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Pushed to finance? Assessing technology export as a motivator for coal finance abroad

Niccolò Manych[1,2,*], Florian Egli[3,4], Nils Ohlendorf[1,2], Tobias S Schmidt[3,5,6,7], Bjarne Steffen[5,8,9], Anna Stünzi[10] and Jan Christoph Steckel[1,11,12]

[1] Mercator Research Institute on Global Commons and Climate Change, Torgauer Straße 12–15, 10829 Berlin, Germany
[2] Technische Universität Berlin, Department Economics of Climate Change, Straße des 17. Juni 145, 10623 Berlin, Germany
[3] ETH Zurich, Energy and Technology Policy Group, Clausiusstrasse 37, 8092 Zürich, Switzerland
[4] University College London, Institute for Innovation and Public Purpose, Gower Street, WC1E 6BT London, United Kingdom
[5] Institute of Science, Technology and Policy, ETH Zurich, Universitätsstrasse 41, 8006 Zürich, Switzerland
[6] Princeton University, Andlinger Center for Energy and the Environment, 86 Olden Street, Princeton, NJ 08544, United States of America
[7] Princeton University, Center for Policy Research on Energy and the Environment, Robertson Hall, Princeton, NJ 08544, United States of America
[8] ETH Zurich, Climate Finance and Policy Group, Haldeneggsteig 4, 8092 Zürich, Switzerland
[9] Massachusetts Institute of Technology, Center for Energy and Environmental Policy Research, 77 Massachusetts Avenue, E19-411, Cambridge, MA 02139-4307, United States of America
[10] University of St. Gallen, Institute for Political Science, Mueller-Friedbergstrasse 8, CH-9000 St. Gallen, Switzerland
[11] Brandenburg University of Technology Cottbus-Senftenberg, Chair of Climate and Development Economics, Erich-Weinert-Str. 1, 03046 Cottbus, Germany
[12] Potsdam Institute for Climate Impact Research, Future Lab CERES, Telegraphenberg A 31, 14473 Potsdam, Germany
[*] Author to whom any correspondence should be addressed.

E-mail: manych@mcc-berlin.net

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Abstract

The construction of new coal-fired power plants is frequently financed by banks from abroad. Recent studies suggest that the opportunity to export technology is a relevant 'push factor' for such financing activities. In this paper, we provide first quantitative evidence for this hypothesis on a global scale. We construct a novel dataset that tracks both public and private financial involvement on a coal unit level, including information on equipment manufacturers and service providers. The findings indicate that financial institutions from various countries, including China, Japan, South Korea, and Western nations provide loans to coal units overseas. These finance flows, particularly from publicly owned banks, are accompanied by technology exports from the same country. Complementing our quantitative analysis with semi-structured interviews, we find indications that political economy factors, such as public banks' requirement for participation of domestic firms in financing deals and the unlocking of export business opportunities for domestic industries in financing countries, contribute to this correlation. Our findings highlight the importance of financing countries and their domestic industries for low-carbon transitions globally.

1. Introduction

Remaining well below 2 °C warming as mandated by the Paris Agreement requires the phase-out of unabated fossil fuels in the power sector [1]. Coal alone has the potential to exhaust the emissions budget for 1.5 °C if all plants currently planned were realized and ran until the end of their expected lifetime [2]. Yet, coal capacity installed globally has been constantly increasing since the early 2000s with 46 GW added in 2022 translating into a net growth of 20 GW [3]. Over the last decades, investment into new coal-fired power capacity has increasingly shifted from the US and Europe to emerging economies in Asia. As a result, most of the coal capacity planned or under construction as of 2023 (537 GW)

is concentrated in China (365 GW), India (61 GW), Indonesia (26 GW), and Bangladesh (12 GW) [4]. Countries seeking to construct new coal plants do so despite the agreement at COP26 to 'phase down' coal [5].

Various countries finance the construction of coal plants abroad despite the agreement in Paris to make 'finance flows consistent with a pathway towards low greenhouse gas emissions' [6]. The literature indicates that banks and institutional investors support the development of coal plants worldwide by providing loans and underwriting, or holding bonds and shares [7]. Studies analysing these financial commitments emphasize their magnitude on a globally aggregated level [8, 9], and the important role of specific financial actors, such as multilateral development banks [10–15]. Many scholars discuss the relevance of financial support from China [16–19]. However, none of the papers comprehensively analyses global public and private debt finance for coal plants on a coal unit level.

Scholars have started to investigate the reasons for above-mentioned financial involvements, including export opportunities for coal technology. Most studies focus exclusively on China [17, 20–23], while fewer examine Japan [24, 25]. Others analyse these two countries in combination with the US [26] or South Korea [27, 28]. These papers suggest that countries provide finance to help their domestic industry in going abroad. Recent frameworks on funding from China [20, 23] discuss technology export, i.e., selling products or services to another country, as a 'push factor', as opposed to demand from host countries that 'pulls' debt and equity to construct coal plants. However, most studies take the export of manufacturing goods and services for granted. Some authors provide information on the share of units or capacity with components from the financing countries—albeit only for specific countries and for merged types of manufacturing companies and service providers [22, 26, 27]. While the existing literature greatly enhances our understanding of certain parts of the global coal financing dynamics, none of the studies mentioned above examines the interplay between the provision of loans and technology exports quantitatively.

In this paper, we aim to address these two gaps by examining the link between private *and* public financing of coal plants and by mapping banks and technology companies involved in the construction of the plants on a global level. Our analysis sheds light on international coal finance flows and on technology exports as a potentially important push factor for financing coal plants even after the Paris Agreement. To achieve this, we employ a mixed methods approach. First, we build and analyse a unique dataset of coal units using multiple sources. Second, we contextualize our results by consulting experts in the field.

Our analysis indicates that China, Japan, and South Korea are the primary sources of debt from public banks, particularly for coal units in Vietnam and Indonesia. Meanwhile, private financing mainly originates from European countries, Singapore, and the US. While most companies responsible for developing and operating these plants are from the host countries, many other companies involved in their construction are foreign. We observe that these companies, such as turbine manufacturers and construction contractors, often come from the same country as the banks providing debt to the projects, especially for public institutions. Although our data do not allow for causal interpretations, the interviewees confirm that exporting technology plays an important role for the provision of finance for coal plants as a push factor, alongside demand from host countries as a pull factor. Profits seem to be the primary motivation for technology export, driven by domestic overcapacity in China. The interviews additionally suggest a potential shift towards financing and technology export from coal to natural gas.

2. Methods and data

2.1. Quantitative analysis

Our analysis draws on four distinct databases for different information: (i) the Global Coal Plant Tracker for data on coal units [29], (ii) the World Electric Power Plants Data Base for information on involved companies [30], (iii) the Global Coal Project Finance Tracker for public sector cross-border financing [31], and (iv) the Financers of the Coal Exit List for additional public and private financial commitments [32]. We employ two databases for coal units, as (i) offers more recent and comprehensive information, whereas (ii) includes information on involved companies. The two databases on financing are required because (iii) solely includes information on public cross-border flows from 2013 to 2020, and (iv) comprises cross-border and domestic funding predominantly by private banks from 2016 to 2020. These two datasets overlap concerning cross-border public loans but also include additional transactions. An overview of other available finance datasets [10, 11, 18, 23, 33–36] is provided in the appendix (section I).

Next to the financer, we are interested in the export credit agency (ECA) that provides credit insurance, the sponsor, i.e., the developer of the plant who can own and/or operate the plant and is a subsidiary of the parent company, the manufacturers of turbines, generators, and the steam supply systems, the architect/engineering firm, and the construction contractor. An overview of the companies and examples thereof can be found in table 1.

We have produced a dataset which links financial transactions to unique units by utilizing Python 3.7 for programming, excel for manual matching, and

Table 1. Considered companies. The table provides an overview of the companies we analyse with the number of unique companies and the two largest companies by capacity in our data as examples. The number of unique sponsor parents exceeds that of unique sponsors because the latter is oftentimes a consortium of different (parent) companies. The five companies with the largest allocated capacity for our final dataset can be seen in table S16 in the appendix.

Company	Description	Unique companies	Examples
Private or public bank	Provides loans	216	China Development Bank, Export Import Bank of China
Export credit agency (ECA)	Provides credit insurance	6	Nippon Export and Investment Insurance, Compagnie Francaise d'Assurance pour le Commerce Exterieur
Sponsor	Operator and/or owner of the plant	206	Eskom, PetroVietnam
Sponsor parent	Parent company of the sponsor	233	Eskom, Sumitomo Corp
Turbine manufacturer	Provides the turbine	22	Alstom SA, Doosan
Generator manufacturer	Provides the generator	22	Alstom SA, Toshiba
Steam supply system manufacturer	Provides the steam supply system	26	Doosan, Hitachi Power Europe GmbH
Architect/engineering firm	Designs the plant	68	WBHO Construction Pty Ltd, Shandong No 3 Elec Power Constr Co
Construction contractor	Constructs the plant	81	Shandong No 3 Elec Power Constr Co, Black & Veatch

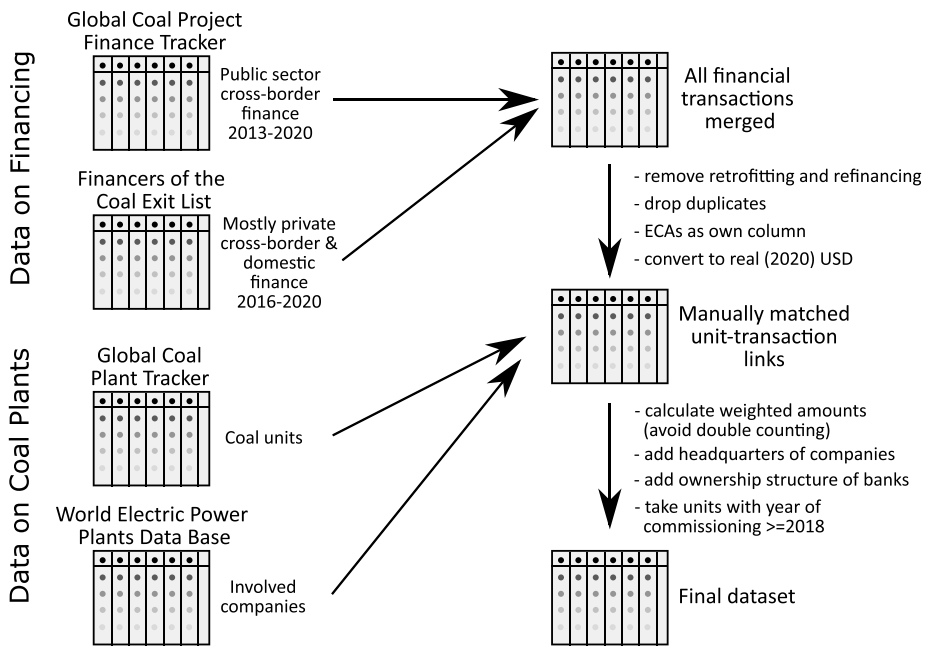

Figure 1. Original data and steps undertaken to create our novel dataset. Data sources: [29–32].

conducting internet searches. The different rigorous steps are shown in figure 1 and explained in detail hereafter.

First, we processed the financing data. We merged all transactions from the two financing databases followed by data cleansing, e.g., removing transactions for retrofitting and refinancing, and dropping duplicates arising from the overlap of the datasets. To ensure an analysis of debt finance, we excluded transactions from ECAs and added the ECAs as credit insurers for the respective units. We converted monetary values to real (2020) USD using the consumer price index published by the International Monetary Fund [37].

Second, we manually matched the financial transactions to power units from the two coal plant datasets, utilizing all the information available in the datasets, e.g., the name of the unit and plant, the year of transaction and commissioning, the name and countries of involved companies, the capacity and others. To support the mapping we browsed different

websites like the Wiki of the Global Energy Monitor [38]. This effort resulted in the creation of a novel dataset with unit-transaction links. It is worth noting that one transaction can be linked to several units of one plant and vice versa. Therefore, the dataset contains more unit-transaction links than unique transactions or units.

Third, we calculated weighted amounts for transactions (USD) and units (MW) to avoid double counting. The total transaction amount for transaction that were matched to several units was split between the units according to their capacity. Likewise, the capacity of units that are included more than once in the dataset was split for each unit-transaction link according to the financing share.

Fourth, we extended and cleansed the dataset. Companies with differing names were manually matched and their countries of origin added by using information provided in the four datasets and internet searches. We define the country of origin as the location of headquarters. Future work could take a closer look into the importance of different sites, e.g. headquarters, sales units, and manufacturing facilities. Our dataset comprises a total of 637 unique companies. For each of the 216 banks, we manually identified ownership structure, i.e., publicly or privately owned.

The above mentioned steps result in a total of 429 unique transactions assigned to 459 distinct units across 204 plants with a combined capacity of 225 GW. The total weighted transaction amount is USD 141 billion. Out of this, USD 104 billion is financed by publicly owned banks, supporting 195 GW, while transactions from the private sector account to USD 36 billion for 30 GW. It is worth noting that financing is almost exclusively debt finance, i.e., loans, with a marginal share of underwriting and some unknown types of finance stemming from the Global Coal Project Finance Tracker.

Finally, we refined the dataset. Specifically, we narrowed our focus to units that are operating, under construction, or permitted, with a year of commissioning of 2018 or later. We chose 2018, two years after the Paris Agreement came into force, as it aligns with the assumed lag of at least two years between financial closure and commissioning of a plant [10]. This is represented in our data, where the financial closure of the vast majority of transactions ranges from 2016 to 2020. The final dataset includes information on 91 GW of coal capacity, out of which 65 GW received cross-border funding, as outlined in table S6 in the appendix.

Based on this final dataset with unit-transaction links, we created one dataset including only unique units, with merged transactions and companies. We also generated separate datasets for each combination of private or public, and domestic or cross-border loans for the analyses.

It should be noted that our novel dataset is not comprehensive. Tables S1–S5 in the appendix outline that we cover around 20% of units with a year of commissioning of 2018 or later. Specifically, we lack financing data for operating plants, in particular those in China, India, and Japan. However, these plants predominantly appear to receive domestic financial support and technology while our analysis focuses on cross-border flows. Additionally, the transactions in 2020 are likely higher than reported in our paper, as our data only cover the first three quarters of 2020. While information on sponsors and their parents is with few exceptions available, this is unfortunately not the case for other companies. Thus, figure 4 illustrates that the origin of companies is unknown for a significant share of capacity.

2.2. Qualitative analysis

The quantitative analysis is supplemented by 11 semi-structured experts interviews conducted in July and August 2021 via zoom, which provides a practical substitute to in person interviews [39]. The 12 interviewed experts have technical, interpretative, or procedural knowledge [40] related to 7 countries. They were identified through our networks in both financing and host countries and work at NGOs (55%), in academia (18%), for private companies (9%), banks (9%), and development cooperation agencies (9%), as shown in table S24 of the appendix. To warrant their anonymity, we held the interviews under the Chatham House Rules and do not state names or positions, referring to the interviews only by numbers such as [i1] or [i4, i7]. All interviews were conducted along the same interview guideline as detailed in the appendix (section Xlll). The guideline requires to first show the quantitative findings followed by a discussion on (i) the robustness of our results, (ii) the political economy mechanisms explaining the interconnection, (iii) implications of the results for the push and pull framework, and (iv) future developments. All interviews were recorded and coded along these four topics. The insights generated from the interviews are used in the Discussion section.

3. Results

This section presents a global analysis of financial support for coal plants, along with an examination of technology export for the construction of coal plants.

3.1. Finance flows

Figure 2 shows the evolution of coal financing since the Paris Agreement. Overall, public and private financial transactions from 2016 to 2020 for coal plants that started operation in 2018 and after amount to USD 80 billion, out of which USD 53 billion is directed overseas. The figure illustrates the debt finance volumes and the share of financial transaction

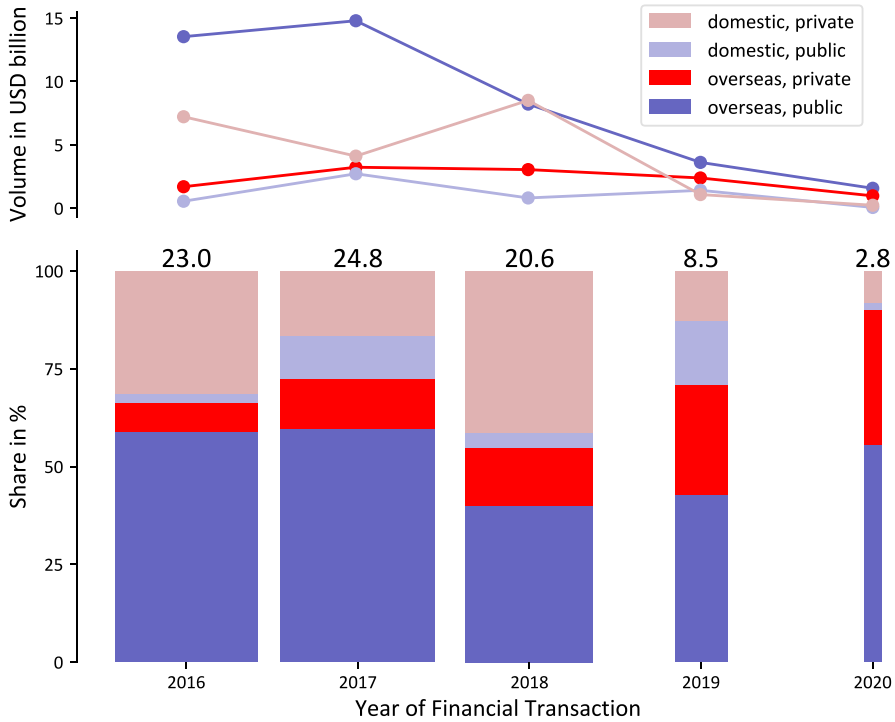

Figure 2. Annual volumes of loans for coal plants. Annual financial commitments split into public and private banks as well as domestic and cross-border flows. The width of each column represents the annual financial volume in USD billion, shown at the top of each bar. The yearly volume of each of the four groups is illustrated in the line chart. Note that this figure only considers data from 2016 to 2020 congruent with one of the financing datasets (see also section 2). For the underlying data see table S7 of the appendix. Data sources: [29–32].

amount by type (private and public) and by destination (domestic and overseas). Notably, both public and private sector financial commitments persisted after the Paris Agreement entered into force in 2016. However, the total volume began to decline in 2017. The downward trend for each of the four groups (domestic private, domestic public, overseas private, and overseas public) can be seen in the line chart. The chart additionally showcases that overseas public funding accounts for over half of total financing in three of the five years. Throughout the entire period, public banks almost exclusively provide debt to coal plants overseas (88%), while private banks primarily support domestic projects (65%).

Figure 3 illustrates cross-border finance flows for 65 GW of coal plant capacity. The left-hand side of the figure shows that financing for these units is largely sourced from China (65%), Japan (18%), and South Korea (9%), primarily from public banks. The remaining financing is distributed among 14 countries. In countries that actively engage in financing coal through public banks, private finance is usually absent, and vice versa. Japan is an exception as the provision of loans from private financial institutions complements that of public entities. Alongside Japan, the primary source of private financing are banks based in Europe, Singapore, and the US.

The right-hand side of figure 3 presents the 22 host countries that receive cross-border funding for coal plants, primarily located in Southeast Asia and Sub-Saharan Africa. Most capacity additions occur in Vietnam (25%) and Indonesia (20%). Coal projects in those two countries receive financial support from many financing countries. By contrast, nine countries, including Turkey and Tanzania, source financing for coal units exclusively from China. Table S12 in the appendix conveys that in ten countries, such as South Africa, Bangladesh, and Botswana, all coal units receive loans from abroad; for Pakistan and Vietnam, the share is slightly lower at 85% and 79%, respectively.

3.2. Technology export

Building upon the overview of global debt finance for coal plants, we investigate the involvement of manufacturers and technical service providers in the coal units that received overseas financing between 2018 and 2020. Of the 65 GW of coal capacity with overseas financing, 59 GW were financed out of China, Japan, and South Korea (first column in figure 4, cf also figure 3). Figure 4 then shows the headquarter locations of the manufacturing and technical service provision companies involved in these deals. Data on these companies is only available for a subset, as shown on top of each bar. ECAs providing credit insurance stem mainly from Japan (10 GW) and France (5 GW). Sponsors and their parent companies are foremost from the host countries (33 GW and

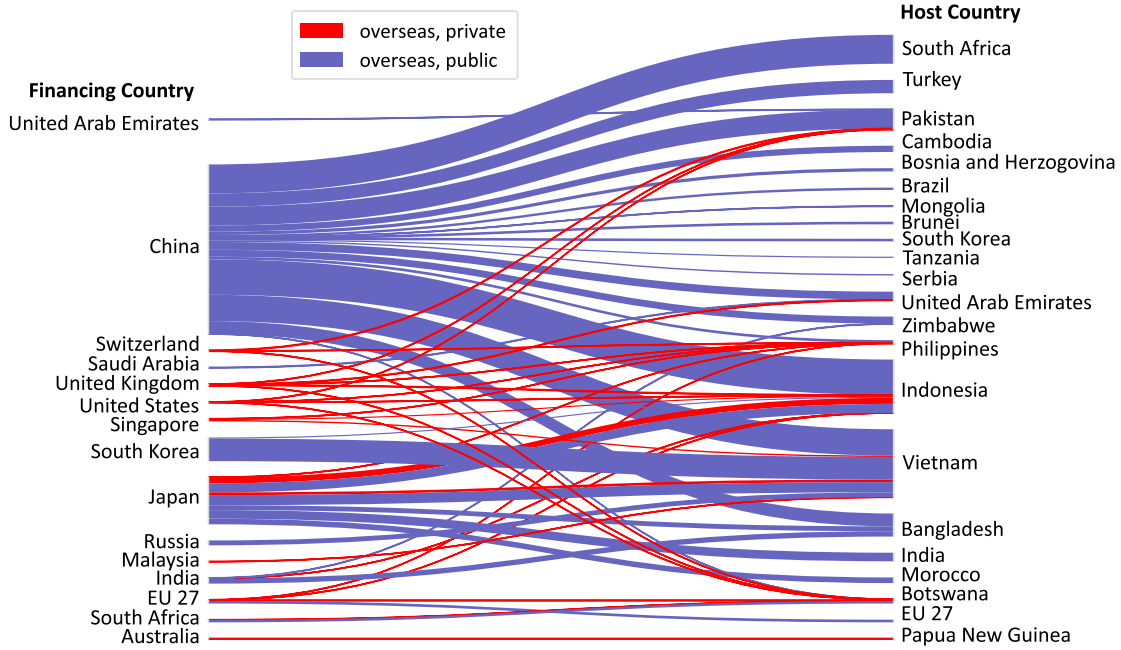

Figure 3. Cross-border flows of funded capacity. Total capacity of units receiving cross-border financing is 65 GW. The capacity of each unit it split between all supporting financing countries according to their share of the financial volume. The countries of the European Union that provide loans for coal plants are Germany, France, and Netherlands, while Greece receives financial support. For the underlying data see table S8 of the appendix. Data sources: [29–32].

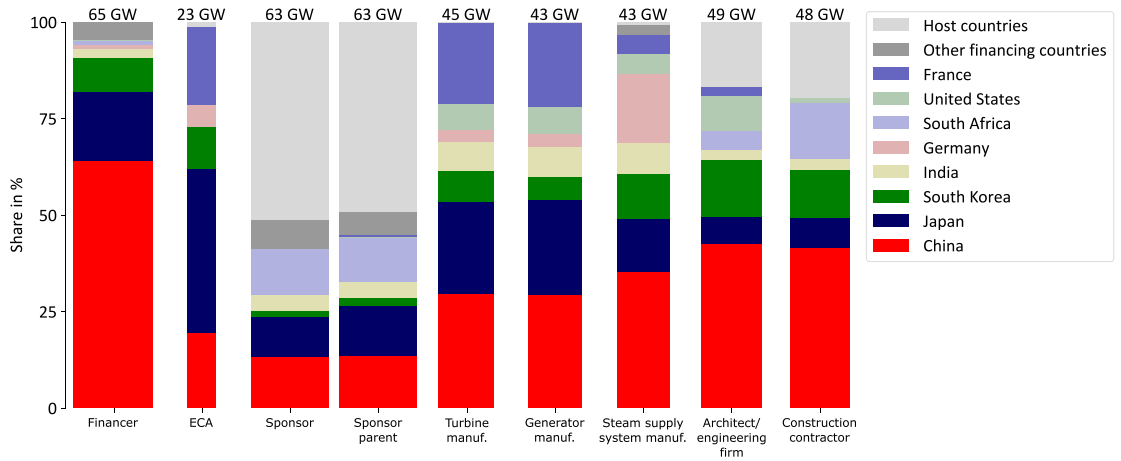

Figure 4. Companies' countries of origin. The graph only considers units that receive cross-border financial support, i.e., 65 GW. The width of each column represents the capacity for that information on the respective companies is available, shown at the top of each bar. All countries that headquarter banks providing loans but not service or equipment providers in a significant amount are grouped in 'Other financing countries'. The units are constructed in the 'Host countries'. An exhaustive table can be found in the appendix table S9. The figure uses data from [29–32].

31 GW, respectively). The manufacturers of turbines and generators for more than 33 GW stem from China, Japan, and France. The origin of companies providing steam supply systems is similar, with additional technology export from Germany (8 GW). The architect/engineering and construction firms for more than 20 GW are from China, the remaining capacity is split by many countries, including the host countries (8 GW and 10 GW, respectively). Some countries, e.g., Singapore, UK, and Switzerland headquarter banks providing loans, but not companies exporting services or equipment. They are grouped in 'Other financing countries'. Figures S1–S4 in the appendix display an overview of the service and technology flows analogous to figure 3. We identify a few countries that play a significant role for the origin of both debt finance *and* equipment and services.

Next we scrutinize the involvement of foreign companies. In a first step, we examine if the companies involved in the construction of a plant, such as turbine manufacturers, are foreign. In a second step, we analyse if the foreign companies identified in the previous step are from the respective financing country.

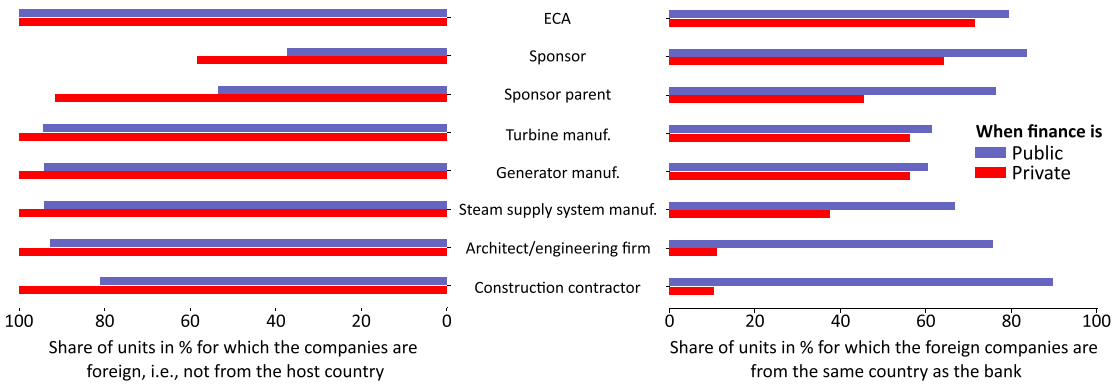

Figure 5. Share of units with foreign companies and companies from the respective financing country. The graph on the left-hand side depicts the share of units for which at least one of the companies is foreign, i.e., from a country other than the host country. Units receiving financial support from both public and private financial institutions are counted twice; units with missing data are omitted. The graph on the right-hand side shows the share of the units identified on the left-hand side with companies from one of the respective unit's financing countries. For example, all units financed with debt from foreign private banks have a foreign turbine manufacturer on the project (visible in the graph on the left-hand side). These foreign turbine manufacturers are for around 60% of the units from the same country as the bank providing loans to the project (right-hand side). We provide more detailed information in tables S10 and S11 in the appendix. Shares are calculated using [29–32].

Figure 5 addresses both of these aspects, differentiating between public and private financing flows.

The left-hand side of figure 5 illustrates the percentage of coal units with foreign manufacturing or service companies. In this context, 'foreign' refers to companies from countries other than the host country, such as, by definition, all ECAs. While a substantial share of sponsors and parent companies are of domestic origin if funded by public banks, i.e., from the country where the unit is built, the vast majority of other involved companies are foreign. The right-hand side of figure 5 examines whether these foreign companies are from the financing country, i.e., if the companies' countries coincide with those of the financial institutions. It shows that, if a company is foreign, it is often from the financing country. Across company types, the likelihood increases to have companies from the financing countries when units are publicly funded. One reason found in our data is that countries such as Switzerland and Singapore headquarter private banks but not manufacturing or service companies. Reasons that relate to the political economy of financing countries are discussed in the Discussion section.

The results suggest that the majority of privately and publicly financed units involve foreign companies. For publicly financed units these companies frequently originate from the same country as the banks providing loans to the project.

We find pronounced differences when comparing the provision of loans and technology across financing countries. For publicly funded units, a high percentage of projects have at least one other company from the respective financing country involved, e.g., China (63%), Japan (100%), South Korea (89%), and South Africa (67%). By contrast, we find few privately funded units with companies from the respective financing country. A notable exception is Japan, where at least one other company from Japan is involved for all units. We discuss the country-specific factors contributing to those differences in the Discussion section.

4. Discussion

Our analysis reveals persistent patterns of coal plant financing and technology exports by financing countries. Here, we discuss our findings, draw on the expert interviews to explore the factors that underlie the findings, examine the implications of the results for recent push and pull frameworks, and discuss potential future developments and policy implications.

What can we learn from the quantitative analysis above? First, it shows that both, public and private financial institutions continued to fund coal plants after the Paris Agreement. Second, the total financial commitments experience a downward trend, both domestically and abroad. Third, banks from China, Japan, and South Korea account for the vast majority of cross-border debt financing. Fourth, most companies providing technologies for the construction of coal plants are from these three countries plus a few others. As a consequence, we do not only find cross-border financial commitments for coal plants, but also substantial technology flows. Fifth, oftentimes the banks—especially when publicly owned—and other companies involved in the construction of coal plants stem from the same country, hinting at the importance of technology export for the provision of loans for coal plants.

This quantitatively identified interconnection between financial involvement and technology export suggests the presence of political economy factors influencing investment decisions. Some factors mentioned by the interviewees relate to the underlying mechanisms, such as that companies responding to a bid have an increased likelihood of winning when securing support from a public bank in advance, and that large technology conglomerates such as from Japan often bring their own (private) financing units, which can offer competitive deals and play a similar role to public banks [i1, i6, i9, i11]. Others are political, such as that governments strategically use their public banks to unlock export business opportunities for the domestic coal industry [i2, i5, i6, i8, i9, i10, i11]. They can do so by securing bilateral investment [i2, i6, i8] [41] and by providing better loan terms when developers use technology from their country [i4, i5, i8, i9, i10, i11] [42].

The role of technology export as a push factor of the provision of debt finance should be viewed in the context of other drivers that have hitherto been identified. Recent scholarship explains the role of both recipient and financing countries with push and pull frameworks [20–23]. Therefore, while technology export to address a saturated domestic market and/or increase profits may serve as a motivation for countries to continue financing coal plants abroad [i2, i8] [20, 22, 25, 28], it is unlikely to be the sole driver behind the ongoing construction of coal plants in general [i5, i8, i11]. The formerly prevailing view that overseas coal investment decisions, particularly from China, are following a top-down strategy has been challenged due to factors such as the lack of human resources in Chinese ministries and agencies [43] and uncertainty regarding the link between investment overseas and the domestic coal sector [i2, i8] [20]. However, the interviewed experts agree that it is difficult to ascertain who initially proposed a project [i5, i6, i8, i11]. It appears that international financing and the preferences of host countries are both important for the construction of coal plants.

The downward trend of financial commitments for coal plants shown in figure 2 is consistent with experts' opinions [i1, i2, i3, i8, i9, i11] and could continue given recent pledges to cease support for coal abroad, including those from China, South Korea, and Japan [44]. However, it remains unclear how these commitments are interpreted and what loopholes will remain [i1, i5]. No overseas energy loans were granted by China's two policy banks in 2021 [45], but in May 2022, a Chinese company signed a contract to provide equipment and services for a coal plant in Laos [46]. Likewise, Japan is believed to still finance coal plants in the pipeline [i1, i5] [47]. Thus, there is no guarantee that these commitments are being adhered to strictly, particularly since the Russian war in Ukraine (and its repercussions on global energy markets) fuelled new interest in fossil energy developments. Some countries are increasingly turning to coal power to reduce dependence on Russian gas [48]. This trend poses a risk to coal (financing) phase-out pledges.

If the current pledges to stop funding coal plants overseas are upheld, industries in financing countries may lose business opportunities abroad, which can lead manufacturers and service providers to retreat to the domestic market. This scenario might already play out in China, where the 2021 announcement to stop building coal overseas is expected to affect the construction of 120 GW of coal capacity in the pipeline [49] and was followed by a surge in permitted domestic coal capacity of 106 GW in 2022, its highest level since 2015 [50]. In China, as in India, coal plants are almost exclusively financed domestically and thus not subject to the pledges. In lieu of retreating to the domestic coal market, companies can diversify their businesses. The interviews reveal that technology providers in South Korea and Japan increasingly invest in and export natural gas infrastructure, owing to the technological similarity of, e.g., turbines and generators [i1, i5, i6, i7, i9, i11] [25]. The outcome appears to be a similar political economy situation for gas as currently for coal: governments support their domestic industry to expand overseas by financing power plants and other gas-related infrastructure overseas [i1, i7, i9, i11] [51, 52]. This trend is particularly important in the current policy context, where African countries invest in gas extraction to meet the rising demand for liquefied natural gas from European countries [53, 54].

Our findings suggest that governments in financing countries should, in addition to reducing public financing for coal and gas projects domestically and abroad while increasing funding for renewables, also consider their domestic industries for energy transitions. Governments can strengthen their domestic low-carbon firms by strategically supporting the export of renewable energy technologies through public investment, as is currently the case for coal. Countries can thus dampen negative short-term effects on their fossil export industries, while reaping long-term benefits if they establish an exporting industry that is aligned with the Paris Agreement.

To manage political economy factors that still make it attractive in host countries to invest in coal, it is crucial to make investments into capital-intensive renewable energy systems more attractive, for example, by reducing the cost of capital [55–57]. Credible policy instruments, such as carbon pricing and renewable energy support mechanisms, can also help to phase out coal and increase the share of renewable energy [28, 58–63]. The international

community can support host countries according to their specific needs. Promising approaches include the Just Energy Transition Partnerships established with South Africa, Indonesia, and Vietnam [64–66]. All three countries currently receive substantial funding for new coal plants (see figure 3). Over the next few years, they will receive loans and grants to close down operating coal units, support affected communities, and enhance their renewable energy capacity. These multilateral endeavours could serve as a blueprint for accelerating just energy transitions tailored to each country's political economy.

5. Conclusion

Building on a novel dataset as well as qualitative interviews, we find that the provision of loans for coal plants, especially from public banks in China, Japan, and South Korea, is closely linked to the export of equipment and services. This pattern can be explained by financing mechanisms and political economy factors, such as countries seeking to unlock export business opportunities for their industry via publicly owned banks. Our findings therefore underscore the importance of considering financing countries and their domestic industries in low-carbon energy transitions. Diminishing business opportunities for coal overseas can be offset by domestic construction, as currently experienced by China. Alternatively, we find that governments, such as in Japan and South Korea, increasingly support the export of natural gas plants and related infrastructure. Given current energy market developments following the Russian attack on Ukraine, there is a threat of investors betting on a short-term gas boom and locking in fossil infrastructure for the decades to come.

Data availability statement

The source data for figures and tables are available in the appendix. We developed scripts for Python 3.7 that are publicly available on GitHub: https://github.com/niccoloMG/Finance_and_technology_export_coal.

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Author contributions

The initial research idea stems from N M, F E, N O, and A S. All authors conceptualized the study including graphs and tables. N M acquired and processed the data and conducted the data analyses including figures and tables. N M and T S conducted the interviews. N M led the writing of the paper, all authors contributed. F E, N O, T S, B S, A S, and J S provided feedback on all previous working steps. All authors discussed and interpreted the results.

Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

ORCID iDs

Niccolò Manych https://orcid.org/0000-0002-2037-9180
Florian Egli https://orcid.org/0000-0001-8617-5175
Nils Ohlendorf https://orcid.org/0000-0001-6629-7255
Tobias S Schmidt https://orcid.org/0000-0002-7971-2187
Bjarne Steffen https://orcid.org/0000-0003-2219-1402
Anna Stünzi https://orcid.org/0000-0002-5854-3126
Jan Christoph Steckel https://orcid.org/0000-0002-5325-9214

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