Accelerating the Speed and Scale of Climate Finance in the Post-Pandemic Context

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Abstract

In this paper, we examine how to trigger a wave of low-carbon investments compatible with the well-below 2°C target of the Paris Agreement in the current post-pandemic context of increasing private and public debt. We argue that one major obstacle to catalyzing global excess savings at sufficient scale and speed on climate mitigation, and to 'greening' economic recovery packages, lies in the up-front risks of low-carbon investment. We then explain why public guarantees should be the preferred risk-sharing instrument to overcome that obstacle. We outline the basic principles of a multilateral sovereign guarantee mechanism able to maximize the leverage effect of public funds and massively redirect global savings towards low-carbon investments, with the double benefit of bridging the infrastructure investment gap in developing countries and reducing tension between developed and developing countries around accelerated funding for low-carbon transitions. We carry out numerical simulations demonstrating how the use of guarantees from AAA-rated sovereigns, calibrated on an agreed-upon 'social value of carbon', is compatible with public-budget constraints of developed countries. In summary, the use of such guarantee mechanisms provides a new form of 'where flexibility', which could turn real-world heterogeneity into a source of reciprocal gains for both developed and developing countries, and contribute to meeting the USD 100 billion + pledge of the Paris Agreement.

Key policy insights

- Catalyzing excess world savings through low-carbon investments (LCIs) would secure a safer and fairer economic recovery from the COVID-19 crisis and avoid locking developing countries into carbon-intensive pathways.
- Public policy instruments focused on creation of public guarantees can reduce the up-front financial risks associated with LCIs, mobilize private money and increase the leverage of public finance.

- A multi-sovereign guarantee mechanism would yield financial support from developed to developing countries in cash grant equivalent and equity inflows two to four times higher than the ‘USD 100 billion and more’ commitment of the Paris Agreement, and provide greater confidence in meeting this commitment equitably and effectively with benefits for all.

Keywords

Climate finance; public guarantees; de-risking; low-carbon investment; post-COVID recovery; 100 billion + pledge

1. Introduction

Recovery from the COVID-19 economic crisis coincides with a pivotal time for climate policies. In 2021, countries are updating their climate action plans for COP26 and preparing for the Global Stocktake of 2023. This may well be the last opportunity for a global agreement able to trigger the wave of low-carbon investments (LCIs) necessary to comply with the Paris Agreement.

The pandemic has depressed the world economy and increased public and private debt. Financial constraints are likely to persist well beyond 2021. Policymakers may only modestly 'green' their 'recovery packages' (Hepburn et al., 2020) without taking collective decisions needed to fulfil Article 2.1(c) of the Paris Agreement (Zamarioli et al., 2021), thereby jeopardizing climate stabilization targets (Forster et al., 2020; Shan et al., 2021).

Our paper shows how a multilateral sovereign guarantee mechanism, preferably in the form of a multilateral sovereign guarantee fund (MSGF), can help avoid these risks by meeting three core requirements as conditions of an effective global climate finance architecture:

- Catalyzing global excess savings at sufficient speed and scale by directing them into LCIs, thus supporting faster and more sustainable recovery paths;
- Securing access to financing for more ambitious nationally determined contributions (NDCs) and aligning the distribution of LCIs with more equitable access to development finance;
- Creating an instrument of trust and reciprocal gains (Ostrom and Walker, 2005) between developed and developing countries, thereby reducing accumulated 'North-South' political tension in climate negotiations (Hourcade et al., 2015).

After identifying the financial constraints of the post-COVID context, we establish why public guarantees are the right instrument to meet the first condition (Section 2), why multilateral sovereign guarantee mechanisms are essential to fulfill the second (Section 3), and, through numerical simulations, why they can yield significant reciprocal gains and address the third condition (Section 4).

2. Climate finance in the post-COVID context

2.1 The climate finance dilemma

The pandemic has caused the deepest recession since WWII, with a 6% decline of global per-capita income in 2020, reaching 8% in developing countries, excluding China (Bulow et al., 2020; OECD, 2021). It has forced countries to undertake unprecedented public spending to fund immediate relief packages, despite falling revenues. A proposal such as a 10-year global 'green stimulus' of about 0.8% of global GDP (about USD 700 billion) annually (IMF, 2020), might be stillborn because of the divergent ability of countries to engage in further debt.

Developed economies are expected to see their total public debt climb from 103% to 125% of their GDP in 2021 (IMF, 2021). They can however implement countercyclical recovery packages (e.g., the EU Green Deal or the USA Biden Rescue Plan) due to deeper domestic financial markets, excess household savings (swelled by stimuli, rising stock markets, and lower consumption), as well as, for some, the control of global reserve currencies. However, the effectiveness of these packages may be undermined if prospects about rising long-term interest rates materialize (ECON Committee, 2020) and higher taxes are needed eventually in a context of domestic inequalities aggravated by the pandemic (Mian, 2020).

Low- and middle-income developing countries (China excluded) face worse odds. Their public debt is expected to increase between 2019 and 2021 from 35% to 50% and 53% to 65% of their GDP, respectively, because of falling commodity exports (WTO, 2020) and remittances, and declining tourism (UNWTO, 2021). Many face pressures on exchange and interest rates because of the plunge in financial inflows, as global capital redirects towards countries perceived as more secure (IMF, 2020; Tiftik and Mahmood, 2020). COVID-19 has lessened confidence in sovereign credit markets for emerging economies (Daehler et al., 2021), widened sovereign spreads by over 500 basis points in 2020 and placed many low-income countries at risk of default.

These divergent prospects undermine global economic recovery. An adequate global response to the COVID-19 crisis could require nearly USD 2 trillion of additional support to developing countries (McKibbin and Vines, 2020). Faced with a 'debt pandemic' in developing countries (Bulow et al., 2020), G20 official creditors have responded with a limited moratorium on government-to-government debt for 73 countries. The IMF has approved USD 650 billion new Special Drawing Rights (SDRs) to increase reserves, but faces the difficulty of devising rules to allocate them to where they are most needed, as current quotas would direct them to developed countries (IMF, 2021).

The scaling-up of LCIs in developing countries could solve this recovery dilemma by targeting debt towards investments in shared objectives. Much of the challenge of ‘unbuilt infrastructure’, which needs to be ‘green’, lies in developing countries. Meeting that challenge is essential for a global recovery based on the infrastructure investment push long advocated for by the IMF (Abiad et al., 2014) and others (Donaldson et al., 2016; Donaldson, 2018). The question is how to unleash this potential through financing that avoids the risk of funding ‘white elephants’ and causing unproductive debt (Albalate et al., 2019).

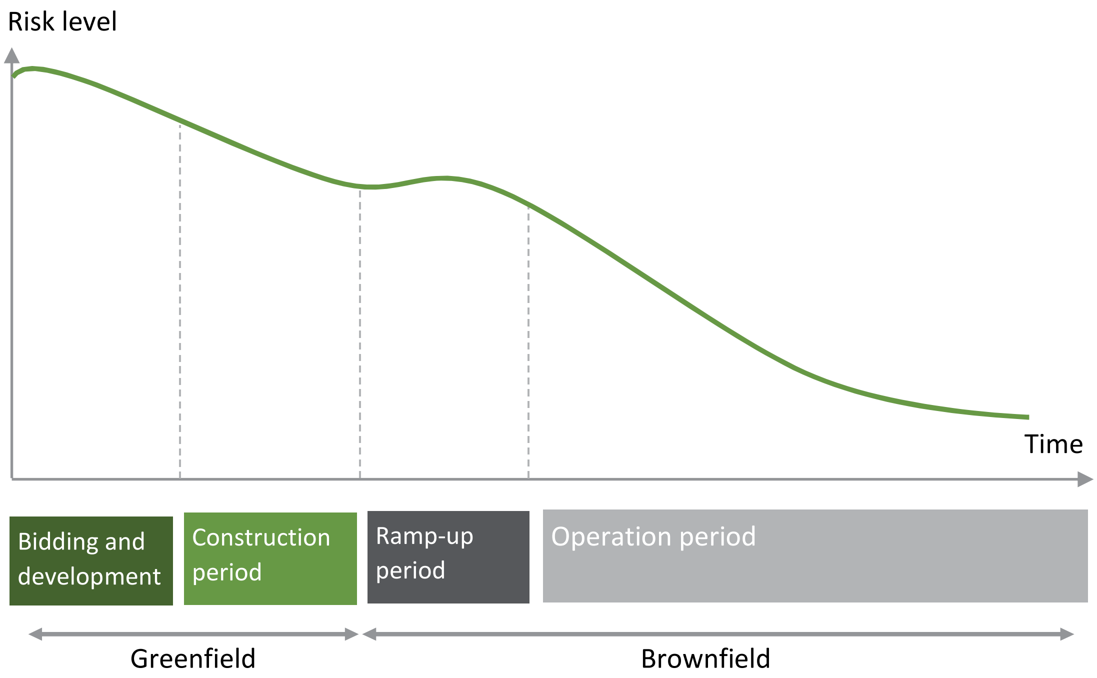
2.2 A structural problem: the infrastructure investment gap

Understanding the ‘green infrastructure’ challenge requires differentiating between investment needs for a well-below 2°C target, their incremental costs and the amounts needed to bridge the infrastructure investment gap (IMF, 2014), especially in developing countries (Gurara et al., 2017). Aggregating energy sector information from Box 4.8 of the IPCC 1.5°C report (IPCC, 2018), the results of Fisch-Romito and Guivarch (2019) on transportation infrastructure and of OECD (2017) for other sectors, suggest global infrastructure investment needs between 3.9% and 8.7% of global GDP over the coming two decades. Incremental costs are much lower (0.34% and 0.94% of GDP) and could be funded by reallocating 1.4% to 3.9% of global savings. Reducing the infrastructure investment gap, projected at 15.9% of investment needs by the Global Infrastructure Hub (2017) and 32% by Arezki et al. (2017) over the next 20 years, is thus as problematic as the low-carbon challenge itself.

This investment gap is not due to global scarcity of funds. It is a consequence of the wedge between propensities to save and invest (Summers, 2015), which causes growth uncertainty and, arguably, secular stagnation (Krugman, 2014; Blanchard, 2019; Summers and Rachel, 2019). On the supply side of financing, this wedge arises from risk aversion of financial intermediaries, who prioritize liquid investments or real estate assets, with USD 17 trillion in safe but negative-earning assets (Bloomberg, 2020). On the demand side, it originates in a pipeline of investment proposals much lower than the volume of economically viable projects (de Gouvello and Zelenko, 2010; Timilsina et al., 2010). This is a microeconomic paradox since infrastructure investments have real returns of 4% to 8% (Bhattacharya et al., 2015), much higher than the current low interest rates.

The reason why investors do not tap what the IMF (Abiad et al., 2014) calls 'free lunch' opportunities lies in the risk time-profile of infrastructure projects (Figure 1).

Figure 1 Risk profile of infrastructure project development



Source: World Economic Forum. The figure ignores political and regulatory risks, especially pregnant in the brownfield stage.

Risks are highest in the bidding and development phases when project initiators commit equity financing. Primarily transactional, they stem from uncertainties about the permitting process and environmental reviews, difficulties in raising pre-funding from credible partners, and threats of contract renegotiation (Bayat-Renoux et al., 2020). They remain high in the construction period for less mature and more capital-intensive low-carbon options since surprises occur on equipment costs and performance, placing developers under threat of large creditworthiness losses. Such 'up-front risks' deter investment. They are particularly high for smaller projects in unfamiliar geographies and with fragmented financing windows, uncertain governance landscapes, and limited project preparation expertise. These risks make capital costs higher in developing countries (UNDP, 2014), which exacerbates the investment gap (Ameli et al. 2021), especially in the post-pandemic period where there are a growing number of countries with low creditworthiness (BFT, 2018a).

2.3 Sovereign guarantees as de-risking instruments

Literature suggests several reasons why existing policy tools cannot overcome such up-front barriers. For example, carbon prices do 'reward' LCIs but only indirectly by penalizing carbon-intensive alternatives, and in later periods.[1] Only carbon prices at very high levels (USD 50-100 per ton CO_2 by 2030 climbing to USD 200-450 by 2050 (Stiglitz et al., 2017)) could equate the risk-weighted marginal

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[1] This explains partly the low leverage of the Clean Development Mechanism of the Kyoto Protocol (Maclean et al., 2008; Ward et al., 2009; MDB, 2019).

costs of LCIs to that of conventional options (Hirth and Steckel, 2016; Iyer et al., 2015; Schmidt, 2014). Such levels face serious implementation issues because of their distributional consequences.

Other policies, such as public grants and subsidies, can address de-risking needs but are constrained by budgetary spending limits and low leverage on private investment (ODI, 2019). Guaranteed feed-in tariffs and long-term renewable power purchase agreements also provide benefits, but only in later operation periods and entail risks of losing control of public costs (Bhattacharya et al., 2016; Lecuyer and Quirion, 2013). Insurance mechanisms operate with trigger conditions that reintroduce uncertainty for financial returns. For example, the Multilateral Investment Guarantee Agency (MIGA) protects cross-border investments from sovereign risk (currency restriction, war, civil disturbances, expropriation), but not from project risks.

One lesson from agency theory (Holmstrom, 1979; Mirrlees, 1999) is that the optimal contract between the Principal (pursuing some collective goal) and the Agent (making in-field decisions) involves trading off incentives and risk-sharing with robust financial institutions. Since public budgets are risk bearers of the last-resort, risk-sharing mechanisms for LCIs must both cover the projects' early phases and maximize the efficacy of any public funding spent.

These policy challenges explain why public guarantees have attracted growing attention in climate finance (Hourcade et al., 2012; Lee et al., 2018; Schiff and Dithrich, 2017), and why the Blended Finance Taskforce (BFT, 2018b) and the OECD-DAC community (OECD-DAC, 2021) recently promoted their scaling-up.

Public guarantees have the double superiority of broad risk coverage because they can be made neutral vis-à-vis different types of risk and, from a fiscal viewpoint, of only being paid out in case of default. They appear in guarantors' books as contingent liabilities at less than 100% their face values, based on expected default probabilities. Moreover, the leverage effects of public guarantees (total investments enabled per unit of effective public cost) are high, because guarantees cover only part of total risks, with private equity and loans carrying the remaining risks, and because expected default rates on such projects are generally low. Even assuming a 25% expected default rate, the leverage effect of one unit of public cost on a portfolio of enabled LCIs could exceed 8.[2] High-risk projects in small and medium enterprises guarantee portfolios in Africa exhibited a low 2.4% default rate over the period 1999-2017 (USAID, 2017). Most default rates over long periods are in the 2%-7% range, which in turn yield very high leverage, typically of 15-20 times the public guarantee costs, as in the EU (see below).

[2] If e is the private equity share of some investment portfolio I, g the share of private loans in the portfolio covered by public guarantee and r the percentage of the guarantee appearing as a liability covering expected default on the guarantor's book, the guarantee's public cost is $r\ (1-e)\ g\ I$. For example, if the equity share is 30% and the share of loans guaranteed is 70%, then the extent of risk carried by the guarantee fund is 49% of total investments ($(1-e)g = 0.7 \times 0.7$) and even setting the expected default rate at 25%, the total public cost of the guarantee is a small share of total investment ($0.49 \times 0.25 = 0.1225$) and the leverage effect is as high as 8. We abstract here from a more complete model that accounts for residual value of restructured investments (accruing to the guarantor and lenders in seniority and not equity holders) in case a default occurs.

Public guarantees have historically been a primary form of financial backing to projects of public interest with high returns but perceived as too risky for financial markets[3] — e.g., rail transport, the Suez Canal, electrification, nuclear power, mobile telephony licensing, and even the recent COVID-19 vaccines (Bloom et al., 2021). They are also used in fossil fuel extractive sectors.[4] Guarantees are crucial to attract institutional investors and mobilize commercial banks (Gropp et al., 2013) when projects lack established track records and present high financial risks at early stages of development.

However, sovereign guarantees at scale have been restricted to national or economically integrated regional settings. For example, the European Fund for Strategic Investments (EFSI), which started in 2017 as part of the Investment Plan for Europe, has dramatically scaled up investments to EUR 547 billion, with public guarantees of about EUR 26 billion from the EU and EUR 7.5 billion from the European Investment Bank's (EIB) own capital. Such figures point to a multiplier above 16. During the pandemic, sovereign guarantees were scaled up to USD 800 billion in the USA (Cares Act) and EUR 1.5 trillion in the EU, covering 70-100% of new loans (Falagiarda et al., 2020).

In contrast, sovereign guarantees play only a limited role in cross-border financing to developing countries other than China (IMF, 2021). Blended operations — generally poorly defined and tracked (Pereira, 2017; Attridge et al., 2019; Basile et al. 2018, Anderson et al., 2019) — and especially those with guarantees, remain a tiny share of official bilateral finance, e.g., 4% of EuropeAid allocations from 2007 to 2013 (Lundsgaarde, 2017). The European Fund for Sustainable Development recently increased guarantee funds by about EUR 5.1 billion for climate investments but reoriented them to the health sector (Gavas and Pleeck, 2021). USAID has long operated an efficient but small guarantee program in sub-Saharan Africa. From 2004-2015, all major Multilateral Development Banks (MDBs), including MIGA, covered 4.4% of their total financing with guarantees (MDB, 2016). Their prudent use of guarantees is rooted in their charters (IEG World Bank, 2009), which require counter-indemnities by host governments and capital provisioning of guarantees at 100% face value to maintain their AAA credit ratings (Humphrey, 2017; Bandura and Ramanujam, 2019; dos Santos and Kearney, 2018). Moreover, because guarantees are not eligible official development assistance (ODA) (Garbacz et al., 2021), only partial risk guarantees are permitted by the International Development Association for low-income countries and bilateral agencies remain averse to their use. Sovereign guarantees might circumvent this obstacle, but their use in overseas aid-based finance confronts a mixture of historic agency inertia, perceived loss of control over use of funds (compared to direct project-based financing), and the politics of fiscal accountability at home.

To break this glass ceiling, many proposals for multilateral guarantees and funding instruments have emerged: Green Climate Fund (GCF) grounded on new SDRs (Bredenkamp and Pattillo, 2010), Green

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[3] Direct public funding is necessary when returns are low (grants for non-marketable services) or when targeting finance directly to investors rather than intermediaries is more efficient (R&D funding) (Whitney, 2020; Geddes et al., 2020).

[4] For example, in 2020 the Total group secured a USD 15 billion loan for a LNG train in Mozambique, the largest project financing for sub-Saharan Africa (Financial Times, July 16, 2020). One-third was guaranteed by the Export-Import Bank of the US, one-quarter by the Japan Bank for International Cooperation and the rest by the African Development Bank and others, including Indian State-owned oil and gas majors.

Infrastructure Funds (de Gouvello and Zelenko, 2010; Studart and Gallagher, 2015), Enhanced Green MIGA (Déau and Touati, 2017), guarantee funds to bridge the infrastructure investment gap (Arezki et al., 2017), and multi-sovereign guarantee mechanism (Dasgupta et al., 2019).

These proposals have in common the credibility-enhancing effect of multilateral arrangements on capital markets: robust, transparent, and accountable selection rules to surmount the suspicion of political bias (which often characterizes bilateral arrangements). They overcome the unfamiliarity of national public administrations, who favor annual budgetary commitments over multi-year obligations, and face difficulties with legislative approval and tax-payers' fiscal conservatism (Peltzman, 1992; Lowry et al., 1998; Alesina et al., 2013; Borge et al., 2020).

3. Principles of a multi-sovereign guarantee mechanism

By 'multi-sovereign guarantee mechanism' we mean a financial architecture that relies on public guarantees backed by sovereigns to accelerate LCIs in developing countries, i.e., achieve scaled-up collective climate targets at least economic cost. The mechanism's primary goal is to facilitate access to guarantees from multiple public sources (sovereigns, multilateral financial institutions, bilateral agencies and development banks) for a range of possible uses (single projects, multiple projects in different sectors and multi-year-sector programs).

We designate a 'multi-sovereign guarantee fund' (MSGF) as the financing instrument established, funded and owned by participating developed and developing countries and multilateral financial institutions, which serves as the primary operational tool of the multi-sovereign mechanism. The MSGF has to be carefully designed to:

- Expand developing countries' access to global capital markets at lower cost and longer maturities with the backing of highly credit-worthy — AAA-AA — guarantors.
- Ensure investment projects' environmental and development integrity through credible selection procedures at low transaction costs.
- Accelerate emergence of low-carbon assets, liquid enough to attract institutional investors.
- Reduce fragmentation of climate finance and help MDBs, the GCF, and other UNFCCC institutions to finance smaller-scale projects with National Development Banks (NDBs).
- Solve a decentralization problem: contrary to historical precedents of systemic technological change involving one major technological breakthrough, the low-carbon transition involves many technical and technological changes in multiple sectors and geographies.

3.1 A guarantee mechanism based on three pillars

The three pillars of a guarantee mechanism required to achieve the above goals are to ensure: (1) additionality of supported projects; (2) efficient carbon abatement incentives, even in the absence of or slow progress on a world carbon price; and (3) powerful credit enhancement from the perspective of capital markets, including large institutional investors.

3.1.1 Securing projects' additionality, efficiency and creditworthiness

Additionality, in the context of guarantees, can be defined in three forms (OECD, 2016): financial additionality (better access to finance at lower cost), mitigation additionality (greater avoided greenhouse gas emissions) and development additionality (larger catalytic impacts on broader development goals). Development additionality, because it includes a diversity of social and economic benefits in the specific context of a country's sustainable development goals (SDGs), appropriately has to provide priority to projects identified by countries in their NDCs under the Paris Agreement.

The financial and mitigation additionalities are intertwined. The benefits of sovereign guarantees will not materialize if funded projects have significant probabilities of default. They will also not materialize if projects generate windfall profits, i.e., would have been undertaken anyway. The quality of project selection is thus critical, and maximization of the avoided carbon emissions provides a useful metric to avoid moral hazard.

One lesson from the Clean Development Mechanism (CDM) and other programs, is that the proof of such additionality contributes significantly to up-front project risks and adds transaction costs (Shishlov and Bellassen, 2012) that can deter proposals. It is thus essential to develop evidence-based standardized assessment methods to lower transaction costs, while ensuring that selected projects provide financial, environmental and development additionality (expected statistically), in the context of imperfect ex-ante information on each project (Hourcade et al. 1992).

A multilateral mechanism might offer an appropriate setting to start with clear 'scorecards' of mitigation additionality benefits (Garbacz et al., 2021). Standardized assessment methods could mobilize additional information from peer-reviewed modeling exercises to determine the upper and lower bounds of expected carbon emission abatement by types of projects in specific countries or regions. When warranted, third-party expert bodies could be responsible for complementing that information with local knowledge and weighting of performance estimates (with uncertainty coefficients) to calibrate the selection of projects and the extent of guarantees (BFT, 2018a).

The challenge is to establish a strong learning-by-doing and evaluation process, capitalizing on ex-ante and ex-post information by classes, types and policy-settings of projects, and improving the scientific assessment methods over time. Standards could be set more stringent at inception of the MSGF and gain greater flexibility with experience. As in the case of solar renewables, the best outcome is if private, cross-border LCIs gain scale and lower costs, with a declining need for multilateral guarantees, freeing up MSGF capacity to engage with a larger pool of more difficult projects and sectors (e.g., transport infrastructure or forestry).

3.1.2 Calibrating guarantees on social values of carbon

Calibrating guarantees on an agreed-upon notional value (Stiglitz et al., 2017) of the avoided ton of emissions would improve the economic efficiency of the portfolio of funded projects. This value should express the "social, economic, and environmental value of mitigation actions [and] their co-benefits" (Article 108 of the Paris Agreement decision). The 'Social Value of Mitigation Action' (SVMA) of a project could be set at the discounted value over the project's lifetime of the marginal cost trajectories of meeting the 2°C target, where the marginal cost is interpreted as the global Social Value of Carbon (SVC) (Table 1).

Host countries willing to complement the multilateral guarantees by domestic ones could select national SVC trajectories representing their willingness to pay for mitigation, considering development co-benefits (e.g., the Indian SVC of Table 1).

Table 1 Trajectories of global and Indian SVC

2016 USD per metric ton CO_2-equivalent	Global SVC Lower bound	Global SVC Upper bound	Indian SVC
2020	39	66	22
2030	68	154	55
2050	154	286	116
2100	1,078	2,530	-

Sources: IPCC (2014) for the global SVC of a 2°C objective, summing up 900 SVC trajectories with optimistic (lower bound) and pessimistic (higher bound) takes on technical change. Shukla et al. (2015) for the Indian SVC, with currency conversion by the authors.

Because SVCs rise sharply over time, calibrating guarantees on SVMAs would counterbalance the adverse effect of discounting the value of long-duration infrastructure projects. For both the upper and lower bounds of the above SVC trajectories, the SVMA of 40-year projects with 3% discounting is higher than that of 10-year projects of identical mitigation performance (Table 2). Even 5% discounting does not significantly penalize longer-term projects.

Table 2 SVMAs as net discounted values of SVCs

SVMA of project in 2016 USD	With global SVC at lower bound		With global SVC at higher bound		With Indian SVC
Discount rate	5%	3%	5%	3%	7%
10-year project	36.7	39.2	73.5	79.1	10.5
20-year project	36.5	41.3	75.8	86.1	7.4
30-year project	35.6	42.5	72.3	86.1	5.1
40-year project	34.3	43.5	68.8	85	

Notes: The table displays the discounted values of projects abating one metric ton of CO_2 over increasing durations, based on the SVC trajectories of Table 1. Global discount rate reflects average 3% growth rates augmented from pure time preference at 2% (Nordhaus, 2008) or 'almost' zero (Stern, 2007). The Indian rate combines 5% growth and 2% pure time preference.

3.1.3 Creditworthiness enhancement with AAA-AA guarantees

Backing LCIs with AAA-AA-rated guarantees would help projects secure better financing terms by reducing their interest rate spreads and costs of debt, increasing the maturity of debt, and lowering the high transaction costs otherwise associated with combining and rolling over several shorter-maturity loans. In 2019 and for 10-year loans, the interest rate spreads of public bonds to the US Libor rate added financial costs of 2.5%, 3.5%, and 9% for BBB-, BB- and B-rated countries, respectively (see Supplementary Material (SM), Section 4, hereafter 'SM-4'). Countries rated C or 'unrated' had difficulties raising finance on terms longer than even two years, even at high interest rates. The situation has deteriorated since.

Important gains can thus be expected from the reduction of interest payments with multilateral sovereign guarantees. However, this raises a macro-creditworthiness problem for host countries, since any foreign loan or bond will first be recorded as national debt. This might deprive them of the capacity to issue loans in national currency. Some might even refuse to take on the risks of new debt. In addition to benefiting the selected projects, the credibility enhancement coming from multilateral guarantees will thus contribute to persuade rating agencies that the new debt is justified by expected economic and fiscal gains from induced growth, to establish the built infrastructure's value as collateral, and, ultimately, to the emergence of climate remediation assets (Section 3.3).

3.2 Credible pre-commitments and hedges against early exit

A critical requirement of the credibility of a multi-sovereign mechanism is to minimize the risk of partners reneging on commitments because of changes in political orientation or adverse shocks to public budgets.

Host countries have built-in incentives to respect their climate policy commitments to safeguard projects' viability and their access to continued external support. For guarantors, well-designed pre-commitments are needed to make project exit costly. Countries can commit to guarantee capital in two forms: 'paid-in' capital, i.e., up-front payments to a guarantee fund, and 'callable' capital, i.e., commitment to payments of future funding should the need arise.[5] Paid-in capital can be provided to either a national public guarantee fund or an international MSGF. The latter has several advantages (Dasgupta et al., 2019):

- A higher leverage effect of public funds: We showed that projects involving 70% private loans with public guarantees covering 70% of those loans produce a leverage of about 8 times the public capital provisioned to cover defaults (Section 2.3). Assuming that this provisioning is further distributed in equal parts between the paid-in capital and the callable capital, only half the guarantees remain as liability since the 'paid-in' capital appears on the asset side of guarantors' books as shares in the MSGF. The leverage effect then doubles from 8 to 16 (see SM-2).
- A capitalization dynamic: The MSGF capital will also increase with the revenues of operational guarantee charges and the returns on capital funds. Thanks to this dynamic, the equity value of the MSGF in guarantors' books will increase over time and make exit less attractive.
- A credible front-line buffer to payment defaults: The MSGF would have the capacity to satisfy guarantees within one to two weeks, in-line with usual contractual deadlines, when called, because it would be capitalized independently of annual public budgets and would avoid the necessity of negotiating new capital injections on a project-by-project basis as the program expands.

3.3 From de-risking to climate remediation assets

If up-front de-risking of LCIs via a MSGF is the basis of a climate-friendly financial architecture, the emergence of new climate asset classes is its vault key. Without such assets, institutional investors will likely not extend their financial backing to 15-20-year term projects, instead holding to their usual preference for 5-8-year terms, and will continue favoring otherwise more secure investments, equities, and assets (Bolton et al., 2011).

The credibility enhancing effect of multi-sovereign guarantees would facilitate the bundling, securitization, and repackaging in standardized liquid financial form of LCIs that can address asset managers' calls for investments over USD 100 million in diversified asset pools (Andersson et al., 2016; Arezki et al., 2016; BFT, 2018a). The MSGF could also incentivize other guaranteeing entities to build

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[5] 'Callable' commitments have been used in the European Stabilization Mechanism (Cotterill, 2011) and most multilateral financial institutions.

platforms or pipelines (Arezki et al., 2017) for new forms of private-public partnerships adapted to diverse sectors and geographies (Déau and Touati, 2017).[6]

As it gains market credibility, the MSGF could eventually issue formal 'climate remediation assets' (CRAs) with pre-established face values. CRAs could represent global offset opportunities for carbon-intensive firms as carbon prices progressively rise and could be made tradeable under Article 6 of the Paris Agreement. Project developers could use them to reimburse part of their debt or keep them on their balance sheets to lower their weighted average capital costs (Aglietta et al., 2015). CRAs would encourage better project management, as they would be issued upon project success. Banks and institutional investors could also accept repayment in CRAs if central banks started using them in interbank payments and to fulfill liquidity requirements under Basel III rules (Sirkis et al., 2015).

4. Reciprocal gains of meeting the USD 100 billion + pledge

The potential for the MSGF to establish greater trust, benefiting both guarantor and host countries in the post-COVID context, ultimately depends on its ability to deliver on the 'USD 100 billion per year' Copenhagen pledge of support to developing countries. To note, more recently this pledge was confirmed as floor to post-2025 action by the Paris Agreement (UNFCCC, 2015, paragraph 53).

To assess this possibility, we use numerical exercises, described in SM. These rest on six 2°C-compatible investment pathways from four integrated assessment models, the IEA and the OECD (SM-1). They provide a range of required energy and transport investments between USD 4.8 and 5.9 trillion annually from 2016-2035.[7] Of that total, LCIs amount to between USD 1.4 and 3.2 trillion annually, for an average of USD 2.1 trillion consistent with the IPCC and other sources (IPCC, 2018; Andrijevic et al., 2020). The specific share of required LCIs in developing countries ranges from USD 855 to 2,020 billion annually (SM-1, Table 1).

[6] An example is the not-yet-materialized proposal by the European Investment Bank (2014) of a Renewable Energy Platform for Institutional Investors (REPIN). The proposal envisions returns on investment closer to those of private equity than to those from long-term infrastructure, which suggests the interest of multi-sovereign guarantees. The African Development Bank has issued a similar proposal (https://platform.africainvestmentforum.com/) to advance projects under the Africa Investment Forum.

[7] More recent estimates for more ambitious scenarios were unavailable at the time of our analyses.

4.1 Gains to host countries: going beyond the Paris pledge

Accounting for the ''USD 100 billion +" pledge is contentious, especially as it relates to cross-border bank loans or bonds. However, our proposed mechanism includes two types of financial benefits that arguably fulfill it: the direct equity share of LCI by foreign investors, and the 'cash grant equivalent' of accessing better financing terms as a result of the guarantees (Section 3.1.3).

Countries treat foreign equity inflows preferentially to debt because only part of profits are systematically repatriated and, unlike outflows for debt service, this only occurs when successful projects have yielded local co-benefits (services, taxes, jobs, and technology transfers). These inflows are a significant part of the additional equity investment (AEI), which represents 30% of total LCIs in our estimates, i.e., USD 128 to 303 billion annually (see SM-1).

The calculation of the potential cash grant equivalent of guarantees (CGEG) benefitting host countries is less straightforward. We stylize the mechanisms at play assuming that 10-year maturity loans support all LCIs and that access to MSGF guarantees reduces the spread over US Treasury interest rates and lender fees (SM-4, Table 6). The resulting interest rate reductions (Table 3, first column) are consistent and comparable with the 50-500 basis-point reductions observed for projects with partial credit guarantees (Winpenny, 2005).

Table 3 Annual average Additional Equity Investment (AEI) and Cash Grant Equivalent of Guarantees (CGEG) benefiting G77 countries over 20 years

Country sov. credit rating	Rate reduction (bps)	Share of G77 LCI	Lower LCI bound AEI	/ CGEG	Upper LCI bound AEI	/ CGEG	Share of G77 CGEG	Share of G77 GDP
A	-123	6%	7	2	17	4	2%	64%
BBB	-175	40%	52	15	122	36	18%	19%
BB	-245	26%	33	13	77	31	15%	8%
B	-630	21%	27	28	63	67	33%	6%
C and below	-1,525	7%	10	27	23	64	32%	3%
Total annual average (billion 2017 USD)			128	85	303	202		

Source: authors' computation (see SM-4). Bps is basis points. AEI totals correspond to the 30% of LCIs covered by equity and self-financing. They are distributed as LCI. The three 'Share' columns report the shares of rating groups in total G77 LCI (approximated by their shares in GDP after exclusion of 95% of GDP of A-rated countries), CGEG, and GDP. GDP calculations exclude Cuba, North Korea, Iran, Syria, and Venezuela for geopolitical reasons.

Such interest rate reductions would set the CGEG at USD 85 to 202 billion annually (Table 3). Adding AEI, the MSGF would largely overshoot the USD 100 billion + annual pledge objective. One equally important result is that its driving mechanisms would contribute to a just transition. Assuming that

LCIs are distributed across countries proportionally to GDP (except those A-rated),[8] countries rated B or below, which are primarily low-income and highly indebted countries, would receive shares of total AEI and CGEG significantly greater than their GDP shares. The lower the countries' creditworthiness, the higher their gains from guarantees. Specifically, B- and C-(and-below-) rated countries would receive about 33% and 32% of the CGEG respectively, whereas their GDP shares are only 6% and 3%. Are there enough high-return economic projects in such countries? An accelerated low-carbon energy access program, primarily in sub-Saharan Africa, is estimated to have unmet USD 50 billion annual investment needs (for one billion people) with very high rates of economic returns, and would eliminate massive burning of biomass and deforestation (Nathwani and Kammen, 2019).

4.2 Gains to guarantor countries from a public finance viewpoint

Notwithstanding its appeal to host countries, the establishment of a MSGF is subject to acceptance by guarantor countries of its net fiscal costs, i.e., its gross fiscal costs (paid-in capital, cash payments to cover defaults and provisions for callable capital), net of the asset value of the MSGF and of the fiscal revenues from exports induced by the funded LCIs. These costs and benefits depend on seven parameters:

- Volumes and time profile of LCIs;
- Rate of return on MSGF capital;
- Guarantee charges covering the operational costs of the MSGF;
- Default rate of guaranteed projects;
- Ratio (a function of risk perception) of the guarantee capital to the amount of the guarantee;
- Amortization rate of the provisions for callable capital;
- Export multiplier, which describes the activity induced by exports associated with LCIs.

In SM-3, we explore the net fiscal costs faced by guarantors under the assumption that firms invest in half the LCIs and that 30% of their investments are funded through equity and self-financing. Thus, bank loans or bonds will need to cover 35% of the total LCIs required in developing countries to reach Paris goals, or between USD 299 and 707 billion annual financial support.[9] Would these large loans backed by MSGF be fiscally costly? From 48 numerical simulations combining contrasting assumptions on the above-noted 7 parameters of the MGSF (SM-3), we derive three results.

Firstly, the MSGF will very likely positively impact guarantors' accounts, thanks to the tax revenues from exports generated by LCI projects and their induced economic activity. An import content of LCIs of 10.5% is enough to offset the gross fiscal cost of guarantees of any portfolio of projects, even assuming high paid-in and callable capital implied by high risk perception as well as an effective 10%

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[8] Countries like China, Singapore, South Korea and Middle East oil exporters do not face the financial constraints of most developing countries. We considered that only 5% of their LCIs, for example in remote regions, will generate demand for foreign guarantees. We also excluded countries 'closed' for geopolitical reasons (SM-4).

[9] $50\% \times (1 - 30\%) = 35\%$ of the USD 855 to 2020 billion LCIs in developing countries.

default rate.[10] This is far below the 35% to 40% export content of typical infrastructure projects in developing countries.[11]

Secondly, starting with higher initial funding of the MSGF has benefits. Accepting higher gross fiscal costs over the first commitment period allows, thanks to capitalization of the MSGF, significantly lower paid-ins in the long term and lower gross public costs net of MSGF asset value (notwithstanding the export multiplier effect).[12] A slower start may be politically more palatable, requiring e.g., a modest 1.6 to 4.3 cents per liter tax on oil products in OECD countries to finance it, versus 2.4 to 6.2 cents under higher initial funding.[13] But it leads to 59% to 92% higher paid-in capital in the last period and, over twenty years, a net fiscal cost USD 21 to 145 billion higher than under the initially higher (linear) path.

Lastly, the MSGF turns out to be far 'fiscally superior' to alternative investment incentives. Our numerical exercises (see SM-3) assess the gross public cost of guaranteeing the required USD 8.6 to 20.2 trillion LCIs over 20 years (half the total LCIs in developing countries) at USD 0.5 to 1.6 trillion.[14] Such spending would only raise USD 0.6 to 2.2 trillion LCIs through conventional grants with an optimistic 1.4 leverage ratio.

4.3 Aligned climate and post-pandemic recovery benefits worldwide

If the above potentials materialize, a MSGF could contribute to a worldwide sustainable economic recovery by helping developing countries to escape their creditworthiness trap in the post-COVID context. In addition, the emergence of CRAs would contribute to their macroeconomic creditworthiness[15] and could help the issuance of SDRs meaningfully targeted to LCIs.

Another short-term development benefit would accrue from the scaling-up of adaptation investments, primarily in low-income countries. Crowding-in private finance on mitigation would indeed lower the need for direct funding by development agencies (85% of their resources currently go to mitigation),

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[10] See SM-5 for computational detail.

[11] The likelihood of net fiscal benefit is increased by MSGF capitalization, which would reach USD 87 to 1,104 billion after 20 years, bringing gross fiscal costs to between USD 600 million and 804 billion. The breadth of this range stems from the contrasted nature of assumptions backing our 48 tests (see SM-3). The close-to-zero lower bound stands for linearly increasing LCIs, a decreasing default rate and risk perception remaining high at 25% throughout the horizon (which maximizes the size of the MSGF).

[12] For 20-year totals of USD $855 \times 20 = 17\,100$ billion to USD $2020 \times 20 = 40\,400$ billion, LCIs starting slowly and scaling-up exponentially induce USD 36 to 94 billion of cumulated gross public costs over the first five years, compared with USD 52 to 136 billion for LCIs rising linearly (see SM-3).

[13] Authors' computation on World Development Indicators (The World Bank) data.

[14] The range is that of the 24 tests of SM-3 that assume the higher bound of risk perception (25%).

[15] This emergence is of importance for oil and gas-exporting countries to facilitate the reinvestment of fossil fuel rents in directions accelerating their economic diversification.

thereby releasing public resources for grant-based adaptation and other non-market based sustainability objectives.

Strategically, calibrating guarantees on a notional carbon value at levels unreachable by effective carbon pricing, would organize a new form of 'where flexibility' by supporting projects where the costs of emission reductions are lowest, while allowing countries, with full sovereignty, to align reinforced NDCs with their SDGs. High notional values could be agreed upon during the early stages of post-pandemic recovery because they do not hurt capital stocks. Rather, they open access to new financing facilities. They would improve the acceptability of future carbon taxes by increasing the amount of LCIs for a given carbon price and accelerate their scaling-up after the slow start recommended by the IMF over the short term (IMF, 2020).

5. Conclusion

We discussed how to trigger a wave of low-carbon investments in developing countries compatible with Paris Agreement objectives and the financial constraints of post-COVID-19 times. We showed that a multi-sovereign guarantee mechanism could do so by redirecting excess global savings and contribute to post-pandemic recovery. Such a mechanism would reduce financial risks that deter low-carbon initiatives, maximize the leverage effect of public funds on private capital, help reduce fragmentation of development finance and accelerate the emergence of a credible class of low-carbon infrastructure assets. Leaning on our proposed instrument of a multi-sovereign guarantee fund, it would fulfil the USD 100 billion + pledge of support to developed countries at low costs to guarantor countries, that could turn into gains for reasonable import contents of guaranteed investments. Based on a notional value of mitigation actions, it would respond to the call from institutional fund managers on ‘creating long-term, durable returns to investing in climate in developing countries with sovereign guarantees’ (Schatzker, 2021), while sending the strong signal needed to close 'the gulf between what markets value and what people value' (Carney, 2020).[16]

There remains an open institutional question. A multilateral sovereign guarantee fund dedicated to low-carbon investments, with legal and organizational backing of sovereigns, has no equivalent in the existing international finance architecture. The nearest to this is the European Fund for Strategic Investments managed by the EIB, with projects subject to that bank's standard procedures. Deciding on whether the best option is to entrust the institutional responsibility of the MSGF to an existing MDB (e.g., the World Bank) or to an existing global fund (e.g., the Green Climate Fund), rather than to an entirely new institution, demands careful examination of suitable governance arrangements. This would need to consider decision-making procedures, staffing and expertise, relative costs, conflicts of

[16] Negotiability of the system would be increased by the low sensitivity of the SVMA to the discount rate (Table 2), which should put into perspective controversies about that rate’s level.

interest between existing charters and setting priorities. Such an examination requires further institutional analysis which lies beyond the scope of this paper.

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