest.

References

Acht, M., Mahmoud, T. O., & Thiele, R. (2015). Corrupt governments do not receive more state-to-state aid: Governance and the delivery of foreign aid through non-state actors. Journal of Development Economics, 114, 20–33. https://doi.org/10.1016/j.jdeveco.2014.11.005

Alesina, A., & Dollar, D. (2000). Who gives foreign aid to whom and why? Journal of Economic Growth, 5, 33-63. https://doi.org/10.1023/A:1009874203400

Alesina, A., & Weder, B. (2002). Do Corrupt Governments Receive Less Foreign Aid? American Economic Review, 92(4), 1126–1137. https://doi.org/10.1257/00028280260344669

Ali, M., Khan, L., Sohail, A., et al. (2019). The relationship between foreign aid and corruption: a case of selected Asian countries. Journal of Financial Crime, 26(3), 692–704. https://doi.org/10.1108/jfc-08-2018-0089

Anselin, L., Gallo, J. Le, & Jayet, H. (2008). Spatial Panel Econometrics. In: Advanced Studies in Theoretical and Applied Econometrics. Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-540-75892-1_19

Anselin, L., Le Gallo, J., & Jayet, H. (2006). Spatial panel econometrics. In: Matyas, L., Sevestre, P. (editors). The econometrics of panel data, fundamentals and recent developments in theory and practice, 3rd ed. Kluwer, Dordrecht. pp. 901-969.

Bahoo, S., Alon, I., & Floreani, J. (2022). Corruption, foreign aid, and international trade. Thunderbird International Business Review, 64(2), 139–167. https://doi.org/10.1002/tie.22253

Bauhr, M., Charron, N., & Nasiritousi, N. (2013). Does Corruption Cause Aid Fatigue? Public Opinion and the Aid-Corruption Paradox1. International Studies Quarterly, 57(3), 568–579. https://doi.org/10.1111/isqu.12025

Belotti, F., Hughes, G., & Mortari, A. P. (2017). Spatial Panel-data Models Using Stata. The Stata Journal: Promoting Communications on Statistics and Stata, 17(1), 139–180. https://doi.org/10.1177/1536867x1701700109

Berthélemy, J. (2006). Bilateral Donors' Interest vs. Recipients' Development Motives in Aid Allocation: Do All Donors Behave the Same? Review of Development Economics, 10(2), 179–194. https://doi.org/10.1111/j.1467-9361.2006.00311.x

Chakrabarti, A., & Ghosh, J. K. (2011). AIC, BIC and Recent Advances in Model Selection. Philosophy of Statistics, 583–605. https://doi.org/10.1016/b978-0-444-51862-0.50018-6

Charron, N. (2011). Exploring the Impact of Foreign Aid on Corruption: Has The "Anti-Corruption Movement" Been Effective? The Developing Economies, 49(1), 66–88. https://doi.org/10.1111/j.1746-1049.2010.00122.x

Corruption Eradication Commission. (2023). Corruption Crime Statistics. Available online: https://www.kpk.go.id/id/statistik/penindakan (accessed on 21 May 2024).

Dang, C. T., & Le, C. Q. (2022). Spatio-Temporal Dependence of Corruption in Vietnam. Applied Spatial Analysis and Policy, 15(4), 1143–1165. https://doi.org/10.1007/s12061-022-09447-1

Dávid-Barrett, E., & Fazekas, M. (2020). Anti-corruption in aid-funded procurement: Is corruption reduced or merely displaced? World Development, 132, 105000. https://doi.org/10.1016/j.worlddev.2020.105000

Dávid-Barrett, E., Fazekas, M., Hellmann, O., et al. (2020). Controlling Corruption in Development Aid: New Evidence from Contract-Level Data. Studies in Comparative International Development, 55(4), 481–515. https://doi.org/10.1007/s12116-020-09315-4

de la Croix, D., & Delavallade, C. (2013). Why corrupt governments may receive more foreign aid. Oxford Economic Papers, 66(1), 51–66. https://doi.org/10.1093/oep/gpt004

Devarajan, S. (2009). Aid and Corruption. Available online: https://blogs.worldbank.org/en/africacan/aid-and-corruption (accessed on 21 May 2024).

Dreher, A., Nunnenkamp, P., & Thiele, R. (2011). Are 'New' Donors Different? Comparing the Allocation of Bilateral Aid Between nonDAC and DAC Donor Countries. World Development, 39(11), 1950–1968. https://doi.org/10.1016/j.worlddev.2011.07.024

Drukker, D. M., Peng, H., Prucha, I. R., et al. (2013). Creating and Managing Spatial-Weighting Matrices with the Spmat Command. The Stata Journal: Promoting Communications on Statistics and Stata, 13(2), 242–286. https://doi.org/10.1177/1536867x1301300202

Elhorst, J. P. (2014). Spatial Panel Models. In: Handbook of Regional Science. Springer.

Ferry, L. L., Hafner-Burton, E. M., & Schneider, C. J. (2020). Catch me if you care: International development organizations and national corruption. The Review of International Organizations, 15(4), 767–792. https://doi.org/10.1007/s11558-019-09371-z

Heidenheimer, A. J. (1989). What is the Problem about Corruption? In: Johnson, M., & LeVine, V. T. (editors). Political Corruption: A Handbook. Transaction.

Hoeffler, A., & Outram, V. (2011). Need, Merit, or Self-Interest—What Determines the Allocation of Aid? Review of Development Economics, 15(2), 237–250. https://doi.org/10.1111/j.1467-9361.2011.00605.x

Indonesian Corruption Watch. (2018). Corruption Prosecution Trends 2018. Available online: https://antikorupsi.org/en/article/trends-corruption-prosecution-2018 (accessed on 29 May 2024).

Isaksson, A. S., & Kotsadam, A. (2018). Chinese aid and local corruption. Journal of Public Economics, 159, 146–159. https://doi.org/10.1016/j.jpubeco.2018.01.002

Jensen, P. S., & Schmidt, T. D. (2011). Testing for Cross-sectional Dependence in Regional Panel Data. Spatial Economic Analysis, 6(4), 423–450. https://doi.org/10.1080/17421772.2011.610813

Kangoye, T. (2013). Does Aid Unpredictability Weaken Governance? Evidence from Developing Countries. The Developing Economies, 51(2), 121–144. https://doi.org/10.1111/deve.12008

Kemp, M. C., & Long, N. V. (2009). Foreign Aid in the Presence of Corruption: Differential Games among Donors. Review of International Economics, 17(2), 230–243. https://doi.org/10.1111/j.1467-9396.2009.00820.x

Knack, S. (2001). Aid Dependence and the Quality of Governance: Cross-Country Empirical Tests. Southern Economic Journal, 68(2), 310. https://doi.org/10.2307/1061596

Knack, S. (2013). Aid and donor trust in recipient country systems. Journal of Development Economics, 101, 316–329. https://doi.org/10.1016/j.jdeveco.2012.12.002

Lee, H., & Ghosh, S. K. (2009). Performance of information criteria for spatial models. Journal of Statistical Computation and Simulation, 79(1), 93–106. https://doi.org/10.1080/00949650701611143

Maqbool, S., & Ali, M. (2021). The relationship between foreign aid and income inequality and the role of corruption. Journal of Public Affairs, 22(4). https://doi.org/10.1002/pa.2687

Menard, A. R., & Weill, L. (2016). Understanding the link between aid and corruption: A causality analysis. Economic Systems, 40(2), 260–272. https://doi.org/10.1016/j.ecosys.2016.01.001

Okada, K., & Samreth, S. (2012). The effect of foreign aid on corruption: A quantile regression approach. Economics Letters,

115(2), 240–243. https://doi.org/10.1016/j.econlet.2011.12.051

Palagashvili, L., & Williamson, C. R. (2021). Grading foreign aid agencies: Best practices across traditional and emerging donors. Review of Development Economics, 25(2), 654–676. https://doi.org/10.1111/rode.12747

Pesaran, M. H. (2004). General Diagnostic Tests for Cross Section Dependence in Panels. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.572504

Sayanak, T., & Lahiri, S. (2009). Foreign Aid as Prize: Incentives for a Pro-Poor Policy. Review of Development Economics, 13(3), 403–415. https://doi.org/10.1111/j.1467-9361.2009.00498.x

Svensson, J. (2000a). Foreign aid and rent-seeking. Journal of International Economics. 51(2), 437-461. https://doi.org/10.1016/S0022-1996(99)00014-8

Svensson, J. (2000b). When is foreign aid policy credible? Aid dependence and conditionality. Journal of Development Economics, 60(1), 61-84. https://doi.org/10.1016/S0304-3878(99)00061-9

Tavares, J. (2003). Does foreign aid corrupt? Economics Letters, 79(1), 99-106. https://doi.org/10.1016/S0165-1765(02)00293-8

Transparency International. (2024). What Is Corruption? Available online: https://www.transparency.org/en/what-is-corruption (accessed on 29 May 2024).

Transparency International. (2023). About Transparency International? Available online: https://www.transparency.org/en/what-is-corruption (accessed on 29 May 2024).

Wooldridge, J. M. (2002). Econometric Analysis of Cross Section and Panel Data. USA: MIT Press.

Appendix: Haversine Weighted

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	0.0E+00	1.4E-07	3.2E-07	6.0E-07	2.0E-07	3.0E-07	1.0E-07	6.8E-07	2.6E-07	2.1E-07	1.7E-07	3.6E-07	1.8E-07	2.0E-07	1.6E-07	1.5E-07	4.6E-07	7.7E-07	3.7E-07	7.0E-08	7.8E-08	1.3E-07	7.8E-08
2	1.4E-07	0.0E+00	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07
3	3.2E-07	9.1E-07	0.0E+00	4.0E-06	4.0E-06	1.7E-04	2.5E-07	3.0E-06	3.0E-05	4.3E-06	1.8E-06	1.7E-06	1.0E-06	1.1E-06	5.3E-07	6.0E-07	5.1E-06	1.5E-06	6.4E-05	1.7E-07	1.6E-07	7.8E-07	2.6E-07
4	6.0E-07	4.2E-07	4.0E-06	0.0E+00	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07
5	2.0E-07	3.3E-06	4.0E-06	2.0E-07	0.0E+00	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07
6	3.0E-07	1.1E-06	1.7E-04	3.0E-07	5.5E-06	0.0E+00	3.0E-07	3.0E-07	3.0E-07	3.0E-07	3.0E-07	3.0E-07	3.0E-07	3.0E-07	3.0E-07	3.0E-07	3.0E-07	3.0E-07	3.0E-07	3.0E-07	3.0E-07	3.0E-07	3.0E-07
7	1.0E-07	5.7E-07	2.5E-07	1.0E-07	3.5E-07	2.6E-07	0.0E+00	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07
8	6.8E-07	4.4E-07	3.0E-06	6.8E-07	9.6E-07	2.6E-06	2.1E-07	0.0E+00	6.8E-07	6.8E-07	6.8E-07	6.8E-07	6.8E-07	6.8E-07	6.8E-07	6.8E-07	6.8E-07	6.8E-07	6.8E-07	6.8E-07	6.8E-07	6.8E-07	6.8E-07
9	2.6E-07	1.3E-06	3.0E-05	2.6E-07	9.7E-06	7.6E-05	2.8E-07	1.8E-06	0.0E+00	2.6E-07	2.6E-07	2.6E-07	2.6E-07	2.6E-07	2.6E-07	2.6E-07	2.6E-07	2.6E-07	2.6E-07	2.6E-07	2.6E-07	2.6E-07	2.6E-07
10	2.1E-07	3.1E-06	4.3E-06	2.1E-07	1.2E-04	6.1E-06	3.8E-07	1.1E-06	1.0E-05	0.0E+00	2.1E-07	2.1E-07	2.1E-07	2.1E-07	2.1E-07	2.1E-07	2.1E-07	2.1E-07	2.1E-07	2.1E-07	2.1E-07	2.1E-07	2.1E-07
11	1.7E-07	9.9E-06	1.8E-06	1.7E-07	1.4E-05	2.3E-06	4.9E-07	7.0E-07	3.1E-06	1.5E-05	0.0E+00	1.7E-07	1.7E-07	1.7E-07	1.7E-07	1.7E-07	1.7E-07	1.7E-07	1.7E-07	1.7E-07	1.7E-07	1.7E-07	1.7E-07
12	3.6E-07	7.5E-07	1.7E-06	3.6E-07	1.3E-06	1.8E-06	4.3E-07	2.3E-06	1.6E-06	1.6E-06	1.3E-06	0.0E+00	3.6E-07	3.6E-07	3.6E-07	3.6E-07	3.6E-07	3.6E-07	3.6E-07	3.6E-07	3.6E-07	3.6E-07	3.6E-07
13	1.8E-07	2.9E-06	1.0E-06	1.8E-07	2.2E-06	1.2E-06	9.3E-07	6.6E-07	1.3E-06	2.7E-06	4.3E-06	2.1E-06	0.0E+00	1.8E-07	1.8E-07	1.8E-07	1.8E-07	1.8E-07	1.8E-07	1.8E-07	1.8E-07	1.8E-07	1.8E-07
14	2.0E-07	1.9E-06	1.1E-06	2.0E-07	1.8E-06	1.2E-06	8.9E-07	7.6E-07	1.3E-06	2.3E-06	3.0E-06	3.2E-06	4.8E-05	0.0E+00	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07
15	1.6E-07	1.2E-06	5.3E-07	1.6E-07	8.2E-07	5.8E-07	2.3E-06	4.4E-07	6.1E-07	9.3E-07	1.2E-06	1.3E-06	5.5E-06	6.1E-06	0.0E+00	1.6E-07	1.6E-07	1.6E-07	1.6E-07	1.6E-07	1.6E-07	1.6E-07	1.6E-07
16	1.5E-07	2.2E-06	6.0E-07	1.5E-07	1.1E-06	6.7E-07	1.8E-06	4.3E-07	7.3E-07	1.2E-06	2.0E-06	1.1E-06	1.0E-05	6.6E-06	1.5E-05	0.0E+00	1.5E-07	1.5E-07	1.5E-07	1.5E-07	1.5E-07	1.5E-07	1.5E-07
17	4.6E-07	6.4E-07	5.1E-06	4.6E-07	1.6E-06	4.7E-06	2.8E-07	1.2E-05	3.2E-06	1.9E-06	1.2E-06	5.5E-06	1.1E-06	1.3E-06	6.5E-07	6.4E-07	0.0E+00	4.6E-07	4.6E-07	4.6E-07	4.6E-07	4.6E-07	4.6E-07
18	7.7E-07	3.9E-07	1.5E-06	7.7E-07	7.3E-07	1.4E-06	2.3E-07	1.1E-05	1.1E-06	8.3E-07	6.0E-07	3.3E-06	6.7E-07	8.2E-07	5.0E-07	4.5E-07	6.7E-06	0.0E+00	7.7E-07	7.7E-07	7.7E-07	7.7E-07	7.7E-07
19	3.7E-07	7.3E-07	6.4E-05	3.7E-07	2.6E-06	2.6E-05	2.3E-07	4.7E-06	1.1E-05	2.8E-06	1.4E-06	1.8E-06	8.9E-07	9.6E-07	4.9E-07	5.3E-07	7.0E-06	2.0E-06	0.0E+00	3.7E-07	3.7E-07	3.7E-07	3.7E-07
20	7.0E-08	4.3E-07	1.7E-07	7.0E-08	2.4E-07	1.8E-07	1.8E-06	1.3E-07	1.9E-07	2.5E-07	3.3E-07	2.2E-07	4.4E-07	4.0E-07	6.2E-07	6.9E-07	1.7E-07	1.4E-07	1.5E-07	0.0E+00	7.0E-08	7.0E-08	7.0E-08
21	7.8E-08	3.5E-07	1.6E-07	7.8E-08	2.2E-07	1.7E-07	4.5E-06	1.4E-07	1.8E-07	2.3E-07	2.9E-07	2.5E-07	4.5E-07	4.3E-07	7.7E-07	7.2E-07	1.8E-07	1.6E-07	1.5E-07	3.9E-06	0.0E+00	7.8E-08	7.8E-08
22	1.3E-07	1.3E-04	7.8E-07	1.3E-07	2.4E-06	9.0E-07	6.2E-07	4.0E-07	1.1E-06	2.3E-06	6.3E-06	6.8E-07	2.7E-06	1.8E-06	1.2E-06	2.3E-06	5.8E-07	3.6E-07	6.4E-07	4.8E-07	3.8E-07	0.0E+00	1.3E-07
23	7.8E-08	1.2E-06	2.6E-07	7.8E-08	4.6E-07	2.8E-07	7.0E-07	1.7E-07	3.1E-07	4.5E-07	6.6E-07	2.7E-07	6.4E-07	5.2E-07	6.0E-07	8.8E-07	2.2E-07	1.7E-07	2.3E-07	1.3E-06	6.1E-07	1.4E-06	0.0E+00
24	3.8E-08	1.2E-07	6.7E-08	3.8E-08	8.6E-08	7.0E-08	2.5E-07	5.9E-08	7.3E-08	8.7E-08	1.0E-07	8.2E-08	1.2E-07	1.1E-07	1.5E-07	1.5E-07	6.8E-08	6.1E-08	6.4E-08	5.1E-07	4.3E-07	1.3E-07	2.3E-07
25	5.3E-08	2.0E-07	1.0E-07	5.3E-08	1.3E-07	1.1E-07	6.6E-07	8.8E-08	1.1E-07	1.4E-07	1.6E-07	1.3E-07	2.1E-07	2.0E-07	2.8E-07	2.9E-07	1.0E-07	9.2E-08	9.5E-08	1.9E-06	1.7E-06	2.1E-07	4.1E-07
26	1.3E-06	2.9E-07	1.2E-06	1.3E-06	5.4E-07	1.1E-06	1.7E-07	8.8E-06	8.7E-07	5.9E-07	4.3E-07	1.3E-06	4.3E-07	5.0E-07	3.3E-07	3.1E-07	2.8E-06	8.9E-06	1.6E-06	1.1E-07	1.2E-07	2.7E-07	1.3E-07
27	1.3E-07	1.7E-06	4.7E-07	1.3E-07	8.2E-07	5.2E-07	2.9E-06	3.5E-07	5.6E-07	9.0E-07	1.4E-06	8.3E-07	4.3E-06	3.3E-06	1.0E-05	3.5E-05	5.0E-07	3.7E-07	4.2E-07	9.3E-07	9.8E-07	1.9E-06	1.0E-06
28	1.2E-07	2.9E-06	4.6E-07	1.2E-07	9.2E-07	5.1E-07	1.8E-06	3.1E-07	5.7E-07	9.7E-07	1.7E-06	6.4E-07	3.1E-06	2.1E-06	3.1E-06	8.6E-06	4.4E-07	3.1E-07	4.1E-07	1.0E-06	8.4E-07	3.6E-06	1.9E-06
29	1.3E-07	1.0E-06	3.8E-07	1.3E-07	5.9E-07	4.1E-07	6.6E-06	3.1E-07	4.4E-07	6.4E-07	8.9E-07	7.3E-07	2.4E-06	2.2E-06	1.1E-05	8.1E-06	4.3E-07	3.4E-07	3.5E-07	1.1E-06	1.4E-06	1.1E-06	8.1E-07
30	9.7E-08	1.1E-06	3.0E-07	9.7E-08	5.0E-07	3.2E-07	3.9E-06	2.2E-07	3.5E-07	5.2E-07	7.6E-07	4.3E-07	1.3E-06	1.0E-06	2.0E-06	2.8E-06	3.0E-07	2.3E-07	2.7E-07	2.6E-06	1.8E-06	1.3E-06	2.1E-06
31	9.1E-08	4.2E-07	2.0E-07	9.1E-08	2.7E-07	2.1E-07	2.0E-05	1.8E-07	2.2E-07	2.9E-07	3.6E-07	3.4E-07	6.3E-07	6.1E-07	1.3E-06	1.1E-06	2.2E-07	2.0E-07	1.9E-07	2.1E-06	1.2E-05	4.6E-07	5.9E-07
32	1.2E-06	2.9E-07	1.3E-06	1.2E-06	5.5E-07	1.2E-06	1.6E-07	7.4E-06	9.2E-07	5.9E-07	4.2E-07	1.0E-06	3.9E-07	4.4E-07	2.9E-07	2.8E-07	2.4E-06	4.0E-06	1.8E-06	1.0E-07	1.1E-07	2.6E-07	1.3E-07
33	5.0E-07	5.7E-07	6.9E-06	5.0E-07	1.5E-06	5.5E-06	2.3E-07	2.5E-05	3.4E-06	1.7E-06	9.9E-07	2.7E-06	8.4E-07	9.6E-07	5.1E-07	5.1E-07	3.2E-05	5.3E-06	1.3E-05	1.5E-07	1.6E-07	5.1E-07	2.0E-07
34	5.5E-06	1.9E-07	5.3E-07	5.5E-06	3.0E-07	4.9E-07	1.3E-07	1.6E-06	4.2E-07	3.2E-07	2.5E-07	6.4E-07	2.7E-07	3.0E-07	2.3E-07	2.1E-07	9.1E-07	2.0E-06	6.4E-07	8.8E-08	9.8E-08	1.8E-07	9.9E-08

23	24	25	26	27	28	29	30	31	32	33	34
7.8E-08	3.8E-08	5.3E-08	1.3E-06	1.3E-07	1.2E-07	1.3E-07	9.7E-08	9.1E-08	1.2E-06	5.0E-07	5.5E-06
1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07	1.4E-07
2.6E-07	6.7E-08	1.0E-07	1.2E-06	4.7E-07	4.6E-07	3.8E-07	3.0E-07	2.0E-07	1.3E-06	6.9E-06	5.3E-07
6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07	6.0E-07
2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07
3.0E-07	3.0E-07	3.0E-07	3.0E-07	3.0E-07	3.0E-07	3.0E-07	3.0E-07	3.0E-07	3.0E-07	3.0E-07	3.0E-07
1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07
6.8E-07	6.8E-07	6.8E-07	6.8E-07	6.8E-07	6.8E-07	6.8E-07	6.8E-07	6.8E-07	6.8E-07	6.8E-07	6.8E-07
2.6E-07	2.6E-07	2.6E-07	2.6E-07	2.6E-07	2.6E-07	2.6E-07	2.6E-07	2.6E-07	2.6E-07	2.6E-07	2.6E-07
2.1E-07	2.1E-07	2.1E-07	2.1E-07	2.1E-07	2.1E-07	2.1E-07	2.1E-07	2.1E-07	2.1E-07	2.1E-07	2.1E-07
1.7E-07	1.7E-07	1.7E-07	1.7E-07	1.7E-07	1.7E-07	1.7E-07	1.7E-07	1.7E-07	1.7E-07	1.7E-07	1.7E-07
3.6E-07	3.6E-07	3.6E-07	3.6E-07	3.6E-07	3.6E-07	3.6E-07	3.6E-07	3.6E-07	3.6E-07	3.6E-07	3.6E-07
1.8E-07	1.8E-07	1.8E-07	1.8E-07	1.8E-07	1.8E-07	1.8E-07	1.8E-07	1.8E-07	1.8E-07	1.8E-07	1.8E-07
2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07	2.0E-07
1.6E-07	1.6E-07	1.6E-07	1.6E-07	1.6E-07	1.6E-07	1.6E-07	1.6E-07	1.6E-07	1.6E-07	1.6E-07	1.6E-07
1.5E-07	1.5E-07	1.5E-07	1.5E-07	1.5E-07	1.5E-07	1.5E-07	1.5E-07	1.5E-07	1.5E-07	1.5E-07	1.5E-07
4.6E-07	4.6E-07	4.6E-07	4.6E-07	4.6E-07	4.6E-07	4.6E-07	4.6E-07	4.6E-07	4.6E-07	4.6E-07	4.6E-07
7.7E-07	7.7E-07	7.7E-07	7.7E-07	7.7E-07	7.7E-07	7.7E-07	7.7E-07	7.7E-07	7.7E-07	7.7E-07	7.7E-07
3.7E-07	3.7E-07	3.7E-07	3.7E-07	3.7E-07	3.7E-07	3.7E-07	3.7E-07	3.7E-07	3.7E-07	3.7E-07	3.7E-07
7.0E-08	7.0E-08	7.0E-08	7.0E-08	7.0E-08	7.0E-08	7.0E-08	7.0E-08	7.0E-08	7.0E-08	7.0E-08	7.0E-08
7.8E-08	7.8E-08	7.8E-08	7.8E-08	7.8E-08	7.8E-08	7.8E-08	7.8E-08	7.8E-08	7.8E-08	7.8E-08	7.8E-08
1.3E-07	1.3E-07	1.3E-07	1.3E-07	1.3E-07	1.3E-07	1.3E-07	1.3E-07	1.3E-07	1.3E-07	1.3E-07	1.3E-07
0.0E+00	7.8E-08	7.8E-08	7.8E-08	7.8E-08	7.8E-08	7.8E-08	7.8E-08	7.8E-08	7.8E-08	7.8E-08	7.8E-08
2.3E-07	0.0E+00	3.8E-08	3.8E-08	3.8E-08	3.8E-08	3.8E-08	3.8E-08	3.8E-08	3.8E-08	3.8E-08	3.8E-08
4.1E-07	1.7E-06	0.0E+00	5.3E-08	5.3E-08	5.3E-08	5.3E-08	5.3E-08	5.3E-08	5.3E-08	5.3E-08	5.3E-08
1.3E-07	5.2E-08	7.6E-08	0.0E+00	1.3E-06	1.3E-06	1.3E-06	1.3E-06	1.3E-06	1.3E-06	1.3E-06	1.3E-06
1.0E-06	1.7E-07	3.5E-07	2.6E-07	0.0E+00	1.3E-05	2.0E-05	5.3E-06	1.5E-06	2.3E-07	4.1E-07	1.8E-07
1.9E-06	1.8E-07	3.5E-07	2.3E-07	1.3E-05	0.0E+00	4.5E-06	7.1E-06	1.1E-06	2.1E-07	3.7E-07	1.6E-07
8.1E-07	1.9E-07	4.0E-07	2.4E-07	2.0E-05	4.5E-06	0.0E+00	4.8E-06	2.7E-06	2.1E-07	3.5E-07	1.7E-07
2.1E-06	2.5E-07	5.8E-07	1.7E-07	5.3E-06	7.1E-06	4.8E-06	0.0E+00	9.7E-08	9.7E-08	9.7E-08	9.7E-08
5.9E-07	3.0E-07	9.0E-07	1.5E-07	1.5E-06	1.1E-06	2.7E-06	2.3E-06	0.0E+00	9.1E-08	9.1E-08	9.1E-08
1.3E-07	5.0E-08	7.2E-08	2.4E-05	2.3E-07	2.1E-07	2.1E-07	1.6E-07	1.3E-07	0.0E+00	1.2E-06	1.2E-06
2.0E-07	6.3E-08	9.4E-08	3.5E-06	4.1E-07	3.7E-07	3.5E-07	2.6E-07	1.9E-07	3.5E-06	0.0E+00	1.0E-06
9.9E-08	4.5E-08	6.4E-08	4.6E-06	1.8E-07	1.6E-07	1.7E-07	1.3E-07	1.2E-07	3.3E-06	1.0E-06	0.0E+00