Chinese Ties and Low Carbon Industrialization in Africa

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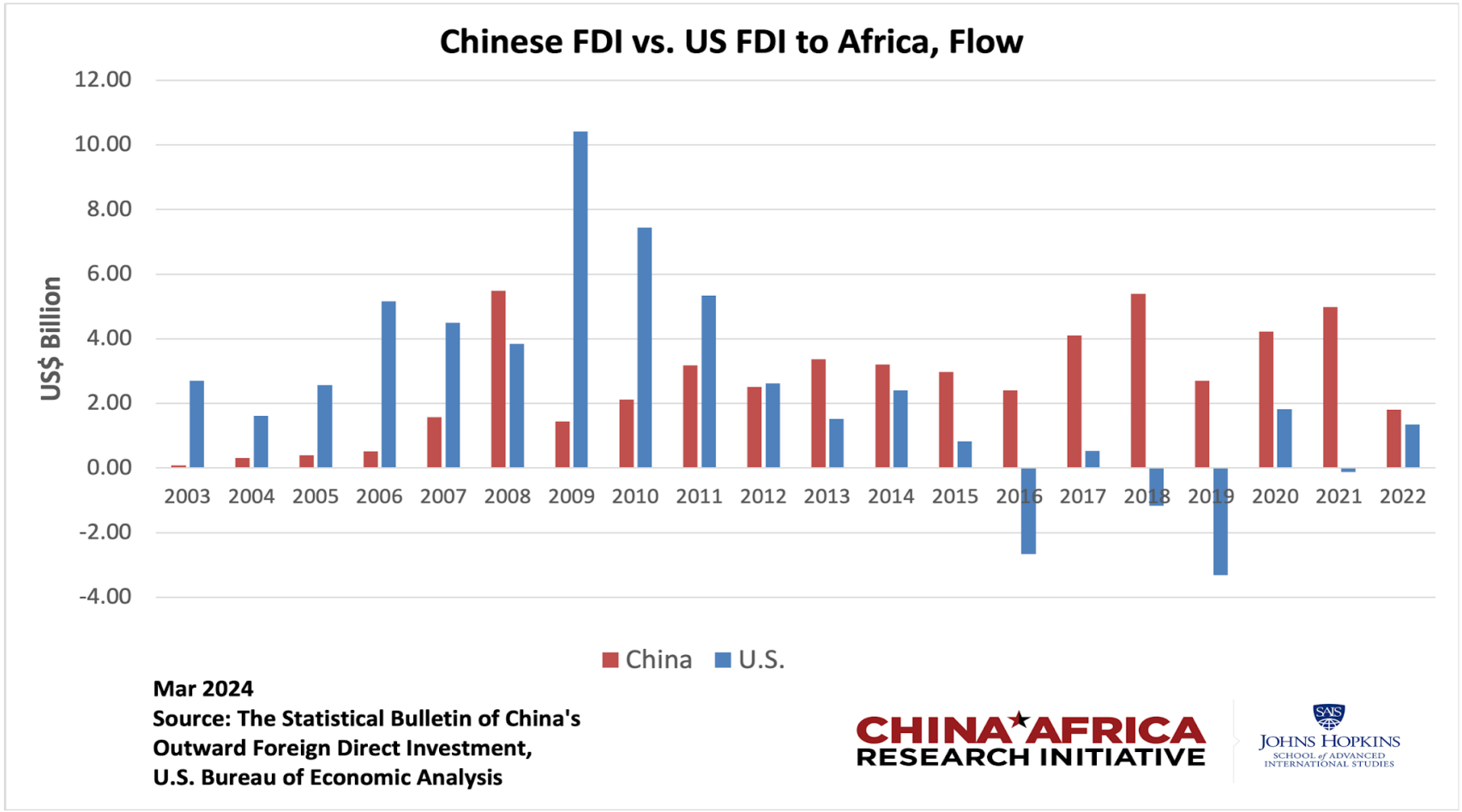
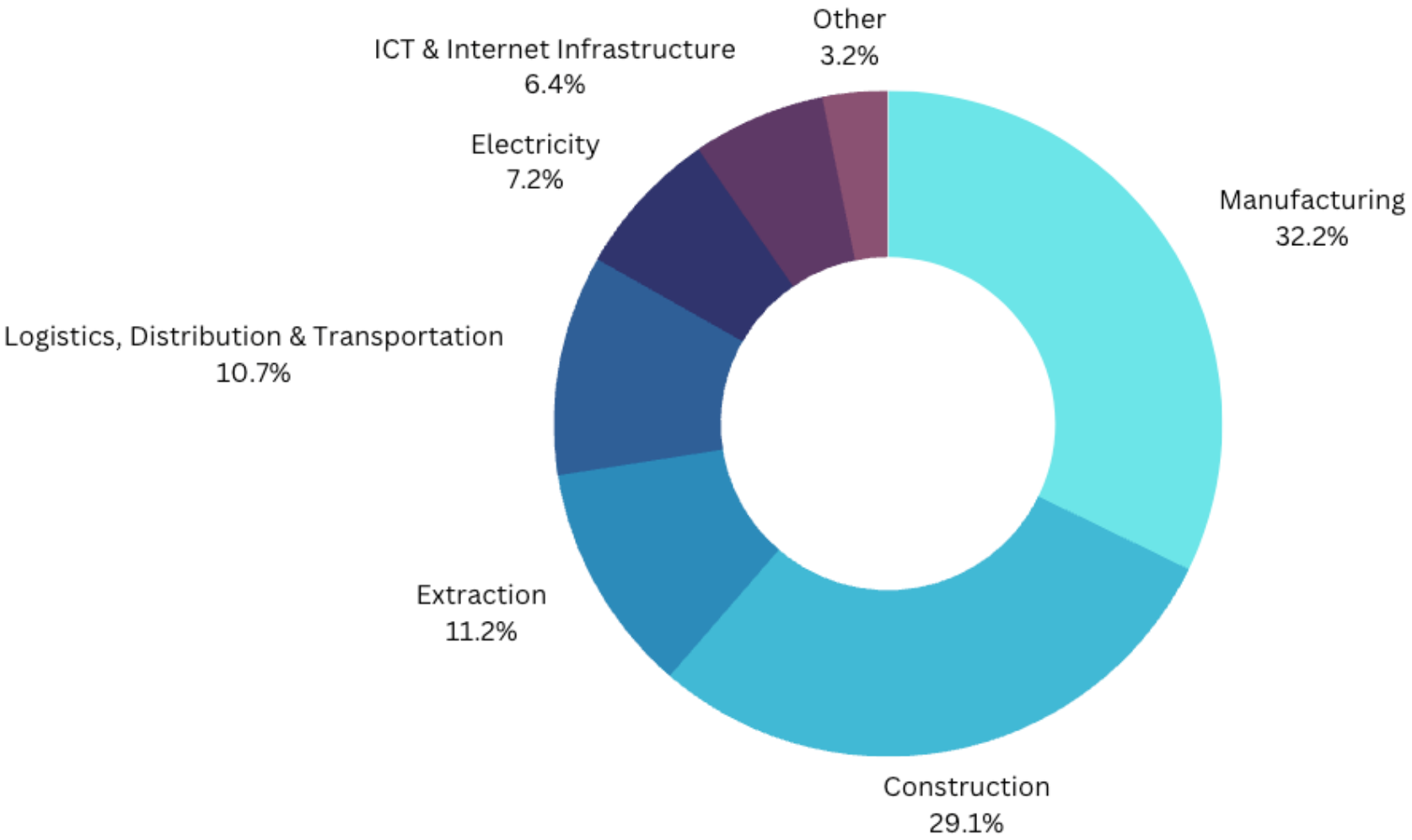
Chinese FDI flows to Africa has exceeded those from the U.S. since 2013



Source: Johns Hopkins SAIS China Africa Research Initiative

Most Chinese FDI in Africa is concentrated in manufacturing sector



Sectors for Chinese FDI to Africa, 2000-2022
Data source: FDI Markets Database, Financial Times

Research Question

Overarching Research Question

- What is the effect of Chinese FDI on Carbon Emissions in Africa's manufacturing industry?

Specific-Research Question

- Is the effect conditioned on the sectors (labor, resource, technology-intensive)?
- How is this effect compared to other sources of FDI?
- Is the effect conditioned on institutional quality?

Argument in brief

- Chinese manufacturing FDI significantly increases industrial CO2 emission, particularly in resource- and labor-intensive sectors.
  - No similar effect observed for OECD manufacturing FDI in Africa.

- **Methodology**
  Sector-country-year panel (34 African countries, 2003–2014) using two instrumental variables (IVs).

Theory: FDI and Low-Carbon Industrialization

Technology transfer, learning and local economic development argument

- FDI driving force behind expansion of recipient countries' productive capacity, GVC participation, and transfer of technology, (Alfaro-Urena et al., 2022) and labor market outcomes (Setzler & Tintelnot, 2021)

- Appropriate technology literature (Acemoglu, 2015; Caselli & Coleman, 2006)

- Relational proximity matters for technology diffusion and catch-up (Basile, Capello, & Caragliu, 2011)

Theory: FDI and Low-Carbon Industrialization

Pollution Haven Hypothesis

- FDI hampers environment by increasing pollution in countries with weak regulations
- Fierce competition for foreign investors may lead to lowered environmental standards
- This often results in the relocation of pollution-intensive industries from advanced to developing countries (Zugravu-Soilita, 2017; Golub et al., 2011)

→*The impact of FDI on low-carbon growth is an open empirical question.*

→*Effects may vary based on FDI type and the regulatory and institutional quality of the recipient country.*

China's role in Africa's industrialization

- Increased investments into productive sectors could **facilitate structural transformation**, making Africa "the next factory of the world." (Sun, 2017; Calabrese and Tang, 2022)

- Chinese FDI leverages and **fosters local comparative advantages**. (Chen et al., 2018)

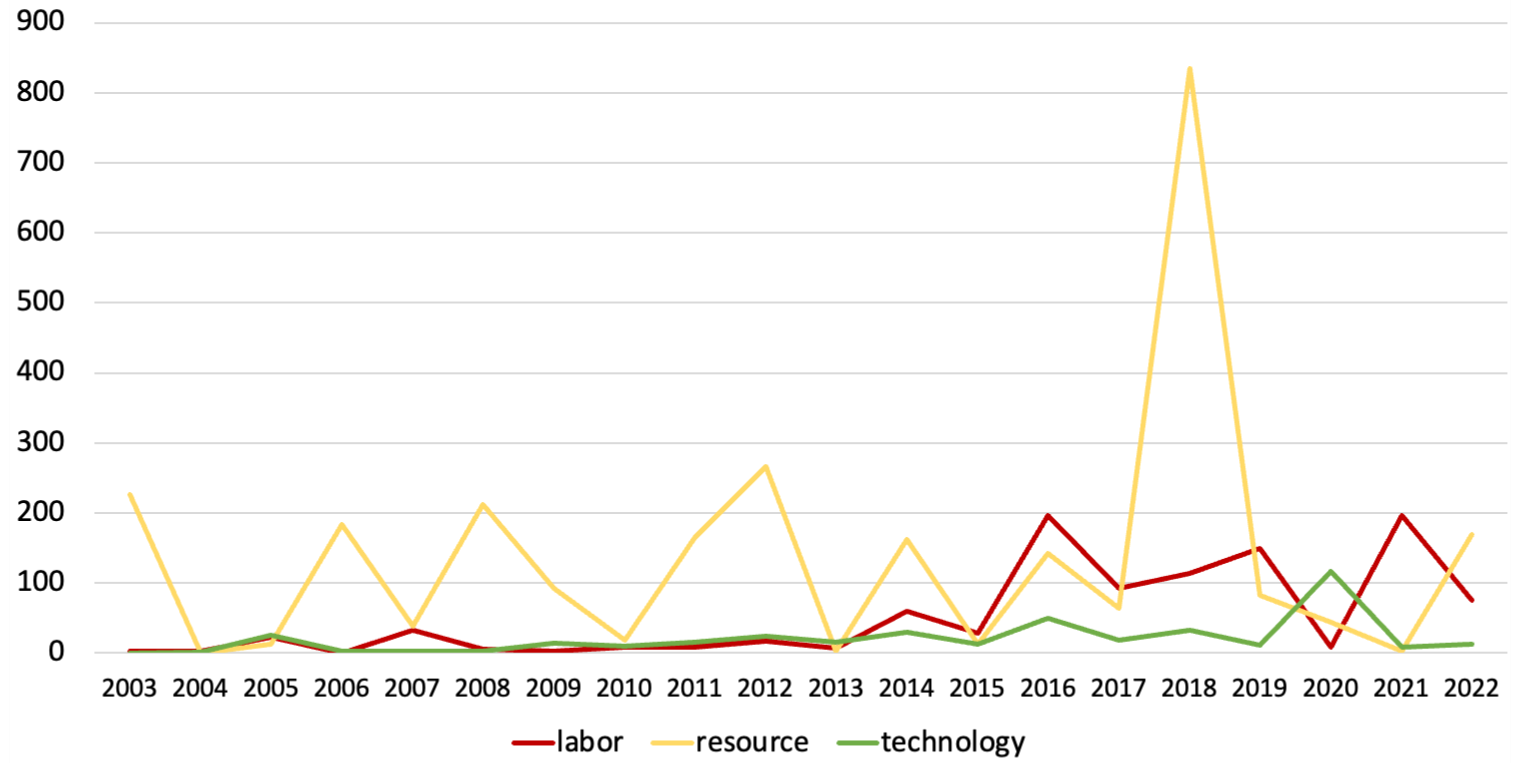
Elevated environmental and social risks with Chinese FDI

- **Environmental**: Greater overlap with crucial biodiversity areas than Western-led projects (Losos et al., 2019; Yang et al., 2021; Parks et al., 2023; Springer et al., 2023)
- **Social**: Poor labor conditions, indigenous displacement, union suppression, corruption exacerbation. (Hensengerth, 2013; Isaksson & Kotsadam 2018; Yang et al., 2021)
- Historically, Chinese **E&S standards** have aligned only with the host country's E&S standards, rather than adhering to higher international standards, until recent years. (Voituriez et al., 2019; Nedopil, 2020)
- The **host countries** where Chinese FDI operates generally have **weak regulations** themselves. (Larsen et al., 2023)

Gaps in previous literature

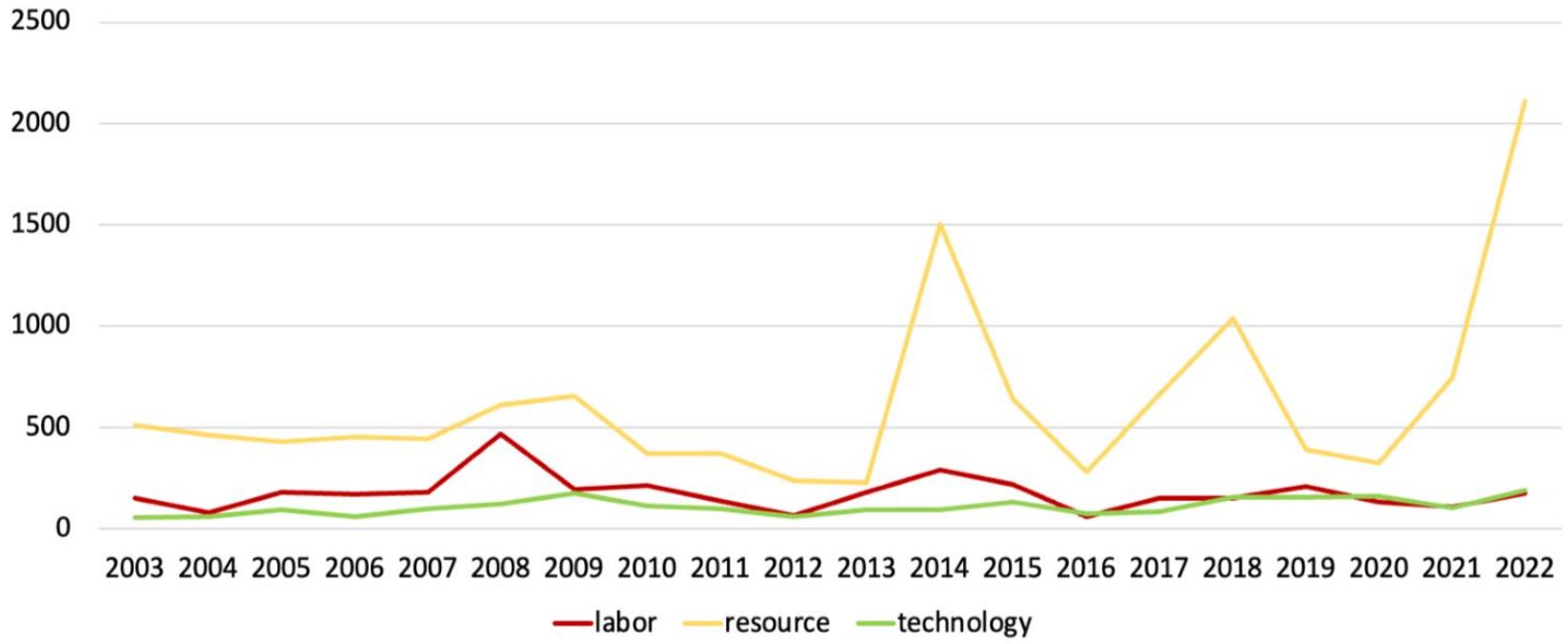
- Does not control for other sources of FDI
- Only focuses on the aggregate FDI level without attention to heterogenous effects of industry activities
- Only looks at country-level total carbon emission
- Moderating role of environmental regulation ignored

Chinese Manufacturing FDI in Africa : From Resource-Intensive to Labor-Intensive and Technology-Intensive since 2015



Annual Chinese FDI Inflow to Africa's Manufacturing by Sector Characteristics, Million USD
Source: Authors' elaboration using data from FDI Intelligence

OECD Manufacturing FDI in Africa: Historic Dominance of Resource-Intensive Sector, Peaking at $2.11 Billion in 2022, accounting for 85% of total FDI that Year



Share of manufacturing FDI from OECD countries by sector characteristics to 34 African countries, 2003-2022
Source: Author's elaboration using data from FDI Intelligence

China vs. OECD: Manufacturing FDI Concentration

- OECD and Chinese FDI both focus on resource-intensive and labor-intensive sectors, with OECD having a higher resource-intensive share.

- Chinese firms may implement lower ESG standards than OECD investors in manufacturing process: (Voituriez et al., 2019; Springer et al., 2023; Morris, 2023)
  - Adhere only to minimum host country standards, not international best practices.
  - Operate in lower-income countries with weaker environmental/social standards.

- China's new green BRI standards raise enforcement challenges across all overseas FDI. (Coenen et al., 2021).

Baseline Model

$$\mathcal{M}_{it} = \beta_0 + \beta_1 Chineses\ FDI_{it} + X_{it}\Phi + \delta_i + \delta_t + \varepsilon_{it}$$

- $\mathcal{M}_{it}$: country i's industrial carbon emission level in year t
- $Chineses\ FDI_{it}$: level of Chinese FDI to a country's manufacturing sector
  - Total FDI
  - By sector: technology, labor, and resource intensive
- δ_i: country fixed effects
- δ_t: year fixed effects
- X_{it} : FDI share from the rest of the world, total population, Per capita GDP, Per capita GDP Square, Environmental regulation, Regulatory quality, industry value added

Identification: IV-2SLS

$$FDI_{it} = avgFDI_{it} + X_{it} + \gamma_i + \delta_t + \xi_{it}$$
$$\rightarrow first\ stage$$

$$FDI_{it} = prebilateralFDI_{it} + X_{it} + \gamma_i + \delta_t + \xi_{it}$$
$$\rightarrow first\ stage$$

$$\mathcal{M}_{it} = (FDI_{it} = 2\ instruments) + X_{it} + \gamma_i + \delta_t + \xi_{it}$$

Instruments:

1. Average Chinese FDI to other African countries
2. Predicted determinants of bilateral FDI (from a gravity structural model)

Results and Discussion: Chinese FDI and Low carbon manufacturing in Africa

On average, a 1% increase in FDI from China increases industrial carbon emission by 0.02%.

No such effect for OECD-sourced FDI.

	OLS		Lewbel-IV	
	(1)	(2)	(3)	(4)
Chinese FDI (log)	0.022***	0.023***	0.022***	0.023***
	(0.008)	(0.008)	(0.007)	(0.007)
Other FDI (log)	0.087		0.086	
	(0.092)		(0.085)	
Non-OECD FDI (log)		0.086		0.086
		(0.086)		(0.080)
OECD FDI (log)		0.164		0.164
		(0.114)		(0.105)
Environmental regulation	-0.067	-0.078	-0.087	-0.078
	(0.294)	(0.292)	(0.285)	(0.270)
GDP pc (log)	1.244	1.271	1.246	1.271
	(0.967)	(0.968)	(0.893)	(0.894)
GDP pc squared	-0.072	-0.074	-0.072	-0.074
	(0.068)	(0.068)	(0.063)	(0.063)
Population (log)	0.771	0.750	0.780	0.750
	(0.534)	(0.530)	(0.498)	(0.490)
Industry (% GDP)	0.009**	0.009**	0.009**	0.009**
	(0.004)	(0.004)	(0.004)	(0.004)
Regulatory quality	-0.159*	-0.154*	-0.161*	-0.154*
	(0.092)	(0.093)	(0.086)	(0.086)
Constant	-16.815**	-16.582*	-16.059**	-15.684**
	(8.528)	(8.455)	(7.592)	(7.473)
Observations	335	335	335	335
R-squared	0.889	0.890	0.889	0.890
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Results and Discussion: Sector Composition

- Chinese manufacturing FDI in resource-seeking and labor-intensive sectors significantly raises industrial carbon emissions.
- Knowledge-intensive Chinese manufacturing FDI has no significant impact on carbon intensity.

	OLS		Lewbel-IV	
	(1)	(2)	(3)	(4)
			Panel A	
Labor intensive Chinese FDI (log)	0.022**	0.018*	0.020**	0.018**
	(0.009)	(0.009)	(0.009)	(0.009)
Constant	2.404***	-18.120**	-17.211**	-17.182**
	(0.061)	(8.527)	(7.545)	(7.554)
Observations	338	335	335	335
R-squared	0.884	0.888	0.888	0.888
Controls	NO	YES	YES	YES
Country Dummies	YES	YES	YES	YES
Year Dummies	YES	YES	YES	YES
Hansen J stat			44	45
Hansen J stat p-val			0.12	0.12
			Panel B	
Resource intensive Chinese FDI (log)	0.015*	0.012	0.016**	0.014*
	(0.008)	(0.008)	(0.008)	(0.008)
Constant	2.412***	-17.985**	-17.089**	-17.065**
	(0.065)	(8.573)	(7.585)	(7.591)
Observations	338	335	335	335
R-squared	0.883	0.887	0.887	0.887
Controls	NO	YES	YES	YES
Country Dummies	YES	YES	YES	YES
Year Dummies	YES	YES	YES	YES
Hansen J stat			44	45
Hansen J stat p-val			0.69	0.63
			Panel C	
Knowledge intensive Chinese FDI (log)	0.007	0.008	0.008	0.008
	(0.009)	(0.009)	(0.008)	(0.008)
Constant	2.418***	-17.927**	-17.000**	-16.993**
	(0.060)	(8.593)	(7.610)	(7.614)

Conclusion

- Chinese FDI in manufacturing increases CO2 emissions in Africa's manufacturing sector, likely due to the more carbon-intensive manufacturing process with lower ESG standards.

- Impact is more pronounced in labor and resource-intensive sectors, but diminishes in knowledge-intensive sectors.

- Stronger regulatory quality in recipient countries can moderate and reverse the effect of Chinese FDI on manufacturing emissions.