Chinese Infrastructure Lending in Africa and Participation in Global Value Chains

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Motivation

China: 'rogue' donor or beacon of south-south co-operation?

How does Beijing's aid model compare with other donors? Is it of mutual benefit or simply exploiting the Africa's natural resources?

📷 China insists its aid strategy is founded on equality and mutual benefit – developing countries helping each other. Photograph: Ding Haitao/XinHua/Xinhua Press/Corbis

- The channels through which Chinese lending could promote growth in Africa are not so much investigated.

- Participation in GVC is one channel though which countries, becoming more integrated in international markets, could accelerate the industrialization process and promote development.

- One of the key features of Chinese lending, compared to traditional bilateral and multilateral lenders, is the concentration in infrastructure sectors—particularly transport and communications— which can reduce trade costs

- **The paper investigates whether Chinese loans are associated with an increase in GVC participation in African countries.**

Chinese lending is concentrated in infrastructure

- In 2007-2022 Chinese development banks provided 2.5 times more finance for public-private infrastructure projects in SSA than the US, Germany, France, and Japan's development finance institutions combined (Lee and Gonzales , 2022);

- Between 2000 and 2019 at least 80 percent of Chinese lending to Africa has funded economic and social infrastructural projects—mostly in sectors such as transport, power, telecoms, and water (Acker and Brautigam, 2021);

- Some very controversial projects (e.g. Standard Gauge Railway project in Kenya, linking Nairobi to Mombasa).

- But also more manageable and successful projects such as expressway in Nairobi and several projects in Côte d'Ivoire (Vines et al.,2022)

- Chinese investments in infrastructures are very diversified and not necessarily should be considered as intrinsically predatory or inevitably problematic.

Lending in infrastructures and GVCs

- Improving transport and communication efficiency increases the speed and reduces the uncertainty of deliveries, therefore decreasing the costs of intermediates used in international production networks.

- Each day in transit equals to an *ad-valorem* tariff between 0.6 and 2.3 % and trade in parts and components can be much more affected by time delays than trade in final goods (Hummels and Shaur, 2013).

- Thanks to the Belt and Road Initiative the average reduction in shipment time ranges between 1.2 and 2.5%, leading to reduction of aggregate trade costs between 1.1 and 2.2% (de Soyres et al., 2019).

- GVCs that are particularly sensitive to delivery time are those specialized in electronics and fruits and vegetables, being the latter of particular importance in African countries (Arvis et al. 2010; Christ and Ferrantino 2011).

- Building new infrastructures and improving the existing ones thanks to aid support can address the diffused infrastructural gaps in African countries with a positive impact on costs and times in trading intermediate inputs within GVCs (OECD and AfDB 2014; IMF 2015).

Aim of the paper

To investigate whether Chinese lending could facilitate the participation in GVCs in Africa.

- combining loan-level data on Chinese lending to African countries with the UNCTAD-Eora Global Value Chain database and comparing with World Bank loans as a benchmark.

The dataset

- Chinese loans are from CARI (China-Africa Research Initiative) database tracking loan commitments from Chinese policy and commercial banks, government entities, companies and other financial institutions to African governments and state-owned enterprises
    - 1,141 loans to 37 African countries (USD 100 billion) from 2000 to 2018;
    - For each loan, there is information about the year, the sector, the value, and the type of lender.
- World Bank loans are available in the World Bank Projects and Operations database
    - 2,231 loans (USD 200 billion).
- On average Chinese loans are larger than World Bank ones: USD 133 million vs. USD 95 million.

Figure 1 Chinese and World Bank lending to Africa (2000-2018)
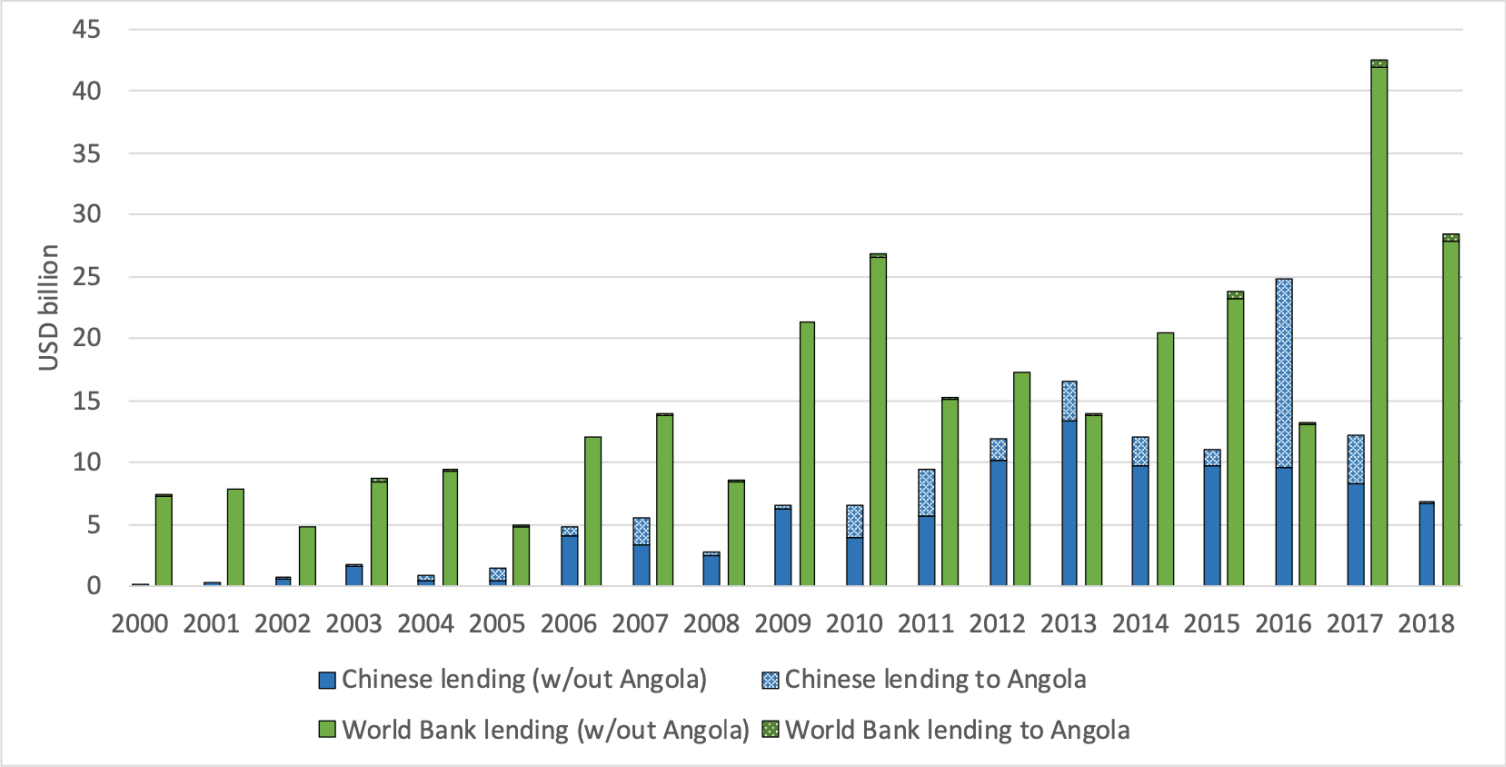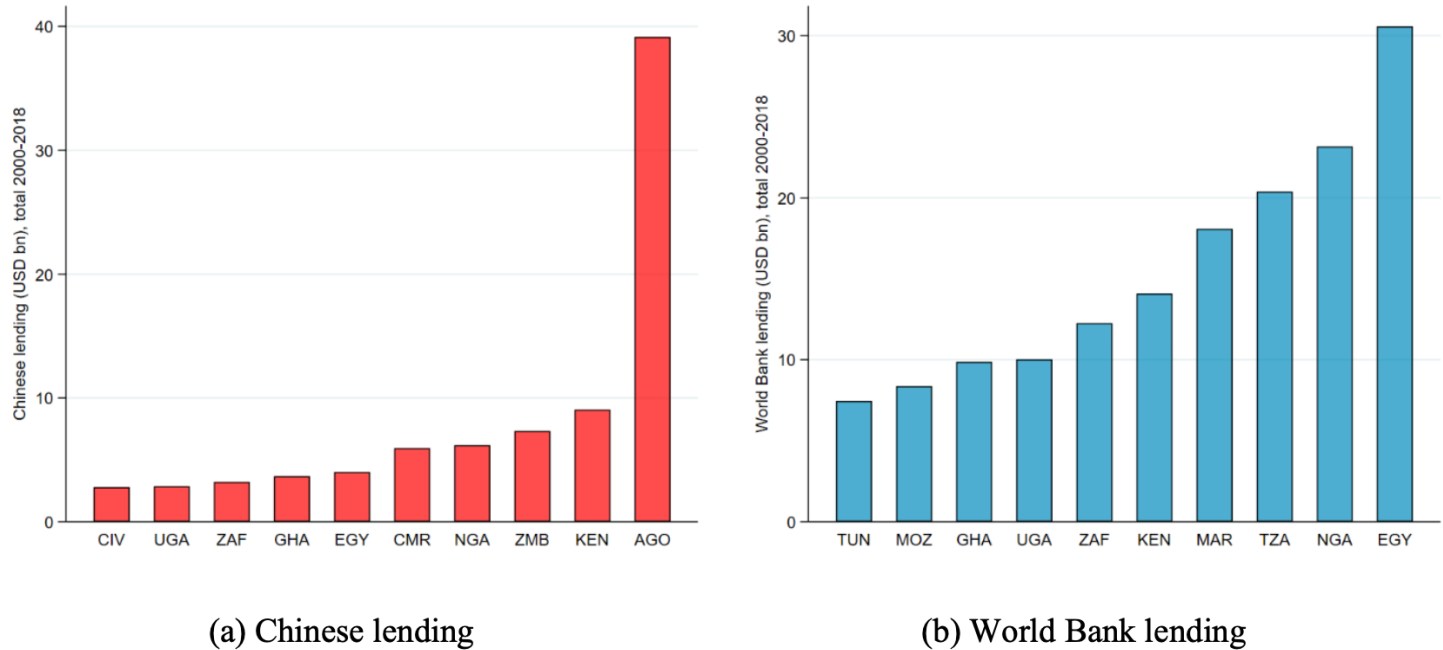

Notes: the chart plots the total amount of lending by China and the World Bank to 50 African countries, from 2000 to 2018. Values are in billion current USD. For both China and the World Bank, lending is shown isolating flows to Angola (dotted bars), which is the largest recipient of Chinese lending.

Source: CLA and World Bank Projects and Operations database

Figure 2 – Chinese and World Bank loans to Africa (2000-2018): Top 10 recipient countries

(a) Chinese lending (b) World Bank lending

Notes: the charts plot the total amount of lending by China (panel A) and the World Bank (panel B) to the top 10 African recipients. Values are in billion current USD, cumulated over the period 2000 to 2018.

Source: CLA and World Bank Projects and Operations database

Figure 3: Chinese and World Bank lending to Africa: Sectoral allocation
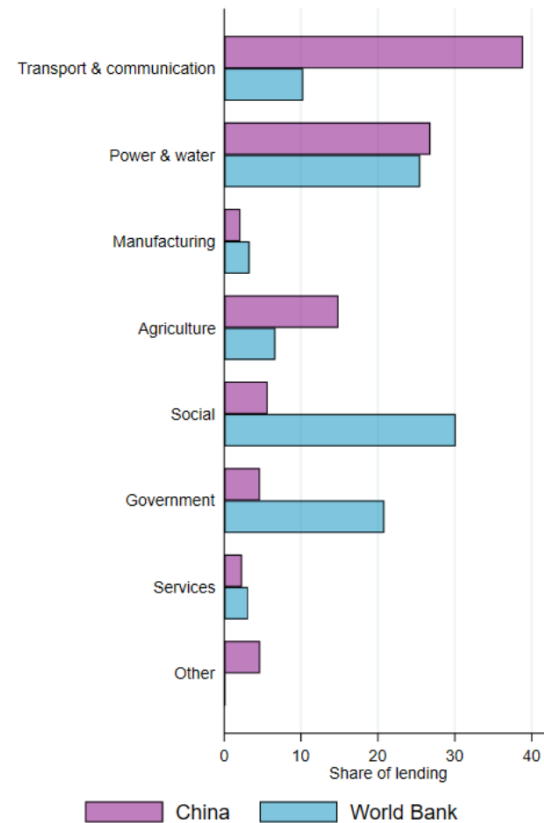
Notes: the chart plots the sectoral allocation of lending by China and the World Bank to 50 African countries, from 2000 to 2018.

Source: CLA and World Bank Projects and Operations database

GVC participation

Figure 4. GVC participation in Africa, upstream and downstream component.
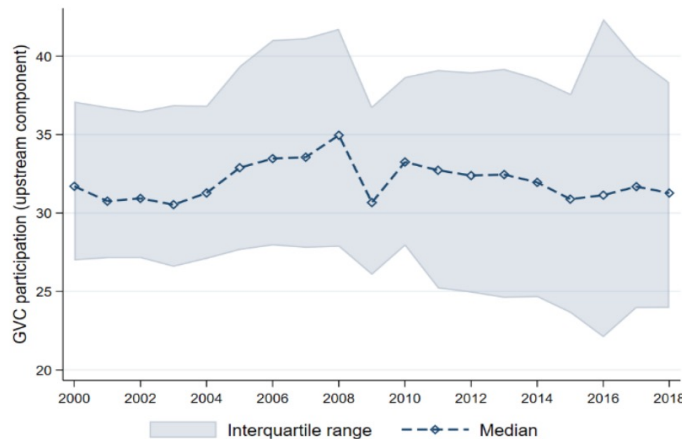
(a) Upstream component
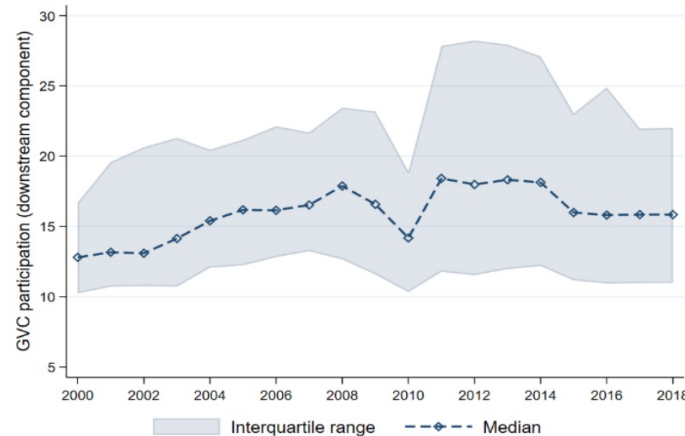
(b) Downstream component

Notes: panel A plot the median and the interquantile range of the ratio between the value added of inputs that are imported to produce intermediate or final goods to be exported, and gross exports. Panel B plots the median and the interquantile range of the ratio between the value added embodied in intermediates exported to third countries that re-exports them to a third economy as embodied in other products, and gross exports.

Source: UNCTAD-EORA database.

GVC participation index (Koopman et al. 2014; and Borin and Mancini 2019):

$$\Delta Y_{i,t+n} = \alpha Chinese\ Lending_{i,t} + X'_{i,t}\beta + \gamma_i + \delta_t + \varepsilon_{it}$$

- $\Delta Y_{i,t+n}$ change in GVC participation by country *i* between year *t* and *t+n* (from 1 to 5 years forward).

- Chinese Lending: amount of lending by China to country *i* in year *t* in USD

- Controls:
  - World Bank lending (in USD)
  - Real GDP growth
  - Rule of Law index from the World Bank World Governance Indicators,

- Year fixed effects δ_t and country fixed effects (γ_i)

Table 1. Chinese lending and GVC participation, baseline results

	(1)	(2)	(3)	(4)	(5)
Dep. Var.: ΔGVC participation between t and	t+1	t+2	t+3	t+4	t+5
Chinese lending	0.0473*	0.1021**	0.1752***	0.2313***	0.1547**
	(0.026)	(0.047)	(0.059)	(0.073)	(0.069)
World Bank lending	-0.0111	-0.0176	-0.0032	-0.0151	0.0039
	(0.034)	(0.051)	(0.067)	(0.079)	(0.089)
GDP growth (%)	0.0078	-0.0149	-0.0293	-0.0177	-0.0495
	(0.024)	(0.040)	(0.039)	(0.043)	(0.049)
Institutional quality	-0.2831	-0.9549	-1.3271	-1.6657	-1.7995
	(0.471)	(0.804)	(1.243)	(1.544)	(1.831)
Observations	651	614	577	539	503
R-squared	0.469	0.541	0.573	0.630	0.641
Country FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y

Lending in infrastructure

Table 2. Chinese infrastructure lending and GVC participation

	(1)	(2)	(3)	(4)	(5)
Dep. Var.: ΔGVC participation between t and	t+1	t+2	t+3	t+4	t+5
Chinese infrastructure lending	0.0279	0.1118*	0.1709**	0.2063***	0.1098
	(0.031)	(0.063)	(0.070)	(0.074)	(0.068)
Chinese lending, other	0.0833**	0.0603	0.0828	0.0748	0.0658
	(0.031)	(0.049)	(0.055)	(0.076)	(0.071)
World Bank infrastructure lending	-0.0117	-0.0432	-0.0203	-0.0230	0.0145
	(0.031)	(0.044)	(0.049)	(0.042)	(0.058)
World Bank lending, other	-0.0033	0.0196	-0.0283	-0.0346	-0.0406
	(0.034)	(0.045)	(0.059)	(0.066)	(0.082)
Observations	651	614	577	539	503
R-squared	0.472	0.544	0.574	0.628	0.640
Country FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y

Lending in transport and communication infrastructures

Table 3. Chinese lending to transport and communication infrastructures and GVC participation

Dep. Var.: ΔGVC participation between t and	(1) t+1	(2) t+2	(3) t+3	(4) t+4	(5) t+5
Chinese lending to transport and communication sectors	0.0240	0.1084*	0.1171**	0.1704**	0.0808
	(0.029)	(0.057)	(0.057)	(0.071)	(0.074)
Chinese lending to water and energy sectors	0.0127	0.0613	0.1586*	0.1736*	0.1223
	(0.048)	(0.064)	(0.089)	(0.097)	(0.099)
Chinese lending, other sectors	0.0825**	0.0577	0.0913	0.0812	0.0714
	(0.031)	(0.051)	(0.057)	(0.076)	(0.073)
World Bank lending to transport and communication sectors	-0.0309	-0.0756	-0.0853	-0.0691	-0.0953
	(0.030)	(0.050)	(0.061)	(0.067)	(0.075)
World Bank lending to water and energy sectors	-0.0036	-0.0191	0.0216	-0.0145	0.0562
	(0.031)	(0.044)	(0.045)	(0.045)	(0.052)
World Bank lending, other sectors	-0.0016	0.0240	-0.0256	-0.0296	-0.0345
	(0.035)	(0.044)	(0.057)	(0.064)	(0.079)
Observations	651	614	577	539	503
R-squared	0.473	0.546	0.577	0.630	0.642
Country FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y

Table 5. Chinese infrastructure lending and GVC participation: downstream and upstream components

Dep. Var.: ΔGVC participation between t and	(1) t+1	(2) t+2	(3) t+3	(4) t+4	(5) t+5
Panel A. Downstream component					
Chinese infrastructure lending	0.0210	0.0854*	0.1367**	0.1798***	0.1724***
	(0.026)	(0.049)	(0.052)	(0.059)	(0.059)
Chinese lending, other	0.0490	0.0504	0.0306	0.0712	0.0649
	(0.033)	(0.044)	(0.057)	(0.092)	(0.094)
World Bank infrastructure lending	-0.0123	-0.0341	-0.0441	-0.0674	-0.0560
	(0.023)	(0.040)	(0.046)	(0.052)	(0.064)
World Bank lending, other	-0.0507*	-0.0421	-0.0687	-0.0914	-0.1059
	(0.028)	(0.034)	(0.053)	(0.060)	(0.064)
R-squared	0.367	0.414	0.475	0.524	0.570
Panel B. Upstream component					
Chinese infrastructure lending	0.0070	0.0264	0.0342	0.0265	-0.0627
	(0.030)	(0.048)	(0.044)	(0.050)	(0.061)
Chinese lending, other	0.0343	0.0099	0.0522	0.0036	0.0009
	(0.039)	(0.052)	(0.064)	(0.087)	(0.081)
World Bank infrastructure lending	0.0006	-0.0091	0.0238	0.0445	0.0705
	(0.029)	(0.042)	(0.045)	(0.041)	(0.048)
World Bank lending, other	0.0474*	0.0617*	0.0405	0.0568	0.0653
	(0.028)	(0.036)	(0.041)	(0.055)	(0.056)
R-squared	0.368	0.411	0.520	0.593	0.664
Observations	651	614	577	539	503
Country FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y

Table 9. Chinese lending and GVC participation: excluding linkages with China

	(1)	(2)	(3)	(4)	(5)
Dep. Var.: ΔGVC participation between t and	t+1	t+2	t+3	t+4	t+5
Chinese lending	0.0501*	0.1059**	0.1795***	0.2401***	0.1772**
	(0.026)	(0.046)	(0.059)	(0.078)	(0.078)
World Bank lending	-0.0107	-0.0203	-0.0135	-0.0316	-0.0071
	(0.032)	(0.049)	(0.070)	(0.084)	(0.090)
Observations	651	614	577	539	503
R-squared	0.427	0.500	0.536	0.592	0.603
Country FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y

Table 6. Chinese infrastructure lending and GVC participation: IV estimates

Dep. Var.: ΔGVC participation between t and	(1) t+1	(2) t+2	(3) t+3	(4) t+4	(5) t+5
Panel A. GVC participation					
Chinese infrastructure lending	0.1105	0.2783*	0.4328*	0.5583*	0.6241*
	(0.092)	(0.146)	(0.222)	(0.275)	(0.321)
Panel B. GVC participation, downstream component					
Chinese infrastructure lending	0.1991**	0.4160**	0.5562*	0.7270*	0.8101
	(0.092)	(0.187)	(0.298)	(0.425)	(0.492)
1st stage F-statistic	23.5317	23.4737	23.6649	31.7760	33.3382
Overidentification test (p-value)	0.2111	0.5857	0.8118	0.8160	0.8297
Observations	651	614	577	539	503
Country FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y

$Steel_{t-3}$ three-year lagged Chinese production of steel multiply with the (country-specific) probability of receiving Chinese lending in infrastructure, calculated as the share of years (in the 2000-2018 period) in which a country received Chines loans to infrastructure sectors $(p_{chn,i})$

$Reserves_{t-3}$ three-year lagged value China's net foreign exchange reserves multiplied—as in the previous case—by the probability of receiving Chinese lending

Conclusions

- Chinese lending—and especially infrastructure lending—is followed by a significant and persistent increase in GVC participation. This result is not visible looking at similar data on World Bank loans.

- There is a positive association between Chinese lending and GVC participation in the downstream component, which denotes a specialization in phases closer to final demand (e.g., use of imported intermediates to produce final goods for exports) which could contribute to export and productivity growth.

- The increase in GVC participation does not only strengthen trade ties with China, but it is also positively associated with GVC participation when excluding China.

- African countries have a massive need for new infrastructures therefore there is a need to go beyond the diffused scepticism by adding evidence about the role that China could play in African development.

- We show that Chinese loans could facilitate involvement in GVCs and through that industrialization and job creation and this is a significant contribution to the complex and evolving presence of China in Africa.

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Table 7. Chinese lending and GVC participation: excluding Angola

Dep. Var.: ΔGVC participation between t and	(1) t+1	(2) t+2	(3) t+3	(4) t+4	(5) t+5
Panel A. Total lending					
Chinese lending	0.0422	0.1004**	0.1809***	0.2334***	0.1546**
	(0.026)	(0.048)	(0.060)	(0.074)	(0.070)
World Bank lending	0.0039	-0.0027	0.0028	-0.0020	0.0123
	(0.032)	(0.052)	(0.072)	(0.082)	(0.095)
R-squared	0.469	0.539	0.570	0.627	0.637
Panel B. Infrastructure lending vs lending to other sectors					
Chinese infrastructure lending	0.0339	0.1124*	0.1766**	0.2138**	0.1205*
	(0.032)	(0.066)	(0.074)	(0.079)	(0.071)
Chinese lending, other	0.0616**	0.0546	0.0967	0.0722	0.0519
	(0.027)	(0.055)	(0.059)	(0.082)	(0.074)
World Bank infrastructure lending	-0.0144	-0.0429	-0.0241	-0.0168	0.0194
	(0.032)	(0.045)	(0.051)	(0.044)	(0.061)
World Bank lending, other	0.0123	0.0306	-0.0223	-0.0286	-0.0415
	(0.033)	(0.046)	(0.062)	(0.069)	(0.085)
R-squared	0.471	0.542	0.571	0.625	0.636
Observations	633	597	561	524	489
Country FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y

Table 8. Chinese lending and GVC participation: flows scaled by GDP

Dep. Var.: ΔGVC participation between t and	(1) t+1	(2) t+2	(3) t+3	(4) t+4	(5) t+5
Panel A. Total lending					
Chinese lending (% GDP)	0.0518*	0.1348***	0.2614**	0.4226**	0.2623
	(0.026)	(0.045)	(0.124)	(0.167)	(0.173)
World Bank lending (% GDP)	0.0031	-0.0276	-0.0452	-0.0647	-0.0700
	(0.022)	(0.028)	(0.053)	(0.045)	(0.048)
R-squared	0.468	0.541	0.569	0.626	0.641
Panel B. Infrastructure lending vs lending to other sectors					
Chinese infrastructure lending (% GDP)	0.0117	0.1262	0.2785*	0.4721**	0.2456
	(0.051)	(0.097)	(0.152)	(0.178)	(0.189)
Chinese lending, other (% GDP)	0.1057***	0.1479**	0.0845	0.1995	0.3353
	(0.039)	(0.068)	(0.293)	(0.341)	(0.330)
World Bank infrastructure lending (% GDP)	0.0178	-0.0330	-0.0279	-0.0949	-0.0626
	(0.038)	(0.051)	(0.078)	(0.084)	(0.070)
World Bank lending, other (% GDP)	-0.0041	-0.0242	-0.0557	-0.0489	-0.0736
	(0.023)	(0.028)	(0.049)	(0.041)	(0.048)
R-squared	0.469	0.541	0.569	0.627	0.641
Observations	633	597	561	524	489
Country FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y

Table 10. Chinese lending and GVC participation: controlling for the initial values

Dep. Var.: ΔGVC participation between t and	(1) t+1	(2) t+2	(3) t+3	(4) t+4	(5) t+5
Panel A. Total lending					
Chinese lending	0.0413	0.0842*	0.1546**	0.1893***	0.1234*
	(0.025)	(0.048)	(0.057)	(0.068)	(0.065)
World Bank lending	-0.0192	-0.0305	-0.0337	-0.0384	-0.0206
	(0.033)	(0.050)	(0.058)	(0.064)	(0.066)
GVC participation	-0.1421***	-0.2513***	-0.3574***	-0.4562***	-0.5647***
	(0.038)	(0.054)	(0.065)	(0.079)	(0.089)
R-squared	0.514	0.607	0.657	0.722	0.750
Panel B. Infrastructure lending vs lending to other sectors					
Chinese infrastructure lending	0.0135	0.0719	0.1310**	0.1631**	0.0833
	(0.029)	(0.059)	(0.063)	(0.068)	(0.060)
Chinese lending, other	0.0871***	0.0726	0.0898*	0.0567	0.0467
	(0.030)	(0.047)	(0.051)	(0.066)	(0.046)
World Bank infrastructure lending	-0.0099	-0.0418	-0.0164	-0.0114	0.0075
	(0.028)	(0.040)	(0.045)	(0.035)	(0.049)
World Bank lending, other	-0.0070	0.0158	-0.0436	-0.0402	-0.0381
	(0.032)	(0.042)	(0.050)	(0.053)	(0.064)
GVC participation	-0.1422***	-0.2496***	-0.3560***	-0.4566***	-0.5654***
	(0.038)	(0.055)	(0.065)	(0.079)	(0.089)
R-squared	0.517	0.608	0.657	0.721	0.749
Observations	651	614	577	539	503
Country FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y

Table 11. Chinese lending and GVC participation: additional controls

Dep. Var.: ΔGVC participation between t and	(1) t+1	(2) t+2	(3) t+3	(4) t+4	(5) t+5
Panel A. Total lending					
Chinese lending	0.0341	0.1079**	0.1988***	0.2582***	0.1806**
	(0.023)	(0.048)	(0.058)	(0.065)	(0.070)
World Bank lending	0.0086	-0.0181	-0.0063	-0.0146	0.0198
	(0.029)	(0.045)	(0.064)	(0.079)	(0.089)
GDP growth (%)	0.0087	-0.0225	-0.0096	-0.0023	-0.0367
	(0.023)	(0.043)	(0.050)	(0.049)	(0.051)
Rule of law	-0.5295	-1.1856	-1.8032	-2.4352	-2.7796
	(0.478)	(0.815)	(1.258)	(1.502)	(1.756)
FDI stock (% GDP)	-0.0012	-0.0041*	-0.0037	-0.0075*	-0.0097
	(0.002)	(0.002)	(0.003)	(0.004)	(0.007)
Bilateral trade agreements with China (0/1)	-0.1954	-0.3946	-0.8639	-0.7180	-0.3248
	(0.302)	(0.667)	(1.043)	(1.178)	(1.321)
Human capital index	1.1167	2.3717	4.7848	7.3769	8.8448
	(0.811)	(2.066)	(3.593)	(5.514)	(8.272)
Mineral rents (% of GDP)	-0.0197	-0.0419	-0.0570	-0.0745	-0.0504
	(0.013)	(0.025)	(0.050)	(0.076)	(0.090)
R-squared	0.517	0.563	0.584	0.647	0.661
Panel B. Infrastructure lending vs lending to other sectors					
Chinese infrastructure lending	0.0203	0.1153*	0.1719**	0.2122***	0.1044
	(0.032)	(0.064)	(0.071)	(0.073)	(0.068)
Chinese lending, other sectors	0.0757**	0.0637	0.1205**	0.1055	0.0989
	(0.030)	(0.044)	(0.055)	(0.077)	(0.077)
World Bank infrastructure lending	-0.0154	-0.0459	-0.0441	-0.0366	0.0094
	(0.034)	(0.048)	(0.056)	(0.047)	(0.062)
World Bank lending, other sectors	0.0243	0.0260	-0.0196	-0.0153	0.0019
	(0.029)	(0.037)	(0.059)	(0.070)	(0.084)
GDP growth (%)	0.0084	-0.0245	-0.0085	-0.0025	-0.0363
	(0.023)	(0.044)	(0.050)	(0.049)	(0.052)
Rule of law	-0.5230	-1.1859	-1.7453	-2.3054	-2.7394
	(0.483)	(0.825)	(1.265)	(1.527)	(1.796)
FDI stock (% GDP)	-0.0010	-0.0037	-0.0033	-0.0072*	-0.0097
	(0.002)	(0.002)	(0.003)	(0.004)	(0.007)
Bilateral trade agreements with China (0/1)	-0.2183	-0.4117	-0.8872	-0.7111	-0.2734
	(0.310)	(0.666)	(1.064)	(1.222)	(1.355)
Human capital index	1.2172	2.3933	4.8004	6.9083	8.4719
	(0.803)	(2.053)	(3.630)	(5.715)	(8.532)
Mineral rents (% of GDP)	-0.0186	-0.0412	-0.0546	-0.0723	-0.0476
	(0.012)	(0.025)	(0.051)	(0.078)	(0.093)
R-squared	0.522	0.567	0.585	0.644	0.658
Observations	593	560	527	494	461
Country FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y