sustainability

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Financial Additionality of Multilateral Development Banks in Private Participation in Infrastructure Projects

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Abstract: This paper aims to provide empirical evidence for demonstrating financial additionality of multilateral development banks (MDBs) in private participation in infrastructure (PPI) projects in terms of financing beyond what is available in the markets. To verify MDB financial additionality, this study examines whether the PPI projects with multilateral support have significantly larger investment commitments than the total average projects by using the PPI database of the World Bank for 1996–2020. The empirical analysis identifies MDB financial additionality, in that the larger investment commitments of multilateral-supported projects beyond the average are confirmed in any income levels and regions in host countries and any sectors and types in the projects. In particular, MDB financial additionality is valid even in low-income countries where private finance is still too premature to be available. In the host countries where their government effectiveness is in the poorest edge, however, MDB financial additionality loses its significance, thereby requiring the governance enhancement and capacity building in the host countries and innovative blended finance instruments for its additionality to work.

Keywords: financial additionality; multilateral development banks; private participation in infrastructure; investment commitments; government effectiveness

Citation: Taguchi, H.; Yasumura, K. Financial Additionality of Multilateral Development Banks in Private Participation in Infrastructure Projects. *Sustainability* **2021**, *13*, 8412. https://doi.org/10.3390/su13158412

Academic Editor: Donato Morea

Received: 30 June 2021
Accepted: 23 July 2021
Published: 28 July 2021

1. Introduction

Developing and emerging market economies have been and will be faced with an enormous demand for infrastructure. Global Infrastructure Outlook by the G20 Initiative [1] projects that global infrastructure investment needs to reach 94 trillion US dollars by 2040 and forecasts the investment gap of about 15 trillion US dollars—equal to a 16% infrastructure investment deficit by that year. The outlook also predicts that meeting the Sustainable Development Goals (SDGs) increases the need by a further 3.5 trillion US dollars, growing the gap to about 18 trillion US dollars. In their projection, developing and some emerging countries continue to have relatively large infrastructure needs and investment gaps. The World Bank [2] reports that new infrastructure could cost low- and middle-income countries anywhere between 2% and 8% of gross domestic product (GDP) per year to 2030 and that investments of 4.5% of GDP would enable them to achieve the infrastructure-related SDGs. Furthermore, the worldwide spread of COVID-19 pandemic in 2020 creates much larger challenges. IMF staff estimates that "on average the public and private sectors will together have to spend some 14 percent of GDP additionally every year between now and 2030 to meet the SDGs in the five sectors, some $2\frac{1}{2}$ percentage points—or 21 percent more—than before the pandemic" [3].

In accordance with the growing demand for infrastructure, the "private participation in infrastructure" (PPI, hereafter) has come to show a significant presence, particularly in developing and emerging market economies. It is because they have suffered from a lack of fiscal space to deal with their infrastructure demand, and the PPI has helped fulfill the gap by mobilizing financial resources with private sectors. Looking at the total investment commitments of PPI projects by the World Bank database (https://ppi.worldbank.org/

en/customquery. accessed on 5 May 2021), their values have grown by 7.3 times from 1990 to 2019, while the world GDP has increased by 3.7 times during the same period (https://www.imf.org/external/pubs/ft/weo/2019/01/weodata/index.aspx. accessed on 5 May 2021). Significant public spending to tackle the COVID-19 pandemic and worsening budgetary status of governments put further pressure on utilization of private resources to fill the funding gap for infrastructure investment.

In this context, multilateral development banks (MDBs) are placed to help bridge the gap between infrastructure investment demand and private sector participation in infrastructure projects. MDBs, such as the World Bank, Asian Developing Bank, and African Development Bank, are international institutions that provide financial assistance to developing countries with the clear mandate of promoting their economic and social development. MDBs can take a significant role in helping fund the investment gap by providing direct financial assistance and also leveraging additional private sector resources in developing countries [4]. A fundamental principle guiding MDBs' engagement with private sector operations is "additionality": MDB support of the private sector should make a contribution that is beyond what is available, or that is otherwise absent from the market, and should not crowd out the private sector (https://www.ebrd.com/downloads/news/mdb.pdf. accessed on 27 April 2012). The MDB Task Force has materialized the harmonized framework of additionality and provided a more detailed breakdown of what composes additionality [5]. In the Task Force report [5] (https://www.adb.org/sites/default/files/institutional-document/456886/mdb-additionality-private-sector.pdf. accessed on 1 October 2018), they define the two types of additionality—financial and non-financial additionality—and show the following criteria as one of the examples of evidence to demonstrate financial additionality in terms of financing beyond what is available in the markets: MDBs provide or mobilize meaningfully "larger loan amounts" compared to what is available in the market at reasonable cost and terms (see Table 1).

Table 1. MDB Additionality in Private Sector Operation.

Category	Type
Financial Additionality	Financing Structure (Financing Beyond What is Available in the Markets) Amount: MDBs provide or mobilize meaningfully larger loan amounts compared to what is available in the market at reasonable cost and terms.
	Innovative Financing Structures and/or Instruments
	MDBs' Own Account Equity
	Resource Mobilization
Non-Financial Additionality	Risk Mitigation
	Policy, Sector, Institutional, or Regulatory Change
	Standard-Setting: Helping Projects and Clients Achieve Higher Standards
	Knowledge, Innovation, and Capacity Building

Sources: Extracted from MDB Task Force [5].

This paper aims to provide empirical evidence for demonstrating MDB financial additionality in PPI projects. The MDB financial additionality was theoretically conceptualized by the MDB Task Force as the "financing beyond what is available in the markets", that is, MDBs provide or mobilize meaningfully "larger loan amounts" compared to what is available in the market. Thus, this study's research question is whether the PPI projects with multilateral support have significantly larger investment values than those without the support. The larger investment commitments by MDB support in infrastructure projects, particularly in least developed countries where private financing is not surely expected in the projects, are considered to be a meaningful proof of MDB financial additionality. As for

the research methods, this study uses the PPI database of the World Bank for 1996–2020 and applies estimators of ordinary least squares (OLS) and Poisson Pseudo Maximum Likelihood (PPML) to ensure the estimation robustness. The major contribution of this study is to quantify MDB financial additionality using the project-level data, while there have been limited empirical studies in this field in the literature. The findings in this study could be summarized briefly as follows: the empirical analysis identifies MDB financial additionality in any income levels and regions in host countries and any sectors and types in the PPI projects. In particular, MDB financial additionality is valid even in low-income countries where private finance is still too premature to be available. Another new finding is that in the host countries where their government effectiveness is in the poorest edge, MDB financial additionality loses its significance.

The remainder of the paper is structured as follows. Section 2 reviews the literature related to the empirical studies of MDB's role and clarifies this study's contributions. Section 3 describes research methodology. Section 4 presents results and discussions on empirical analyses. The last section summarizes and concludes the paper.

2. Literature Review and Contributions

This section reviews the literature related to the empirical studies of MDB's role and clarifies this study's contributions. The major issue that has so far been discussed as a MDB's role is the "mobilization of private finance," that is, the MDB's ability to crowd-in capital from private creditors. The MDB's role of "resource mobilization" is also identified as a vital element of financial additionality in the aforementioned MDB Task Force report [5], though it is classified differently from the category of "financing beyond what is available in the markets" in this study's focus (see again Table 1) (in a broad sense, the MDB role could be reconsidered under the situations with financial risks increasing, such as the trade war between the US and China (e.g., [6]) and the coronavirus pandemic (e.g., [7])).

Regarding the resource mobilization, there have been serious disputes on whether MDB lending has a crowding-in effect or a crowding-out effect on private capital inflows. Rodrik [8] revealed little evidence that multilateral lending has acted as a catalyst for private capital flows, although it argued a rationale for multilateral lending in terms of information provision and conditionality. Basilio [9] showed that multilateral support even reduces the private participation in infrastructure projects, thereby implying its substitution effect, through the empirical analysis of the determinants of the projects. On the other hand, Broccolini et al. [4] identified positive and significant mobilization effects of MDBs on private capital in terms of the size of bank inflows, the number of lenders, and the average maturity by using loan-level data on syndicated lending to a large sample of developing countries. In their study, however, there is no evidence of mobilization effects in the infrastructure sector alone. MDBs themselves estimated their mobilization effects of private finance by collecting the commitment data directly from their own financial reports. MDBs [10] reported that the total long-term finance mobilized by the MDBs from private investors in all low- and middle-income countries in 2019 was $63.6 billion and those for the infrastructure sector accounted for 46% out of them. The empirical evidence on "innovative financing structure", another category of financial additionality, was also provided as in Probst et al. [11]. They examined the crowd-in performance of the novel financial scheme, that is, the Global Energy Transfer Feed-in Tariffs (GET FiT), which was introduced in renewable energy projects in Uganda in 2013, aiming to jointly improve risk and return of private investors. They found that the GET FiT program attracted $453 million in private funding for $104 million in multilateral donor funds (leverage ratio around 1:4.5), including the projects that would not have happened otherwise, thereby representing financial additionality.

As for the non-financial additionality in Table 1, there have been empirical studies of the following MDB functions: providing a signal to private markets on investment-friendly environments, such as macroeconomic stability and the country's commitment to reform (e.g., [12]), mitigating political risks (e.g., [13]), financing risky projects with higher

borrowing costs and longer maturities (e.g., [14]), and alleviating information asymmetry through technical assistance and capacity building (e.g., [15]). However, there have also been counterarguments against the MDB additionality: multilateral lending might create incentives for moral hazards, with borrowing government financing low-return projects and delaying reforms, and would even signal severe economic distress (see [4]).

While the outcomes of the aforementioned empirical studies have been inconclusive on MDB additionality, this study contributes to enriching its evidence from the following perspectives. First, this study demonstrates MDB financial additionality in terms of financing beyond what is available in the markets, whereas the previous studies have rather concentrated on the aspect of resource mobilization effects on private capital. Basílio [16] showed the empirical result that the participation of MDBs is higher for less populous and poorer countries, which could be a proof of MDB financing beyond what is available in the markets. This study extends Basílio [16] by verifying the larger investment commitments with MDB support than those without it, even in less developed countries. Second, this study focuses on the infrastructure sector in terms of PPI projects. The seminal work of Broccolini et al. [4] could not present evidence of MDB mobilization effects in the infrastructure sector alone, though they identified the effects in the total syndicated lending. Probst et al. [11], though identifying financial additionally in infrastructure, focused on a specific sector in a country: renewable energy projects in Uganda. Since the definition of multilateral support in the PPI database includes not only syndicated lending but also other financial support such as equity, guarantee, loan (https://ppi.worldbank.org/en/methodology/glossary#letterM. accessed on 5 May 2021), it would be significant if this study could reveal MDB financial additionality in the infrastructure sector from another angle.

3. Research Methodology

This study applies two kinds of analyses for examining MDB financial additionality: a descriptive analysis and an econometric estimation. This section starts with the description of the research sample, data collection, and variables, and then moves onto method of analysis.

3.1. Research Sample, Data Colletion, and Variables

This section describes research sample, data collection, and variables for a descriptive analysis and an econometric estimation. The latter covers all the variables needed for the analyses, and so the description starts with dependent and independent variables for the econometric estimation.

The variables for estimating MDB financial additionality in PPI projects are listed with their measurement and data sources in Table 2. The estimation equation is designed to equip one dependent variable (total investment commitments of PPI projects), five explanatory variables to control time-varying country-specific effects (the host country's macroeconomic conditions), and dummy variables for the projects with multilateral support and for categorizing the projects by income levels, government effectiveness, and regions in the host country, and sectors and types in the projects. The variables for macroeconomic conditions are selected from those used commonly in the related literature on the determinants of PPI [17–20].

The research sample and data collection of each variable are shown as follows. The total investment commitments (*ppi*) of PPI projects are retrieved from the World Bank PPI database. From this database, this study extracts all the PPI projects (8161 projects) for 1996–2020 in 121 low- and middle-income countries. The total investment commitments are expressed in terms of millions of US dollars and transformed in logarithms to avoid scaling problems in the estimation.

Table 2. List of Variables.

Variables	Description	Data Sources
Dependent Variables		
ppi	Total Investment Commitments of PPI (million $, log term)	WB_PPI
Explanatory Variables: Host Country's Macroeconomic Conditions		
gdp	Gross Domestic Product (current USD, log term, lagged)	IMF_WEO
ypc	GDP per capita (current USD, log term, lagged)	
inf	Inflation, consumer prices (annual %, lagged)	
exr	National currency per USD (period average, log term, lagged)	
gbl	General government net lending/borrowing (percent of GDP, lagged)	
Explanatory Variables: Dummy Variables (*d_x*=1, othewise o)		
d_nulti	Projects with multilateral support	WB_PPI
Host Country's Income Levels		
d_low	Low income	WB_CL
d_lmid	Lower middle income	
d_umid	upper middle income	
Host Country's Government Effectiveness (*gve*)		
d_gvel	$gve < -1$	WB_WGI
d_gvem	$-1 < gve < 0$	
d_gveh	$gve > 0$	
Host Country's Regions		
d_Asia	Asia and Pacific (East Asia and Pacific, and South Asia)	WB_PPI
d_Africa	Sub-Saharan Africa	
d_Latin	Latin America (Latin America and the Caribbean)	
Project's Sectors		
d_energy	Energy	WB_PPI
d_tranport	Transport	
d_other	Others (ICT, Water and Sewerage, and Municipal Solid Waste)	
Project's Types		
d_green	Greenfield project	WB_PPI
d_brown	Brownfield project	

Notes: WB_PPI: PPI database, World Bank; IMF_WEO: World Economic Outlook Database, International Monetary Fund; WB_CL: Country Classification, World Bank; WB_WGI: Worldwide Governance Indicators, World Bank. Source: author's description.

Regarding the variables for country-specific macroeconomic conditions, the estimation adopts five indicators: Gross Domestic Product (GDP) (*gdp*), GDP per capita (*ypc*), inflation (*inf*), exchange rate (*exr*), and government budget balance (*gbl*): GDP and GDP per capita are shown by current US dollars (GDP by billion US dollars); inflation is expressed by year-on-year rate of changes in consumer prices; exchange rate is presented by the period average of national currency per US dollars; and government budget balance is expressed by the general government net lending or borrowing as a percent of GDP. All the macroeconomic data come from the World Economic Outlook Databases of the International Monetary Fund. GDP, GDP per capita, and exchange rate are set in logarithms to avoid scaling issues. All the macroeconomic variables are lagged by one year as they might be endogenous to the model. GDP and GDP per capita are supposed to have coefficients with a positive sign since they represent the market size and purchasing power

of host countries. The coefficient of inflation is expected to have a negative sign because it shows macroeconomic instability. The coefficient in the exchange rate and the negative coefficient of government budget balance are expected to be positive because the currency depreciation and budget deficit might attract PPI projects in host countries.

Turning to dummy variables, the most important one is the dummy for the projects with multilateral support (*d_multi*) so that MDB additionality can be identified when the coefficient of this dummy is significantly positive. The estimation also equips the dummies by five categories: income levels, government effectiveness, and regions in the host country, and sectors and types in the projects. The reason for adopting these dummies is to check the existence of selection bias: when the projects with multilateral support concentrate only on specific region, sector, and type, for instance, the estimation result might lose its validity to prove MDB additionality. The additionality could be justified only when the exceedance of investment commitments for multilateral-supported projects are identified in any components of any categories. For that purpose, the estimation equips cross terms of dummies: a dummy for multilateral-supported projects times a dummy of each component in five categories, and the coefficients of these dummies are expected to be significantly positive, regardless of the components of the categories. The category of income levels is classified according to the World Bank country classification (https://datahelpdesk.worldbank.org/knowledgebase/articles/906519. accessed on 5 May 2021). The category of government effectiveness is classified by the Worldwide Governance Indicators (WGI) of the World Bank, which takes the number ranging from approximately −2.5 (low) to 2.5 (high) (https://info.worldbank.org/governance/wgi/. accessed on 5 May 2021) The government effectiveness index represents the government's institutional quality and governance, defined in the database as "perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies." The classifications of the other categories follow those of the World Bank PPI database. Each category has the following components' dummies: income levels have the dummies of low income (*d_low*), lower middle income (*d_lmid*), and upper middle income (*d_umid*); government effectiveness (*gve*) has the dummies of $gve < -1$ (*d_gvel*), $-1 < gve < 0$ (*d_gvem*), and $gve > 0$ (*d_gveh*); regions have the dummies of Asia and the Pacific (*d_Asia*), sub-Saharan Africa (*d_Africa*), and Latin America (*d_Latin*); sectors have the dummies of energy (*d_energy*), transport (*d_transport*), and others (*d_other*); and types have the dummies of greenfield (*d_green*) and brownfield (*d_brown*).

The study then constructs an unstructured dataset with 8161 PPI projects for 1996–2020 containing 121 countries for the subsequent econometric estimation, which follows the data constraint of each variable.

3.2. Method of Analysis

The equations for the econometric estimation are specified as follows. For the simple estimation of total projects:

$$\ln ppi_{itk} = \beta \times E_{it} + \mu \times d\_multi_k + \nu_t + \varepsilon_{itk} \quad (1)$$

$$ppi_{itk} = \exp\left[\beta \times E_{it} + \mu \times d\_multi_k) + \nu_t\right] + \varepsilon_{itk} \quad (2)$$

For the estimation considering five categories of the projects:

$$\ln ppi_{itk} = \beta \times E_{it} + \gamma \times D_j + \mu \times (d\_multi_k \times D_j) + \nu_t + \varepsilon_{itk} \quad (3)$$

$$ppi_{itk} = \exp\left[\beta \times E_{it} + \gamma \times D_j + \mu \times (d\_multi_k \times D_j) + \nu_t\right] + \varepsilon_{itk} \quad (4)$$

where Equations (1) and (3) are the forms of OLS estimation and Equations (2) and (4) are the ones of PPML estimation. The subscripts i, t, and k denote host countries (the 121 low- and middle- income countries), years (1996–2020), and project number (8161 PPI projects),

respectively; E represents the variables for country-specific time-varying macroeconomic conditions: GDP (*gdp*), GDP per capita (*ypc*), inflation (*inf*), exchange rate (*exr*), and government budget balance (*gbl*); ν denotes year fixed effects; ε represents error terms; β, γ, and μ are parameters of variables; and D_j is the dummies under the five categories: j = 1–5; that is, *d_low*, *d_lmid*, and *d_umid* in income levels; *d_gvel*, *d_gvem*, *d_gveh* in government effectiveness; *d_Asia*, *d_Africa*, and *d_Latin* in regions; *d_energy*, *d_transport*, and *d_other* in sectors; and *d_green* and *d_brown* in types. The most critical parameter is μ, in particular, in Equations (3) and (4)—that is, the coefficient of cross term of dummies: a significantly positive coefficient in any components of any categories implies the existence of MDB additionality.

The reason why this study applies the PPML estimator in Equations (2) and (4), as well as the OLS one in Equations (1) and (3), is that the investment commitments in the PPI database contain zero value and are plagued by the "heteroskedasticity" problem. The OLS estimator with log-linear form drops zero observations from the estimation sample and also leads to a bias and an inconsistency in its estimate under the heteroskedasticity. Instead, as Santos Silva and Tenreyro [21] advocated, the PPML estimator takes advantage of information with zero value and accounts for the heteroskedasticity. This study applies both estimators for a robustness check.

4. Results and Discussion

The empirical results on MDB financial additionality in this study are composed of a descriptive analysis and an econometric estimation. This section starts with a descriptive analysis.

4.1. Descriptive Analysis

The analysis in this section is to observe the World Bank PPI database and to simply compare investment commitments of multilateral-supported projects with those of total average projects. Table 3 reports how the individual PPI projects with multilateral support have larger investment commitments, compared with the average of total projects, as well as the frequency of the projects with multilateral support for total and categorized projects by income levels, government effectiveness, and regions in the host country, and sectors and types in the projects.

In totally aggregated projects, the number of projects with multilateral support is 1167, accounting for 14.3% of the total projects numbered 8161. The average total investment commitments of the projects with multilateral support are $268.4 million, larger by 18% than those of total average projects valued $227.7 million.

In the first place, the total projects are classified by the host country's income level into those in low-income and lower-middle-income and upper-middle-income countries. In this classification, the investment commitments of the multilateral-supported projects exceed those of total projects by around 20%, regardless of income classes. The point worth noting is that the frequency of the multilateral-supported projects in low-income countries, 18.61%, is larger than that of the total project, 14.3%. It suggests that the multilateral support has been working well even in low-income countries where private finance has been still too premature to accept.

Second, the classification goes to the degree of government effectiveness in the PPI host countries. The interesting finding is that the higher the index that is attached to the country that the projects belong to is, the larger excess in investment commitment values on the multilateral-supported projects relative to those in total average projects is found: 1.19 in $gve > 0$, 1.10 in $-1 < gve < 0$, and 1.04 in $gve < -1$. It should also be noted that in the lowest edge of the index ($gve < -1$), there is little gap in the commitments between the multilateral-supported projects and the total average ones. It implies that the MDB financial additionality, for its better performance, would require the enhancement of the host country's government effectiveness, thereby necessitating the MDB assistances for its capacity building on the PPI projects.

Table 3. Descriptive analysis of MDB financial additionality in PPI projects.

	Total Projects		Projects with Multilateral Support			
	Number (a)	**Investment (ave. million $) (b)**	**Number (c)**	**Investment (ave. million $) (d)**	**c/a (%)**	**d/b**
Total	8161	227.7	1167	268.4	14.30	1.18
Host Country's Income Levels						
Low	908	132.5	169	163.2	18.61	1.23
Lower middle	3216	208.0	495	248.6	15.39	1.20
Upper middle	4037	264.8	503	323.3	12.46	1.22
Host Country's Government Effectiveness (*gve*)						
$gve < -1$	116	225.8	27	235.7	23.28	1.04
$-1 < gve < 0$	4046	237.4	653	261.3	16.14	1.10
$gve > 0$	3040	224.8	340	268.1	11.18	1.19
Host Country's Regions						
Asia and Pacific	3880	199.9	281	292.0	7.24	1.46
Sub-Saharan Africa	483	190.0	147	253.5	30.43	1.33
Latin America	2746	235.7	469	255.8	17.08	1.09
Project's Sectors						
Energy	4602	212.3	860	237.6	18.69	1.12
Transport	1935	339.2	186	397.4	9.61	1.17
Others	1624	138.4	121	289.0	7.45	2.09
Project's Types						
Greenfield	5085	222.7	740	256.1	14.55	1.15
Brownfield	2186	216.7	264	290.1	12.08	1.34

Sources: author's calculation based on the World Bank PPI database.

The remaining classifications do not seem to seriously affect the picture in the aforementioned case of the total projects: the investment commitments of multilateral-supported projects exceed those of total average projects. The points worth noting are summarized as follows: in the regional classification, the frequency of multilateral-supported projects is relatively higher in sub-Saharan Africa and lower in Asia and the Pacific, while the exceedance in investment commitments of those projects is higher in Asia and the Pacific; in the sectoral classification, the energy sector has higher frequency of multilateral-supported projects, 18.69%, though it shows relatively lower exceedance in investment commitments of that projects; and in the type classification, there appears to be no serious difference in greenfield and brownfield projects.

The findings above come from the simple observation of the PPI project database. However, the investment commitment values are also affected by time-varying country-specific factors including the host country's macroeconomic conditions, as well as year fixed effects, such as world economic conditions. Here comes the necessity to apply an econometric approach to control these effects in the next section so that the pure exceedance in investment commitments of multilateral-supported projects could be extracted.

4.2. Econometric Estimation

Before showing the estimation results, Table 4 displays the descriptive statistics of data for the estimation variables. Table 5 reveals the bivariate correlations and the variance inflation factors (VIF) among the macroeconomic variables for investigating their multicollinearity. The correlations together with the VIF index indicate that there is no serious threat in the multicollinearity among the explanatory variables, thereby, the selection of the five macroeconomic variables being justified statistically.

Table 4. Descriptive Statistics.

Variables	Obs.	Mean	Std. Dev.	Min.	Max
ppi	8108	229	666	1	35,587
gdp	7894	2071	3288	0	14,340
ypc	7891	4940	3831	159	18,832
inf	7850	6.39	8.13	−3.90	325.03
exr	7888	602	2844	0	31,458
gbl	7790	−3.45	3.23	−33.59	21.76

Source: author's estimation.

Table 5. Correlation matrix and variance inflation factors.

	gdp	***ypc***	***inf***	***exr***	***gbl***
gdp	1.000				
ypc	0.393	1.000			
inf	−0.176	−0.110	1.000		
exr	−0.299	−0.458	0.049	1.000	
gbl	−0.128	0.177	−0.101	−0.023	1.000
VIF	1.475	2.312	1.124	1.626	1.339

Source: author's estimation.

Table 6 reports the results of OLS estimation on total projects in Equation (1) and on the projects containing five categories in Equation (3), and Table 7 reports the results of PPML estimation in Equations (2) and (4) in the form of log-link function. Column (a), (b), (c), (d), (e), and (f) denote the results of total projects, and the categorized projects by income levels, government effectiveness, regions, sectors and types, respectively.

Table 6. OLS Estimation Results.

	(a)	**(b)**	**(c)**
gdp	0.001	−0.002	0.000
	(0.161)	(−0.245)	(0.975)
ypc	0.377 ***	0.283 ***	0.329 ***
	(20.504)	(5.579)	(11.829)
inf	0.003	0.003	0.003
	(1.315)	(1.282)	(1.210)
exr	0.088 ***	0.072 ***	0.074 ***
	(10.079)	(6.891)	(7.165)
gbl	−0.055 ***	−0.049 ***	−0.050 ***
	(−9.125)	(−7.770)	(−7.810)
d_low		1.265 ***	
		(2.924)	
d_lmid		1.265 ***	
		(2.709)	
d_umid		1.328 **	
		(2.534)	
d_gvel			1.261 ***
			(3.451)
d_gvem			0.890 ***
			(2.647)
d_gveh			0.825 **
			(2.427)
d_nulti	0.671 ***		
	(12.557)		

Table 6. *Cont.*

	(a)	(b)	(c)
d_multi × *d_low*		0.703 ***	
		(4.872)	
d_multi × *d_lmid*		0.631 ***	
		(7.705)	
d_multi × *d_umid*		0.660 ***	
		(8.615)	
d_multi × *d_gvel*			0.342
			(0.979)
d_multi × *d_gvem*			0.626 ***
			(9.057)
d_multi × *d_gveh*			0.582 ***
			(6232)
Year Fixed Effect	Yes	Yes	Yes
R-squared	0.087	0.088	0.084
Adjusted R-squared	0.083	0.084	0.080
Observation	7357	7357	7357
	(d)	**(e)**	**(f)**
gdp	0.045 ***	0.008	−0.004
	(3.008)	(0.738)	(−0.403)
ypc	0.352 ***	0.303 ***	0.387 ***
	(15.509)	(11.232)	(20.909)
inf	0.001	0.002	0.003
	(0.426)	(0.828)	(1.274)
exr	0.102 ***	0.055 ***	0.090 ***
	(10.137)	(5.530)	(10.060)
gbl	−0.062 ***	−0.026 ***	−0.056 ***
	(−10.102)	(−4.210)	(−9.212)
d_Asia	−0.465 ***		
	(−5.823)		
d_Africa	0.011		
	(0.103)		
d_Latin	−0.284 ***		
	(−4.193)		
d_energy		1.250 ***	
		(3.808)	
d_tranport		1.871 ***	
		(5.685)	
d_other		0.533	
		(1.621)	
d_green			−0.110 *
			(−1.732)
d_brown			−0.109
			(−1.578)
d_multi × *d_Asia*	0.860 ***		
	(8.526)		
d_multi × *d_Africa*	0.695 ***		
	(4.310)		
d_multi × *d_Latin*	0.603 ***		
	(7.350)		

Table 6. *Cont.*

	(a)	(b)	(c)
d_multi × *d_ebergy*		0.617 ***	
		(10.288)	
d_multi × *d_transport*		0.474 ***	
		(3.898)	
d_multi × *d_other*		1.321 ***	
		(8.632)	
d_multi × *d_green*			0.617 ***
			(9.228)
d_nulti × *d_brown*			0.726 ***
			(6.856)
Year Fixed Effect	Yes	Yes	Yes
R-squared	0.089	0.151	0.083
Adjusted R-squared	0.085	0.147	0.079
Observation	7357	7357	7357

Note: ***, **, and * denote rejection of null hypothesis at the 99%, 95%, and 90% level of significance, respectively. The figure in () denotes t-value. The coefficients of the time dummy are omitted here due to the space limitation. Sources: author's estimation.

Table 7. PPML estimation results.

	(a)	(b)	(c)
gdp	0.002	−0.000	−0.000
	(0.619)	(−0.169)	(−0.050)
ypc	0.115 ***	0.067 ***	0.079 ***
	(18.995)	(4.185)	(8.899)
inf	0.000	0.000	0.000
	(1.071)	(0.996)	(0.949)
exr	0.027 ***	0.017 ***	0.017 ***
	(9.983)	(5.258)	(5.474)
gbl	−0.015 ***	−0.012 ***	−0.012 ***
	(−8.217)	(−5.927)	(−5.961)
d_low		0.725 ***	
		(5.282)	
d_lmid		0.727 ***	
		(4.916)	
d_umid		0.745 ***	
		(4.480)	
d_gvel			0.721 ***
			(6.190)
d_gvem			0.635 ***
			(5.917)
d_gveh			0.623 ***
			(5.755)
d_nulti	0.157 ***		
	(9.745)		
d_multi × *d_low*		0.172 ***	
		(3.780)	
d_multi × *d_lmid*		0.147 ***	
		(5.833)	
d_multi × *d_umid*		0.140 ***	
		(8.217)	
d_multi × *d_gvel*			0.079
			(0.745)

Table 7. *Cont.*

	(a)	(b)	(c)
d_multi × *d_gvem*			0.140 ***
			(6.730)
d_multi × *d_gveh*			0.128 ***
			(4569)
Year Fixed Effect	Yes	Yes	Yes
Observation	7357	7357	7357
	(d)	**(e)**	**(f)**
gdp	0.007	0.001	0.000
	(1.569)	(0.513)	(0.089)
ypc	0.118 ***	0.072 ***	0.118 ***
	(15.629)	(8.128)	(19.205)
inf	0.000	0.000	0.000
	(0.751)	(0.620)	(1.057)
exr	0.028 ***	0.013 ***	0.027 ***
	(8.795)	(4.000)	(9.848)
gbl	−0.017 ***	−0.006 ***	−0.016 ***
	(−8.986)	(−3.122)	(−8.220)
d_Asia	−0.073 ***		
	(−2.935)		
d_Africa	0.031		
	(0.912)		
d_Latin	−0.067 ***		
	(−3.172)		
d_energy		0.731 ***	
		(6.821)	
d_tranport		0.872 ***	
		(8.117)	
d_other		0.538 ***	
		(5.007)	
d_green			−0.015
			(−0.752)
d_brown			−0.019
			(−0.883)
d_multi × *d_Asia*	0.199 ***		
	(6.581)		
d_multi × *d_Africa*	0.170 ***		
	(3.469)		
d_multi × *d_Latin*	0.137 ***		
	(5.574)		
d_multi × *d_ebergy*		0.139 ***	
		(7.375)	
d_multi × *d_transport*		0.095 ***	
		(2.623)	
d_multi × *d_other*		0.332 ***	
		(6.778)	
d_multi × *d_green*			0.144 ***
			(7.153)
d_nulti × *d_brown*			0.162 ***
			(5.126)
Year Fixed Effect	Yes	Yes	Yes
Observation	7357	7357	7357

Note: *** denotes rejection of null hypothesis at the 99% level of significance. The figure in () denotes t-value. The coefficients of the time dummy are omitted here due to the space limitation. Sources: Author's estimation.

Both OLS and PPML estimations show almost the same outcomes in the sign and significance of each coefficient except its magnitude. Looking at the estimation results on total projects in Column (a), the coefficients of the dummies for multilateral-supported projects (*d_multi*) are exp. (0.671) = 1.956 in OLS estimation in Table 6 and exp. (0.157) = 1.170 in PPML estimation in Table 7. Considering that the investment commitments of multilateral-supported projects are larger than those of total average projects by 18% from the simple observation in Section 4.1, the PPML estimation that can deal with the zero value and heteroskedasticity seems to reveal a reasonable result. Thus, the subsequent description focuses on the results of PPML estimation.

Regarding macroeconomic variables, it is commonly found from Column (a) to (f) that the coefficients of GDP per capita (*ypc*) and exchange rate (*exr*) are significantly positive and the government budget balance (*gbl*)'s coefficient is significantly negative, as are expected in Section 3.1., and that the coefficients of GDP (*gdp*) and inflation (*inf*) are insignificant, which suggests that the market size and price stability of host countries are not important factors that affect the PPI investments.

The result focusing on the category of income levels shown in Column (b) shows that all the coefficients of the cross terms of dummies, *d_multi* times *d_low*, *d_lmid*, and *d_umid* are significantly positive. It should be noted that the low-income countries represented by *d_multi* times *d_low* have the largest magnitude of coefficients. This implies that the multilateral support has been effective even in low-income countries in terms of its financial additionality in PPI projects. As for the category of government effectiveness (*gve*), the cross term of *d_multi* times *d_low* is insignificant, whereas the other cross terms are significantly positive. This means that in the host countries where their government effectiveness index is extremely low by $gve < -1$, multilateral support loses its significance, thereby requiring the governance enhancement and capacity building in the host countries for MDB financial additionality to work. In the other categories—that is, regions, sectors, and types—all the coefficients of the cross terms are significantly positive regardless of their components, implying the validity of MDB financial additionality.

The findings above contribute to the literature in this field as follows. First, the result of identifying MDB additionality in low-income countries in this study seems to be consistent with Basilio (2015), which argued the high participation of MDBs in poorer countries. Second, the new finding of this study is that the estimation verifies the MDB role in infrastructure projects, whereas Basilio (2017) and Broccolini et al. (2020) could not find out MDB mobilization effect in the infrastructure sector. Third, another new insight in this study is that MDB additionality role is affected by the host country's government effectiveness, which implies some need for MDB assistances for capacity building in the host countries and need for a different approach other than ordinary MDB finance. As for the different approach, the 2015 Addis Ababa Action Agenda of the Third International Conference on Financing for Development recognizes the potential of blended finance (https://sustainabledevelopment.un.org/content/documents/2051AAAA_Outcome.pdf. accessed on 27 July 2015). OECD advocates for the usage of blended finance to finance sustainable development that aims to attract commercial capital towards projects that benefit society while also providing financial returns to investors (OECD, 2021). Although MDBs are expected to utilize the blended finance instruments to provide their financial additionality of structuring innovative financing structures, the PPI database is not tailored to assess MDB financial additionality through its blended finance operation. In addition, blended finance may create market distortion or moral hazard issues due to its subsidy element. On these points, MDBs formed the DFI Working Group on Enhanced Blended Concessional Finance for Private Sector Projects to ensure a strict and disciplined approach to blended concessional finance and provide data for the blended finance projects (https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/bf/bf-details/bf-dfi. accessed on 5 May 2021). Further research is needed to assess MDB financial additionality of structuring innovative financing structures on the blended finance operation.

In summation, the econometric estimation verifies MDB financial additionality in PPI projects, as the exceedances in investment commitments of multilateral-supported projects compared to the total average projects are identified in any income levels, regions, sectors, and types. In particular, MDB financial additionality is valid even in low-income countries where private finance is still too premature to be available. It is also found that in the host countries where government effectiveness is in the poorest edge, MDB financial additionality loses its significance, thereby requiring the governance enhancement and capacity building in the host countries and innovative blended finance instruments (https://blogs.worldbank.org/psd/now-time-mobilize-blended-finance-instruments. accessed on 4 May 2020) for its additionality to work.

5. Conclusions

This paper provided empirical evidence for demonstrating MDB financial additionality in PPI projects in terms of financing beyond what is available in the markets. To verify the existence of MDB financial additionality, this study examined whether the PPI projects with multilateral support have significantly larger investment commitments than the total average projects, by using the PPI database of the World Bank. The major contribution of this study is to quantify MDB financial additionality using the project-level data, while there have been limited empirical studies in this field in the literature.

The main findings through the data observation and econometric analysis are summarized as follows. MDB financial additionality is identified in PPI projects, in that the larger investment commitments of multilateral-supported projects beyond the average are confirmed in any income levels and regions in host countries and any sectors and types in the projects. In particular, MDB financial additionality is valid even in low-income countries where private finance is still too premature to be available, in terms of the large investment commitments and the higher frequency of multilateral-supported projects in these countries. In the host countries where their government effectiveness is in the poorest edge, however, MDB financial additionality loses its significance, thereby requiring the governance enhancement and capacity building in the host countries and innovative blended finance instruments for its additionality to work.

Lastly the limitations of this study and the directions for future research should be noted as follows. This study's target of MDB financial additionality is confined to the scope of "financing beyond what is available in the markets" and to the stage of "quality-at-entry", and thus there should be much room to enrich the evidence in this field. In the scope, for instance, the financial additionality of "structuring innovative financing structures on blended finance projects" might be assessed by using different data from the PPI database. In the stage, the MDB additionality during implementation of the PPI projects should be investigated, and an empirical analysis on difference of default rates by MDB loans and commercial loans might shed the light on this question.

Author Contributions: Conceptualization, H.T. and K.Y.; methodology, H.T. and K.Y.; software, H.T.; validation, H.T. and K.Y.; formal analysis, H.T. and K.Y.; investigation, K.Y.; resources, K.Y.; data curation, H.T.; writing—original draft preparation, H.T.; writing—review and editing, K.Y.; visualization, H.T. and K.Y.; supervision, H.T.; project administration, H.T. Both authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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