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Linking KfW-financed aid projects and FDI: Global evidence at the sub-national level

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Linking KfW-Financed Aid Projects and FDI: Global Evidence at the Sub-national Level

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Abstract

This study analyzes the empirical link between German bilateral development finance and Foreign Direct Investment (FDI) at the sub-national (ADM2) level. We construct a unique dataset by merging geo-referenced development aid projects—implemented by KfW Development Bank—over more than two decades with FDI project data. The analysis investigates four research hypotheses, and finds that: (i) development finance activity is positively and significantly associated with FDI inflows; (ii) the positive link is similarly pronounced in both hard and soft sectors; as well as (iii) irrespective of recipient countries' income level; and (iv) the positive aid–FDI association appears to be driven by projects with stronger implementation, as measured by higher ex-post evaluation ratings. For these higher-rated projects, KfW aid is significantly more likely to be associated with FDI from Germany and the EU. Our findings suggest that FDI may be an important channel through which development aid simultaneously benefits both recipient—by providing capital and technology—and donor countries, by signaling investment opportunities for its enterprises.

JEL classification codes: F23, F35, O12, O18

Keywords: Development aid, development finance, FDI

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1 Introduction

Both development aid and Foreign Direct Investment (FDI) are critical sources of foreign finance for low- and middle-income countries (LMICs). However, despite the conjecture that aid projects may encourage FDI inflows to the same locations, existing studies on the aid-FDI linkage remain often restricted to country level analyses (e.g., Kimura and Todo, 2010; Garriga and Phillips, 2014; Donaubauer et al., 2016). Only a few studies have explored this relationship at the sub-national level, and these are typically confined to specific regions (e.g., Africa in Brazys and Jung, 2024). A more profound understanding of whether and in which way aid is related to FDI is therefore required, in particular given the current ODA (Official Development Assistance) budget cuts in several major donor countries, and the increased pressure on donors to prove that ODA spending benefits not only the recipients, but the donors, too (Heidland et al., 2025).

To address this research gap, this study examines the association of German bilateral aid and FDI in LMICs worldwide by leveraging unique data on KfW Development Bank’s development finance projects and FDI at the sub-national level.¹ On behalf of the German Federal Government, who until recently was already the second-largest ODA donor worldwide after the US (OECD, 2025), KfW is the main agency responsible for Germany’s bilateral financial cooperation.² KfW’s annual commitments amounted to EUR 10.3 billion (USD 11.1 billion) in 2024, and its portfolio spans all sectors that large multilateral donors also engage in. The funds are primarily sourced from the German Federal Ministry for Economic Cooperation and Development (BMZ) and are allocated to development finance projects in almost 100 countries across Africa, Asia, Latin America and the Caribbean, and South-Eastern Europe.

Specifically, we investigate whether KfW’s aid in certain regions or cities is linked to FDI projects to those areas. Connecting this to previous findings in the literature (see section 2), we derive and investigate four research hypotheses: (i) Development finance (aid) projects are associated with higher FDI levels at the local (sub-national) level; (ii) the local link between aid projects and FDI is stronger for infrastructure projects; (iii) the local link between aid and FDI is stronger in more developed recipient countries; and (iv) the association is more nuanced for projects with a stronger implementation (as measured by independent success ratings).

The first part of our data on KfW projects builds on hand-coded and geo-referenced data that were initially constructed by Eilers et al. (2025). We merge these data to our main dependent variable, geographically disaggregated data on FDI obtained from fDi Markets (The Financial Times Ltd., 2025), resulting in a novel dataset linking development finance activity over more than two decades (1992-2018) with FDI at the ADM2-level in 71 LMICs worldwide.³

¹This study subsumes grants and concessional loans as development finance. In the following, we use the terms development finance, aid, assistance and KfW projects interchangeably.

²Note that for brevity throughout the paper we use KfW to refer specifically to KfW Development Bank, the international part of KfW Group channeling ODA.

³ADM levels refer to sub-national administrative divisions and are geopolitical units. ADM1 (e.g., provinces, states, regions) refers to the first layer below the national borders and ADM2 (e.g., districts, counties, departments) are the sub-units of these ADM1 regions.

Our findings contribute more generally to the aid-effectiveness literature (Doucouliagos and Paldam, 2009; Clemens et al., 2012; Dreher and Lohmann, 2015; Galiani et al., 2017) and more specifically to research on the correlates of FDI at the sub-national level (Brazys and Kotsadam, 2020; Brazys and Jung, 2024; Brazys et al., 2025; Palmtag, 2019).

Additional relevance of these questions arises from the current controversy in many donor countries concerning ODA budget cuts and the political pressure to prove that aid not only serves the recipient country, but also the donor country. Heidland et al. (2025) present a conceptual framework for the analysis of such “mutual benefits” for a broad taxonomy of aid types. Our study is, thus, a timely contribution to the debate.

The paper is structured as follows. Section 2 reviews the relevant literature and derives the research hypotheses. Section 3 introduces our unique geo-coded data combining KfW development finance projects with FDI data from fDi Markets at the granular level, and outlines the empirical strategy. Section 4 presents and discusses the main findings, robustness checks, and results from mechanisms analyses. Section 5 concludes and outlines the direction for future research.

2 Literature and Hypotheses

Several studies have examined the effects of development aid on a range of outcomes, particularly economic growth, but the results remain inconclusive (Dreher et al., 2024). For instance, Burnside and Dollar (2000) report that aid positively affects growth, but only in countries with sound fiscal, monetary, and trade policies. Similarly, Galiani et al. (2017) identify a positive effect of aid on GDP at the national level. In contrast, Dreher and Langlotz (2020) find no significant effects of bilateral aid on growth.

FDI represents another important driver of development (Hansen and Rand, 2006; Chakraborty and Nunnenkamp, 2008). Heidland et al. (2025) highlights the association between aid and FDI as a potential mechanism with substantial benefits for both recipient and donor. On the recipient side, FDI may contribute to technology diffusion, jobs and economic growth (Abebe et al., 2022; Javorcik, 2015; Basu and Guariglia, 2007). On the donor side, increased FDI can translate into resource access, additional export markets, soft power and political influence (Bunte et al., 2018; Krautheim, 2013; Wang et al., 2022; Lee, 2023). However, the literature is ambiguous on whether development aid crowds in or crowds out FDI (Liao et al., 2020).

Several cross-country analyses have investigated the link between aid and FDI. For example, Selaya and Sunesen (2012) study the relationship between aid and FDI for the 1970-2001 period. Their analysis reveals that aid allocated to complementary inputs attracts FDI at the country level, whereas aid focused on physical capital deters it. With respect to complementary inputs, an intriguing study by Donaubauer et al. (2016), while also at the country level, studies sector-specific transmission channels from aid to FDI. In particular, the authors find that aid specifically targeted at economic infrastructure in transportation, communication, energy, and finance helps LMICs attract higher FDI inflows. There is also an indication that below a certain

country-income threshold, increasing FDI through ODA is less effective, possibly because of bottlenecks such as low human capital and weak governance in lower income countries. Tian (2025) presents evidence on another mechanism, where ODA would affect financial regulation and openness in recipient countries.

When considering specific donors for the 1990–2002 period, Kimura and Todo's (2010) analysis suggests that this effect might be driven by FDI of the same donor countries. Thus, third-countries' FDI flows do not necessarily benefit, raising the question whether ODA is associated with FDI creation or FDI diversion. In that respect, Ono and Sekiyama (2023) examine the impacts of various types of aid from the five largest DAC donors on FDI at the country level from 1996 to 2020. Their findings indicate that loans provided by Japan, the UK, and Germany lead to increased FDI inflows from these donor countries to the recipient countries by improving infrastructure in key sectors such as transportation, finance, telecommunications, and energy.

Garriga and Phillips (2014) argue that ODA can signal trust in the recipient governments to foreign investors in low-information contexts and provide empirical support for post-conflict developing countries in the 1973–2008 period. Institutional trust seems particularly relevant because Liao et al. (2020) show that ODA may even crowd out FDI, except in countries with higher institutional quality. In that respect, Girod and Tobin (2016) argue that ODA project performance and contract compliance may signal trust. A related strand of the literature delves deeper into this question based on data from project evaluations. These studies stipulate that effectiveness differs less across countries than within countries due to project performance and micro-determinants, such as previous experience of project managers (Denizer et al., 2013; Eilers et al., 2025). It is therefore reasonable to conjecture that ex post evaluations send a credible signal on the varying impacts of aid across sub-national regions.

These conclusions, however, are drawn from analyses conducted only at the country level. In the aid literature, there has been a shift toward analyses of sub-national regions (Dreher and Lohmann, 2015) and projects (Heinzel, 2022; Ashton et al., 2023), as many projects in the infrastructure, education, or health sectors are implemented locally rather than nationally. To date, only a few studies have examined the aid-FDI link beyond the country level. Blaise (2005) examines the relationship between aid and FDI from Japan to China at the provincial level from 1980 to 1999, finding that aid contributed to an increase in FDI. At the district level in India, Nunnenkamp et al. (2017) find that the WB tends to provide infrastructure aid more to regions with higher levels of FDI. Brazys and Jung (2024) study the effect of World Bank (WB) and Chinese aid on FDI, finding a positive relationship; however, they focus solely on sub-Saharan Africa (SSA).

Our reading of the limited evidence on the aid-FDI link so far is that the country level studies suggest a tentatively positive, albeit not fully conclusive, positive link, and that the few studies at the sub-national level, all restricted to specific regions, provide additional evidence for a positive aid-FDI link. This overall pattern is augmented by the results on heterogeneities by sector and country-income level. Based on these, we derive the following three research hypotheses:

(i) Development finance (aid) projects are positively related to FDI at the local (sub-national) level.

(ii) The local (sub-national) link between aid projects and FDI is stronger for infrastructure sectors.

(iii) The local (sub-national) link between aid and FDI is stronger in more developed countries.

As the hypothesis concerning economic sector indicates, development finance projects are heterogeneous by design. An additional source of heterogeneity potentially affecting projects' link to FDI is whether a given development finance project is actually implemented as planned, achieving all of its stated objectives. One strength of our data is that each project observation comes with an independent, standardized evaluation success rating (further detailed below). We can use this to test a fourth research hypothesis, conjecturing that specifically those projects with a stringent and sustained implementation are more significantly linked to FDI inflows:

(iv) The local (sub-national) link between aid and FDI is stronger for aid projects with stronger implementation, as measured by higher ex-post evaluation ratings.

We are able to test these hypotheses based on the granular micro-data from KfW evaluation reports along with the geo-coded FDI project data that we describe in the following.

3 Data and Methodology

3.1 KfW Data on Bilateral Development Finance Projects

KfW Development Bank is responsible for the majority of Germany's official international financial cooperation. In 2024, KfW committed EUR 10.3 billion (USD 11.1 billion) to developing countries globally, positioning it as one of the largest bilateral donor agencies worldwide. These engagements span all major sectors, including agriculture, energy, water supply, and the financial sector, and are comparable in scope to those of major multilateral development financiers.

The funds committed by KfW are executed through projects that involve dedicated investments or sector reforms. These projects are collaboratively designed and implemented by local, predominantly public, agencies such as line ministries, with whom financing agreements are established. Approximately three years after completion, an independent ex-post evaluation is conducted on a randomly selected sample of 50% of the projects, to assess their success or failure.⁴ Evaluations follow an internationally recognized standard by applying the OECD DAC criteria: specifically, for each project, an overall success rating on a scale from 6 (best) to 1 is given, based on individual ratings for relevance, effectiveness, efficiency, impact, sustainability, and coherence (the latter newly introduced in 2020).

The data we use were initially constructed by Eilers et al. (2025) who present a study identifying determinants of success and failure of KfW's development finance projects. The extensive database covers the universe of evaluated KfW projects and combines, inter alia, evaluation success ratings hand-coded from evaluation reports with a large set of project characteristics.

⁴Since the disbursement of aid funds is subject to a certain degree of path dependency (Dreher and Lohmann, 2015), the 50% sample may proxy other KfW projects in these geo-locations.

Among other things, we have information on the dates of the contract, implementation and project completion. In our sample, project lengths from contract to final review range from 0 to 21 years, with an average (median) duration of 7.71 (7) years.

For the purpose of this study, we leverage an additional feature of the data: geo-coded project locations obtained from the reports in combination with FDI-relevant project characteristics. An overview of variables used and their definitions can be found in Appendix Table B.1. As we are interested in sub-national linkages between aid and FDI, we run our analysis at the GADM2-level (GADM, 2018).⁵ Note that not every project in the database contains information at this level of granularity, since e.g. projects from the financial sector such as micro credit programs that are channeled through financial intermediaries cannot be pinpointed to the ADM2 level.

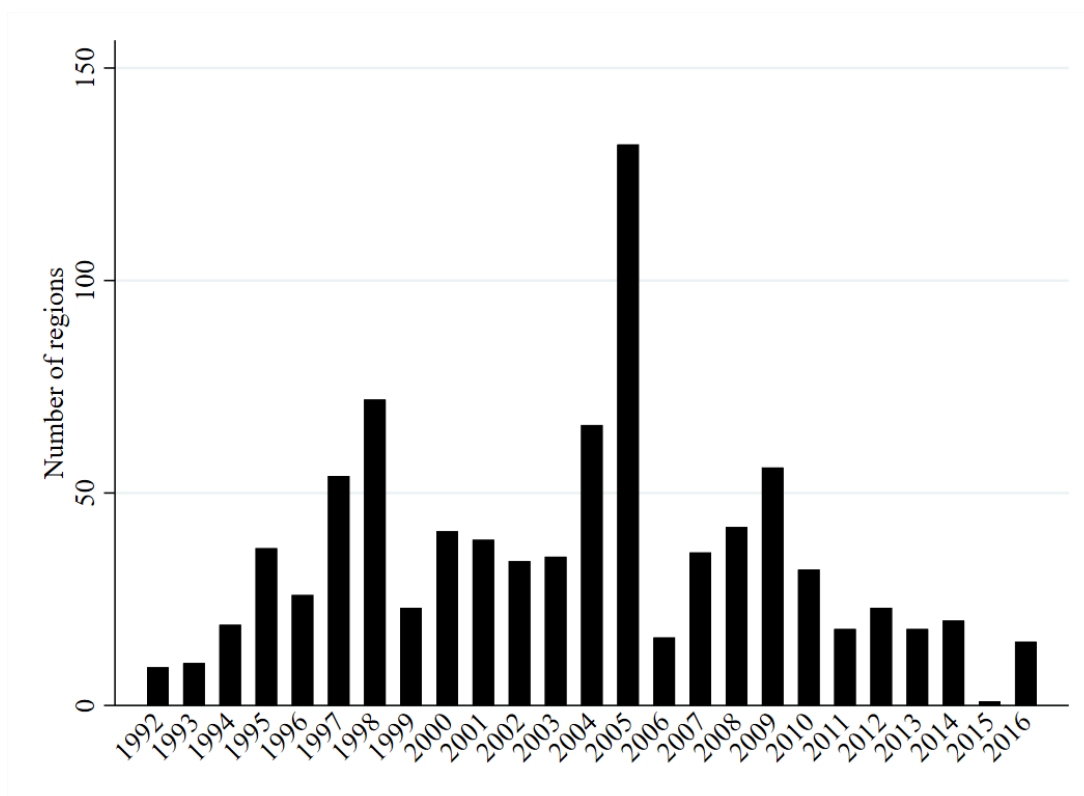


Figure 1: Treatment Timing: Year of first contract by ADM2 region

Note: Each bar represents the number of ADM2 regions for which a KfW project contract is being signed for the first time in a given year.

Figure 1 displays the distribution of project locations by year of project contract signing, or in other words, the project start. It reveals two notable insights into the data structure: First, there is a stable pipeline of new project locations, despite some fluctuation across years. This is caused by the fact that our data rely on evaluation reports which on average are written around three years after project completion. Hence, later years have fewer evaluated projects, as for example part of the projects approved in 2015 were still not evaluated by 2018, the last year of evaluation reports in our sampling period. Second, the year 2005 exhibits a pronounced outlier in the distribution of project locations. This anomaly is not attributable to an overall increase

⁵We use Version 3.6 from GADM (GADM, 2018).

in project approvals by KfW during that year. Rather, it reflects the approval of a subset of projects characterized by a high number of small-scale implementation sites. Notably, projects within the governance and decentralization sectors tend to encompass numerous localized, small interventions, which disproportionately contribute to the observed deviation in 2005.⁶

The geo-coded data from KfW is not the first attempt to exploit spatial information of donor agencies. Other endeavors, most notably by AidData, have geo-located aid projects for several other donors, e.g., the African Development Bank or China (Strandow et al., 2011; Goodman et al., 2024), or for multiple donors in one specific recipient country (AidData, 2016). The Geocoded Official Development Assistance Database (GODAD) is arguably the most comprehensive endeavor in that respect, relying on a natural language processing (NLP) to assign aid projects to sub-national locations based on project titles and project descriptions from the OECD’s Creditor Reporting System (CRS).⁷ For our main analysis, we rely on the KfW evaluation department’s data since the project reports offer more detailed project-level information to investigate heterogeneities and mechanisms. Nevertheless, we later complement our analysis with GODAD data to reduce omitted-variable bias (OVb) from aid projects by other donors.

3.2 FDI Data

The key next step in constructing our data is to merge the detailed KfW project data with correspondingly granular information on FDI. FDI data are sourced from fDi Markets (The Financial Times Ltd., 2025) and start in 2003. This dataset has been widely utilized in prior research to examine a range of political and economic outcomes.⁸ Crucially for our analysis, the dataset includes information on the destination country of each FDI project, as well as sub-national location details. While not all entries specify the location at the ADM2-level—the spatial unit of our analysis—we restrict our sample to those projects that do, and that also fall within countries where KfW projects were implemented, as well as to the period from 1992 to 2018, because the last aid contracts in the KfW data are signed in 2016.⁹ This yields a refined dataset of 60,775 FDI projects across 71 countries. Accordingly, we restrict the KfW sample to the same 71 countries, resulting in 318 unique aid projects implemented across 2,040 project locations in 874 ADM2 regions. The analysis focuses on greenfield FDI as we hypothesize that foreign aid will rather facilitate new establishments (Lee and Ries, 2016). Appendix Figure B.1 illustrates the temporal distribution of the onset of these projects over the study period.

⁶Our main result is robust to excluding 2005.

⁷For a more detailed description, see Bompreszi et al. (2025). We matched the two project-level databases for KfW as the implementing agency to verify the expected overlaps. Based on this exercise, we find that out of the 1,063 unique projects in the KfW data, 268 are also covered by GODAD (25%). At the location level this share rises to 32%, where we find that our hand-coded database covers on average more locations per project.

⁸This includes the impact of FDI on corruption experience (Brazys and Kotsadam, 2020), electoral outcomes in Brazil (Owen, 2019), protest and conflict in Africa (Palmtag, 2019; Brazys et al., 2025), the influence of the EU’s Aid for Trade initiative on African states’ dependency on EU-based FDI (Saltnes et al., 2020), the effects of the global financial crisis on FDI flows (Gil-Pareja et al., 2013), and the role of WB and Chinese aid in shaping FDI patterns in Sub-Saharan Africa (Brazys and Jung, 2024).

⁹The main result is robust to truncating the panel in 2016.

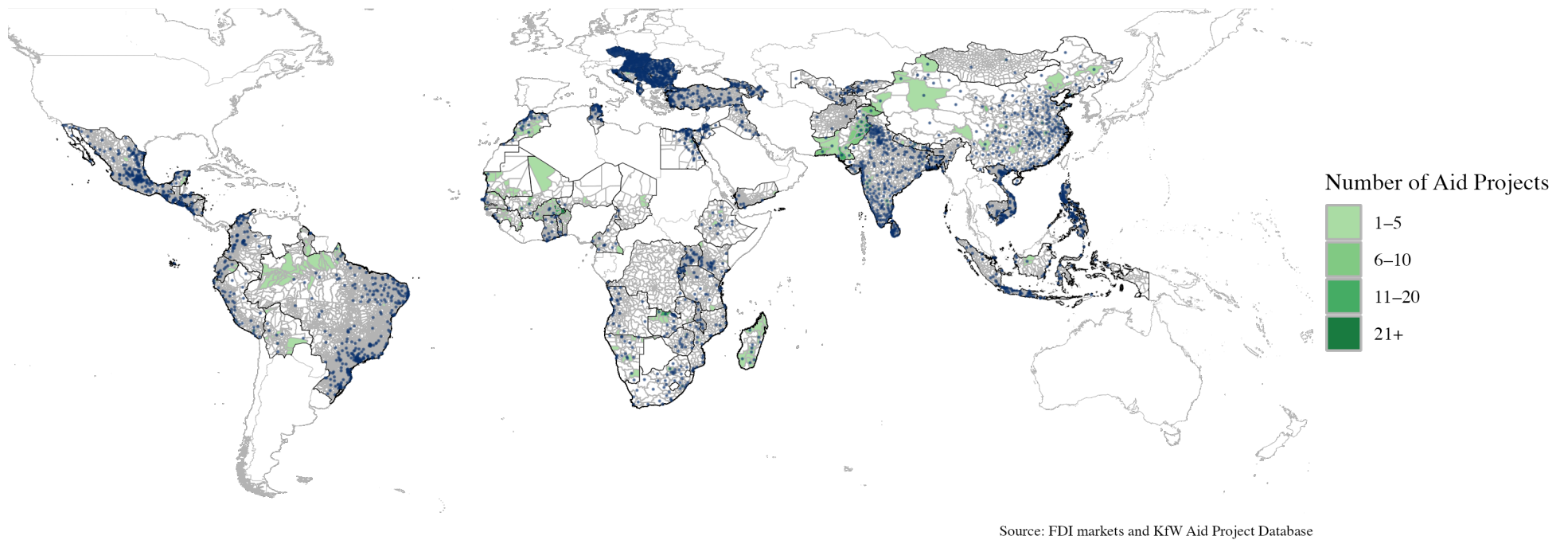


Figure 2: FDI Projects (blue dots) and Number of Aid Projects by ADM2 region

In Figure 2 we combine our project location data with information on FDI destinations in the sample. Blue dots indicate the location of a FDI project as captured in the fDi Markets data, and ADM2 regions highlighted in shades of green indicate the location of KfW projects from our sample. The graph reveals substantial spatial overlap between KfW-financed and FDI projects across all regions encompassed in the sample. This intersection provides a robust empirical foundation for the empirical analysis undertaken in this study.

3.3 Empirical Framework

By spatially merging our KfW project location with FDI data at the ADM2-level, we can analyze the relationship of aid and FDI. Our dataset comprises a total of 24,669 ADM regions over the period 2003-2018 for a total number of observations of 394,704. The use of sub-national data allows us to cancel out relevant omitted variables and reduce bias via a conservative fixed effects strategy. First, we can control for a set of constants at the district (ADM2) level that affect both aid and FDI. This within-district comparison allows us to factor out time-invariant selection bias at the district level that arises from e.g., geography, resource deposits, agro-climatic conditions, or sub-national institutions. For instance, a well-functioning provincial bureaucracy is more likely to apply for development projects and attract FDI projects, a factor for which we can control with these sub-national region fixed effects (FEs). Second, the sub-national data enables us to control for a set of otherwise unobserved factors that vary over time, both on the country and regional level. Throughout our models, we add FEs at the country-year or the province-year (ADM1-year) level. These specifications capture country-specific or region-specific events—e.g., presidential elections or local disasters—that induce uncertainty and sequentially deter aid and investment projects.

We estimate the following equation:

$$FDI_{i,t} = \beta_1 KfW\ Project_{i,t} + \beta_2 X_{i,t} + \lambda_i + \sigma_{cr \times t} + \epsilon_{i,t} \quad (1)$$

where $FDI_{i,t}$ is a binary variable indicating whether a FDI project was committed in the ADM2 region i in year t . $KfW\ Project_{i,t}$ indicates ADM2 regions i that received aid in period t . A region is coded as having received a project in the year when the project starts, that is, when the financing agreement is signed. For robustness, we will later replace this with the year the first disbursement was made. In our robustness tests, we adjust both the main independent and outcome variable to represent count rather than binary indicators. $X_{i,t}$ refers to population, which we add as control variable.¹⁰ λ_i are ADM2 and $\sigma_{cr \times t}$ are year-ADM0 (c) or year-ADM1 (r) fixed effects.

¹⁰We derive these data from Bomprezzi et al. (2025) and add a constant of one to include regions with zero population before log-normalizing the data.

4 Results and Discussion

4.1 Main results

Baseline results building on equation 1 are presented in Table 1. Column (1) shows results from a parsimonious model that includes the treatment indicator (“KfW project”) along with ADM2 region and country-year FE, while in column (2) we add population as an additional control to reduce OVB. Given the comprehensive set of FE in our baseline specification, the point estimate only marginally changes. One of the most obvious and potentially consequential concerns with respect to single-donor analyses is an OVB due to the simultaneous implementation of ODA projects from other donors.¹¹ Previous geo-spatial effectiveness analyses were only able to address this problem partially by controlling for ODA from China or the World Bank (Isaksson and Kotsadam, 2018). Using GODAD we can go beyond that, and control in column (3) for major donors’ disbursements via *Other aid project*.

Table 1: Aid and FDI — Main Results

	(1)	(2)	(3)	(4)
	FDI	FDI	FDI	FDI
KfW project	0.0210*** (0.00751)	0.0209*** (0.00750)	0.0209*** (0.00750)	0.0154** (0.00755)
Population (log)		0.00511*** (0.00158)	0.00511*** (0.00158)	0.0200*** (0.00484)
Other aid project			-0.000460 (0.00122)	-0.000288 (0.00132)
Mean in sample	0.032	0.032	0.032	0.031
R-squared	0.539	0.539	0.539	0.572
N of obs.	394,704	394,704	394,704	393,696
ADM2	YES	YES	YES	YES
ADM0-year	YES	YES	YES	NO
ADM1-year	NO	NO	NO	YES

The outcome is a dummy variable taking the value one for FDI projects and zero otherwise. The variable *KfW project* is defined in all columns as equal to one after the contract of a KfW project is signed in a sub-national region. Standard errors (in parentheses) clustered at the ADM2-level. * p<0.1, ** p<0.05, *** p<0.01.

The stable positive and significant coefficient of our variable of interest implies a 2.09 percentage point higher probability of FDI project presence in ADM2 regions that received KfW

¹¹There is ample literature that suggests that donors adjust their allocation patterns in response to other countries (e.g. Röthel, 2025; Zeitz, 2021).

projects. This result provides evidence that our findings are not driven by OVB. At the same time, it also points to an overall insignificant association with aid by other donors.¹² The stability of the results across specifications, support the model specification in column (3) as the baseline for subsequent robustness checks and mechanism analyses.¹³ Finally, column (4) introduces even more conservative ADM1-year FE. While the coefficient’s statistical significance drops to the 5%-level, once we control for unobserved factors at the ADM1-year level, the coefficient remains positive and of sizable magnitude (1.54 percentage points) in our most conservative estimation.

Across models, the signature of a KfW project contract is robustly associated with a 1.54 to 2.10 percentage points higher probability of FDI presence. Relative to the sample mean of 0.032, these estimates are of significant economic relevance, but within a reasonable range.¹⁴

4.2 Robustness Checks

Table 2 presents results from multiple robustness tests for the main specification. A key discussion point in the comprehensive literature on the aid-growth link is whether aid is the catalyst or the consequence in this relationship (Clemens et al., 2012). In other words, regions with higher economic activity could receive more aid and arguably also more FDI. We address this potential OVB by including a lagged value of nightlight luminosity $Nightlight(log)_{t-3}$ as a proxy for regional GDP (Henderson et al., 2011) in column (2) of Table 2. The coefficient remains qualitatively unchanged. A potential limitation of our regression approach is the implicit assumption of a permanent relationship between aid and FDI following the initiation of KfW projects. In our analysis, we define the start of a KfW project as the date of contract signing, which typically marks the first public disclosure of the intervention. We posit that this moment serves as a salient signal for firms considering investment commitments.

However, it is plausible that firms may not respond to this initial signal, instead deferring investment decisions until the project becomes operational, that is upon the commencement of financial disbursements. Leveraging the granularity of our dataset, we test whether defining the project start as the date of first disbursement *KfW project 1st Disb* alters our core findings, as reported in column (3) of Table 2. The results indicate that already the announcement of an aid project is associated to a higher probability of FDI projects. In an additional robustness test, we define the “start” as the year of actual project completion *KfW project End* (in column 4), e.g., when the aid-financed infrastructure is actually operational. The operationalization of completion as project “start” does significantly affect the estimated relationship between development finance and FDI. This finding supports the view that a signaling mechanism for the onset of FDI after aid project announcement is at play. In column (5), we control for the

¹²This does not imply that aid by specific other donors may not be associated to FDI—a question we further study in a companion paper.

¹³Our results are robust to the exclusion of potential outliers, notably large FDI originators (China, India, Brazil, and Mexico) or aid recipients (Burkina Faso, Brazil, Rwanda, Pakistan, West Bank and Gaza).

¹⁴For example, Brazys and Jung (2024) find that in African countries, Chinese development projects increased FDI by 8.79 percentage points compared to a sample mean of only 0.015.

number of years since the most recent prior aid project was implemented. The coefficient of our treatment changes only marginally when compared to baseline results.

In our primary specification, we consider *KfW project* as a binary variable, facilitating straightforward interpretation of the estimated coefficients. However, in practice, multiple KfW projects with differing financial volumes may be implemented concurrently within a single ADM2 region. We also consider the cumulative logged project amount per location *KfW project amount (log)* in column (6).¹⁵ To understand in more detail whether our main finding is driven by the extensive (e.g., is there a KfW project) or intensive (e.g., how many USD were disbursed per project location) margin, we include the treatment indicator along with the cumulative logged project amount per location in column (7).

Table 2: Aid and FDI — Robustness

	(1) FDI	(2) FDI	(3) FDI	(4) FDI	(5) FDI	(6) FDI	(7) FDI
KfW project	0.0209*** (0.00750)	0.0209*** (0.00750)			0.0173** (0.00783)		0.0139* (0.00816)
Population (log)	0.00511*** (0.00158)	0.00515*** (0.00159)	0.00513*** (0.00159)	0.00515*** (0.00159)	0.00509*** (0.00158)	0.00509*** (0.00159)	0.00509*** (0.00158)
Other aid project	-0.000460 (0.00122)	-0.000465 (0.00122)	-0.000459 (0.00122)	-0.000407 (0.00122)	-0.000425 (0.00122)	-0.000424 (0.00122)	-0.000447 (0.00122)
Nightlight (log) _{t-3}		-0.000801 (0.000890)					
KfW project 1st Disb			0.0186*** (0.00643)				
KfW project End				0.00647 (0.00529)			
Years since KfW project					0.000941* (0.000551)		
KfW project amount (log)						0.00153** (0.000607)	0.000845 (0.000671)
Mean in sample	0.032	0.032	0.032	0.032	0.032	0.032	0.032
R-squared	0.539	0.539	0.539	0.539	0.539	0.539	0.539
N of obs.	394704	394704	394704	394704	394704	394704	394704

In columns (1) to (6), the outcome is a dummy variable taking the value one for all FDI projects and zero otherwise. In columns (1) and (2), *KfW project* is defined as equal to one after the contract of a KfW project is signed in a sub-national region. In column (2), we control additionally for (mean) nightlight (log) - lagged by 3 years. In column (3), *KfW project* becomes in the year when the first disbursement is made. In column (4), *KfW project* takes the value one with the year when the final inspection is done; otherwise it is zero. In column (5), we control for the number of years since the last treatment. In column (6), the independent variable of interest is cumulative amount (in million USD (log)) per project location. In column (7), *KfW project* is defined as equal to one from the year when a contract is signed and we control additionally for the cumulative amount (in million USD (log)) per project location. ADM2 and ADM0-year fixed effects are included in all models. Across all columns, we control for Population (log) and Other aid project. Standard errors (in parentheses) clustered at the ADM2-level. * p<0.1, ** p<0.05, *** p<0.01.

¹⁵Since we do not have information on the financial volume spent on each project location for the case of projects implemented across multiple locations, we compute it by dividing the total project volume by the number of locations per projects. Moreover, we add a small constant of 1, since otherwise the amount would be non-defined (log of zero) in untreated regions.

Taken together, these results imply a robust link between KfW projects and FDI. The coefficient size implies a 1.39 to 2.09 percentage point higher probability of FDI presence in regions with a KfW project. Moreover, the different operationalizations of the treatment indicator in Table 2 reveals that signaling rather than the provision of complementary resources drives the relationship.

4.3 Heterogeneity and Mechanism Analyses

Our data allows for testing detailed mechanisms of how the observed positive link between development finance projects and FDI translates. We specifically test three hypotheses that have been established in the literature: (i) That the aid-FDI link materializes particularly in countries that are economically developed further, as the markets are larger and the environments more stable (Donaubauer et al., 2016; Bulman et al., 2017). (ii) That the link is stronger for hard infrastructure projects as they pave the way for private sector investments. (iii) And that the pattern found in the main result stems particularly from positively evaluated projects, as a measure of strong implementation or projects realized as planned (Denizer et al., 2013; Ashton et al., 2023).

To test whether ADM2 regions with KfW projects are linked to a higher FDI probability in economically more developed countries, we exploit World Bank public macro data on country income level classifications, ranging from low- to high-income (World Bank, 2025). In our sample, 40 countries are in the low income (LIC), 23 in the lower-middle income, and 8 in the upper-middle income category. We combine the latter two into one middle income category.¹⁶ Table 3 column (2) displays the results, contrasting binary indicators for KfW projects implemented in either LIC or MIC. *KfW project (A)* equals one for provinces with a project in low-income countries (LIC), *KfW project (B)* equals one for project provinces in middle-income countries (MIC). While both coefficients are statistically significant, we find no evidence that the association differs depending on income-status of the host country. The coefficients in column (2) are qualitatively similar in size, and not statistically different from each other.

To test our sectoral hypothesis, we use KfW micro project data (Eilers et al., 2025) and aggregate KfW's ten broad sectoral classifications into two broader categories: infrastructure-oriented interventions ("hard sectors," 1024 project locations) and non-infrastructure interventions ("soft sectors," 1386 project locations).¹⁷ Table 3 reports the results, incorporating binary indicators for the presence of KfW projects in the respective ADM2 regions simultaneously. We find that both development finance projects from the hard and the soft sector are associated with a statistically significantly higher likelihood of FDI (column (3)). While approximately 2.5 times larger, the estimated coefficient for infrastructure-oriented projects is not statistically signifi-

¹⁶We measure the country income status in 2000 before the beginning of our sample period.

¹⁷The "hard" sector includes electricity, transport, and water-related projects, as defined by KfW's sectoral classifications shown in Appendix Figure B.2. Appendix Figure B.2 presents the distribution of project locations within our sample. There is a pronounced concentration in the water sector, which accounts for over 500 ADM2-level locations. At the lower end of the distribution are projects related to waste management and housing, each comprising a relatively small number of locations in the low double digits.

cantly different from that for non-infrastructure projects. Thus, this finding provides only weak empirical support for our hypothesis that infrastructure investments exert a more substantial influence on foreign investment decisions.

Additionally, in column (4) we distinguish between projects with a lower and a higher success rating, respectively, using the independent OECD DAC standard evaluation results (Eilers et al., 2025). Specifically, projects scoring a 6 or 5 on the 6-to-1 scale are ranked as “higher rating,” while projects scoring a 4 or below are ranked as “lower rating”. This serves as a measure for projects with a strong implementation: projects evaluated with a 6 or 5 are those projects that were realized as planned, achieving or even surpassing their objectives. The results indicate that the overall positive correlation between KfW projects and FDI is driven strongly by a pronounced and statistically significant relation between the particularly successful projects and FDI. This provides evidence that project quality matters.

Table 3: Aid and FDI — Mechanisms

	(1) Baseline	(2) LIC MIC	(3) Soft sector Hard sector	(4) Lower rating Higher rating
KfW project	0.0209*** (0.00750)			
KfW project (A)		0.0261* (0.0121)	0.0140* (0.00842)	0.00545 (0.00882)
KfW project (B)		0.0172* (0.00951)	0.0377*** (0.0126)	0.0368*** (0.0134)
F test		0.332	2.357	3.687
p value		0.565	0.125	0.055
Mean in sample	0.032	0.032	0.032	0.032
R-squared	0.539	0.539	0.539	0.539
N of obs.	394,704	394,704	394,704	394,704

The outcome is a dummy variable taking the value one for FDI projects and zero otherwise. In column (1), we present the baseline results, *KfW project* is defined as equal to one after the contract is signed. In column (2), *KfW project (A)* equals one for treated provinces in low-income countries (LIC), *KfW project (B)* equals one for treated provinces in middle-income countries (MIC). In column (3), *KfW project (A)* equals 1 from the year the first soft-sector contract is signed, and *KfW project (B)* equals one from the year the first hard-sector contract is signed. In column (4), *KfW project (A)* equals one for treated provinces with lower project evaluation ratings (scores 1-4); *KfW project (B)* equals one for treated provinces with higher project evaluation ratings (scores 5-6). ADM2 and ADM0-year fixed effects are included in all models. Across all columns, we control for Population (log) and Other aid project. Standard errors (in parentheses) clustered at the ADM2-level. * p<0.1, ** p<0.05, *** p<0.01.

Finally, in Appendix Table B.3 we present our results separately by world regions. We find that the significant association seems attributable to Sub-Saharan African (SSA) countries, whereas

the statistical link seems weaker in other world regions.¹⁸ Additionally, Table B.4 reports results by FDI source country, distinguishing between projects with higher and lower ratings since we found significant results for this heterogeneity. For higher-rated projects, KfW aid is significantly more likely to be associated with FDI from Germany and the EU (excluding Germany). For lower-rated projects, the pattern differs. This suggests that project quality matters for the alignment of KfW aid with German and European FDI, while for non-European investors—particularly China—the association is more pronounced for lower-rated projects. The differences between higher- and lower-rated projects are statistically significant for Germany and the EU.

5 Conclusion

Against the background of ODA budget cuts in several major donor countries and the increasing pressure on donor agencies to prove that development aid benefits not only the recipient, but also the donor, it is imperative to further study the relationship of development aid and international commercial links. Specifically, this study investigates whether, and through which major channels, aid projects are associated to inflows of FDI at the sub-national level. The empirical analysis is based on unique data for this purpose: we combine FDI data at the ADM2-level, comprising more than 390,000 unit-year-observations, with hand-coded sub-national development finance project data from Germany's KfW Development Bank from more than 71 low- and middle-income countries worldwide.

Our main finding is that there is a statistically significant positive association between KfW development finance projects and FDI at the sub-national level, providing further robust evidence for a positive aid-FDI link that adds to the existing literature. In order to better understand this association, we derive and test three additional hypotheses. First, we find no evidence for the hypothesis that the positive aid-FDI link is statistically more pronounced in more developed middle-income countries. Second, the results lend only weak evidence that the link between FDI and development aid is stronger for projects focused on hard infrastructure. Instead, the results suggest that both the endowment with soft (e.g., agriculture, education, health, natural resources, waste management) and hard infrastructure (e.g., transportation, communication, energy, finance) relate to higher FDI to the respective region. Third, we find a significantly higher probability of FDI projects in regions with KfW projects that received a higher evaluation rating, indicating that project quality—a strong implementation achieving or surpassing planned objectives—is of particular importance for linkages to FDI. And for regions with higher-rated aid projects, FDI originates significantly more often from Germany and the EU.

Both methodologically and concerning the broader political debate, our analysis and findings suggest that the recent shift toward more granular analyses of development aid is justified and should be continued. The resulting detailed data sources appear to be an increasingly valuable—and perhaps the only—way to credibly identify the local impact of global assis-

¹⁸Please note that the coefficient sizes across models are likely statistically not different from each other.

tance. At the same time, we are careful to draw conclusions with respect to causality, given the correlative design of our empirical methodology.

Future research based on the newly available GODAD database could extend the analysis to examine aid projects by different donors. A multi-donor analysis would offer interesting pathways to examine more demanding quasi-experiments and heterogeneous effects, e.g., whether the aid–FDI relationship differs in fragile and conflict-affected states, or across different FDI sectors. Given that we find in this paper a statistically significant association even before project completion, it seems promising to further study a potential signaling effect of aid projects on FDI. Additional work could also examine how aid characteristics (e.g., visibility) and variations in political context shape the potential of aid to attract FDI.

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6 Appendix

6.1 Further Tables and Figures

Table B.1: Summary Statistics

Variable	Description	Obs	Mean	SD	Min	Max
KfW project	Equals 1 if an ADM2 region is treated (contract); 0 otherwise.	394,704	0.030	0.170	0.00	1.00
Years since KfW project	Count of years since the most recent treatment (0 in treatment year).	394,704	0.226	1.623	0.00	26.00
KfW project - 1st Disb	Equals 1 if an ADM2 region is treated with the 1st disbursement; 0 otherwise.	394,704	0.028	0.166	0.00	1.00
KfW project - End	Equals 1 if an ADM2 region is treated after completion; 0 otherwise.	394,704	0.015	0.122	0.00	1.00
KfW project amount (log)	Log of treatment amount in million USD.	394,704	0.195	1.672	0.00	19.11
Other aid project	Equals 1 if an ADM2 region is treated under GODAD; 0 otherwise.	394,704	0.288	0.453	0.00	1.00
Hard sector	Equals 1 if an ADM2 region is treated in hard sectors; 0 otherwise.	394,704	0.017	0.128	0.00	1.00
Soft sector	Equals 1 if an ADM2 region is treated in soft sectors; 0 otherwise.	394,704	0.018	0.132	0.00	1.00
LIC	Equals 1 if an ADM2 region is treated in a Low-Income Country (LIC); 0 otherwise.	394,704	0.016	0.126	0.00	1.00
MIC	Equals 1 if an ADM2 region is treated in a Middle-Income Country (MIC); 0 otherwise.	394,704	0.014	0.116	0.00	1.00
Higher rating	Equals 1 if an ADM2 region is treated with higher-rated evaluations; 0 otherwise.	394,704	0.011	0.105	0.00	1.00
Lower rating	Equals 1 if an ADM2 region is treated with lower-rated evaluations; 0 otherwise.	394,704	0.020	0.141	0.00	1.00
FDI	Equals 1 if at least one FDI project is present; 0 otherwise.	394,704	0.032	0.175	0.00	1.00
Nightlight (mean)	Average night-time lights intensity.	394,704	6.845	11.140	0.00	63.00
Population (log)	Log of total population.	394,704	10.177	1.861	0.00	17.23

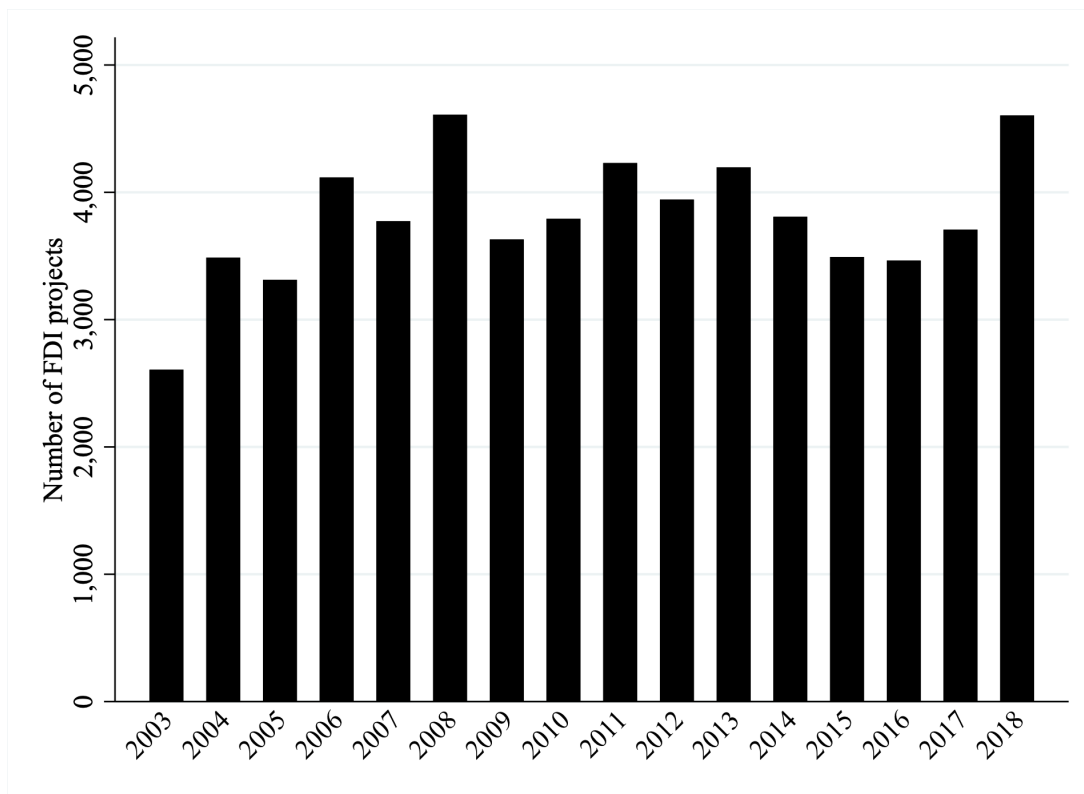


Figure B.1: FDI Project Count by ADM2 region over time

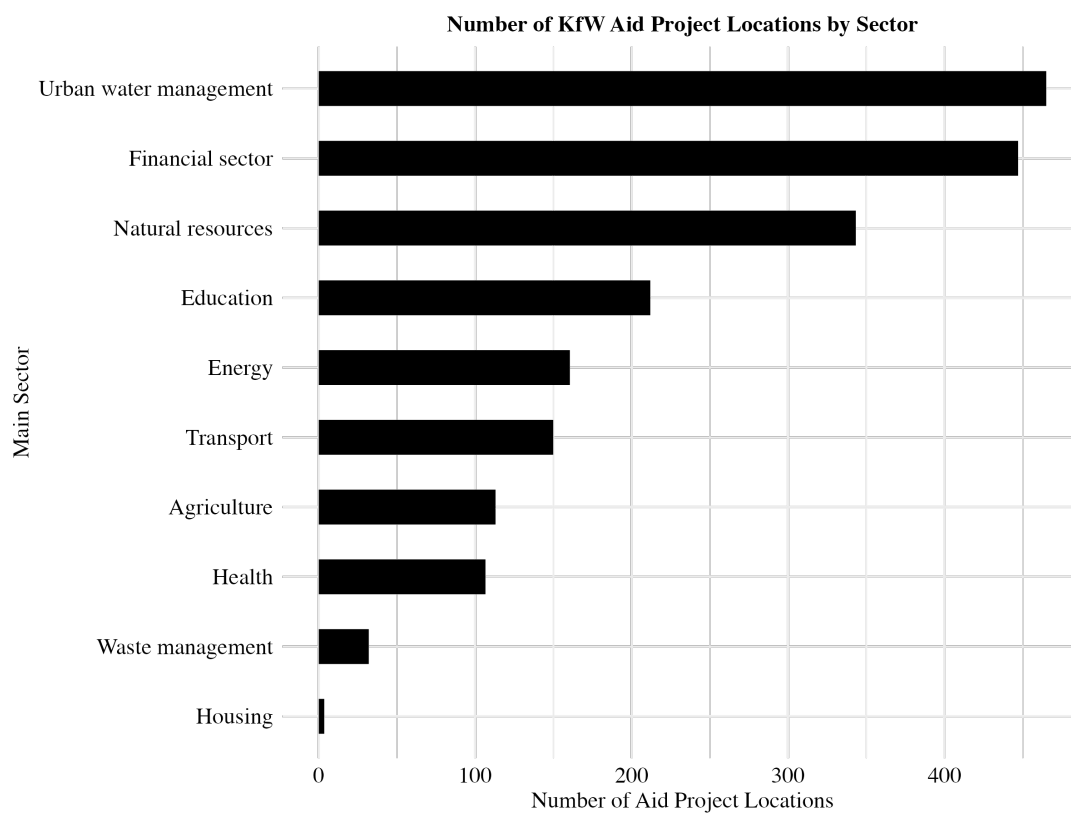


Figure B.2: Number of KfW Project Locations by Sector

Table B.2: Summary Statistics by Region

Region	Variable	N	Mean	SD
Asia and Oceania	FDI (Dummy)	86,384	0.049	0.217
Asia and Oceania	KfW project (Dummy) - Contract	86,384	0.019	0.138
Europe and Caucasus	FDI (Dummy)	86,384	0.046	0.209
Europe and Caucasus	KfW project (Dummy) - Contract	86,384	0.011	0.106
Latin America	FDI (Dummy)	161,744	0.016	0.126
Latin America	KfW project (Dummy) - Contract	161,744	0.018	0.134
MENA	FDI (Dummy)	18,688	0.033	0.178
MENA	KfW project (Dummy) - Contract	18,688	0.074	0.262
Sub-Saharan Africa	FDI (Dummy)	41,504	0.025	0.156
Sub-Saharan Africa	KfW project (Dummy) - Contract	41,504	0.114	0.318

Table B.3: Aid and FDI by Region

	(1) Asia and Oceania	(2) Europe and Caucasus	(3) Latin America	(4) MENA	(5) SSA
KfW project	0.0449 (0.0284)	0.0438 (0.0291)	0.00734 (0.00739)	-0.0180 (0.0208)	0.0280* (0.0144)
N of countries	15	12	11	7	26
Mean in sample	0.049	0.046	0.016	0.033	0.025
R-squared	0.584	0.529	0.499	0.497	0.487
N of obs.	86,384	86,384	161,744	18,688	41,504

The outcome is a dummy variable taking the value one for FDI projects and zero otherwise. The variable *KfW project* is defined as equal to one after the contract is signed in all columns. ADM2 and ADM0-year fixed effects are included in all models. Across all columns, we control for population (log) and Other aid project. Standard errors (in parentheses) clustered at the ADM2-level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.4: Aid and FDI — By FDI Source Countries and Differences by Project Rating

	(1) Germany	(2) EU	(4) US	(5) China	(6) Japan	(7) UAE
Higher rating	0.0193** (0.00843)	0.0312** (0.0128)	0.00394 (0.00852)	0.00852 (0.00520)	0.00761 (0.00723)	-0.00464 (0.00664)
Lower rating	-0.00273 (0.00553)	-0.00431 (0.00596)	-0.00270 (0.00503)	0.00773*** (0.00265)	0.00333 (0.00334)	0.00471* (0.00252)
F test	4.758	6.173	0.492	0.018	0.284	1.860
p value	0.029	0.013	0.483	0.893	0.594	0.173
Mean in sample	0.008	0.014	0.010	0.002	0.005	0.002
R-squared	0.44	0.45	0.50	0.27	0.48	0.34
N of obs.	394,704	394,704	394,704	394,704	394,704	394,704

The outcome is a dummy variable taking the value one for FDI projects and zero otherwise. ADM2 and ADM0-year fixed effects are included in all models. Across all columns, we control for Population (log) and Other aid project. EU excludes Germany. Standard errors (in parentheses) clustered at the ADM2-level. * p<0.1, ** p<0.05, *** p<0.01.