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Aid modality and growth under post-conflict conditions

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Abstract

Amid a massive influx of development assistance, considerable skepticism remains regarding the effectiveness of aid in promoting the development of conflict-affected states under post-conflict conditions. Although the importance of aid modalities and policies for allocating aid to improve aid effectiveness has been the subject of much discussion, there is still limited research on post-conflict countries. The current paper, accordingly, contributes to the aid-development literature by offering an assessment of the effectiveness of specific aid modalities in the context of post-conflict circumstances. We measure the effects of four key aid modalities—financial program aid, project aid, technical assistance, and food aid—on the economic growth of conflict-affected countries employing the system-GMM estimator and using the conflict database of the Uppsala Conflict Data Program and Organization for Economic Co-operation and Development's Development Assistance Committee aid database. We find that financial program aid, which generally supports national finance and state-led development programs, has a marginally significant positive effect when it is administered in post-conflict conditions, particularly for non-least developed and African countries. In contrast, other aid types—food aid and technical assistance show statistically insignificant or negative effects on the GDP per capita growth under post-conflict conditions. These heterogeneous effects of aid by type depending on a country's development status and region suggests that the allocation of aid to conflict-affected countries must be strategic, considering the conflict type, development policy, and absorptive capacity of the recipients to be effective.

Keywords Aid modality · Post-conflict · Growth

JEL Classification O1 · F35

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1 Introduction

The number of violent conflicts worldwide has reached its highest level since the end of World War II (UN, 2023). These conflicts not only inflict significant human casualties and material destruction during their occurrence but also exert lasting effects on the lives of individuals in post-conflict regions even after the signing of peace agreements and the official end of hostilities. Nations in post-conflict circumstances often experience a decline in the ability to efficiently allocate resources, which can lead to persistent poverty, and ultimately ensnare a nation in a conflict-trap (Collier, 2003). Two billion people—a quarter of the world's population—live in conflict-affected states, where poverty rates ($1.90 per day) are close to 40 percent (Mueller & Techasunthornwat, 2020). Furthermore, 40 percent of civil war affected countries relapse into conflict within a decade (Collier et al., 2008; Hoeffler, 2012).

Given the detrimental impact of violent conflicts, increased attention has been paid to approaches for successfully reconstructing conflict-affected nations. In addition, growing scholarly interest in examining the allocation of aid in post-conflict scenarios and its impact on the economic recovery and development of these countries has emerged. The choice of aid modality, in reference to the forms and instruments used for aid delivery, is a key concern in aid allocation that warrants further investigation in the context of post-conflict status.

For example, in the context of Afghanistan's post-conflict status after 2001, the modality of aid has become a crucial issue in investigating state-building endeavors and the impact of aid on the process of state reconstruction. Recognizing the significance of enhancing the government's capacity and reducing transaction costs, both the Afghanistan government and donors reached a consensus that at least 50 percent of total development aid should be allocated as "on-budget" support, encompassing budgetary assistance, core contributions, and pooled funds (Bizhan, 2018), resulting in a substantial increase in the proportion of aid categorized as on-budget of 41 percent in 2016, in comparison to a mere 17 percent in 2010 (OECD CRS, 2023). However, a paradox arose regarding the fact that while the donors desired a strong and effective governmental framework to facilitate the allocation of on-budget aid, they also recognized the urgent need to address the weak governance and widespread corruption in Afghanistan (Bizhan, 2018). Consequently, high aid-dependency on government expenditure and weak governance became the primary challenge for Afghanistan's ability to escape the conflict-trap, culminating in a tragic takeover by the Taliban in 2021 (Knez & Lokar, 2022).

Studies have found that each modality has varying impact on growth, implying that aggregate treatment of aid will lead to biased findings (Bandstein, 2007; Feeny, 2005; McGillivray, 2006; Ouattara & Strobl, 2008; Quibria, 2014; Tilley & Tavakoli, 2012). For example, recipients' unique circumstances shape the varying outcomes of financial program aid, which relies on recipient country systems and donor partnerships, in contrast to project aid with predefined input, activities, and output (Bandstein, 2007; OECD DAC, 2020). The Paris Declaration on

Aid Effectiveness directs partner (i.e., recipient) countries to determine "the most effective modalities of aid delivery," and the donor community to "be guided by development strategies and priorities established by partner countries" (High Level Forum, 2005). To emphasize recipient countries' ownership and capacity building, the proportion of financial program aid to developing countries has increased in the past decade (Molenaers et al., 2015). From 2015 to 2017, 72.6 percent of development aid to conflict-affected countries was in the form of project aid, and only 8.9 percent was in the form of financial program aid (including budgetary support). While there are variations, an increase in financial program aid for conflict-affected states is also apparent. For example, in the case of Afghanistan, the proportion of this type of aid has increased by 9.8 percent in the past 5 years after donors agreed to enhance domestic capacity and ownership.[1]

While studies have explored the varying returns to aid modalities, a gap remains in the literature regarding specific impacts in the context of post-conflict states, which often confront unique challenges and require tailored approaches for effective assistance. Post-conflict states often face weak governance, political instability, social unrest, and have specific needs that arise from unstable environments, including humanitarian aid and peacebuilding efforts (Feeny & McGillivray, 2009). Consequently, it is reasonable to hypothesize that aid modalities may exhibit distinct behaviors within such contexts.

Our study addresses this significant gap by conducting a systematic analysis of the effects of different aid modalities on GDP per capita growth in conflict-affected states. For the purposes of our research, conflict-affected states refer to those currently experiencing or recently emerging from conflict. We build on the work of Ouattara and Strobl (2008) and Winters and Martinez (2015), using four explanatory variables of project aid, financial program aid, technical assistance, and food aid as main aid modalities. To gain a better understanding of the heterogeneous effects of aid modalities resulting from various kinds of conflict-affected circumstances, we divide the sample based on development status and regional categorization, representing different conflict types (state-based armed conflict, non-state conflict, and one-sided violence). Thus, the study extends previous research by introducing the heterogeneous nature of aid by modality and the heterogeneity of aid recipients.

Using data obtained from the conflict database of the Uppsala Conflict Data Program (UCDP)[2] database, we establish a post-conflict indicator for each state and construct panel data for 96 conflict-affected states from 2002 to 2020. To avoid the potential for endogeneity bias in our assessment of the effectiveness of the aid, we employ the generalized method of moments (GMM) estimation procedure, which has been widely used in the literature, referencing (Hansen & Tarp, 2001).

The results of our estimation indicate that financial program aid, which generally supports national finance and state-sponsored development programs, does not have a statistically significant effect on GDP per capita growth overall in post-conflict nations. Further dividing the sample by development status and continent,

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[1] Authors' calculation based on OECD DAC CRS (2020) data.
[2] Uppsala Conflict Data Program (https://ucdp.uu.se).

we identify a marginally positive effect of financial program aid on GDP per capita growth in post-conflict conditions, with the size of the financial aid effect more pronounced for non-least developed countries (LDCs) and African countries. Non-LDC countries also show a statistically significant positive project aid effect. Food aid and technical assistance are found to have statistically insignificant or negative effects on GDP per capita growth.

In what follows, we first survey the relevant literature on the effectiveness of development aid to fragile and conflict-affected states in Sect. 2. Section 3 describes the estimation method and data, and Sect. 4 presents the estimation results and robustness tests. Finally, the paper concludes with a discussion of the significance of the findings in Sect. 5.

2 Literature review

Since the pioneering studies of Collier and Hoeffler (2002, 2004), scholars have investigated the impact of development aid on peace, conflict recurrence, and socio-economic development for conflict-affected states, with inconclusive results. Flores and Nooruddin (2009) examine the effect of a post-conflict project by the World Bank to promote peace, determining that aid has a marginal effect on the recurrence of conflict in vulnerable countries. In contrast, Nielsen et al. (2011) determine that development aid actually exacerbates and protracts violent conflicts. Strandow et al. (2012) reveal a positive correlation between the amount of aid distributed to a region and the number of deaths in an armed conflict in the region based on the number of days after aid is delivered. Conducting a comprehensive review of studies on the nature and effectiveness of development assistance in vulnerable countries, Dreher et al. (2017) draw attention to the extreme poverty in these countries and donors' failure to implement effective strategies for distributing aid.

Studies have compared the heterogeneous effects of financial program aid with those of project aid (e.g., Ouattara and Strobl (2008) and Bandstein (2007)). Financial program aid includes budgetary support, core contributions, and pooled fund programs that generally employ the recipient country's systems and partnerships with other donor communities. In contrast, project aid consists of predefined input, activities, and output that are implemented over a specified period of time. The main difference between these types of aid is that financial program aid, particularly in the form of budgetary or sectoral support, relies on recipient countries' own financial management systems, supports internal development strategies, and is more sustainable and predictable in comparison to project aid (Bandstein, 2007; OECD DAC, 2020).

While studies exploring the mechanisms through which aid impacts specific sectors and the heterogeneous effects across aid modalities have used disaggregated data (Bandstein, 2007; Feeny, 2005; McGillivray, 2006; Ouattara & Strobl, 2008; Quibria, 2014; Tilley & Tavakoli, 2012), research regarding conflict-affected states has primarily focused on the relationship between aid and growth at the aggregate level. Although accumulating evidence has examined donors' modality selection for conflict-affected states based on partner countries' quality of governance (Clist

et al., 2012; Molenaers et al., 2015; Winters & Martinez, 2015), it remains unclear whether certain modalities of aid are more effective and why.

Scholars have extensively explored how aid operates differently based on recipient countries' economic and political development status (Asiedu & Nandwa, 2007). Conflict has been increasingly recognized as having an influence on aid effectiveness. Collier and Hoeffler (2002) and Donaubauer et al. (2019) demonstrate that aid effectiveness depends on a state's system of governance and stability, which improves with the transition to post-conflict conditions. Characteristics of conflict are likely to affect the governance, institutional circumstances, and poverty status of a country (Brinkerhoff, 2007; Savun & Tirone, 2011), and have been acknowledged as key determinants of aid effectiveness (Burnside & Dollar, 2000; Collier & Dollar, 2002). For instance, state-based armed conflict, non-state conflict, and one-sided violence (as categorized by the UCDP based on the parties involved) exhibit notable differences in the number of fatalities overall, fatalities per conflict, and the pace at which some conflicts recur depending on the conflict type, regions, and countries (Davies et al., 2022). State-based armed conflict has a higher number of fatalities, whereas non-state conflict, particularly in sub-Saharan Africa and the Middle East, has a lower death rate but a higher likelihood of recurrence (Davies et al., 2022; Kreutz, 2010). Brinkerhoff (2007) argues that non-state-involved conflicts do not significantly affect state governance, while state-involved conflicts lead to weak governance in post-conflict times. State-based conflicts can also produce more infrastructural damage and loss of lives because they are often larger in scale than non-state-based and one-sided conflicts (Davies et al., 2022). Additionally, state-based armed conflict raises the probability of substantially altering local and state institutions in addition to polarization within communities based on sectarian or political identities (Davenport et al., 2019). Such a domestic environment can negatively influence the effectiveness of financial programs, which are predominantly overseen by state/local governance in post-conflict conditions (Walter, 2015).

This study addresses two types of heterogeneity in the aid–growth relationship in post-conflict contexts: heterogeneity based on aid modality and recipient characteristics. The first form of heterogeneity acknowledges that different types of aid operate through distinct mechanisms to influence growth; therefore, the initial part of our empirical analysis examines whether financial program aid that leverages the recipient's domestic system has a stronger impact on growth compared with other forms of aid in the post-conflict context. Considering that the transition from conflict to post-conflict conditions enhances the effort to shape the governance and domestic systems of conflict-affected countries (Brinkerhoff, 2007), we expect the effectiveness of financial program aid to increase.

The second form of heterogeneity pertains to recipients of varied conflict-affected circumstances. States' economic and political contexts and different conflict types can exert diverse impacts of different aid modalities on growth. As a novel contribution, we divide the sample according to region and income categories; the former capturing diverse conflict types, and the latter representing different levels of development for the first time. We hypothesize that countries with more developed systems (non-LDCs) benefit more from financial program aid compared with their counterparts (LDCs) in post-conflict circumstances. Africa has experienced more

non-state-involved conflicts than other continents, which may have resulted in minimal impact on state governance; thus we also test the hypothesis that the region has benefited more from financial program aid compared to other continents that are mostly affected by state-involved conflicts.

3 Methodology and data

3.1 Methodology

We first address endogeneity when estimating the aid–growth equation, as aid and other independent variables on the right side of our equation are not generated independently, but are determined by other factors, such as diplomatic and historical relations, the distance between donor and recipient countries, and whether they share a common language (Arndt et al., 2015; Rajan & Subramanian, 2008). Aid can also be contemporaneously predetermined with the growth rate (Burnside & Dollar, 2000). Previous research has included various econometric methodologies intended to solve the endogeneity problem.[3] The most widely used approaches are fixed-effects models, two-stage least squares methods using instrumental variables (Burnside & Dollar, 2000), and the system-GMM (Hansen & Tarp, 2001; Ouattara & Strobl, 2008).

Hansen and Tarp (2001) argue that bias arises when estimating the effect of aid on economic growth when lagged independent variables serve as explanatory variables, as the economic growth variable is affected by lagged independent variables (such as GDP) in the initial period even when other control variables are strongly exogenous. Arellano and Bond (1991) devise first-order conditions for GMM to eliminate the endogeneity issue caused by lagged independent variables. Hansen and Tarp (2001) note that the potential for bias remains in circumstances in which the time series is short (which is true of the analysis of the effectiveness of aid), and for this reason, the authors advocated the use of the GMM technique of Arellano and Bover (1995) and Blundell and Bond (1998). System-GMM refers to the method of combining the level equation and the first-differenced equation into one system. To eliminate endogeneity, lagged difference variables for explanatory variables are used as an instrument in the level equation, and level and lagged variables are adopted as instrument variables in the first differenced equation. Ouattara and Strobl (2008) adopt system-GMM for the purpose of avoiding endogeneity bias when estimating the effectiveness of aid on economic growth.

Following Ouattara and Strobl (2008) and Donaubauer et al. (2019), we first estimate the effectiveness of aid on economic growth in conflict-affected contexts by modality using the fixed-effects model with the following equation:

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[3] Bitzer and Goeren (2018) conducted a detailed meta-analysis regarding the methodologies used for measuring aid effectiveness.

$$g_{jt} = \alpha + \beta Aid_{jt} + \sigma X_{jt} + \gamma_j + \delta_t + \varepsilon_{jt} \tag{1}$$

where g_{jt} is the economic growth rate in period t for recipient country j, and Aid_{jt} is the vector of aid for recipient country j in period t across the four aid modalities (financial program aid, project aid, technical assistance grants, and food aid) and other aid. With this equation, we calculate the three-year moving averages of donors' aid disbursement in the four modalities as a proportion of the recipient country's GDP and employ these averages as independent variables. To smooth the volatility of aid and growth rate, period t indicates the three-year moving average. X_{jt} represents the growth rate in the first period,[4] γ_j is country fixed effect, δ_t reflects the time specific fixed effect, and ε_{jt} is an i.i.d. residual term.

To estimate the effect of post-conflict aid for comparison with the conflict period, we include a dummy variable that indicates a post-conflict period referencing Collier and Hoeffler (2004) and Donaubauer et al. (2019) with the following equation:

$$g_{jt} = \alpha + \beta Aid_{jt} + \gamma Postconfl_{jt} + \delta\left(Aid_{jt} * Postconfl_{jt}\right) + \sigma X_{jt} + \gamma_j + \delta_t + \varepsilon_{jt} \tag{2}$$

where $Postconfl_{jt}$ is a dummy variable that represents 1 (in a post-conflict stabilization phase),[5] if a country has suffered no more than 25 annual conflict-related deaths for at least four consecutive years following the outbreak of a conflict or 0 indicating in dispute.[6] In addition, to obtain the effect of the aid in post-conflict stabilization phases, we set the interaction variable, $Postconfl_{jt}$ interacted with Aid_{jt} as an independent variable.

To address the potential endogeneity of Aid_{jt}, we estimate Eqs. (1) and (2) using the system-GMM technique with Windmeijer-corrected standard errors. For instance, the lagged differences of each of the aid modalities are used as instruments in the level equation and the lagged levels of each of the aid modalities are used as instruments in the difference equation.

3.2 Data

3.2.1 Aid by modality

This study employs the annual disbursement data provided by the OECD Credit Reporting System (CRS) database in the analysis. This database includes

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[4] We also conduct the same analysis including a set of control variables that include inflation rate, broad money to GDP ratio, government expenditure, and institutional (government) quality that have been widely used in previous literature on the aid–growth nexus (Burnside and Dollar, 2000). The regression results including these control variables are available upon request.

[5] The post-conflict dummy variable is a binary variable with a value of 1 or 0 that is not derived from a three-year moving average.

[6] Controversy continues regarding how many years the death toll should remain below a certain level to define the post-conflict stabilization stage. This study referenced Collier and Hoeffler (2004) and Donaubauer et al. (2019), who contended that a country has entered a stabilization phase when the annual number of deaths due to conflict is less than 25 for 4 consecutive years. In that case, the *Postconflict* indicator will be 1 as a dummy variable in the fifth year.

Table 1 Summary statistics

Variables (unit)	Mean	Std. Dev	Min	Max
GDP per capita growth rate (%)	2.21	5.87	−50.73	85.69
Financial program aid/GDP (%)	2.56	20.73	0.00	623.78
Project aid/GDP (%)	8.62	56.65	−0.03	1194.16
Technical assistance grants/GDP (%)	0.94	4.30	0.00	75.34
Food aid/GDP (%)	0.33	3.35	0.00	116.01
Other aid/GDP (%)	35.27	209.87	−0.11	5754.90
Post-conflict	0.27	0.44	0.00	1.00

Source: We calculated summary statistics referencing World Bank and OECD databases. The proportion of aid in GDP is computed by type

type-specific aid data related to projects, budgetary support, and programs, and sector-specific aid data broken down by sector. Some studies of aid to fragile and conflict-affected countries use commitment data rather than disbursement data because of inconsistency and unavailability for the 1990s (Donaubauer et al., 2019). However, development economists recommend the use actual disbursement data because it is uncertain whether a commitment has been disbursed and the development and economic growth indicators of recipient countries do not change in response to the level of commitment (Kodama, 2012; Leurs, 2005); therefore, we use disbursement rather than commitment data. We use OECD DAC CRS project purpose codes to assign each project aid to one of four categories—financial program aid, project aid, technical assistance, and food aid—from 2002 to 2017, referencing the modality labeling method of (Winters & Martinez, 2015).

Previous studies have generally employed a three- or five-year moving average of aid per capita to control for volatility in aid disbursement over time related to external (i.e., political and economic) and internal (i.e. administrative procedures, personnel changes, and departmental circumstances) factors (Donaubauer et al., 2019; Ouattara & Strobl, 2008) and adjusted to the GDP of the recipient country. We likewise use a three-year moving average to calculate the amount of aid by modality as a percentage of the recipient country's GDP, obtaining the GDP data from the World Bank's World Development Indicators.

3.2.2 Post-conflict dummy

The post-conflict dummy is one of the main independent variables along with aid by type in Eq. (2). The UCDP database provides statistics on the first and last years of disputes, the parties involved, the amount of damage caused, and the number of associated deaths. Of these statistics, the death toll is often used to define post-conflict stabilization phases in previous studies, including Collier and Hoeffler (2004), Donaubauer et al. (2019), and Pettersson and Wallensteen (2015). In this study, as

noted above, in cases in which the annual death toll remains below 25 for four consecutive years following the outbreak of conflict, the dummy variables are assigned a value of 1 for the fifth year.[7] Table 1 presents basic summary statistics for the main variables used in the equations.

3.2.3 Sample countries

The countries included in this study are those that have experienced at least one-armed conflict events with 25 or more conflict-related deaths since 1990 (see online Appendix Table A1).

4 Results

4.1 Effect of aid on growth by modality

Table 2 presents the estimation results of the fixed-effects model and the system-GMM analysis of the effects of aid by type on GDP per capita growth from Eqs. (1) and (2). The fixed-effects models demonstrate positive effects from financial program and technical assistance aid on conflict-affected countries' economic growth, while project aid, food aid, and other types of aid do not affect the overall economic growth of these countries (i.e., including pre-conflict, conflict, and post-conflict periods combined). However, in post-conflict periods, financial program aid, project aid, and technical assistance do not have positive effects on GDP per capita growth. Notably, technical assistance is negatively associated with GDP per capita growth when it is interacted with the post-conflict dummy variable, revealing that a 1 percent increase in the technical assistance-to-GDP ratio in the post-conflict period decreases GDP per capita growth in conflict-affected states by around 0.23 percent points.

The system-GMM results, which control for the collinearity and potential endogeneity issues in the aid–growth equation, are presented in columns 3 and 4 of Table 2. Two conditions must be satisfied to verify that this methodology is valid. The first condition is that the null hypothesis that the set of instrumental variables has validity, which is confirmed by using the Hansen test, is not rejected. The p-values for the Hansen test presented in the last lines of columns 3 and 4 of Table 2 indicate that the set of instrumental variables used in this analysis model is valid. The second condition is that the second- and further-differenced error terms should not show autocorrelation; that is, the Arellano and Bond (AR) (2) test should not reject the null hypothesis.

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[7] We also modify periods of peace by defining the post-conflict stage after 8 years of peace instead of the four-year period used in the baseline. The estimation results using this modified peace period showed only weak and marginal effects on GDP per capita growth and sectoral development compared with the baseline estimations. These results are available upon request.

Table 2 The effects of aid on economic growth by type

Variables	Fixed effect		System-GMM	
	(1)	(2)	(3)	(4)
Lagged GDP per capita growth	0.486***	0.483***	0.569***	0.521***
	(0.085)	(0.087)	(0.084)	(0.120)
Financial program aid	0.105***	0.078*	− 0.039	− 0.117
	(0.028)	(0.043)	(0.061)	(0.093)
Project aid	− 0.167	− 0.245	− 0.216	− 0.202
	(0.144)	(0.190)	(0.248)	(0.303)
Technical assistance	0.284**	0.417***	0.212	0.444**
	(0.109)	(0.130)	(0.178)	(0.214)
Food aid	− 0.065	− 0.050	0.026	− 0.004
	(0.060)	(0.048)	(0.101)	(0.147)
Other aid	0.549	0.215	0.294	0.558
	(0.554)	(0.832)	(1.361)	(1.894)
Post-conflict * Financial program aid		0.064		0.166
		(0.046)		(0.130)
Post-conflict * Project aid		0.181		0.103
		(0.166)		(0.374)
Post-conflict * Technical assistance		− 0.234*		− 0.666*
		(0.128)		(0.393)
Post-conflict * Food aid		− 0.305		− 0.963**
		(0.286)		(0.401)
Post-conflict * Other aid		0.595		0.213
		(0.931)		(2.137)
Post-conflict		− 0.118		1.753
		(0.301)		(1.863)
Observations	1623	1623	1623	1623
Number of countries	96	96	96	96
AR(2) (p-value)			0.0284	0.0276
Hansen test (p-value)			0.117	0.324

Standard errors are clustered at the country level and reported in parentheses

*$p<0.1$, **$p<0.05$, ***$p<0.001$. Coefficients for country-time fixed effects are not reported

The results of the system-GMM analysis partially support those of the fixed-effect analysis. As shown in column 4 of Table 2, while technical assistance positively affects GDP per capita growth, financial program aid, which exhibits positive effect in the fixed-effect model (in column 2), does not have a statistically significant effect on the conflict-affected countries' GDP per capita growth. This result is consistent with previous research, such as Rajan and Subramanian (2008) and Birdsall (2007), indicating that financial program aid may not stimulate (and may even hamper) economic development in recipient countries with unstable governments. For post-conflict periods, the GMM result suggests that

Table 3 The effects of aid by type on economic growth for LDCs and non-LDCs (GMM)

Variables	Low and lower middle		Upper middle and high	
	(1)	(2)	(3)	(4)
Lagged GDP per capita growth	0.568***	0.954**	0.599***	0.561***
	(0.111)	(0.375)	(0.126)	(0.147)
Financial program aid	− 0.172	− 0.144	− 0.163	− 0.485*
	(0.119)	(0.117)	(0.111)	(0.254)
Project aid	− 0.283	0.064	− 0.016	− 0.335
	(0.273)	(0.914)	(0.464)	(0.925)
Technical assistance	0.120	0.113	− 0.445	− 0.634
	(0.338)	(0.455)	(0.457)	(1.329)
Food aid	0.025	0.864	− 0.020	− 0.177**
	(0.406)	(1.035)	(0.076)	(0.082)
Other aid	0.309	− 0.151	2.110	6.559**
	(1.568)	(2.531)	(2.064)	(2.721)
Post-conflict * Financial program aid		0.354*		0.806*
		(0.211)		(0.483)
Post-conflict * Project aid		− 0.435		1.800*
		(1.086)		(0.922)
Post-conflict * Technical assistance		− 0.547		0.322
		(0.569)		(1.700)
Post-conflict * Food aid		− 1.656*		− 10.522*
		(0.878)		(5.808)
Post-conflict * Other aid		1.801		− 4.185
		(2.645)		(6.243)
Post-conflict		2.313		− 1.706
		(4.271)		(2.330)
Observations	636	636	987	987
Number of countries	38	38	58	58
AR(2) (p-value)	0.0310	0.0146	0.124	0.147
Hansen test (p-value)	0.669	0.338	0.337	0.715

Standard errors are clustered at the country level and reported in parentheses

$*p<0.1$, $**p<0.05$, $***p<0.001$

technical assistance and food aid negatively affect countries' GDP per capita growth, wherein a 1 percent increase in the technical assistance-to-GDP ratio is associated with a 0.667 percent point decrease in the GDP per capita growth rate and a 1 percent increase in the food aid-to-GDP ratio is associated with a 0.963 percent point decrease in the GDP per capita growth rate. The implication of this finding is that types of aid that largely rely on relatively short-term planning and are smaller in size (Ouattara, 2001; Winters & Martinez, 2015) have a negative impact or no impact on the GDP per capita growth of countries in a post-conflict era.

4.2 Heterogeneous effects of aid by modality, development status, and regions

We also conduct GMM estimations after categorizing sample countries into LDCs and non-LDCs. Scholars and policymakers have debated the heterogeneous effect of aid on growth depending on countries' development status, contending that LDCs lack the resources and capacity to fund and manage foreign investment and/or development assistance (Morrissey, 2015).

Table 3 presents the GMM results estimating the effect of aid by type on GDP per capita growth under post-conflict circumstances for LDCs (columns 1 and 2) and non-LDCs (columns 3 and 4). The results indicate that financial program aid contributes to GDP per capita growth for both LDCs and non-LDCs at a marginally significant level (p-value < 0.1); however, the size of the effect differs depending on development status. For LDCs, a 1 percent increase in financial program aid-to-GDP boosts GDP per capita growth by 0.4 percentage points, whereas for non-LDCs, it increases GDP per capita growth by 0.8 percentage points. Notably, project aid, which is primarily managed through shared contributions from donors and recipient countries, only has statistically significant and positive effects for non-LDCs. In contrast, technical assistance aid does not appear to have an impact on GDP per capita growth in post-conflict conditions for LDCs or non-LDCs.

Considering the findings from the previous research regarding the heterogeneous effect of aid by region, such as Mandon and Woldemichael (2022) and Doucouliagos and Paldam (2011), an obvious consideration is whether the effectiveness of aid by type under post-conflict conditions might also differ across regions. In this regard, we compare African and non-African regions (including Asia, Latin America, the Caribbean, and Middle Eastern countries). Table 4 presents the GMM estimation results of the effect of aid by type on GDP per capita growth under post-conflict conditions for African countries (columns 1 and 2) and non-African countries (columns 3 and 4). Overall (column 1), only technical assistance is positively associated with GDP per capita growth for African countries, while financial program aid does not have a statistically significant effect on GDP per capita growth and project aid is negatively associated with the GDP per capita growth in African countries. Turning to our variable of interest, post-conflict interacted by aid by type (column 2), financial program aid is positively associated with GDP per capita growth in African countries, wherein a 1 percent increase in financial program aid-to-GDP boosts GDP per capita growth by 0.53 percentage points; however, other types of aid (except financial program aid) are not associated with GDP per capita growth under post-conflict conditions in African countries.

In contrast, financial program aid does not have any statistically significant impact on the GDP per capita growth in post-conflict settings (column 4) for non-African nations. We also find technical assistance to be marginally but negatively associated with GDP per capita growth in non-African countries under post-conflict conditions.

We find that conflict-affected countries with non-LDC status are more effective in deploying financial program and project aid than those in the LDC group. A rationale for this outcome could be that conflict-affected nations with better development processes are more likely to recover effectively and expediently use the development assistance provided to the government and/or shared management with donor

Table 4 The effects of aid by modality on economic growth by continent

Variables	Africa		Other (Asia, Latin America, and the Middle East)	
	(1)	(2)	(3)	(4)
Lagged GDP per capita growth	0.520***	1.316**	0.657***	0.509***
	(0.131)	(0.595)	(0.134)	(0.155)
Financial program aid	0.001	− 0.292	− 0.100	0.041
	(0.103)	(0.244)	(0.220)	(0.187)
Project aid	− 0.765**	− 1.583	0.084	− 0.370
	(0.357)	(2.255)	(0.270)	(0.443)
Technical assistance	1.059***	0.137	0.106	0.330**
	(0.388)	(1.283)	(0.254)	(0.164)
Food aid	− 0.329	1.492	0.064	0.009
	(0.381)	(1.838)	(0.071)	(0.110)
Other aid	1.139	2.000	− 0.951	0.166
	(1.321)	(3.165)	(2.600)	(4.097)
Post-conflict * Financial program aid		0.530*		− 0.387
		(0.313)		(0.358)
Post-conflict * Project aid		1.938		0.477
		(2.921)		(0.548)
Post-conflict * Technical assistance		0.330		− 0.673**
		(2.647)		(0.319)
Post-conflict * Food aid		− 2.799		− 0.338
		(1.719)		(0.487)
Post-conflict * Other aid		− 4.476		− 0.853
		(5.742)		(4.652)
Post-conflict		− 4.869		1.678
		(14.702)		(2.244)
Observations	706	706	917	917
Number of countries	42	42	54	54
AR(2) (p-value)	0.0618	0.106	0.197	0.206
Hansen test (p-value)	0.755	0.453	0.158	0.159

Standard errors are clustered at the country level and reported in parentheses

*$p < 0.1$, **$p < 0.05$, ***$p < 0.001$

countries during the post-conflict era in comparison to conflict-affected countries with LDC status. This conjecture supports previous research on the likely mechanisms of aid–growth relationships, such as governance (Bräutigam & Knack, 2004; Feeny & McGillivray, 2009), investment (Hansen & Tarp, 2001), and human capital (Fashina et al., 2018), all of which are positively correlated with income level (Hansen & Tarp, 2001; Kaufmann et al., 2002; Radelet, 2004). Our results also illustrate possible reasons for the considerable difference in aid effectiveness for

low- and middle-income countries in previous research (Doucouliagos & Paldam, 2009).

Another possible explanation for the difference in aid effectiveness by modality between African and non-African countries could be the heterogeneous effects of aid depending on conflict type (Brinkerhoff, 2007; Mousseau, 2021; Savun & Tirone, 2011). African countries have historically been dominated by non-state or one-sided conflict, whereas non-African regions (Asian, Latin American and Caribbean, and Middle Eastern countries) have typically suffered from state-based armed conflict (Davies et al., 2022). State-involved conflicts are associated with weaker governance during the post-conflict stage, indicating that nations with weaker institutions may experience more state-involved conflicts (Walter, 2015), or institutions may be weakened following a state-based conflict (Brinkerhoff, 2007). Moreover, because state-based conflicts are typically larger in scale than non-state-based and one-sided conflicts (Davies et al., 2022), they are likely to result in greater infrastructural damage and human casualties, state and local institutions are more likely to be compromised, and the country could experience communal polarization around sectarian or political identities (Davenport et al., 2019). The restoration of local and state institutions and efforts to reduce polarization drain resources, which can hinder the effectiveness of aid projects and programs in post-conflict environments. Therefore, it is logical that a statistically significant impact of financial and project aid programs on GDP per capita growth is not evident for non-African nations. Because African conflicts are predominantly state-involved, such nations are less capable of effectively managing financial and project aid programs that could bolster GDP per capita growth.

Notably, our estimates could be upper-bound biased since donor countries could allocate the aid modalities within countries depending on development status. For example, a donor might grant less financial program aid and more project aid due to presumed fiduciary risk and easier management for LDCs. Furthermore, post-conflict status could influence donors' choice of the aid instrument.

4.3 Robustness tests

We conduct additional analyses to assess the robustness of the baseline results presented in Tables 2, 3, and 4. First, to control for the potential endogeneity issue related to the reverse causality in the aid–growth estimation, we modify the lag structure of the empirical model using two-year lags for the aid variable. The robustness test results are presented in online Appendix Table A2. The result shows the effect of two-year lagged aid to conflict-affected countries by type on GDP per capita growth, with a similar set of results to those of Tables 2, 3, and 4, confirming that lagged financial program aid has a heterogeneous effect on growth depending on the country's development status and region. While most of the effects of aid by type are similar to Tables 2, 3, and 4, Table A2 suggests a negative and statistically significant (although marginal) effect of financial program aid on growth for non-African countries (column 5) in post-conflict conditions.

We also examine whether sectoral development in the post-conflict environment is affected by aid type, referencing the classification of Donaubauer et al. (2019) and adopting indicators to measure the degree of development in eight sectors as dependent variables. Online Appendix Table A3 reports the effect of aid modalities by sector on social and economic infrastructure applying the System-GMM technique according to Eq. (2) by development status and continent. Columns 1, 4, 7, and 10 of Table A3 include all eight sectors (education, health, water and sanitation, government and civil society, transport, communication, energy, and banking and finance). Among these sectors, four (education, health, water and sanitation, and government and civil society in columns 2, 5, 8, and 11 in Table A3, respectively) are categorized as social infrastructure and the remaining four (transport, communication, energy, and banking and finance in columns 3, 6, 9, and 12, respectively) as economic infrastructure, referencing Donaubauer et al. (2019) once again. The results reveal differences in aid–sectoral development depending on development status and region in post-conflict periods. While technical assistance contributes to social infrastructure development for LDCs in post-conflict settings, which is consistent with Donaubauer et al. (2019), no pronounced positive effect of any aid type is evident on social infrastructure for non-LDCs. However, this finding does not suggest the precise mechanism of the aid on infrastructure by type, which is primarily due to data limitations in disaggregating aid by type and sector, which indicates the necessity of conducting further studies using supplemental data.

5 Conclusion

Our analysis estimates the impact of distinct aid modalities and different recipient characteristics in conflict-affected states, providing valuable insights to guide donor and government decisions for enhancing aid effectiveness within this context. The findings suggest that the effects of various types of aid on conflict-affected countries differ by development status and region. Financial program aid, which typically supports national finances and state-led development initiatives, has a modestly beneficial impact when disbursed in post-conflict settings, particularly for non-LDC and African nations. The effectiveness of financial program aid on growth for non-LDC and African countries in post-conflict periods supports the efforts following the Paris Declaration to increase this type of aid as a means to enhance recipient countries' ownership and domestic capacities following a conflict. Conversely, we find that the association between technical assistance and GDP per capita growth in post-conflict conditions is marginally negative or statistically insignificant (only for non-African countries).

The study's findings make a valuable contribution to the current understanding of the effects of aid in post-conflict states, indicating that conflict-affected countries with greater absorptive capacity (those with relatively better development status and governance) benefit from a small but positive impact of financial program aid on GDP per capita growth. Our analysis also reveals a disparity between African and non-African countries in the effectiveness of financial aid in post-conflict circumstances, which may be attributable to variations in conflict types, as supported by

previous research (e.g., Davies et al., (2022) and Davenport et al. (2019)). These novel findings advance the existing literature on aid effectiveness and post-conflict reconstruction.

We assert that policymakers can benefit from our results for decision making regarding aid allocation across modalities. The insights revealed can help policymakers to formulate strategies that enhance aid effectiveness in post-conflict countries that considers the specific characteristics and needs of each nation.

Future studies could further explore the relationship between conflict type, stage, and absorptive capacity. Examining the reasons that the impact of aid differs by modality using more granular data and case studies is another direction for related research.

Declarations

Conflict of interest All authors declare that they have no conflicts of interest.

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