Cofinancing and Infrastructure Project Outcomes in Chinese Lending and Overseas Development Finance

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Milan, July 2023

Trillion-scale financing gap in the Global South


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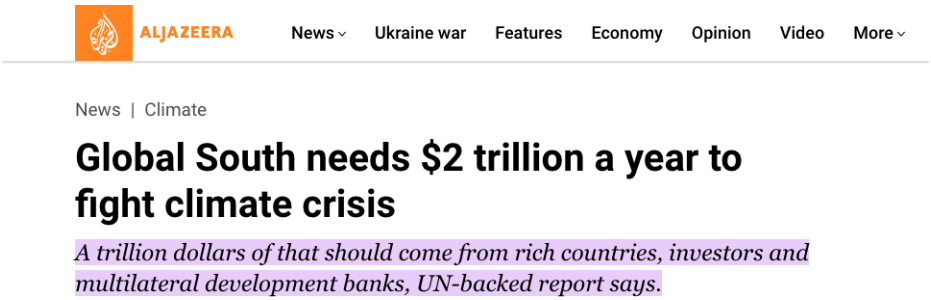
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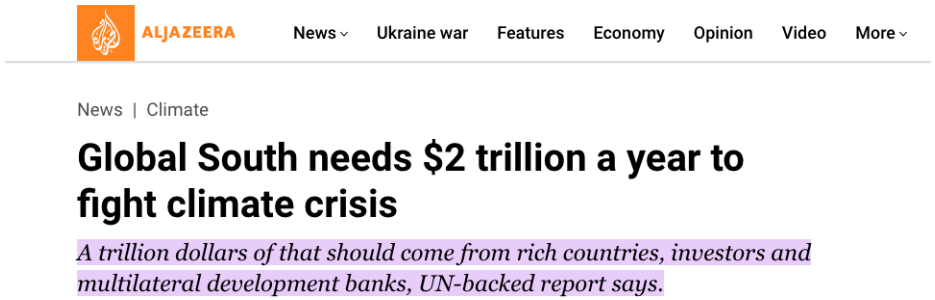
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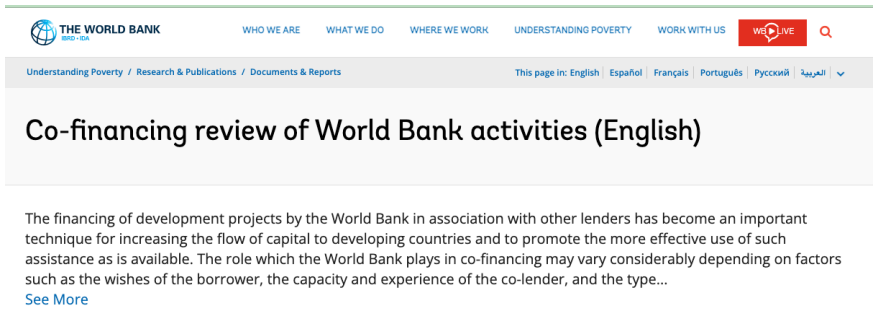
Global South needs $2 trillion a year to fight climate crisis

A trillion dollars of that should come from rich countries, investors and multilateral development banks, UN-backed report says.

- Cofinancing: mobilise financial resources, esp. for costly and complex infrastructure projects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Co-financing review of World Bank activities (English)

The financing of development projects by the World Bank in association with other lenders has become an important technique for increasing the flow of capital to developing countries and to promote the more effective use of such assistance as is available. The role which the World Bank plays in co-financing may vary considerably depending on factors such as the wishes of the borrower, the capacity and experience of the co-lender, and the type...

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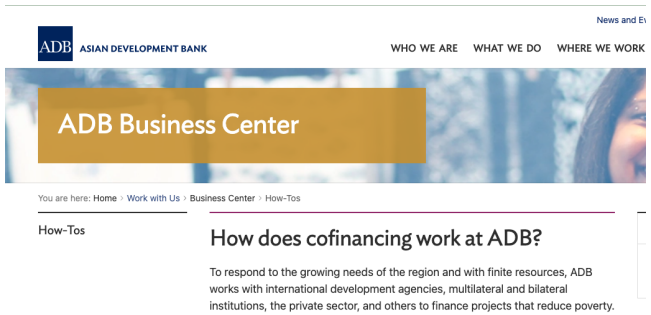
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How-Tos

How does cofinancing work at ADB?

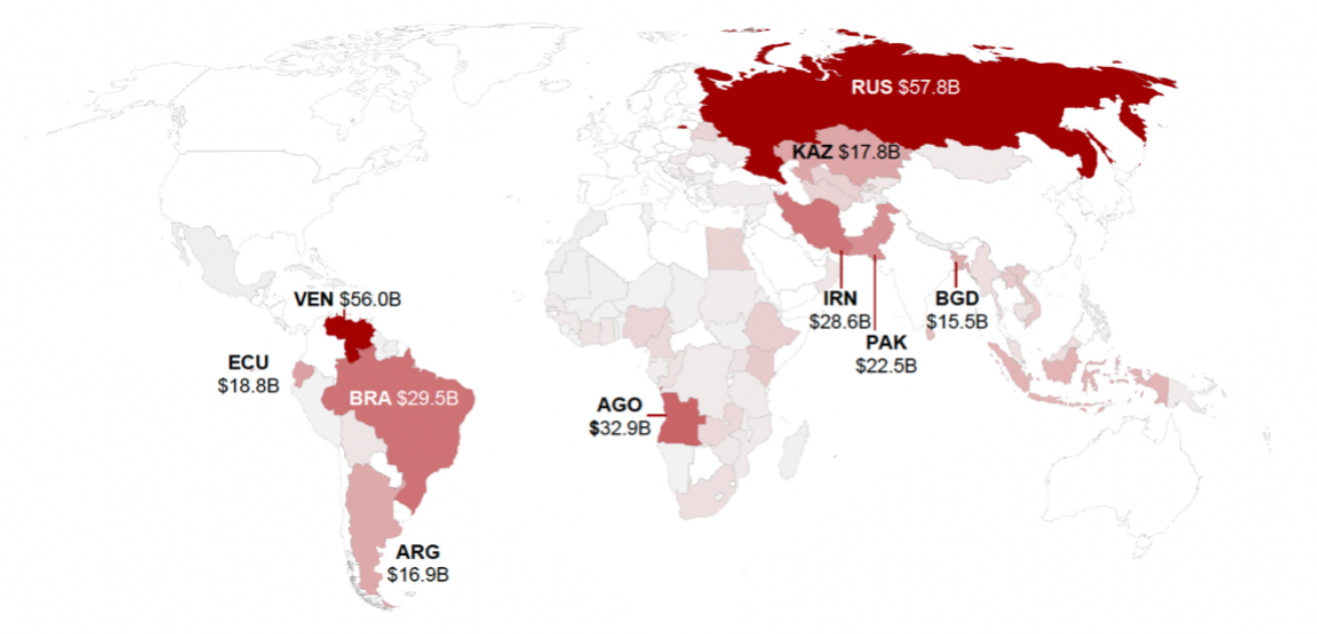
To respond to the growing needs of the region and with finite resources, ADB works with international development agencies, multilateral and bilateral institutions, the private sector, and others to finance projects that reduce poverty.

Cofinancing in development finance

- Heated policy debate on cofinancing
- Limited academic understanding
  - Macroeconomic effects of cofinancing (Chatterjee et al., 2003; Kalaitzidakis and Kalyvitis, 2008)
  - Determinants of cofinancing, mostly based on Global Environmental Facility projects (Wezel, 2004; Miller and Yu, 2012; Kotchen and Negi, 2019; Dite et al., 2019; Cui et al.,2020)
  - Syndicated loan: multilateral and national development bank's participation (Gurara et al. 2020; Gong et al. 2023)

China has become a major development financier

- Two major CN bilatral policy banks lent $498 billion 2008-2021, 83% of World Bank's sovereign lending (BU GDP Center, 2023)



(a) Mombasa–Nairobi railway in Kenya

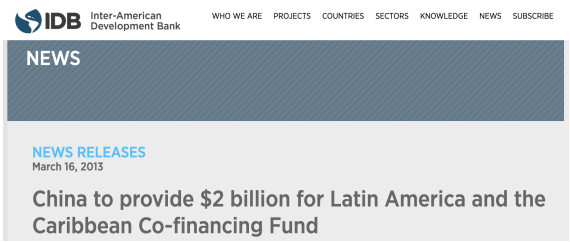
(b) Tanque Novo Wind power in Brazil

(c) Morowali industrial park in Indonesia

China's approach of cofinancing

- "Coordinated credit space" theory (Chin and Gallagher, 2019)
  - Cofinancing drives CN development finance to a large scale quickly

- By geographic origin
  - International partner
  - Recipient partner
  - Chinese partner
- By source
  - Public partner
  - Private partner
- Cofinancing examples



(a) Cofinancing fund

(b) Bilateral

(c) Project level

Cofinancing and project outcomes

- **H1** Cofinanced projects less/more likely to be cancelled or suspended
  - Cofinancing can boost ownership, share risks, improve transparency (Miller and Yu, 2012; Nelson, 2001; Shin, Kim and Sohn, 2017)
  - Coordination cost, additional staff time, cost overrun (Park and Papadopoulou, 2012; Ray and Gallagher, 2018; Sovacool et al., 2014)
- **H2** Recipient cofinancing has more local agencies involved in implementation
  - Strengthen relations with local economy, enable knowledge transfer, access to local information (Kernen and Lam, 2014; Harrison and Mulley,2007; Auffray and Fu,2015; Chen, 2021)
  - Source of funding can influence localisation level (Van der Kley, 2020)
- **H3** International cofinancing has better environmental performance
  - International institutions have sound environmental safeguards
  - Cofinanced projects adhere to common standards (World Bank, 2020)

Data and variables

- Project-level data from Aiddata
  - 2997 infrastructure projects committed between 2000 and 2017
  - 1) Energy, 2) Transport & Storage, 3) Mining, industry & construction
- Project outcomes:

Dimensions	Variables	Sample	Source
Project implementation	Project cancelled or suspended	All infrastructure projects	Aiddata
	Recipient implementor involved		
	Number of recipient implementors		
Environmental impacts	Carbon emission intensity	Fossil fuel power projects	Estimates based on tech parameters in WEPP database
	Biodiversity risk index	Infrastructure projects w. accurate geolocation	Index from Yang et al. (2021)

▸ Details

Empirical specification

- **Compare cofinanced and non-cofinanced projects**

$$Outcome_{i,sct} = \beta_1 Cofinanced_i + Controls_i + \alpha_s + \gamma_c + \mu_t + \epsilon_i \quad (1)$$

$Outcome_{i,sct}$: Outcome of project i
$Cofinanced_i$: one if project i is cofinanced
$Controls_i$: project-level control variables i

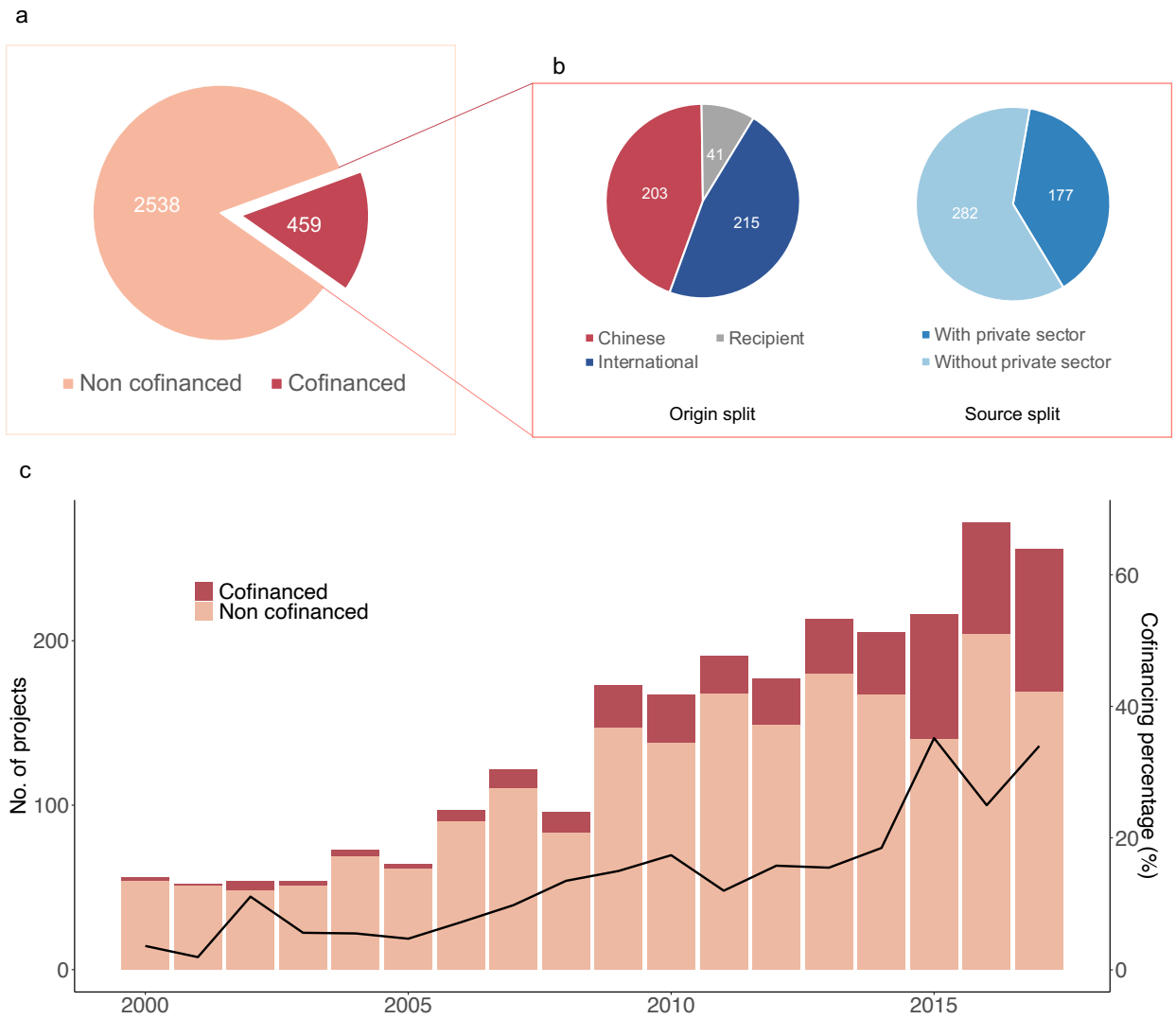
α_s, γ_c, μ_t: sector, country, year dummies

- **Investigate specific cofinancing arrangement**

$$\begin{aligned} Outcome_{i,sct} = {} & \beta_2 CofInternational_i + \beta_3 CofRecipient_i \\ & + \beta_4 CofChinese_i + Controls_i \\ & + \alpha_s + \gamma_c + \mu_t + \epsilon_i \end{aligned} \quad (2)$$

$$\begin{aligned} Outcome_{i,sct} = {} & \beta_5 CofPrivate_i + \beta_6 CofNoprivate_i \\ & + Controls_i + \alpha_s + \gamma_c + \mu_t + \epsilon_i \end{aligned} \quad (3)$$

Chinese development finance infrastructure projects



Descriptive statistics

	Means	Std.Dev.	Min.	Max.	Obs.
All infrastructure projects					
Project cancelled or suspended	0.03	0.17	0	1	2997
Recipient implementor involved	0.60	0.49	0	1	2347
Number of recipient implementors	0.74	0.75	0	7	2347
Project size (constant 2017 million USD)	410.58	1419.84	0.012	32064.84	2401
CN bilateral policy bank financing	0.57	0.49	0	1	2997
Infrastructure proejcts being fossil fuel power units					
CO_2 emission intensity (tons CO2/MWh)	0.85	0.12	0.45	1.15	282
Power unit capacity (MW)	327.20	252.00	2	1050	282
Infrastructure projects with accurate geolocation					
Biodiversity risk index	0.17	0.20	0.00	0.85	298

Project implementation: project cancelled or suspended

Outcome variable:	Project cancelled or suspended					
	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample			Drop ongoing projects		
Cofinanced	-0.033**			-0.070***		
	(0.014)			(0.024)		
-w. international partner		-0.024			-0.050*	
		(0.016)			(0.025)	
-w. recipient partner		-0.041***			-0.070***	
		(0.016)			(0.019)	
-w. Chinese partner		-0.040**			-0.097***	
		(0.018)			(0.034)	
-w. private partner			-0.049***			-0.079***
			(0.016)			(0.023)
-wo. private partner			-0.022			-0.063**
			(0.017)			(0.028)
Project size	0.008***	0.008***	0.008***	0.016***	0.016***	0.016***
	(0.002)	(0.002)	(0.002)	(0.005)	(0.005)	(0.004)
CN policy bank funded	0.008	0.009	0.006	-0.008	-0.005	-0.009
	(0.010)	(0.010)	(0.009)	(0.015)	(0.016)	(0.016)
Year, Sector, Country dummy	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	2390	2390	2390	1446	1446	1446

Notes: Linear probability model.*P<0.10, **P<0.05, ***P<0.01.SE clustered at recipient country level.

Project implementation: recipient implementor involved

Outcome variable:	Recipient involved			No. of recipient implementors		
	(1)	(2)	(3)	(4)	(5)	(6)
Cofinanced	-0.07			-0.136*		
	(0.044)			(0.073)		
-w. international partner		-0.022			-0.062	
		(0.057)			(0.079)	
-w. recipient partner		0.204**			0.110*	
		(0.092)			(0.065)	
-w. Chinese partner		-0.177***			-0.260**	
		(0.063)			(0.117)	
-w. private partner			-0.002			-0.062
			(0.057)			(0.077)
-wo. private partner			-0.111**			-0.181**
			(0.050)			(0.086)
Project size(USD in log)	-0.013	-0.01	-0.012	0.005	0.008	0.005
	(0.008)	(0.007)	(0.008)	(0.010)	(0.010)	(0.010)
CN policy bank funded	-0.011	0.002	-0.003	0.065	0.083**	0.075*
	(0.029)	(0.028)	(0.029)	(0.041)	(0.040)	(0.042)
Year, Sector, Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	1921	1921	1921	1921	1921	1921

Notes: *P<0.10, **P<0.05, ***P<0.01.SE clustered at recipient country level.

Environmental impact: CO_2 emission intensity

Outcome variable (log):	CO_2 emission intensity			Emission factor	Heat rate
	(1)	(2)	(3)	(4)	(5)
Cofinanced	-0.014				
	(0.010)				
-w. international partner		-0.027**		-0.026***	0.004
		(0.012)		(0.007)	(0.010)
-w. recipient partner		0.007		0.006	0.002
		(0.016)		(0.010)	(0.009)
-w. Chinese partner		-0.013		-0.008	-0.005
		(0.023)		(0.017)	(0.009)
-w. private partner			-0.020		
			(0.012)		
-wo. private partner			-0.009		
			(0.011)		
Project size(MW in log)	-0.013**	-0.012**	-0.012**	0.005	-0.018***
	(0.005)	(0.006)	(0.005)	(0.004)	(0.005)
Year, Sector, Country dummies	Yes	Yes	Yes	Yes	Yes
Number of obs.	272	272	272	272	272

Notes: Infrastructure proejcts being fossil fuel power units. *P<0.10, **P<0.05, ***P<0.01.SE clustered at recipient country level.

Environmental impact: biodiversity risk

Outcome variable:	Biodiversity risk index		
	(1)	(2)	(3)
Cofinanced	-0.012		
	(0.028)		
-w. international partner		-0.083**	
		(0.037)	
-w. recipient partner		-0.073	
		(0.093)	
-w. Chinese partner		-0.016	
		(0.026)	
-w. private partner			-0.066
			(0.048)
-wo. private partner			-0.015
			(0.047)
Project size(USD in log)	0.009	0.007	0.011
	(0.009)	(0.010)	(0.009)
Year, Sector, Country dummies	Yes	Yes	Yes
Number of observations	276	276	276

Notes: Infrastructure projects with accurate geolocation sample.*P<0.10, **P<0.05, ***P<0.01.SE clustered at recipient country level.

Robustness checks

- Standard error cluster
- Country-level time-varying controls
- Probit, logit models for binary outcomes, account for rare events
- Endogenous treatment effect model
- Propensity score matching

Mechanism: Implementation time

Outcome variable(yrs):	Implementation time		
	(1)	(2)	(3)
Sample:	Completed projects		
Cofinanced	0.288		
	(0.207)		
-w. international partner		0.707**	
		(0.325)	
-w. recipient partner		0.304	
		(0.362)	
-w. with Chinese partner		-0.237	
		(0.357)	
-w. private partner			0.246
			(0.249)
-wo. private partner			0.318
			(0.314)
Project size	0.354***	0.359***	0.353***
	(0.057)	(0.057)	(0.057)
CN policy bank funded	0.102	0.171	0.095
	(0.198)	(0.209)	(0.202)
Year, Sector, Country dummies	Yes	Yes	Yes
Number of obs.	865	865	865

Notes: *P<0.10, **P<0.05, ***P<0.01. SE clustered at recipient country level.

Discussions and conclusions

- Positive link between cofinancing and project outcomes in Chinese development finance
  - Cofinanced projects are 3-7 p.p. less likely to be suspended/cancelled
  - Recipient cofinancing: 20 p.p more likely to involve local implementors
  - International cofinancing: 2.7 percent lower CO_2 emission intensity and 0.42 SD decrease in biodiversity risk
- **Policy implications**
  - Cofinancing can be a tool to improve outcomes of Chinese overseas development projects
  - Collaborative approach of development finance in the Global South
- **Further questions**
  - Mixed effect on localised implementation
  - Private sector's role in development finance

Thank you!

Questions and comments?

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Environmental impact variables

- Carbon dioxide emission intensity:

$$CO_2 Intensity = HeatRate \times EmissionFactor \tag{4}$$

HeatRate: determined by fuel, turbine, capacity and steam conditions of generators
EmissionFactor: fuel's carbon content

- Biodiversity risk index: from 0 (lowest) to 1 (highest)

$$BiodiversityRisk_i = \frac{CH_i + PA_i + SR_i}{3} \tag{5}$$

CH_i: cell's critical habitat score, likely CH=1, potential CH=0.5
PA_i: binary indicator of protected areas
SR_i: continuous 0-1 scale of threatened species richness
Calculated at 1km^2 cell and averaged based on project shape (point, line, polygon)

References: Pfeiffer, A. et al. (2018) 'Committed emissions from existing and planned power plants and asset stranding required to meet the Paris Agreement', Environmental Research Letters
Yang, H. et al. (2021) 'Risks to global biodiversity and Indigenous lands from China's overseas devel- opment finance', Nature Ecology Evolution

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