

# Aid and Sectoral Growth in Thailand

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## Abstract

This study examines the relationship between foreign aid and sectoral growth in Thailand from 1960 to 2021 using ordinary least squares. While it is important to see how foreign aid impacts the recipient country, few studies provide analyses in this field. The estimation results show a linear relationship not only between foreign aid and secondary industry growth, but also between foreign aid and tertiary industry growth, whereas a relationship between foreign aid and primary industry growth is not necessarily seen. The results are consistent with previous studies.

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## 1 Introduction

Whether foreign aid impacts the recipient country remains under discussion. One of the reasons is that it is difficult to see the impact, especially from a macroeconomic point of view separate from the microeconomic point of view, such as the person or village level; this is called the “macro-micro problem.” There are two ways to confirm the impact of foreign aid. One is through local government areas, such as the state or city. Although dividing local government units is easy to understand, creating datasets and eliminating other effects such as spillover effects are difficult. Another method is measuring the effect of each sector on foreign aid. This makes it easier to collect data and see the effect, although it is not necessarily easy to understand because the whole country may be affected by foreign aid delivered to part of the country.

Thailand has received foreign aid for more than half a century, and sectoral data have been collected. This study examined the relationship between foreign aid and sectoral growth in Thailand from 1960 to 2021 using ordinary least squares (OLS). The remainder of this paper is organized as follows. Section 2 presents a review of the literature on the relationship between foreign aid and sectoral growth. Section 3 describes the data for the key variables and the methodology. Section 4 provides the estimation results and discusses their interpretation. Finally, section 5 summarizes and concludes the paper.

## 2 Literature Review

The effect of foreign aid on economic growth remains controversial. One reason for this is that it is difficult to grasp the impact of foreign aid on an entire country. Semi-macro data such as provincial and sectoral effects can demonstrate the impact of foreign aid.

Relative to this concept, a “macro-micro problem” exists. Although foreign aid has an impact on the recipient, it is difficult to measure the impact on the entire country, even when a huge amount of money is distributed. This was introduced by Mosley (1987) and extended by Arndt et al. (2010). Still, it is difficult to extend further, partly due to data restrictions in areas such as cities or provinces, and partly due to other effects such as spillover effects.

In this regard, the effect of foreign aid appears relatively easier to grasp for each industry in a country because acquiring whole-country industrial data is easier than acquiring semi-macro data. It is widely believed that the effect of foreign aid depends on the governance of the recipient country, as shown by Burnside and Dollar (2000). Selaya and Thiele (2010) examined the relationship between foreign aid and sectoral growth using panel data from Burnside and Dollar (2000) and showed that foreign aid has an impact on secondary and tertiary industries.

In addition, recent research shows the effect of foreign aid more in detail. One method provides the effect of foreign aid in each sector into the economic growth. Haldar and Sethi (2022) examines the effect of sectoral foreign aid toward the economic growth in 32 sub-Saharan African countries from 2002 to 2019. Results show that the foreign aid of agriculture is positive on growth but negative on structural transformation whereas that of industry is negative significant results on growth. These results infer that foreign aid to agriculture sector has also some meanings whereas foreign aid to the industry may need to release labor market. The other method provides the effect of foreign aid by the governance divided into innovation and institutional quality. Pradhan et al. (2023) examines the relationships among foreign aid, innovation, and institutional quality in 79 middle-income countries from 2005 to 2020 using time series analysis. Results show that these three elements have mutual relationship in the Granger causality in the short term as well as institutional quality and innovation affect to the foreign aid in the long term.

Related literatures above emphasize how foreign aid affects to the growth in some way. This study examined the effect of foreign aid on sectoral growth in Thailand from 1960 to 2021 following Selaya and Thiele (2010) to show the effect of foreign aid in Thailand.

### 3 Data and Methodology

#### 3.1 Methodology

We examined Equation (1) based on Selaya and Thiele (2010):

$$GDP_{kt} = \beta_0 + \beta_1 ACAID_t + \beta_2 ACAID_t^2 + \beta_3 M_t + \beta_4 REER_t + u_t \quad (1)$$

where  $t$  refers to the year and  $k$  denotes all industries—primary, secondary, tertiary, and tradable industries (primary and secondary). GDP is the gross domestic product, ACAID refers to foreign aid accumulated since 1960, and REER denotes the real effective exchange rate. Although Selaya and Thiele (2010) used policy and natural conditions as explanatory variables, we did not include these variables because our estimation focused on one country. Tradable industries and real effective exchange rates were added because the effect of foreign aid may be offset by the Dutch disease caused by foreign aid as capital inflows (Rajan and Subramanian 2011). The reason for the accumulated foreign aid from the initial year is that most foreign aid is used to create social infrastructure, such as deep-sea ports and highways.

The estimation method was as follows: First, a unit root test was conducted for each variable to determine whether  $I(0)$  or  $I(1)$ . If  $I(1)$ , we checked whether the error term was  $I(0)$ .  $I(0)$  in the error term indicated a co-integration relationship. In contrast, if the error term was  $I(1)$ , we would not use the regression because it inferred a spurious regression.

#### 3.2 Data

We used GDP and foreign aid from the World Development Indicators by the World Bank and converted them into the 2007 US dollar price. Foreign aid has accumulated since 1960, as most of it is used as social infrastructure and considered capital stock. The Bank of Thailand, the central bank in Thailand, provided the money supply data. As these data were only M1 until the 1990s, the money supply was M1 in this study. The real effective exchange rate was taken from Darvas (2012, 2021) from Bruegel, a European think tank. Descriptive statistics are presented in Table 1. The GDP of all sectors and each individual sector, as well as accumulated foreign aid, are depicted in Figure 1.

**Table 1: Descriptive statistics**

	<b>GDP</b>	<b>GDP<sub>1</sub></b>	<b>GDP<sub>2</sub></b>	<b>GDP<sub>3</sub></b>	<b>GDP<sub>12</sub></b>	<b>ACAID</b>	<b>M1</b>	<b>REER</b>
<b>N</b>	62	62	62	62	62	62	62	62
<b>MAX</b>	378.803	35.908	128.880	220.757	159.306	24.094	64.417	1.677
<b>MIN</b>	13.095	4.772	2.425	5.898	7.197	0.208	2.259	0.848
<b>MEAN</b>	148.651	16.734	53.188	78.729	69.922	12.937	17.648	1.208
<b>STD</b>	117.329	8.918	43.926	65.195	52.545	8.684	16.112	0.228

Notes

GDP<sub>1</sub>, GDP<sub>2</sub>, GDP<sub>3</sub>: GDP in the agricultural, industrial, and service sectors, respectively.

GDP<sub>12</sub>: Total GDP of agricultural and industrial sectors.

ACAID: Accumulated foreign aid since 1960.

M1: Money supply (M1)

REER: Real effective exchange rate.

The statistics in this table, except for the REER, are divided by one billion.

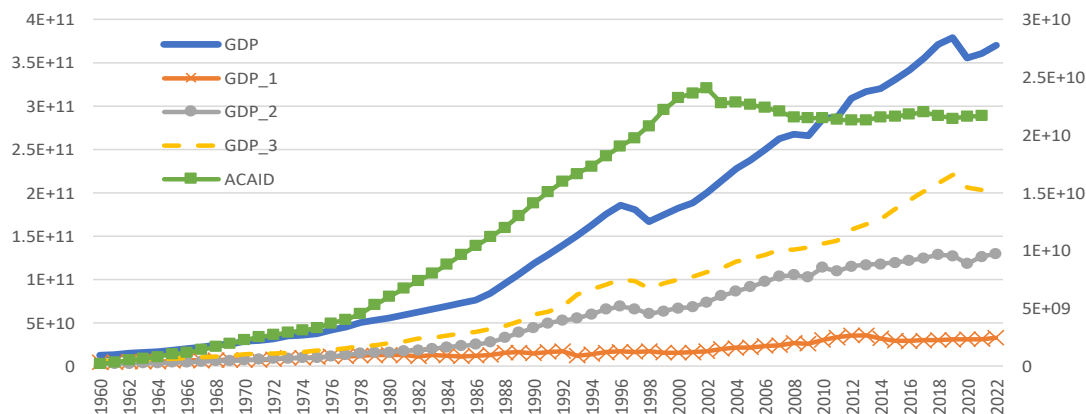


Figure 1: Descriptive statistics

## 4 Estimation Results

### 4.1 Unit Root Tests

First, we performed a unit root test to determine the trend for each variable. As shown in Table 2, most variables were I(1), accumulated foreign aid was I(2), and no variable was I(0). Hence, the error term must be viewed as I(0) if the estimation holds in the level series.

Table 2: Unit root tests

GDP: I(1)				
	ADF		PP	
	intercept	Intercept & trend	intercept	Intercept & trend
level	2.059	-2.188	1.812	-2.164
first difference	-5.735***	-6.173***	-5.735***	-6.137***
GDP <sub>1</sub> : I(1)				
	ADF		PP	
	intercept	Intercept & trend	intercept	Intercept & trend
level	-0.145	-2.061	-0.233	-2.234
first difference	-6.477***	-6.446***	-6.425***	-6.391***
GDP <sub>2</sub> : I(1)				
	ADF		PP	
	intercept	Intercept & trend	intercept	Intercept & trend
level	1.053	-2.303	0.932	-2.310
first difference	-7.347***	-7.563***	-7.389***	-7.587***
GDP <sub>3</sub> : I(1)				
	ADF		PP	
	intercept	Intercept & trend	intercept	Intercept & trend
level	1.213	-2.003	1.723	-1.889
first difference	-5.223***	-5.627***	-5.171***	-5.627***
GDP <sub>12</sub> : I(1)				
	ADF		PP	
	intercept	Intercept & trend	intercept	Intercept & trend
level	1.015	-2.189	0.917	-2.198
first difference	-6.985***	-7.154***	-6.981***	-7.153***
ACAID: I(2)				
	ADF		PP	
	intercept	Intercept & trend	intercept	Intercept & trend
level	-1.444	-1.590	-1.105	-0.541
first difference	-1.999	-2.197	-2.895*	-3.074
second difference	-7.138***	-11.465***	-11.862***	-12.197***
M1: I(1)				
	ADF		PP	
	intercept	Intercept & trend	intercept	Intercept & trend
level	3.944	0.573	9.449	2.411
first difference	-6.494***	-8.167***	-6.532***	-8.266***
REER: I(1)				
	ADF		PP	
	intercept	Intercept & trend	intercept	Intercept & trend
level	-1.394	-1.123	-1.394	-1.337
first difference	-6.378***	-6.517***	-6.378***	-6.493***

Notes: \*\*\*, \*\*, and \* indicate significance at 1%, 5%, and 10%, respectively.

## 4.2 Estimation Results

Next, we estimated equation (1) as OLS under the level series, including the autoregressive and moving average processes held for all industries and the primary, secondary, tertiary, and tradable industries (primary and secondary), as shown in Tables 3–7. Each table includes seven types of equations to robustly determine the estimation. All equations effectively estimated the error terms as  $I(0)$ .

Table 3 shows the estimation results for all industries. Table 3 lists the following points: First, linear relationships between GDP and foreign aid are shown by equations (1), (3), and (5), whereas quadratic relationships are not shown by equations (4), (6), and (7). Second, foreign aid has a positive relationship with total growth, as shown by all equations. The coefficient of foreign aid (ACAID) is approximately 4 from equations (1), (2), and (5), and is stable. Third, the significance level was not high, and the conclusions must be viewed as flexible.

**Table 3: Estimation results for all industries**

Equation	①	②	③	④	⑤	⑥	⑦
Dependent Variable	GDP	GDP	GDP	GDP	GDP	GDP	GDP
ACAID	4.085	4.717	3.553	16.157	4.218	13.839	15.441
	(2.224)*	(2.139)**	(2.458)	(8.871)*	(2.179)*	(11.992)	(9.931)
ACAID <sup>2</sup>				0.000		-0.000	-0.000
				(0.000)*		(0.000)	(0.000)
M1			1.117		0.985	1.154	1.004
			(0.600)*		(0.516)*	(0.618)*	(0.541)*
REER		41,300,000,000		45,000,000,000	37,500,000,000		41,100,000,000
		(21800000000)*		(21,300,000,000)	(22,400,000,000)*		(21,700,000,000)
C	140,000,000,000	80,600,000,000	108,000,000,000	25,500,000,000	57,400,000,000	59,800,000,000	1,400,000,000
	(122,000,000,000)	(123000000000)	(93,100,000,000)	(115,000,000,000)	(102,000,000,000)	(104,000,000,000)	(103,000,000,000)
AR(1)	0.996	0.997	0.994	0.994	0.995	0.989	0.991
	(0.016)***	(0.016)***	(0.031)***	(0.022)***	(0.026)***	(0.040)***	(0.037)***
MA(1)	0.393	0.383	0.362256	0.379	0.349	0.344	0.333
	(0.120)***	(0.142)***	(0.138)**	(0.133)***	(0.148)**	(0.147)**	(0.149)**
Adjusted R-squared	0.995	0.996	0.996	0.996	0.996	0.996	0.996
Durbin-Watson stat	1.723	1.669	1.828	1.655	1.790	1.816	1.775

Notes

AR: Autoregressive

MA: Moving average

\*\*\*, \*\*, and \* indicate significance at 1%, 5%, and 10%, respectively.

Table 4 shows the estimation results for the primary industry (agriculture). The equations in Table 4 do not estimate foreign aid effectively. Thus, foreign aid does not necessarily affect the sectoral growth of Thailand's agricultural industry.

By contrast, Table 5 shows the estimation results for the secondary industries (manufacturing, mining, and construction). Foreign aid is effectively positively estimated by equations (15), (16), (17), and (19), but the estimation is not quadratic. Since equations (16) and (19) are effectively positively estimated as 5% and the coefficient is similar at around 2, it can be inferred that there is a relatively stable relationship between foreign aid and secondary industry growth.

**Table 4: Estimation results for the primary industry (agriculture)**

Equation	⑧	⑨	⑩	⑪	⑫	⑬	⑭
Dependent Variable	GDP <sub>1</sub>	GDP <sub>1</sub>	GDP <sub>1</sub>	GDP <sub>1</sub>	GDP <sub>1</sub>	GDP <sub>1</sub>	GDP <sub>1</sub>
ACAID	-0.083	-0.072	0.430	2.180	0.436	1.870	1.903
	(0.369)	(0.372)	(0.297)	(1.309)	(0.305)	(1.823)	(1.869)
ACAID <sup>2</sup>				0.000		-0.000	-0.000
				(0.000)*		(0.000)	(0.000)
M1			0.208		0.208	0.170	0.168
			(0.112)*		(0.114)*	(0.124)	(0.137)
REER		584,000,000		1,330,000,000	213,000,000		889,000,000
		(4,760,000,000)		(4,480,000,000)	(5,480,000,000)		(5,280,000,000)
C	18,700,000,000	17,900,000,000	7,290,000,000	5,600,000,000	6,970,000,000	4,470,000,000	3,090,000,000
	(10,600,000,000)*	(13,000,000,000)	(3,490,000,000)**	(17,000,000,000)	(8,390,000,000)	(20,500,000,000)	(23,100,000,000)
AR(1)	0.989	0.989	0.869	0.965	0.869	0.925	0.924
	(0.025)***	(0.025)***	(0.065)***	(0.038)***	(0.065)***	(0.050)***	(0.051)***
MA(1)	0.264	0.264	0.195	0.269	0.195	0.170	0.170
	(0.097)***	(0.099)***	(0.112)*	(0.105)**	(0.121)	(0.101)*	(0.106)
Adjusted R-squared	0.971	0.971	0.970	0.972	0.970	0.973	0.972
Durbin-Watson stat	1.986	1.669	1.968	1.966	1.968	1.971	1.972

Notes: \*\*\*, \*\*, and \* indicate significance at 1%, 5%, and 10%, respectively.

**Table 5: Estimation results for secondary industries (manufacturing, mining, and construction)**

Equation	⑮	⑯	⑰	⑱	⑲	⑳	㉑
Dependent Variable	GDP <sub>2</sub>	GDP <sub>2</sub>	GDP <sub>2</sub>	GDP <sub>2</sub>	GDP <sub>2</sub>	GDP <sub>2</sub>	GDP <sub>2</sub>
ACAID	1.878	2.206	1.694	6.690	2.015	5.730	6.262
	(0.969)*	(0.960)**	(0.881)*	(3.530)*	(0.846)**	(4.785)	(4.347)
ACAID <sup>2</sup>				-0.000		-0.000	-0.000
				(0.000)*		(0.000)	(0.000)
M1			0.593		0.556	0.616	0.577
			(0.213)***		(0.199)***	(0.284)**	(0.253)**
REER		16,300,000,000		17,500,000,000	14,700,000,000		15,800,000,000
		(8,860,000,000)*		(8,450,000,000)**	(10,200,000,000)		(10,300,000,000)
C	42,300,000,000	17,600,000,000	24,800,000,000	-2,660,000,000	3,340,000,000	7,070,000,000	-16,700,000,000
	(38,600,000,000)	(38,900,000,000)	(23,600,000,000)	(46,600,000,000)	(27,600,000,000)	(56,800,000,000)	(51,800,000,000)
AR(1)	0.995	0.995	0.988	0.991	0.989	0.977	0.978
	(0.022)***	(0.021)***	(0.037)***	(0.030)***	(0.034)***	(0.054)***	(0.052)***
MA(1)	0.150	0.145	0.091	0.141	0.078	0.080	0.070
	(0.105)	(0.116)	(0.105)	(0.117)	(0.109)	(0.132)	(0.126)
Adjusted R-squared	0.993	0.993	0.993	0.993	0.993	0.993	0.994
Durbin-Watson stat	1.808	1.761	1.913	1.743	1.885	1.904	1.880

Notes: \*\*\*, \*\*, and \* indicate significance at 1%, 5%, and 10%, respectively.

Table 6 presents the estimation results for tertiary (service) industries. Similar to the secondary industries, foreign aid is effectively positively estimated by equations ②②, ②③, ②④, and ②⑥, but the estimation is not quadratic. Since equations ②②, ②③, and ②⑥ are effectively positively estimated at 5% or 1%, and the coefficient is similar at around 3, it can be inferred that there is a relatively stable relationship between foreign aid and tertiary industry growth.

**Table 6: Estimation results for the tertiary industry (service sector)**

Equation	②②	②③	②④	②⑤	②⑥	②⑦	②⑧
Dependent Variable	GDP <sub>3</sub>	GDP <sub>3</sub>	GDP <sub>3</sub>	GDP <sub>3</sub>	GDP <sub>3</sub>	GDP <sub>3</sub>	GDP <sub>3</sub>
ACAID	2.876	3.163	2.644	7.901	2.785	6.500	7.435
	(1.240)**	(1.149)***	(1.437)*	(5.347)	(1.282)**	(6.256)	(5.989)
ACAID <sup>2</sup>				-0.000		-0.000	-0.000
				(0.000)		(0.000)	(0.000)
M1			0.728		0.64500	0.720	0.623
			(0.307)**		(0.296)**	(0.326)**	(0.330)*
REER		23,400,000,000		24,900,000,000	19,800,000,000		21,500,000,000
		(13,700,000,000)		(13,800,000,000)*	(15,200,000,000)		(15,800,000,000)
C	69,800,000,000	37,100,000,000	47,200,000,000	12,000,000,000	24,000,000,000	25,600,000,000	-3,250,000,000
	(64,300,000,000)	(64,400,000,000)	(44,900,000,000)	(67,400,000,000)	(50,000,000,000)	(62,300,000,000)	(66,100,000,000)
AR(1)	0.995	0.995	0.988	0.992	0.991	0.980	0.984
	(0.019)***	(0.017)	(0.032)***	(0.022)***	(0.028)***	(0.038)***	(0.038)***
MA(1)	0.501	0.488	0.585	0.492	0.578	0.571	0.562
	(0.114)***	(0.118)***	(0.120)***	(0.114)***	(0.128)***	(0.123)***	(0.128)***
Adjusted R-squared	0.995	0.995	0.995	0.995	0.995	0.995	0.995
Durbin-Watson stat	1.785	1.760	1.926	1.772	1.935	1.909	1.924

Notes: \*\*\*, \*\*, and \* indicate significance at 1%, 5%, and 10%, respectively.

Table 7 presents the estimation results for the tradable industries (total of primary and secondary). Because the estimation results show a mixture of the primary and secondary industries, only equations ③① and ③③ are positively estimated at the 10% significance level. It can be inferred that tradable industries do not necessarily affect foreign aid in Thailand.

**Table 7: Estimation results for the tradable industries (primary and secondary industries)**

Equation	②⑨	③①	③①	③②	③③	③④	③⑤
Dependent Variable	GDP <sub>12</sub>	GDP <sub>12</sub>	GDP <sub>12</sub>	GDP <sub>12</sub>	GDP <sub>12</sub>	GDP <sub>12</sub>	GDP <sub>12</sub>
ACAID	1.626	1.950	1.406	8.474	1.736	7.382	7.951
	(1.148)	(1.150)*	(1.034)	(4.716)*	(1.036)*	(5.261)	(4.914)
ACAID <sup>2</sup>				-0.000		-0.000	-0.000
				(0.000)*		(0.000)	(0.000)
M1			0.679		0.644	0.723	0.682
			(0.264)**		(0.254)**	(0.330)**	(0.297)**
REER		16,800,000,000		18,700,000,000	14,900,000,000		16,600,000,000
		(11,900,000,000)		(11,200,000,000)	14,400,000,000		(13,700,000,000)
C	63,600,000,000	38,300,000,000	43,800,000,000	8,690,000,000	21,900,000,000	17,200,000,000	-7,720,000,000
	(52,900,000,000)	(54,300,000,000)	(34,900,000,000)	(56,700,000,000)	(41,800,000,000)	(55,000,000,000)	(52,400,000,000)
AR(1)	0.996	0.996	0.992	0.991	0.992	0.981	0.982
	(0.023)***	(0.023)	(0.032)***	(0.032)***	(0.031)***	(0.049)***	(0.047)***
MA(1)	0.202	0.199	0.122	0.193	0.114	0.103	0.097
	(0.127)	(0.137)	(0.118)	(0.141)	(0.121)	(0.142)	(0.136)
Adjusted R-squared	0.993	0.993	0.993	0.993	0.993	0.993	0.994
Durbin-Watson stat	1.804	1.767	1.910	1.748	1.887	1.905	1.883

Notes: \*\*\*, \*\*, and \* indicate significance at 1%, 5%, and 10%, respectively.

In summary, the estimation results indicated the following. First, the accumulated foreign aid was effectively estimated to be positive, except for the agricultural industry. In particular, the secondary and tertiary industries had relationships with foreign aid, in accordance with the literature. Second, the real effective exchange rate was considered to be effectively facilitated by the secondary industry but did not have a strong effect. Third, the tradable industries did not necessarily have a positive effect on foreign aid, partly because agriculture was included. By contrast, the GDP of all industries was effectively positively estimated, partly because the weight of the primary industry was relatively low compared to that of the tradable industries.

Finally, these estimation results are not necessarily robust because they can be altered by changing the explanatory variables, taking logarithms, or even changing the digits. Further research is required to confirm the hypothesis.



## 5 Conclusion

This study examined the relationship between foreign aid and sectoral growth in Thailand from 1960 to 2021 using OLS under data restrictions. While it is important to see how foreign aid impacts the recipient country, few studies have provided analyses in this field. The estimation results were summarized as the following three points. First, the relationship between foreign aid and secondary and tertiary industry growth was seen. This was partly because the manufacture products made in the factories are easier to improve the productivity. Second, a relationship between foreign aid and primary industry growth was not observed partly due to reflect on the difficulty of strengthening the productivity. Third, the relationship between foreign aid and secondary and tertiary industry growth was seen as linear, but not quadratic. It inferred that the relationship did not necessarily have extreme value such as maximum or adequate flow of foreign aid. These results were consistent with previous studies. Because this research was limited by data restrictions, further research that includes dataset creation is needed.

## References

- Arndt, C., Jones, S., and Tarp, F. (2010) Aid, growth, and development: Have we come full circle? UNU-WIDER Working Paper No. 2010/96.
- Burnside, C. and Dollar, D. (2000) Aid, policies, and growth. *American Economic Review*, 90(4), 847–868.
- Darvas, Z. (2012) Real effective exchange rates for 178 countries: A new database. Working Paper 2012/06, Bruegel.
- Darvas, Z. (2021) Timely measurement of real effective exchange rates. Working Paper 15/2021, Bruegel.
- Haldar, A., and Sethi, N. (2022) Effect of sectoral foreign aid allocation on growth and structural transformation in sub-Saharan Africa-Analysing the roles of institutional quality and human capital. *Economic Analysis and Policy*, 76, 1010-1026.
- Mosley, P. (1987) *Overseas aid: Its defense and reform*. Wheatshead Books: Brighton.
- Pradhan, R. P., Arvin, M. B., Nair, M. S., and Bennett, S. E. (2023) Does foreign aid affect innovation and institutional quality in middle-income countries? *Evaluation and program planning*, 100, 102340-102340.
- Rajan, R. G. and Subramanian, A. (2011) Aid, Dutch disease, and manufacturing growth. *Journal of Development Economics*, 94(1), 106–118.
- Selaya, P. and Thiele, R. (2010) Aid and sectoral growth: Evidence from panel data. *Journal of Development Studies*, 46(10), 1749–1766.