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International Development Lending and Global Value Chains in Africa

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ABSTRACT

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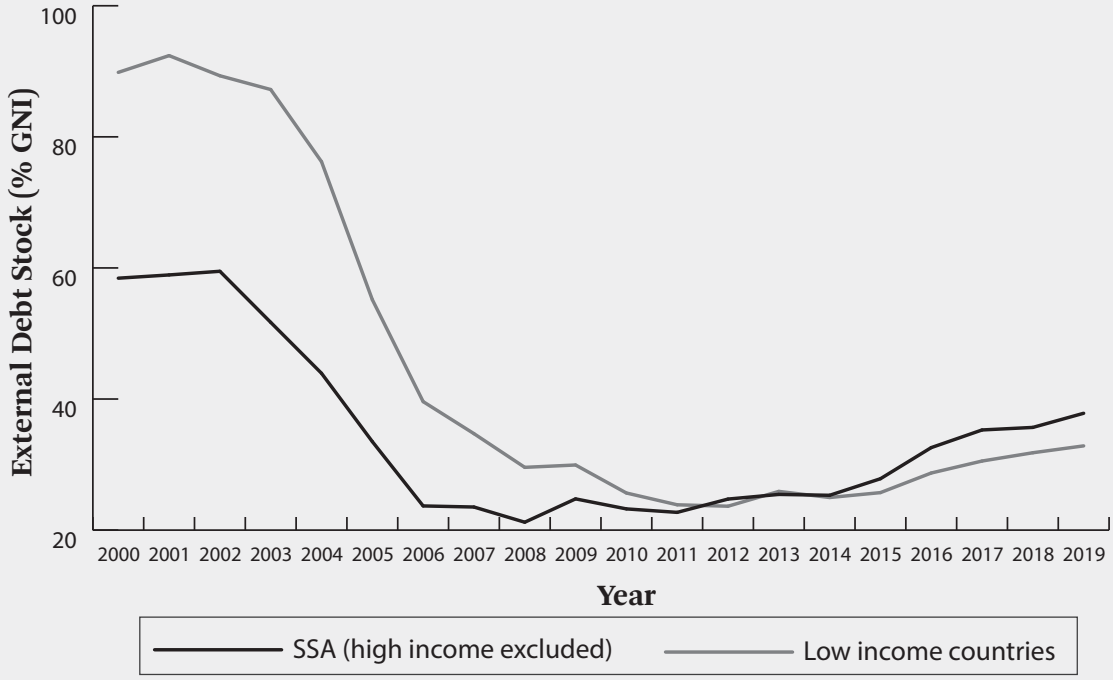
Participating in the process of global production fragmentation by connecting to global value chains (GVCs) provides a "golden" opportunity for developing countries to access international markets and boost economies. International institutions such as the World Bank, International Monetary Fund, and the United Nations Industrial Development Organization (UNIDO) have expended great effort to promote proper policies that can help low-income countries take advantage of such opportunities. This work explores the extent to which international development lending can support African countries in trading intermediate goods with foreign partners with the goal of further specializing in high value-added activities within cross-national production networks. The empirical analysis relies on a dataset that includes both Chinese and World Bank loans to a set of 35 African countries from 2000 to 2018. Based on this research, it appears that Chinese lending increases the involvement of borrowing countries in the international trade of intermediate goods, while World Bank loans contribute to move African countries toward higher valued added activities along international production chains. This first result is explained by the different sectoral composition of Chinese and World Bank loans, with the former focusing more extensively on infrastructure, particularly transport and communications, and the latter on social sectors, such as education and health. The second research question investigates the specific role Chinese lending plays in infrastructure sectors. My research provides evidence that loans to transport and communication sectors significantly improve African countries' participation in GVCs by reducing trade costs and enhancing connection to foreign partners. Such results become more evident over time, especially with concessional loans.

INTRODUCTION

This paper aims to shed light on the role international lending has in boosting developing countries' participation in global value chains (GVCs consist of a production process that is undertaken in more than one country). The analysis focuses on African countries, where the external debt has dramatically increased in recent years. As shown by Figure 1, the external debt stock as share of Gross National Income (GNI) in sub-Saharan Africa collapsed at the beginning of 2000s. However, from 2012 to 2019 external debt share has increased by 13 percentage points, rising from 24.7 percent to 37.8 percent of GNI, surpassing the average of all low-income countries in recent years.

Figure 1: External Debt Stock in sub-Saharan Africa and Developing Countries



Source: Author's elaboration on World Bank data.

According to Were, the reasons for the recent rise of African indebtedness to foreign lenders are related to both the demand and the supply side.[1] On the demand side, African economies have increased borrowing because of recent declines in commodity prices and, at the same time, their desire to improve infrastructure and investment climate. On the supply side, international creditors are increasingly attracted by the high-risk and high-return loans to African countries (the average return on African loans is six percent, higher than those directed to other developing economies).

Over the past several years China has become one of the most important lenders worldwide: according to Horn *et al.* in 2018 China's direct loans and trade credits accounted for about two percent of world gross domestic product (GDP).[2] As highlighted by Morris *et al.*, although the World Bank – the most representative multilateral-type Western lender – still gives out more loans

to the rest of the developing world, China seems to have a specific focus on the sub-Saharan region where it allocates one-third of its total official lending.[3] In fact, Brautigam *et al.* reports that Chinese debts represent 60 percent of bilateral lending and 17 percent of total public and publicly guaranteed debt for the 40 low-income African countries.[4]

As shown in the literature, GVCs represent an opportunity for developing countries to participate in the global market by specializing in some specific stages of the production process.[5] Given that a limited manufacturing base prevents African countries from developing comparative advantages through the entire value chain, the access to GVCs represents a golden opportunity to take advantage of technological spillovers from global players.[6]

Taking advantage of the loan database created by the China-Africa Research Initiative (CARI), this research investigates the impact Chinese lending has on the involvement of African countries in GVCs. It also aims to contribute to the literature about the drivers of developing countries' participation in GVCs, adding international development lending as a further potential contributor.[7]

The empirical analysis is carried out using an original dataset merging the CARI dataset, which provides detailed information on Chinese loans to African countries since 2000, and the UNCTAD-Eora Global Value Chain Database, which contains GVC metrics for most of the world's countries. To better understand the specificity of Chinese lending, the dataset is completed with data of World Bank loans to Africa, which are sourced by the World Bank Projects and Operations database. The dataset covers 35 African countries, observed in a time span from 2000 and 2018.

The comparison between Chinese and World Bank loans is motivated by the different general approaches the two lenders have shown so far. On the one hand, in contrast to their Western counterparts, Chinese development finance institutions such as China Development Bank and China Export-Import Bank (Eximbank) tend to support large projects in transport and energy infrastructure, following a "big push" industrialization approach that can support value-added production and trade.[8] Therefore, Chinese Development Lending (CDL) could complement China's Belt and Road Initiative by building infrastructure that can help reduce both the time and costs associated with the trade in intermediate inputs that are within global production networks.[9] On the other hand, World Bank Development Lending (WBDL) openly pursues the reduction of extreme poverty and the expansion of prosperity, and is distinguished by more concessional terms.[10] For instance, using a concessionality index that measures how financing is subject to below-market rates, Morris *et al*. found that 60 percent of the World Bank's portfolio of loans to sub-Saharan Africa were subject to concessionality, which is almost three times higher than the percentage of loans subject to concessions within the Chinese portfolio (at only 22.5 percent).[11]

This research has two main targets. The first goal is to investigate the impact of both CDL and WBDL on two different GVC-related outputs: (1) the intensity of African countries' participation in GVCs and (2) the specialization of those same countries as exporters rather than importers of intermediate goods. Given that more than 50 percent of Chinese loans to Africa are directed to

infrastructure sectors, the second target explores the effects Chinese loans have on infrastructure sectors, specifically looking at the two GVC output variables and distinguishing by infrastructure type and concessionality terms.[12]

The empirical analysis led to the following results: (1) CDL affects African countries' participation in GVCs, while WBDL has a stronger effect on borrowing countries' specialization as exporters of intermediate goods. (2) CDL in transport and communication sectors enhance the involvement of African countries in GVCs. (3) African countries enhanced involvement in GVCs, as a result of CDL in transport and communication sectors, becomes stronger over time and is more significant in the case of concessional loans.

LITERATURE ON BENEFITS AND DETERMINANTS OF GLOBAL VALUE CHAINS

The literature provides evidence that participating in GVCs – through the import and export of intermediate goods and services - can enhance income and employment growth and, moreover, contribute to poverty reduction.[13] GVCs provide a crucial opportunity for developing countries. First, GVCs facilitate engagement in international markets by specializing and exploiting comparative advantages in certain stages of production. This is particularly relevant for African economies, which are often prevented from developing comparative advantages along the entire value chain due to their limited manufacturing capacities.[14] Second, GVCs expose local producers to the international markets' more sophisticated demand, giving those local producers the opportunity to benefit from technological transfers by global manufacturers, thereby improving productivity.[15] By selling production inputs made by local subsidiaries, GVCs allow local producers to increase their chances to establish backward linkages with foreign companies.[16] By pushing local companies to increase the variety and the quality of inputs they produce for foreign producers, backward linkages are likely to boost the positive effects of incoming foreign direct investments (FDI) in developing countries.[17]

Additional positive effects can come from taking a more advantageous position along GVCs, by specializing in upstream (i.e., far from the final demand) rather than downstream (i.e., close to the final demand) stages of the production process. Moving toward a GVC's upstream stage means increasing the exports of local inputs that foreign companies use in their production process. In the African case, such inputs can move beyond natural resources to include, for instance, primary/processed foods and beverages, primary/processed industrial supplies, or parts and accessories for capital goods and transport equipment.[18] Taking a more upstream position along GVCs requires local producers in developing markets to specialize in the production of intermediate goods that meet international standards. Conversely, specializing in downstream stages of GVCs, by importing intermediate goods produced abroad, implies a focus on low value-added assembly tasks that rely on a low-cost local labor force.[19] Amendolagine *et al.* find that placing sub-Saharan African economies in more upstream stages of GVCs exposes local producers to larger opportunities for knowledge and technological transfers from global buyers.[20] Moreover, Krummritz *et al.*, in a macro-level study on a large set of countries, shows that participating in upstream stages of global production has larger positive effects on economic growth.[21]

Therefore, international institutions have exerted great effort to identify policies that can support economies, particularly in developing countries, to enter GVCs and specialize in high value-added production stages with processes carried out in multiple countries. With a focus on African economies, the Organization for Economic Co-operation and Development (OECD), African Development Bank, and the International Monetary Fund (IMF) highlight gaps in infrastructure, institutional, and industrial capabilities as the main problems to fix to increase chances to access international value chains.[22] Particularly, developing communication and transport infrastructure is crucial to manage and coordinate geographically dispersed production activities.[23] Hummels and Shaur show how important efficient transport infrastructure is for accessing GVCs: they estimate that each day in transit equals an ad-valorem tariff between 0.6 and 2.3 percent and that trade in parts and components can be much more affected by time delays than trade in final goods.[24] Thus, improving transport and communication efficiency increases the speed and reduces the uncertainty of deliveries and, therefore, can reduce the cost of intermediate goods used in international production networks. Examples of GVCs that are particularly sensitive to delivery time are electronics and produce, produce being of particular importance for African countries.[25]

The World Bank describes further factors that can be importing in determining access to GVCs.[26] First, attracting FDI can help developing countries to overcome gaps in technology and managerial skills, apart from capital endowments. In fact, FDI has been identified as the most common way to connect developing countries into GVCs because multinational corporations are, directly (i.e., intra-firm) or indirectly (through contracts), responsible for a large share of trade in value-added.[27] Second, opening domestic markets to foreign trade can tackle problems related to thin local demand and the scarcity of local inputs. For instance, Pierola *et al*. show that Peru's unilateral tariff cuts in the 2000s boosted GVC exports because they gave local producers access to a larger variety and quality of inputs imported from foreign countries.[28] Third, signing international trade agreements can be extremely useful to access GVCs, as also suggested by UNIDO.[29] Orefice and Racha find a positive relationship between the intensity of GVC participation and preferential trade agreements (regional and bilateral), since they can strengthen trade relationships between participants.[30] Trade agreements also push institutional improvements that enhance contract enforcement and property rights and, moreover, promote national certification and testing capacity, which are required to meet international standards. Finally, policies aimed at boosting education and innovation can be very important. A highly educated labor force increases the chances to not only access GVCs, but to also push into further upstream and higher value-added activities.[31] In fact, investment in innovation can help local producers meet the international standards required by global buyers.

Fernandes *et al.*, in an empirical work on a set of 100 countries observed since the 1990s, confirm the relevance of the GVC determinants and the respective supporting policies highlighted above.[32] Furthermore, Fernandes *et al.* also provide interesting insights about factors that can define the position that countries take within GVCs. From their study, it appears that boosting domestic industrial capabilities can reduce imports and increase value-added exports, thus moving economies toward upstream positions in international production networks. On the one hand, strong domestic industrial capacities lower the need to import inputs used in the production of

exported goods. On the other hand, they reduce search frictions in case of production disruptions and enhance production of domestic value-added and participation in upstream GVC stages.

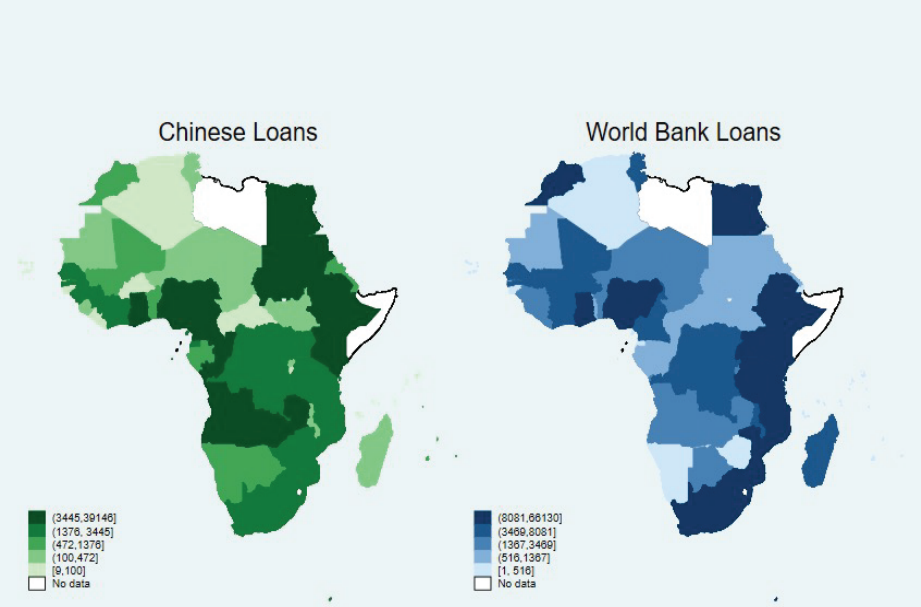
Financial market imperfection can also reduce international trade flows and chances to participate in GVCs. Manova and Chaney show that liquidity constraints can limit exporting at both extensive (newly established bilateral relationship between countries that have not traded in the past) and intensive (a bilateral trade relationship that can increase over time) margins since exporters are more likely to need external capital to enter foreign markets.[33] Therefore, weak financial institutions can be an important issue for developing countries wishing to trade and produce on an international scale. Lu *et al.* and Manova and Yu, focusing on Chinese companies, find that financial constraints affect chances of, respectively, accessing GVCs and taking upstream positions within them.[34] Lu *et al.* find that liquidity limitations directly reduce the probability to enter GVCs by lowering the chances to access international production chains for more productive companies.[35] Manova and Yu, instead, show that credit constraints prevent companies from moving to higher value-added GVC stages, which require larger working capital endowments, and increase the likelihood to be stuck in low value-added assembling tasks.[36]

DATA AND METHODOLOGY

The dataset

The empirical analysis is carried out on a database at country-year level covering a large number of African countries observed for almost two decades (from 2000 to 2018). Data on CDL come from CARI's interactive database of Chinese loan commitments to African governments, which includes data on 1,141 loan commitments to African governments and their state-owned enterprises. For

Figure 2: Maps of Chinese and World Bank Loans in Africa (2000-2018)



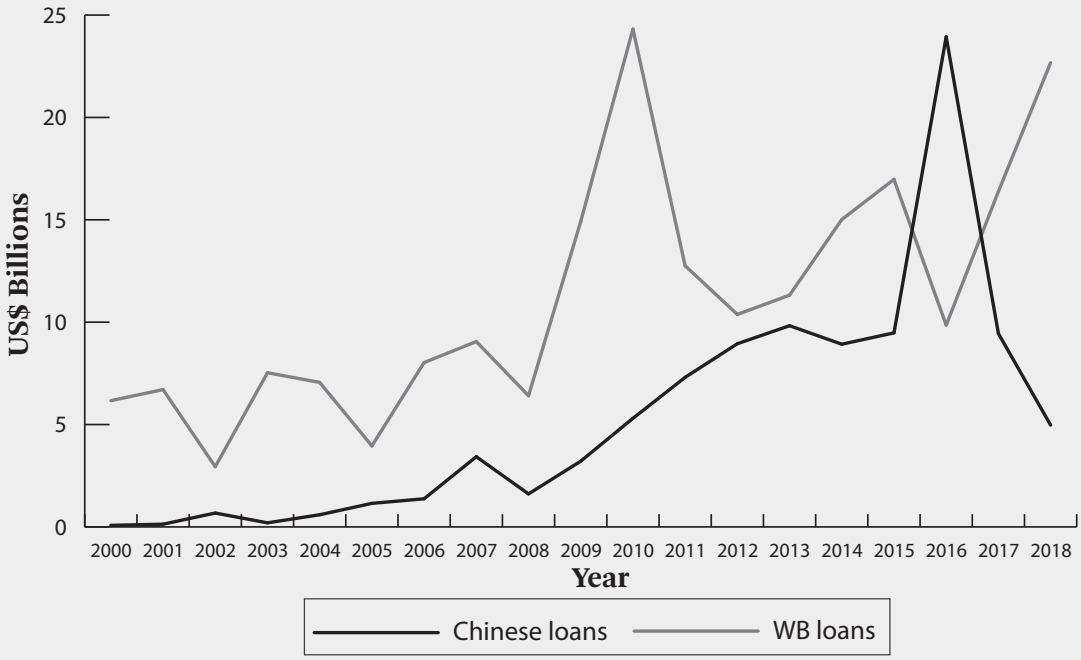
Source: Author's elaboration on SAIS-CARI and World Bank databases.

each loan, several useful data points are reported, including loan year, sector, value, and type of lender; all of these are used in the analytical framework.[37] Similar information is also taken for the World Bank loans, which are added to the dataset. In this case, data are drawn from the World Bank Projects & Operations database.[38]

An examination of lending destinations in Africa from 2000 to 2018 (Figure 2) shows that both China and the World Bank gave large loan amounts to Ethiopia (US$ 13.7 billion and US$ 66.1 billion, respectively), Egypt (US$ 4 billion and US$ 30 billion), Nigeria (US$ 6 billion and US$ 23 billion), Kenya (US$ 9 billion and US$ 14.4 billion), and South Africa (US$ 3 billion and US$ 12 billion). For China, other very important African borrowers are Angola (US$ 39 billion), Zambia (US$ 7 billion), Cameroon (US$ 5.9 billion), and Congo (US$ 5 billion). For the World bank other important destinations are Tanzania (US$ 20 billion) and Morocco (US$ 18 billion).

I build GVC indicators by data sourced from the UNCTAD-Eora Global Value Chain database, which provides details on international value-added trade for 189 countries observed from 1990 to 2018.[39] In more detail, for each country-year this data source reports foreign value-added, domestic value-added and indirect value-added (i.e., domestic value-added used for exports of third countries) included in gross exports (generated by using EORA Multi-Region Input-Output tables).[40] Although data are available for almost all African countries, those countries for which value-added trade data are of insufficient quality according to the provider are excluded. Therefore, the analysis focuses on 35 African countries that have received Chinese lending and for which the UNCTAD Eora database offers reliable GVC indicator data.[41]

Figure 3: Dynamics of CDLs and WBDLs (2000-2018)



Source: Author's elaboration on SAIS-CARI and World Bank data.

Figure 3 shows the pattern of both CDL and WBDL in the African countries included in the dataset since 2000. Overall, the total amount of World Bank loans is larger than Chinese loans in all years, except for 2016, when CDL reached the peak of an increasing trend started in 2008. WBDL reached its peak just after the financial crisis in 2008, that did not significantly affect developed economies; in the most recent years, it is again on a steep upward pattern, reaching US$ 22.7 billion in 2018.

Table 1 reports details on the total amount of Chinese loans to each country and the distribution of loans across different sectors and concessionality types. Overall, Chinese loans included in our dataset amount to US$ 100.6 billion, that is around two-thirds of the entire value directed to the African continent.[42] In terms of sectoral distribution, around 60 percent of CDLs are directed to infrastructure sectors, particularly to transport and communication (36 percent). In Burundi, Gambia, Lesotho, Liberia, Mauritania, Rwanda, Sierra Leone, and Togo more than 80 percent of loans go to transport and communication industries, while in Botswana, Ghana, and Uganda a very large share of loans finance other infrastructure sectors, such as power and water. Production sectors represent 21 percent of all Chinese lending: they take the largest share in Angola (50 percent), Namibia (43 percent), and Chad (37 percent). Finally, social sectors represent 10 percent of CDLs (91 percent in Malawi and 66 percent in Seychelles), while financial sectors only 2.6 percent (49 percent in Egypt, 11 percent in Central African Republic, and 10 percent in Tanzania). In terms of concessionality distribution, 26 percent of CDL's are concessional, granted below the market rate by Eximbank and MOFCOM. The countries where CDLs are mostly concessional are Central African Republic (CAR), Chad, Lesotho, Liberia, Mauritania, Mauritius, Niger, and the Gambia (100 percent), plus Seychelles and Uganda (each more than 90 percent).

Table 2 shows the sectoral distribution of WBDLs. Overall, the countries in the dataset borrowed US$ 212 billion from the World Bank within the 2000-2018 span. In this case, social sectors took very large share of loans (40.6 percent), particularly in Namibia (80 percent), CAR (76 percent), Lesotho (62 percent), and Chad (60 percent). In turn, infrastructure sectors had lower shares with respect to CDLs (about 44 percent). In detail, WBDLs to transport and communication sectors were only 11 percent, or approximately one third of CDLs to the same sectors. These sectors are more relevant in Liberia (45 percent), Madagascar (31 percent), and Mozambique (27 percent), while loans to other types of infrastructure take the largest shares in South Africa (98 percent) and Botswana (82 percent). Production sectors take half of the share of lending in the same sectors from CDLs (11 percent); WBDLs to those sectors are more relevant in Mali and Tunisia (each 28 percent). Financial sectors are more important destinations for WBDLs, taking almost 4 percent of all loans. Most of the countries report positive shares of WBDLs to those sectors, that turn out to be more representative in Seychelles (15 percent), Egypt (10 percent), and Tunisia (10 percent).

Table 1a: Chinese Development Lending Distribution by Sector & Concessionality

Country	Total Value (US$ millions)	Distribution by Sector (%)						Distribution by Concessionality (%)	
		Transport & Communication	Power & Water	Production	Social	Finance	Other Sectors	Concessional	Non-concessional
Angola	39,146	19.3	11.9	50.5	11.7	0.0	6.5	0.1	99.9
Botswana	931	4.6	88.6	0.0	6.0	0.0	0.8	7.7	92.3
Burundi	45	100	0.0	0.0	0.0	0.0	0.0	33.3	66.7
Cameroon	5,933	49.0	37.2	0.3	12.5	0.0	1.0	65.5	34.5
CAR	35	0.0	51.4	0.0	0.0	11.4	37.1	100.0	0.0
Chad	247	10.1	52.6	37.2	0.0	0.0	0.0	100.0	0.0
Cote d'Ivoire	2,791	39.9	52.4	0.0	6.6	0.0	1.1	44.3	55.7
Djibouti	1,298	73.0	26.3	0.0	0.0	0.0	0.6	54.4	45.6
Egypt	4,021	0.0	17.2	0.4	1.5	49.7	31.2	3.3	96.7
Gabon	1,344	37.1	33.7	0.0	21.7	0.0	7.5	54.0	46.0
Ghana	3,671	15.1	73.1	0.0	10.2	0.0	1.7	22.6	77.4
Kenya	9,048	64.7	21.7	7.4	4.3	1.6	0.4	37.1	62.9
Lesotho	106	92.5	0.0	0.0	0.0	0.0	7.5	100.0	0.0
Liberia	55	90.9	0.0	9.1	0.0	0.0	0.0	100.0	0.0
Madagascar	456	45.0	43.2	0.0	11.0	0.0	0.9	99.1	0.9
Malawi	262	8.8	0.0	0.0	91.2	0.0	0.0	100.0	0.0
Mali	964	65.7	25.7	1.9	0.0	0.0	6.7	57.3	42.7
Mauritania	431	88.4	0.0	0.0	0.0	0.0	11.6	100.0	0.0
Mauritius	489	58.3	28.8	0.0	4.5	0.0	8.4	100.0	0.0
Morocco	1,182	15.6	39.0	0.1	1.1	0.0	44.2	16.8	83.2
Mozambique	2,269	73.8	0.0	10.1	15.6	0.0	0.5	15.8	84.2
Namibia	546	30.4	0.0	42.7	7.1	0.0	19.8	59.2	40.8
Niger	351	34.8	35.9	29.3	0.0	0.0	0.0	100.0	0.0
Nigeria	6,176	62.3	26.0	0.0	11.8	0.0	0.0	59.0	41.0
Rwanda	415	83.4	0.0	0.0	0.5	0.0	16.1	82.9	17.1
Senegal	1,886	72.0	19.7	1.2	6.9	0.0	0.2	25.0	75.0
Seychelles	35	31.4	2.9	0.0	65.7	0.0	0.0	97.1	2.9

Source: CARI-SAIS database. Production sectors include agriculture, industry, mining and multi-sector; social sectors include education, environment, food, government, health, other social sectors; financial sectors are banking, budget, and credit sectors. Concessional loans include loans defined as concessional, plus zero interest loans and preferential export buyers' credit.

Table 1b: Chinese Development Lending Distribution by Sector & Concessionality

Country	Total Value (US$ millions)	Distribution by Sector (%)						Distribution by Concessionality (%)	
		Transport & Communication	Power & Water	Production	Social	Finance	Other Sectors	Concessional	Non-concessional
Sierra Leone	230	91.7	1.3	0.0	7.0	0.0	0.0	21.7	78.3
South Africa	3,220	49.4	43.5	0.0	0.0	7.1	0.0	0.0	100.0
Tanzania	2,043	17.1	57.2	0.0	14.7	9.8	1.2	78.2	21.8
The Gambia	25	100.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
Togo	634	80.1	12.9	0.0	3.9	0.0	3.0	81.2	18.8
Tunisia	131	97.7	0.0	0.0	0.0	0.0	2.3	24.4	75.6
Uganda	2,863	27.0	70.3	0.3	1.4	0.0	0.9	93.0	7.0
Zambia	7,318	49.6	19.0	2.5	27.9	0.4	0.6	27.7	72.3
Total	100,597	35.9	24.5	21.3	10.6	2.6	5.1	26.1	73.9

Source: CARI-SAIS database. Production sectors include agriculture, industry, mining and multi-sector; social sectors include education, environment, food, government, health, other social sectors; financial sectors are banking, budget, and credit sectors. Concessional loans include loans defined as concessional, plus zero interest loans and preferential export buyers' credit.

Table 2a: World Bank Development Lending, Distribution by Sector

Country	Total Loan Value (US$ millions)	Distribution by Sector (%)					
		Transport & Communication	Power & Water	Production	Social	Finance	Other Sectors
Angola	3,093	4.3	33.0	12.1	50.6	0.0	0.0
Botswana	2,521	15.3	81.9	0.8	2.0	0.0	0.0
Burundi	1,795	7.7	21.8	11.3	53.8	5.3	0.0
Cameroon	5,545	10.2	53.8	12.2	23.9	0.0	0.0
CAR	700	8.4	8.9	4.6	76.7	1.4	0.0
Chad	1,548	10.8	11.1	18.2	59.9	0.0	0.1
Cote d'Ivoire	4,329	19.4	22.9	21.6	35.8	0.4	0.0
Djibouti	408	10.3	33.8	8.2	46.5	1.2	0.0
Egypt	30,576	6.0	41.9	7.3	34.5	10.3	0.0
Gabon	825	23.2	7.3	10.6	58.9	0.0	0.0

Source: World Bank database. Production sectors include agriculture, industry, mining and multi-sector; social sectors include education, environment, food, government, health, other social sectors; financial sectors are banking, budget, and credit sectors.

Table 2b: World Bank Development Lending, Distribution by Sector

Country	Total Loan Value (US$ millions)	Distribution by Sector (%)					
		Transport & Communication	Power & Water	Production	Social	Finance	Other Sectors
Ghana	9,863	19.6	18.1	8.1	51.8	2.3	0.0
Kenya	14,088	13.2	34.9	7.5	43.2	1.1	0.1
Lesotho	582	12.3	13.1	12.2	62.4	0.0	0.0
Liberia	2,278	45.9	12.6	3.2	36.2	2.2	0.0
Madagascar	4,450	30.8	5.2	22.2	39.8	2.1	0.0
Malawi	4,450	4.4	16.2	23.9	52.2	3.4	0.0
Mali	3,640	9.2	13.7	28.5	46.7	1.7	0.1
Mauritania	1,299	19.6	14.6	9.9	55.9	0.0	0.0
Mauritius	444	18.3	5.8	17.6	56.9	1.4	0.0
Morocco	18,089	8.7	51.0	13.1	20.7	6.5	0.0
Mozambique	8,365	26.9	23.6	7.0	41.1	1.4	0.0
Namibia	192	0.0	0.2	19.1	80.4	0.0	0.3
Niger	3,298	8.2	24.5	17.8	48.1	1.5	0.0
Nigeria	23,164	6.8	21.3	12.1	55.6	4.2	0.0
Rwanda	4,248	5.7	17.4	25.1	46.7	5.0	0.0
Senegal	6,589	24.1	21.2	7.8	44.4	0.0	2.5
Seychelles	58	3.7	12.9	19.4	48.5	15.6	0.0
Sierra Leone	1,420	9.5	21.5	10.0	53.7	5.3	0.0
South Africa	12,265	0.0	98.2	0.9	0.2	0.8	0.0
Tanzania	20,376	12.0	19.0	7.3	59.5	1.5	0.7
The Gambia	554	5.0	25.3	11.3	57.5	0.9	0.0
Togo	855	0.2	24.1	13.8	60.6	1.4	0.0
Tunisia	7,456	10.5	7.1	28.6	43.1	10.7	0.0
Uganda	10,019	14.1	28.8	14.4	41.5	1.1	0.0
Zambia	3,047	24.0	20.8	15.8	37.9	1.5	0.0
Total	212,428	11.6	32.5	11.4	40.6	3.8	0.0

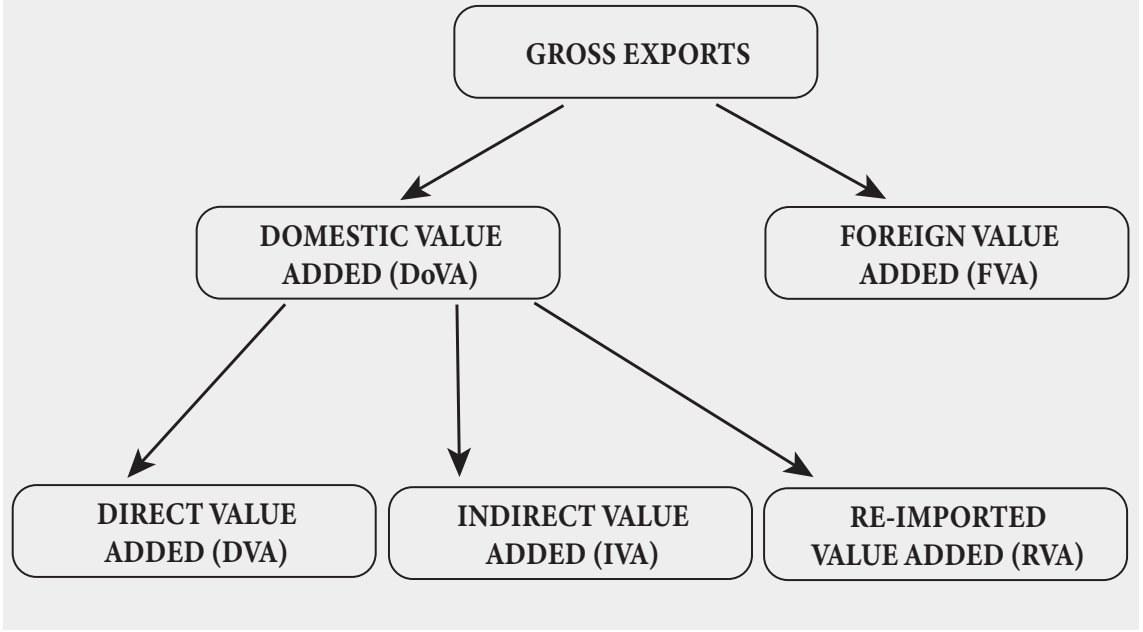
Source: World Bank database. Production sectors include agriculture, industry, mining and multi-sector; social sectors include education, environment, food, government, health, other social sectors; financial sectors are banking, budget, and credit sectors.

GVC INDICATORS

The involvement of African countries in GVCs is measured by two indicators that are constructed following Koopman *et al*.[43] Koopman *et al.* propose a breakdown of gross exports which allows for the identification of exports involving intermediate goods. The World illustrates an example of an export that involves intermediate goods, detailing the intermediate goods used to build the "final" good, a Bianchi bicycle.[44] In this case the Bianchi company, which is headquartered in Italy, assembles parts and components (i.e., intermediate goods) that are imported from different countries, such as Japan (brakes), China (handlebars), and Spain (saddles).

Gross exports are broken down into two main components (see Figure 4): 1) the *foreign value-added* (FVA) content of intermediate imports embodied in gross exports, and 2) the *domestic value-added* (DoVA), that is the value of exports produced domestically. Domestic value-added is further broken down into three parts: 1) *direct domestic value-added* (DVA)—that is the value-added embodied in exports of final and intermediate goods, absorbed by direct importers; 2) *indirect domestic value-added* (IVA)—that is value-added embodied in intermediate goods re-exported to third countries; and 3) re-imported domestic value-added (RVA)—that is the value-added of exported intermediate goods that return home.

Figure 4: Decomposition of Value Added in Gross Exports



FVA and IVA pick out the part of gross exports represented by intermediate goods since they measure value-added that crosses at least two national borders. IVA measures value-added included in intermediate goods that are exported to other countries which use them to produce their export goods. It is a measure of upstream type participation to GVCs, since it relates to the first stage of value chains, which are far from the final demand. FVA measures value-added included in intermediate goods that are imported by other countries and then used to produce

export goods. It is a measure of downstream participation in GVCs, since it relates to the final stages of value chains which are closer to the final demand.

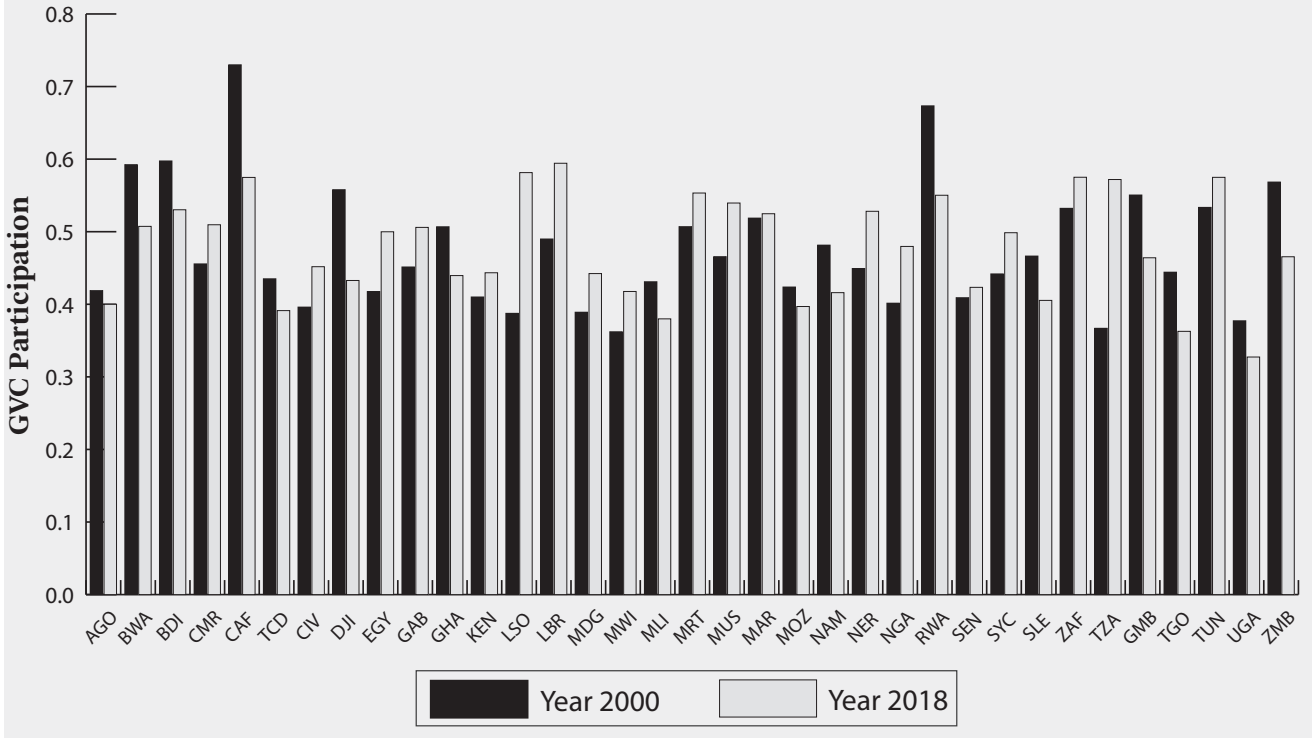
The GVC indicator measuring the participation of country *i* in the cross-border trade of intermediates at time *t* is defined as follows:

$$GVC\ PARTICIPATION_{it} = FVA_{it} + IVA_{it}\ , \qquad (1)$$

where FVA_{it} is the foreign value-added and IVA_{it} is the indirect domestic value-added, both divided by total country exports.

Figure 5 compares the GVC participation value index for each country at the beginning and the end of the time span covered by the dataset. The countries ranking in the top positions are different in the two years observed: in 2000 the countries where the international trade of intermediate goods takes the largest share of gross exports were Central African Republic (73 percent), Rwanda (63 percent), and Botswana (50 percent); in 2018 the African countries reporting the largest GVC participation value index were Liberia (59 percent), Lesotho (59 percent), and South Africa (58 percent). Overall, it appears that 19 out of 35 countries improved their involvement in GVCs. Tanzania saw the largest jump forward, where the index increased by 20 percentage points (from 37 percent to 57 percent), followed by Lesotho (19 percent), Liberia (10 percent) and Egypt, Niger, and Nigeria (8 percent each). The countries that dropped down on the index were Central African Republic (-15 percent), Djibouti and Rwanda (-12 percent each), and Zambia (-10 percent).

Figure 5: GVC Participation Index in 2000 and 2018[45]



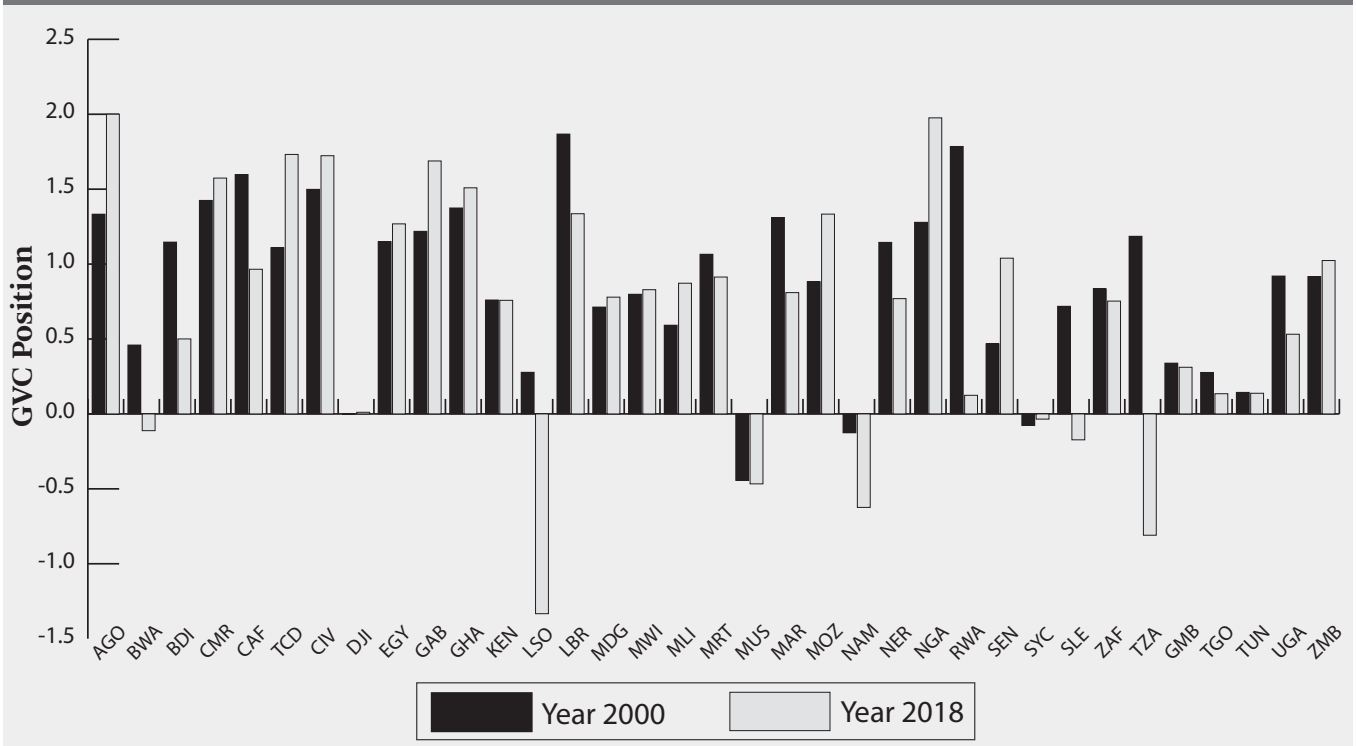
Source: Author's elaboration on UNCTAD-EORA database.

The second indicator measures the relative position of country *i* within the GVCs at time *t*. It is calculated as the log-difference between the upstream (*IVA*) and the downstream component (*FVA*) of the GVC participation index:[46]

$$GVC\ POSITION_{it} = Ln(IVA_{it}) - Ln(FVA_{it}) \quad (2)$$

Positive values indicate an upstream specialization in GVC stages of the production process that are far from the final demand; negative values reveal downstream specialization in stages close to the final demand.

Figure 6: GVC Position Index in 2000 and 2018



Source: Author's elaboration on UNCTAD-EORA database.

Figure 6 shows the GVC position of countries in the dataset in 2000 and 2018. In 2000, Liberia and Rwanda's economies were more specialized in upstream GVC stages, while in Mauritius, Namibia, and Seychelles value-added imports overcame value-added exports. At the end of the time span considered, Angola and Nigeria had the most relatively upstream economies, while comparatively Lesotho, Tanzania, and Namibia had the most downstream economies. Between 2000 and 2018 some countries reported important improvements toward upstream positions along GVCs, such as Nigeria, Angola, Chad, Senegal, and Gabon. Other countries, instead, moved toward more relatively downstream GVC positions in Tanzania, Sierra Leone, Lesotho, and Botswana.

Econometric model

I employ OLS regressions to estimate the average dynamic impact of CDLs and WBDLs on the GVC involvement of the 35 African countries included in the sample. Such empirical strategy gives the opportunity to control for potential confounding factors, which are included in the analysis as additional variables. In detail, I estimate the following model on a dataset defined at country *i* - time *t* level:

$$\Delta Y_{it} = Lending_{it-s} + X_{it-s} + \gamma_i + \delta_t + \varepsilon_{it} \quad (3)$$
with s = 1,2,3,4

I consider two different output variables: (i) the annual growth rate of GVC participation; (ii) the annual growth rate of GVC position. The variable *Lending* measures the log value of Chinese or World Bank loans to African country *i*, lagged up to four years before the investment. *X* includes a set of variables, taken at the same lag of *Lending* variable, controlling for some of the most important factors of GVC participation and GVC position according to the literature: (i) the log value of inward FDI stock; (ii) the institutional quality, proxied by the Rule of Law index, which measures the quality of contract enforcement, property rights, and the likelihood of crime and violence; (iii) the share of mineral rents in GDP, proxying the relevance of natural resources; (iv) human capital index, based on years and returns to education; (v) the presence of bilateral international agreements between China and the borrowing country, captured by a dummy variable. The World Bank database provides the first three variables, while Penn World Table (version 10.0) gives the human capital index; the UNCTAD database contains information on all worldwide bilateral investment agreements, including those that involve China and African countries.[47] All models include fixed effects for the borrowing countries (γ_i) and year of loans (δ_t).

RESULTS

I first investigate the effects of CDLs and WBDLs on the growth rate of African economies' participation in GVCs (Table 3). Analysis revealed that only aggregate values of Chinese loans are related to an increasing involvement of borrowing economies in the international trade of intermediate goods. Their effect become statistically significant from the second year after the loan onward and the magnitude increases by time: on average, a one percent increase in CDLs is related to a 0.55 percent increase in GVC involvement in the fourth year after the loan.[48] Thus, the "big push" industrialization approach followed by Chinese development finance institutions and highlighted by Chin and Gallagher appears to be effective for enhancing African markets' chances for accessing GVCs.[49]

Table 3: Effects of Chinese and World Bank Lending on GVC Participation

	Chinese Development Lending				World Bank Development Lending			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Chinese Loans (lag 1)	0.068 (0.056)							
Chinese Loans (lag 2)		0.186* (0.104)						
Chinese Loans (lag 3)			0.383*** (0.135)					
Chinese Loans (lag 4)				0.549*** (0.159)				
World Bank Loans (lag 1)					0.034 (0.071)			
World Bank Loans (lag 2)						-0.029 (0.111)		
World Bank Loans (lag 3)							0.042 (0.164)	
World Bank Loans (lag 4)								0.006 (0.196)
Control Variables	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	572	540	508	476	572	540	508	476

The table reports the regression coefficients and in brackets the robust standard errors clustered at country level. The output is the annual growth rate of GVC participation index. All regressions include constants. Control variables include: log of inward FDI, rule oflLaw index, human capital index, share of mineral rents in GDP, presence of bilateral investment agreement between China and African borrowing country. * Significant at 10%, ** Significant at 5%, *** Significant at 1%.

Turning to the contribution that CDLs and WBDLs give African economies to upgrade along GVCs (Table 4), only the aggregate values of World Bank loans significantly drive African economies toward more upward positions by exporting more value-added products than they import. Also in this case, the effect becomes statistically significant from the second year after the loan and increases by time in magnitude, which is quite low. Instead, CDLs do not have any significant effect. This might be due to two reasons. First, WBDLs are more focused on sectors that are closely related to education and innovation, which are key factors to climb up towards higher value-added GVC stages.[50] Second, loans from the World Bank are more likely to be subject to concessional terms, and these terms may be more beneficial for developing economies aiming at exporting their value-added.[51]

As shown in Table 1 a large part of CDLs are directed to infrastructure sectors (about 60 percent) and all the countries in the sample have received at least one loan to those sectors in the 2000-2018 span. Table 5 shows the output of regression models testing the specific impact of Chinese loans to infrastructure sectors on the two GVC dependent variables. Results confirm that Chinese loans to

Table 4: Effects of Chinese and World Bank Lending on GVC Position

	Chinese Development Lending				World Bank Development Lending			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Chinese Loans (lag 1)	-0.001 (0.003)							
Chinese Loans (lag 2)		-0.003 (0.004)						
Chinese Loans (lag 3)			-0.003 (0.135)					
Chinese Loans (lag 4)				-0.008 (0.005)				
World Bank Loans (lag 1)					0.004 (0.003)			
World Bank Loans (lag 2)						0.006* (0.003)		
World Bank Loans (lag 3)							0.010* (0.006)	
World Bank Loans (lag 4)								0.012* (0.007)
Control Variables	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	572	540	508	476	572	540	508	476

The table reports the regression coefficients and in brackets the robust standard errors clustered at country level. The output is the annual growth rate of the GVC position index. All regressions include constants. Control variables include: log of inward FDI, Rule of Law index, Human capital index, share of mineral rents in GDP, presence of bilateral investment agreement between China and the African borrowing country. * Significant at 10%, ** Significant at 5%, *** Significant at 1%.

those sectors are likely to drive the positive and significant impact that overall CDLs have on borrowing countries' GVC participation, although showing to be ineffective to alter the relative position of those countries along GVCs. This empirical finding supports what international institutions such as the IMF, the OECD, and the World Trade Organization claim about the importance of filling infrastructure gaps to enhance developing countries chances to access GVCs.

By the following tests I separately investigate the effects of Chinese loans on different infrastructure sectors: transport & communication versus and Power & Water. I find that only lending to the transport and communication sectors significantly affect borrowing countries' GVC participation, while loans to power and water sectors do not yield significant results. This test confirms the crucial importance of reducing transport and communication costs to compete in the trade of intermediate goods.[52] Some examples of such loans in our dataset are the US$ 3.6 billion loan to Kenya, supporting the building of the railway line connecting the capital Nairobi with Mombasa, which is home to the largest port in East Africa; the US$ 1.3 billion loan to Nigeria,

Table 5: Effects of Chinese Lending to Infrastructure Sectors on GVC Participation & Position

	GVC Participation Growth Rate				GVC Position Growth Rate			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Chinese Infrastructure Loans (lag 1)	0.056 (0.076)				0.001 (0.002)			
Chinese Infrastructure Loans (lag 2)		0.223 (0.142)				-0.001 (0.004)		
Chinese Infrastructure Loans (lag 3)			0.372** (0.169)				-0.002 (0.004)	
Chinese Infrastructure Loans (lag 4)				0.476*** (0.178)				-0.006 (0.004)
Control Variables	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	572	540	508	476	572	540	508	476

The table reports the regression coefficients and in brackets the robust standard errors clustered at country level. The outputs are the annual growth rate of GVC participation index (models 1-4) and the annual growth rate of the GVC position index (models 5-8). All regressions include constants. Control variables include: log of inward FDI, rule of law index, human capital index, share of mineral rents in GDP, presence of bilateral investment agreement between China and the African borrowing country. *Significant at 10%, **Significant at 5%, ***Significant at 1%.

financing the railway connection between the capital Lagos and Ibadan, Nigeria's third largest city; the US$ 932 million loan to Angola, financing the world-class Porto de Caio at Cabinda.

Finally, I test whether concessional loans, which MOFCOM and Eximbank give at a below-market rate, can provide additional benefits in terms of GVC participation. Within this scope, I focus on the loans that are more likely to boost the output variable, which are those directed to transport and communication sectors, and distinguish between concessional and non-concessional loans. Table 7 reports the results of this test. Although effects are statistically significant for both concessional and non-concessional loans, I find that the magnitude of coefficients is larger in case of concessional loans: on average, a 1 percent increase in the volume of loans generates an increase of the borrowing country's GVC participation by 0.52 percent (concessional) and 0.38 percent (non-concessional) in the fourth year after the loan.

Table 6: Effects of Chinese Lending to Different Infrastructure Sectors on GVC Participation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Chinese Loans to Transport & Communication (lag 1)	0.031 (0.060)							
Chinese Loans to Transport & Communication (lag 2)		0.277** (0.123)						
Chinese Loans to Transport & Communication (lag 3)			0.331*** (0.125)					
Chinese Loans to Transport & Communication (lag 4)				0.487*** (0.163)				
Chinese Loans to Power & Water (lag 1)					0.052 (0.121)			
Chinese Loans to Power & Water (lag 2)						0.126 (0.168)		
Chinese Loans to Power & Water (lag 3)							0.323 (0.221)	
Chinese Loans to Power & Water (lag 4)								0.393 (0.247)
Control Variables	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	572	540	508	476	572	540	508	476

The table reports the regression coefficients and in brackets the robust standard errors clustered at country level. The output is the annual growth rate of the GVC participation index. All regressions include constants. Control variables include: log of inward FDI, rule of law index, human capital index, share of mineral rents in GDP, presence of bilateral investment agreement between China and the African borrowing country. * Significant at 10%, ** Significant at 5%, *** Significant at 1%.

CONCLUSIONS

Taking advantage of CARI's database on Chinese lending to African governments and EORA-UNCTAD data, this work attempted to shed light on the effects of international lending on African involvement in international value-added trade. I carried out an econometric analysis on a dataset that allowed for comparison between Chinese and World Bank loans to a set of 35 African countries from 2000 to 2018. The output variables were the borrowing countries' growth rates in GVC participation and GVC position. GVC participation was measured as the share of intermediate goods trade in gross exports; GVC position was measured as the ratio of intermediates exports to intermediates imports and proxies the relative upstream position of GVC production.

The first result is that Chinese and World Bank loans affect different outputs. Chinese lending enhances the intensity of GVC participation, while World Bank lending is related to an upgrade of African countries along GVCs. One of the reasons for this is the different sectoral composition of Chinese and World Bank loans. Chinese lenders target large infrastructure sectors, particularly,

Table 7: Effects of Chinese Concessional and Non-Concessional Lending to Transport & Communication Sectors on GVC Participation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Concessional Loans								
Chinese Loans to Transport & Communication (lag 1)	-0.028 (0.068)							
Chinese Loans to Transport & Communication (lag 2)		0.247* (0.149)						
Chinese Loans to Transport & Communication (lag 3)			0.342** (0.158)					
Chinese Loans to Transport & Communication (lag 4)				0.522*** (0.200)				
Non-Concessional Loans								
Chinese Loans to Transport & Communication (lag 1)					0.094 (0.074)			
Chinese Loans to Transport & Communication (lag 2)						0.244** (0.112)		
Chinese Loans to Transport & Communication (lag 3)							0.252 (0.157)	
Chinese Loans to Transport & Communication (lag 4)								0.386** (0.162)
Control Variables	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	572	540	508	476	572	540	508	476

The table reports the regression coefficients and in brackets the robust standard errors clustered at country level. The output is the annual growth rate of the GVC participation index. All regressions include constants. Control variables include: log of inward FDI, rule of law index, human capital index, share of mineral rents in GDP, presence of bilateral investment agreement between China and the African borrowing country. * Significant at 10%, ** Significant at 5%, *** Significant at 1%.

transport and communications, which are key factors to accessing international production chains. The World Bank, on the other hand, prioritizes loans to social sectors, such as education and health, which in turn are more likely to move countries toward more upstream and higher value-added GVC stages.

The second result comes from a focus on Chinese lending on infrastructure sectors, which, as expected, is found to positively increase borrowers' GVC participation but with no effects on GVC position. By identifying loans to different types of infrastructure projects, my analysis reveals the crucial relevance of loans to transport and communication sectors; such loans are likely to significantly reduce the costs of trading intermediate goods and, therefore, help African countries to intensify their participation in international production chains.

Furthermore, the positive impact of Chinese loans on the intensity of trade in intermediate goods becomes stronger over time, becoming statistically significant from the second year after the lending occurs. Finally, additional benefits come from concessional loans, whose effect on African countries' GVC participation is stronger with respect to loans granted at market rate.

In conclusion, this research points out that international lending can, indeed, help African countries boost their participation in international production networks, which is an important channel of economic development. Loans to transport and communication sectors, in particular, are crucial since they are likely to directly affect costs of trading with foreign partners. Nevertheless, while the econometric analysis here shows average effects over a set of 35 different countries, case studies could add further important insights about the country-specific institutional or technological conditions under which international lending is more effective. ★

Appendix A: 3-digit Country Codes Used in Graphs

Country	3-digit Code
Angola	AGO
Botswana	BWA
Burundi	BDI
Cameroon	CMR
Central African Republic	CAF
Chad	TCD
Cote d'Ivoire	CIV
Djibouti	DJI
Egypt	EGY
Gabon	GAB
Ghana	GHA
Kenya	KEN
Lesotho	LSO
Liberia	LBR
Madagascar	MDG
Malawi	MWI
Mali	MLI
Mauritania	MRT
Mauritius	MUS
Morocco	MAR
Mozambique	MOZ
Namibia	NAM
Niger	NER
Nigeria	NGA
Rwanda	RWA
Senegal	SEN
Seychelles	SYC
Sierra Leone	SLE
South Africa	ZAF
Tanzania	TZA
The Gambia	GMB
Togo	TGO
Tunisia	TUN
Uganda	UGA
Zambia	ZMB

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41. From the list of countries receiving CDL I have excluded the following: Algeria, Benin, Burkina Faso, Cape Verde, Comoros, Democratic Republic of Congo, Equatorial Guinea, Eritrea, Ethiopia, Guinea, Guinea-Bissau, Republic of Congo, South Sudan, Sudan, and Zimbabwe. Moreover, Algeria and Cape Verde are dropped since there are no loans to infrastructure sectors, which are focal for the empirical analysis.

42. The total value is equal to US$ 153 billion, as per http://www.sais-cari.org/data.

43. Robert Koopman, William Powers, Zhi Wang and Shang-Jin Wei, "Give Credit Where Credit is Due: Tracing Value Added in Global Production Chains," National Bureau of Economic Research, working paper no. 16426 (December: 2011).

44. World Bank, 2019.

45. See table in Appendix A for countries' corresponding 3-digit codes used in Figures 5 and 6.

46. Koopman *et al.*, "Give Credit Where Credit is Due."

47. Robert C. Feenstra, Robert Inklaar, and Marcel P. Timmer "The Next Generation of the Penn World Table," *American Economic Review* 105, no. 10 (2015): 3150-3182, available for download at www.ggdc.net/pwt; Penn World Table (version 10.0).

48. Here and in the tests reported later in the text the results related to control variables are not statistically significant. They are not reported for saving space. They are available upon request.

49. Chin and Gallagher, "Coordinated credit spaces."

50. Gereffi and Luo, "Risks and opportunities."

51. Morris *et al.*, "Chinese and World Bank Lending Terms"; Ruta *et al.*, "Belt and Road Economics"; Manova and Yu, "How firms export."

52. Hummels and Schaur, "Time as a trade barrier."

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