

Financing Vaccine Equity

Funding for Day-Zero of the Next Pandemic

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Abstract

A lack of timely financing for purchases of vaccines and other health products impeded the global response to the COVID-19 pandemic. Based on analysis of contract signature and delivery dates in COVID-19 vaccine advance purchase agreements, this paper finds that 60–75 percent of the delay in vaccine deliveries to low- and middle-income countries is attributable to their signing purchase agreements later than high-income countries, which placed them further behind in the delivery line. A pandemic

Advance Commitment Facility with access to a credit line on day-zero of the next pandemic could allow low- and middle-income countries to secure orders earlier, ensuring a much faster and equitable global response than during COVID-19. The paper outlines four options for a financier to absorb some or all of the risk associated with the credit line and discusses how the credit would complement other proposals to strengthen the financing architecture for pandemic preparedness, prevention, and response.

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Financing Vaccine Equity: Funding for Day-Zero of the Next Pandemic

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1. Introduction

At the start of the COVID-19 pandemic, the international community established a new initiative—the Access to COVID-19 Health Tools Accelerator (ACT-A)—for the purpose of securing vaccines, tests, treatments, and personal protective equipment (PPE) for low- and middle-income countries. The pillar of the ACT-A that received the most funding was the COVAX (COVID-19 Vaccines Global Access) facility. Under the facility, the COVAX AMC (Advance Market Commitment) purchased vaccines on behalf of low- and lower-middle-income countries using funds raised from donors.² The facility was empowered to make these purchases ‘at risk’, defined as in advance of regulatory emergency use authorization.³ In principle, this capability should have allowed the COVAX AMC to move as quickly as high-income countries did to secure low- and lower-middle-income countries a place in line for vaccines. However, a lack of timely financing limited its ability to do so at scale. In December 2020, when high-income countries had already placed many purchase orders, the COVAX AMC had raised only \$2 billion of the more than \$10 billion it would eventually deploy.

This paper argues that in a future pandemic on the scale of COVID-19, the delay in deliveries of vaccines and other health products to low- and middle-income countries could be reduced substantially, without any greater commitments from donors than those they eventually made in the COVID-19 pandemic. Section 2 develops this argument based on a novel analysis of COVID-19 vaccine advance purchase agreements between governments and manufacturers. The results confirm that low- and middle-income countries did experience delays in vaccine deliveries regardless of which vaccine they ordered or when—potentially due to export restrictions favoring high-income countries as a group. Nonetheless, the majority (60-75 percent) of the delay in vaccine deliveries to low- and middle-income countries is attributable to their signing purchase

² The COVAX AMC was implemented as a partnership between many organizations, including CEPI, a foundation that finances research to develop vaccines against emerging infectious diseases; GAVI, a public-private partnership that supports routine immunization campaigns in low- and middle-income countries; UNICEF, a United Nations agency responsible for vaccine procurement on behalf of low- and middle-income countries; and the World Health Organization.

³ At-risk purchases are implemented through advance purchase agreements, which typically provide the manufacturer some prepayment and a legally binding commitment to procure the vaccine conditional on regulatory authorization. Such contracts can secure a buyer a place in line, provide manufacturers the certainty needed to procure inputs and other production capacity, and help manufacturers secure loans from banks. In the event the vaccine is not authorized by the regulator, the buyer potentially loses the prepayment.

agreements later than high-income countries, which placed them further behind in the delivery line.

Section 3 discusses the design of an Advance Commitment Facility to purchase health products on behalf of low- and middle-income countries in a pandemic. The defining feature of the Facility is that, unlike ACT-A, it would have access to resources on day-zero, which we define as the date when the WHO declares a global pandemic (March 11, 2020, for COVID-19) and/or when a pre-agreed number of deaths from a pathogen is recorded in multiple countries. The Facility is intended to be active only in ‘wartime,’ i.e., during the acute phase of novel pandemics—such as the first two years of COVID-19 or the 1918 Spanish flu. A benchmark for the resources that should be available to the fund is \$20 billion, comparable to the amount ACT-A raised within the first two years of the COVID-19 pandemic. Donors have shown they are willing to provide this amount to benefit low- and middle-income countries during a pandemic, if not before.

During a pandemic, the operations of the Facility need not follow the exact model of the COVAX AMC, which as implemented had some shortcomings we discuss (e.g., excessive reliance on a single large vaccine producing country that restricted exports; allocation of scarce funds for free vaccines away from low-income countries towards middle-income countries that could potentially afford to purchase them on their own). The Facility would ideally have independent management to ensure a rapid response and to avoid conflicts of interest that could arise when the Facility competes with individual countries in making purchase orders.

The international community could provide cash for the Facility today, to be held in safe securities that pay some interest and be ready for the next pandemic. However, fundraising for a future event is difficult, especially for governments facing trade-offs and elections. A financier could overcome this challenge by taking some risk and providing a credit line to the Facility that it could draw loans from starting on day-zero. Any financier could provide this credit line, for instance a commercial bank, consortium of development banks, private foundation, or a newly established global health financing agency. This paper does not take a stance on this organizational aspect, which depends on institutional, political, and legal constraints. Instead, we outline general principles for managing the risk associated with the credit line.

The key question is how the financier can manage its exposure to the credit risk. When the Facility draws a loan from the credit line to purchase health products, who can the financier count on to pay back the loan? There are four options to manage the credit risk, either separately or in combination. Under Option A, donors (e.g., high-income countries, foundations) make a legally binding commitment to repay the loan after the next pandemic. This option would be equivalent to donors pledging in advance of COVID-19 to fully fund the ACT-A and a financier lending against this commitment. Under Option B, a group of low- and middle-income countries make a legally binding commitment to repay the loan, without involvement from high-income countries. This option would be like low- and middle-income countries forming their own Facility to make purchases on their behalf. Under Option C, the private sector assumes the risk by buying pandemic-linked bonds. The financier would issue these bonds and repay the principal only if no pandemic is declared before its maturity. Donors and/or low- and middle-income countries themselves would have to provide the financier with funds annually to service interest on the bonds if a pandemic is not declared (akin to paying an insurance premium).⁴ Under Option D, no advance commitments are made by anyone, but the financier is empowered by its shareholders to retain the full risk of loans drawn from the credit line on its balance sheet. In this case, the financier's shareholders may have to replenish its capital after the pandemic (if no grants are raised ex-post). In addition, ahead of the pandemic, carrying such risk may impact lending activities if the financier's capital constraint is binding.

Of course, the political economy could constrain a financier's ability to manage risk in these ways. Low- and middle-income countries may lack the fiscal space to guarantee the credit line themselves (Option B). High-income countries may be unwilling to commit in advance to fund a Facility that would compete with them to buy health supplies for their own populations in the next pandemic (Option A). Further, donor countries backing the Facility may nudge its management to make purchases from their own developers, potentially trading off speed of delivery or quality of health products to promote national interests. Options C and D may help in part to overcome these challenges, though if the financier is an international financial institution owned by national governments, political economy constraints would still be relevant.

⁴ Section 3 discusses this option from the perspective of the World Bank's pilot Pandemic Emergency Financing facility, which issued pandemic-linked bonds and used the proceeds to respond to the COVID-19 pandemic.

Related literature and policy context

This paper contributes to the literature on Advance Market Commitments (AMCs). Kremer and Glennerster (2004) originally proposed AMCs to incentivize research on vaccines against diseases primarily affecting low-income countries. Kremer, Levin, and Snyder (2020) outline the design of an AMC for new vaccines in which, before a vaccine is developed, donors commit to a fund from which a specified subsidy is paid per unit of vaccine purchased by low-income countries until the fund is exhausted. In this design, the payments would only be made if the vaccine satisfies certain regulatory requirements (e.g., Emergency Use Listing from the WHO). The “market” component of this AMC design is that the subsidy is triggered only when the low-income country makes a purchase decision, requiring it to make a small copayment, to ensure that the fund does not finance products that low-income countries do not want. The Advance Commitment Facility described here can be seen as a more general case of the AMCs proposed in Kremer and Glennerster (2004) and Kremer, Levin, and Snyder (2022), since it could cover the full cost of health products (as opposed to subsidizing their purchases as a co-payment) and could also make purchases even after a product has been developed. The COVAX AMC as implemented had both features. In addition to strengthening suppliers’ incentives to invest in research, development, and capacity, a role of the Facility would be to secure low- and middle-income countries a place in line for delivery by placing purchase orders at the same time as high-income countries.

The intensity and frequency of extreme novel epidemics has increased over time (Marani, Katul, Pan, and Parolari 2021). In this context, this paper informs ongoing policy work on financing pandemic prevention, preparedness, and response (PPR) (see, e.g., G20 HLIP 2021; Pandemic Preparedness Partnership 2021; Agarwal, Farrar, Gopinath, Hatchett, and Sands, 2022). A day-zero credit line to the proposed Facility is complementary to a Global Health Security Fund proposed by the G20 HLIP 2021. Investments under consideration for the Fund to make include emerging infectious disease surveillance; interruptions of the interaction of humans and wildlife; maintenance of “ever warm” manufacturing capacity to manufacture health products in many countries; and research on vaccines, tests, and treatments (World Bank and World Health Organization 2022). One way to think about these specific investments is that they are ‘peace-

time' investments to address pandemic risks. In contrast, the day-zero credit line described here provides 'war time' resources to respond to pandemics when they occur. In addition, the credit line would complement existing sources of financing for broader emergency response, such as the emergency financing provided by the IMF and World Bank during COVID-19, and the domestic fiscal support mobilized by national governments.

Further, any new mechanisms should be considered in the context of the current structure of global surge emergency financing that can be applied to pandemics (Sawatzky et al., 2021), which includes the WHO's Contingency Fund for Emergencies (CFE), the IMF's Rapid Financing Instrument (RFI) and Catastrophe and Containment and Relief Trust (CCRT), the World Bank's Fast-Track COVID-19 facility, etc. The design of a new, targeted, emergency financing facility should ensure that it does not increase fragmentation or complexity of the global emergency financing architecture.

2. The benefit of day-zero financing for vaccine purchases in pandemics

In the COVID-19 pandemic, vaccinating the world was described as the highest-return public investment ever (see, e.g., Agarwal and Gopinath 2021). Economic analysis showed that the benefit from vaccinating the population of every country as quickly as possible would exceed the cost by many times (Ahuja et al. 2021; Castillo et al. 2021). This benefit had at least three sources: (i) direct health benefits to individuals; (ii) domestic economic benefits, accruing from consumers, students, and workers being free to undertake normal activities, either because they were unafraid of being infected, or because governments lifted lockdowns; and (iii) global economic benefits, accruing from a reduced likelihood of more contagious and deadly variants and a recovery in global aggregate demand. International equity in vaccine access was valuable because vulnerable populations (e.g., health care workers, the elderly and immunocompromised) reside in all countries, and because a uniform distribution of vaccination across populations would make the global economic benefits arrive faster. Economic analysis also found substantial benefit from rapid deployment of testing (Siddarth and Weyl 2020; Reed et al. 2021) and treatment (Rowthorn and Maciejowski 2020). The discussion in this section focuses on vaccines due to the data analyzed.

Despite the economic case for access to vaccines, as of March 2021, more than a year into the pandemic, the international community had not yet committed to purchase enough vaccines for the world's population, even though developers then reported available capacity to produce at least 10 vaccine candidates with Phase 3 trial results suggesting efficacy above the WHO minimum threshold (Agarwal and Reed 2021). High-income countries made advance commitments to purchase more vaccine than needed for their populations, including to hedge against the risk that some candidates would fail to secure approval. Low- and middle-income countries and institutions operating on their behalf did not take a comparable risk, committing to purchase far less than needed for their populations.

Earlier vaccine purchases by low- and middle-income countries could lead to earlier deliveries and equitable access

It is an open question whether earlier purchases of health products would have accelerated deliveries to low- and middle-income countries. It might not have made a difference, if high-income countries paid extra for priority delivery, or if export restrictions favored deliveries to high-income countries as a group. We use a novel data set of vaccine advance purchase agreements between developers and governments (“bilateral purchase agreements”) to quantify the role of late purchase orders in delivery delays to low- and middle-income countries, relative to other factors causing delay that are independent of the purchase date.⁵

Available data suggest that middle-income countries and some low-income countries did have capacity to enter into advance purchase agreements, but that they did so later than high-income countries (Table 1). High-income countries signed contracts as early as May 2020, and on average in December 2020. Middle-income countries signed contracts on average three months later. The low-income countries that did sign contracts signed them on average five months later. The earliest purchase by a low-income country was in February 2021, nine months later than the earliest purchase by a high-income country. ACT-A did make an advance commitment to procure vaccine doses in June 2020 but did not manage to raise resources to scale up purchases until after December 2020 (see Agarwal and Gopinath, forthcoming). The Africa Vaccine

⁵ Data on contract dates are from the IMF-WHO COVID-19 Vaccine Supply Tracker, and data on delivery dates for those contracts are from the UNICEF COVID-19 Vaccine Market Dashboard.

Acquisition Trust, another multilateral initiative, made its first purchase commitment in April 2021.

Table 1: When low- and middle-income countries entered bilateral contracts for vaccines, they did so later than high-income countries

World Bank country income classification	Number of advance purchase agreements	Average month contract signed	Earliest month contract signed
High income	211	December 2020	May 2020
Low income	8	May 2021	February 2021
Lower-middle income	105	March 2021	August 2020
Upper-middle income	135	February 2021	August 2020

Source: IMF-WHO Vaccine Supply Tracker

To quantify the role of these later orders in explaining late deliveries, Table 2 reports the results of a regression of the month of first delivery (measured in months since January 2020, the month the WHO declared COVID-19 a Public Health Emergency of International Concern) on the month the contract is signed (also measured in months since January 2020), fixed effects for the country’s income classification, fixed effects for each vaccine candidate, and a constant. In this regression, the effect of the contract signature date can have a causal interpretation, as vaccine developers reported publicly that they allocated vaccines through delivery queues.⁶ The vaccine fixed effects control for developer-specific delays, providing reassurance that the effect of the contract signature date is not driven by countries that ordered later also selecting specific vaccines that ended up facing long delays due to production difficulties or regulatory delays. The vaccine fixed effects also control for vaccine price, to account for the fact that vaccines with faster delivery times may have been more expensive. Overall, the regression summarizes the average delivery

⁶ For instance, Pfizer CEO, Dr. Bourla, said, “I had asked heads of state by letters that I sent them to [place orders] because I didn’t want to see a distribution predominantly to the high-income countries, and they didn’t do it.” When they subsequently placed orders, he said, “it was too late because the doses had already been allocated.” (Josh Nathan-Kazis, “Pfizer CEO Says Poor Countries Need to Order Covid Vaccines Earlier” Barrons. Nov. 2, 2021)

time across all vaccines, given the time the contract was signed, and the income level of the country signing the contract.

Table 2: Regressions of delivery data on purchase contract date and fixed effects

VARIABLES	(1) Month of first delivery	(2) Month of first delivery
Month contract is signed	0.432*** (0.0759)	-0.115 (0.137)
Month signed X Contract signed in 2021		0.823*** (0.168)
Low-income or lower-middle-income (=1)	1.447*** (0.461)	1.450*** (0.462)
Upper-middle income (=1)	1.159*** (0.351)	1.449*** (0.349)
Contract signed in 2021 (=1)		-10.49*** (2.110)
Constant	10.55*** (0.706)	15.68*** (1.191)
R-squared	0.431	0.515
Number of observations	367	367
Vaccine candidate fixed effects	Yes	Yes

Source: Authors' calculations based on the IMF-WHO Vaccine Supply Tracker and the UNICEF Vaccine Market Dashboard

Notes: Months are measured in months since January 1, 2020. Data include contracts for which there were partial or full deliveries, 77 percent of contracts by HICs, 83 percent by UMICs, 84 percent by LMICs, and 50 percent by LICs. The fixed effects for a high-income country and the AstraZeneca/Oxford vaccine are omitted from the regression. Standard errors in parentheses are robust to heteroskedasticity.

*** p<0.01, ** p<0.05, * p<0.1

The coefficient on the month the contract is signed, in Column (1) of Table 2, is positive and statistically significant, its value indicating that for each month later a contract is signed, the first delivery arrives 0.432 month later (standard error = 0.0759). Table 1 showed that low-income countries ordered on average 5 months later than high-income countries, so this implies their first delivery arrived $0.432 \times 5 = 2.16$ months later on average, because they ordered later.

The fixed effects for income classification quantify the average delay that is specific to low- and middle-income countries but independent of the contract date, arising for instance because production was concentrated in some high-income countries that imposed regulations requiring manufacturers to prioritize domestic orders before exporting (see Bown forthcoming on the United States' use of the Defense Production Act). The estimate of the fixed effect for low- and lower-middle income countries (we pool them because of the small number of contracts for low-income countries) is 1.447 months (s.e. = 0.461). Summing this fixed effect with the effect of later delivery times indicates that low-income countries on average received their first delivery $2.16 + 1.447 = 3.607$ months later than high-income countries, and that about 60 percent of the delay was because they ordered later. Put differently, earlier ordering on behalf of low-income countries could cut the delivery time by 60 percent.⁷ A similar proportional reduction in delivery times could be achieved for middle-income countries.

An average delay in first deliveries of only 3.607 months to low-income countries ordering bilaterally may appear surprising, given that inequity in vaccine access lasted much longer than that, for most of 2021. One reason for this is that multilateral vaccine purchase efforts, which were responsible for deliveries to low-income countries, faced idiosyncratic delays making them outliers relative to the bilateral contracts studied in here. For instance, the June 2020 ACT-A vaccine purchase commitment was to the Serum Institute of India, which was subjected to export restrictions in April 2021. Even if one does order early, things can still go wrong. Nonetheless, despite outliers, our results are informative about the average experience of all market participants.

Another reason for the surprising result could be that the effect of contract signature date on delivery date varies with the contract signature date, and so is not fully captured in the specification in Column (1). Indeed, low- and middle-income countries ordered on average in 2021, once vaccine candidates began receiving emergency use authorization, and the market then may have been more congested, leading to even greater delays. To test this hypothesis, in Column (2) of Table 2, we estimate the effect of the contract signature date on the delivery date separately in 2020 and 2021. For 'early mover' countries that signed a contract in 2020, the

⁷ The share of delivery delay attributed to later orders is quantitatively similar in a regression specification excluding vaccine fixed effects.

coefficient on contract signature date is small and not statistically significant, indicating that these countries all received their deliveries around the same time. However, the contract date did have a significant impact among the ‘late movers’ that signed a contract in 2021. In that year, a delay in signing the contract by one month was associated with a delay in delivery of about 0.82 month. For low- and lower-middle-income countries that ordered 5 months later and in 2021, their orders would be on average $0.823 \times 5 = 4.115$ months later. Adding this effect to the fixed effect for income classification from Column (2) indicates that low-income countries that ordered in 2021 received their first delivery $4.115 + 1.450 = 5.565$ months later than high-income countries, about double the amount estimated in Column (1) where the effect of contract signature date was assumed constant across years.⁸ We prefer this estimate to the previous estimate from Column (1) since it captures better the effects of market congestion in 2021. Using the estimate from Column (2), earlier ordering on behalf of low-income countries could cut the delivery time by about 75 percent.

In summary, these results suggest that earlier purchase orders on behalf of low- and middle-income countries could have significantly reduced delays in vaccine delivery. One caveat is that, if low- and middle-income countries had ordered earlier, high-income countries could have still outbid them while supplies were limited. If so, then an effect of earlier purchases could have been to simply increase the price paid by high-income countries—a transfer to the pharmaceutical companies—and still low- and middle-income countries might not have received doses any earlier. However, this is not the only potential effect of earlier orders on prices. Earlier orders could also have incentivized firms to invest in capacity, allowing for the discovery and resolution of supply chain bottlenecks and input shortages, expanding aggregate supply, and lowering costs (Agarwal and Reed 2021, Bown forthcoming). Consistent with this mechanism, vaccine prices stayed steady or fell during 2021, even as orders accelerated once vaccine candidates began receiving emergency use authorization. On this basis, it is plausible that prices would have remained the same, even if low- and middle-income countries ordered earlier. Athey et al. (forthcoming) discuss how purchase agreements could include specific clauses requiring firms to scale production capacity, providing assurance that more orders will lead to lower costs.

⁸ This finding is consistent with analysis by Murthi and Reed (2021), who had forecast that orders placed by low- and middle-income countries in late 2021 would not arrive until early 2022.

Hypotheses explaining delayed purchases

Several hypotheses could explain why, despite global benefits, low- and middle-income countries and agencies operating on their behalf in the COVID-19 pandemic did not make advance purchase commitments of vaccines sufficient to cover their populations:

- 1) Limited bargaining power. Given the small size of their orders relative to larger countries, smaller countries may have had less bargaining power with developers of health products. In addition, some low-income countries may have had less institutional experience negotiating advance purchase agreements, especially if they had traditionally relied on aid agencies to procure vaccines on their behalf.
- 2) Limited access to timely financing. A flight of international capital from low- and middle-income countries in March 2020 left interest rates on their sovereign bonds elevated, making borrowing less attractive (Goldberg and Reed 2020; Beirne, Renzhi, Sugandi, and Volz 2021). Though interest rates on development bank loans remained low and relatively unchanged, development banks did not provide loans to purchase vaccines before they had received emergency use authorization (World Bank, 2021, para. 42).⁹ As an institution, the COVAX AMC was not restricted from making ‘at risk’ vaccine purchases, but it did lack timely access to capital. When founded in June 2020, it had only \$300 million in grants available from the Bill and Melinda Gates Foundation, Italy, and the United Kingdom. By December 2020 it had raised just \$2 billion. Only in June 2021 had it raised about \$10 billion dollars, sufficient to cover about 30 percent the population in low- and lower-middle income countries (Agarwal and Reed 2021).
- 3) Low perceived benefit relative to price. Confirmed COVID-19 mortality is lower in low-income countries, even once correcting for different levels of testing, a result which has been attributed to younger populations (Demombynes 2020; Goldberg and Reed 2020;

⁹ The Asian Development Bank and World Bank, for example, both did not finance purchases of vaccines that had not received emergency use authorization from a stringent regulatory authority or emergency use listing from the WHO. This policy precluded countries from borrowing to make prepayments in advance purchase agreements (see description of such agreements in note 3).

Bollyky et al. 2022). Given scarce resources, authorities may have made the choice not to allocate resources away from programs to fight diseases such as malaria that have higher fatality rates than COVID-19 in younger populations. Further, despite immediate health benefits from purchasing vaccines, countries may have anticipated that vaccines would be provided for free (as donations) in the future.¹⁰

In principle, a pandemic Advance Commitment Facility with access to day-zero financing could overcome these three constraints. First, with experienced staff and sufficient finance to aggregate all low- and middle-income country demand, the Facility could potentially have even more bargaining power than high-income countries: the population of low- and lower-middle-income countries alone is 2.5 billion people, more than the populations of the G7 economies and the European Union combined. Indeed, COVAX was able to negotiate some purchases quite rapidly, though it was constrained by access to finance early on. Second, with access to day-zero financing, the Facility could move quickly, avoiding delays in purchases and deliveries. Third, the Facility could internalize the positive externalities of pandemic response, by making decisions using cost-benefit analysis that incorporates global and domestic economic benefits alongside direct health benefits.

The facility would still be constrained by the fact that international vaccine production, presently, is concentrated in a small number of (predominantly high-income) countries. Indeed, 25%-40% of the delay in vaccine deliveries to low- and middle-income countries occurred independently of the time they ordered. Still, the evidence suggests that earlier orders could have accelerated deliveries. Ongoing efforts to diversify research, development, and production of health products across countries would offer the Facility a more diverse pool of suppliers, potentially accelerating deliveries even more.

¹⁰ In Section 3, we emphasize that making eligibility for free vaccines clear ex-ante can ensure that countries not eligible for free or subsidized products do not delay purchases using their own resources based on the expectation that they will receive free or subsidized products in the future.

3. Design of a pandemic Advance Commitment Facility with a day-zero credit line

Our regression analysis suggests that earlier orders on behalf of low- and middle-income countries could potentially achieve more equitable and timely access to vaccines (and other health products) in a pandemic. These earlier orders could be made by an Advance Commitment Facility empowered to enter into advance purchase agreements on behalf of low- and lower-middle income countries on day-zero of the next pandemic, following rules in place at the onset. But where would financing for this come from? Under current institutional arrangements, an ACT-A-like structure could again face the daunting challenge of raising adequate and timely funds, likely leading to a repeat of the slow and unequal global response during COVID-19.

Here is how an alternative solution could work, starting today:

- **Step 1. Countries establish a pandemic Advance Commitment Facility.** The role of the Facility will be the pooled purchase of vaccines, tests, treatments, and PPE on behalf of low- and middle-income countries during pandemics. The defining feature of the Facility is that, unlike ACT-A, it would have access to resources on day-zero, which we define as the date when the WHO declares a global pandemic (March 11, 2020, for COVID-19) and/or when a pre-agreed number of deaths from a pathogen is recorded in multiple countries. The Facility would have an independent management team, with oversight from a Board with representatives from participating countries. In ‘peace-time’, operations would be minimal, with the Board holding annual meetings, and management consulting periodically with civil society, global health agencies, and national health authorities. The Facility would be activated during global pandemics, following rules agreed ahead of time.
- **Step 2. A financier establishes a credit line to the Facility.** Any financier could provide the credit line, for instance a commercial bank, consortium of development banks, private foundation, or a newly established global health financing agency. The credit line could be backed by commitments by participating countries made in advance of the next pandemic.

- Step 3. The Facility rapidly responds to pandemics on day-zero. In ‘war time,’ the Facility is activated, and its management can draw on the credit line to execute its mission to purchase a portfolio of health products for low- and middle-income countries.¹¹ Free or subsidized health products are then allocated to eligible countries according to an agreed rule. The allocation of investment across the health products would be determined based on the nature of the pathogen and guided by an independent panel of experts. For instance, if the timeline to develop a vaccine is slower than during COVID-19, early access to tests and treatments would be useful.

An (optional) feature could be that low- and middle-income countries would have the option to buy directly from the Facility at cost, like the COVAX self-financing participant (SFP) facility. Funds from these sales would be used to repay loans made by the credit line.

Table 3 summarizes the key features of the proposed Facility. The experience of ACT-A provides several lessons learned that motivate these features:

- Credit line size: The credit line size could target \$20 billion in 2020 dollars, comparable to the amount ACT-A raised within the first two years of the COVID-19 pandemic. Donors have shown they are willing to provide this amount to benefit low- and lower-middle-income countries during a pandemic, if not before. Indexing the size of the credit line to global inflation will ensure its purchasing power does not decline over time. Low- and middle-income countries could contribute additional funds, for instance the amount they spent on health products during COVID-19 without the support of donors.
- Credit risk management: There are four options to manage the credit risk, either separately or in combination.
 - Option A: Donor countries assume risk through legally binding pledges. Even if donors pledge in advance to assume the liability from the credit line, they may not

¹¹ CEPI has raised over \$1.5 billion to fund research and development of new vaccines at the onset of the next pandemic, a key component of the 100 days mission. The Facility would be complementary, as it would fund sizable purchases of the vaccines once they have been discovered, incentivizing firms to scale up production capacity.

uphold this commitment (both in the size and timing of payments) once a pandemic begins. To overcome this issue, donors can make their pledges legally binding. Examples are the irrevocable long-term pledges from donors to Gavi, a public-private partnership that supports routine immunization campaigns. The International Finance Facility for Immunization (IFFIm) issues vaccine bonds to market participants backed by these pledges. The money raised by these bonds provides Gavi with funds upfront to purchase vaccines, while the pledges are used to repay principal and interest over time. The risk of default on these bonds is comparable to the risk that the donor countries default on their own sovereign bonds, which is quite low in IFFIm's case as donors are high-income and upper-middle-income countries.¹² As a result, interest payments are low. Under Option A, the financier would be in a similar position as a buyer of an IFFIm vaccine bond, though in this case donor payments would be contingent on a global pandemic occurring, rather than certain as in the case of support for routine immunization campaigns. A benefit of this option is that, because of the low risk that donor countries default on their commitments, the financier would only need to hold a minimal amount of capital against this credit line to mitigate this risk.¹³

- Option B: Low- and middle-income countries assume the risk through joint guarantees. Under this option, the credit line would be structured as a credit line to a group of low- and middle-income countries overseeing the Facility (without involvement of donors). Participating countries would jointly guarantee the risk themselves, with clear risk-sharing rules agreed in advance. Option B may require the financier to hold more capital against the credit line than Option A if the risk of sovereign default by the participating countries is assessed to be higher than that of donors under Option A. An example of a country-owned facility is the Pan American

¹² IFFIm's asset base consists primarily of irrevocable and legally binding multi-year sovereign pledges from donors ("Grantors"). As of 30 June 2021, the Grantors were France, Italy, Netherlands, Norway, South Africa, Spain, Sweden, United Kingdom, Australia, and Brazil, with the pledges amounting to \$8 billion. S&P has rated IFFIm bonds AA, and Moody's has rated IFFIm bonds Aa1.

¹³ During the COVID-19 pandemic, once donors pledged resources to the COVAX AMC, the European Investment Bank and the US Development Finance Corporation lent to the COVAX AMC using these pledges as collateral (about €1B and \$1B, respectively). Similar loans could be made on day-zero of the next pandemic if donors made commitments in advance.

Health Organization's (PAHO) Revolving Fund (*fondo rotario*), in which participating countries pool their resources to make bulk purchases of vaccines. Historically, when countries face a sudden excess need for certain vaccines (e.g., due to an outbreak or large movements of immigrants that need to be vaccinated), the fund has been able to scale up purchases by reprogramming existing funds or coordinating among members to secure additional resources. In principle, a financier could lend to the fund as well if members made commitments to repay the loan. The Africa Vaccine Acquisition Trust (AVAT) established by the African Union is another example of a regional vaccine purchase initiative, which secured credit from the African Export-Import Bank to purchase COVID-19 vaccines. A disadvantage of Option B relative to Option A is that low- and middle-income countries may have less fiscal space to guarantee pandemic risk relative to donors or the private sector.

- Option C: The private sector assumes the risk through pandemic-linked bonds and is compensated for carrying the risk through annual donor or country contributions. Under this option, the financier issues a pandemic-linked bond and holds the proceeds in safe securities, ready to be distributed to the Facility in a pandemic. The financier will repay the principal only if no pandemic is declared before its maturity. This option is like buying pandemic insurance on behalf of low- and middle-income countries. Unlike Options A and B, this option would require either donors and/or low- and middle-income countries to commit to make annual payments to the financier to cover the excess interest payments on the vaccine bond (relative to what is earned on the safe securities). To minimize risk for the financier, the donors or countries could make a legally binding pledge to make the annual interest payments until the pandemic bond matures. From a cost perspective, the feasibility of this option depends on the market's appetite to 'sell' enough pandemic insurance. Given that market participants are also likely to be hit by a negative shock during pandemics, they may charge a premium for such insurance. The World Bank's pilot Pandemic Emergency Financing (PEF) facility, which operated from 2017 to 2020 and issued pandemic-linked bonds whose interest payments were covered by donors, provides one benchmark: its Class A bond, which was structured so that tranches paid out in the events of 250, 750, and 2,500 influenza or coronavirus deaths in multiple low-

income countries, and which paid out to support the response of 64 countries to the COVID-19 pandemic, had a three year duration and carried an interest rate of 6.9%.¹⁴ The pricing structure of a bond designed to cover risks of a pandemic is directly correlated to the severity of the disease outbreak that triggers the calling of the bond.

- Option D: The financier and its shareholders retain all the risk. Under this option, no advance commitments are made by donors or countries, but the financier is empowered by its shareholders to retain the full risk of the credit line on its balance sheet. An interesting case is the one in which the financier is a multilateral development bank, whose shareholders are countries. Shareholders may prefer Option D to Options A, B, and C if they are unable to make credible upfront commitments due to political or legal constraints.¹⁵ This option solves the problem of day-zero financing for the Facility but leaves the development bank—and ultimately its shareholders—liable for any losses. After the pandemic, the bank could require a capital increase to cover any potential losses on the credit line. Even if the current operational rules of development banks may not permit retaining risk along these lines, this option serves as a useful benchmark to evaluate the pros and cons of Options A, B, and C. A disadvantage of Option D is that the bank would have to provision for expected losses ahead of time, which, if the bank faces a binding capital constraint, could reduce its resources available to lend for other purposes (e.g., climate change mitigation and adaptation, education, health systems strengthening, infrastructure).¹⁶

¹⁴ Through the bond issuance, a facility funded with only \$181 million in donor contributions was able to make \$258 million in payouts, a 42.5 percent return on donor capital, or a 12.5 percent return annualized over the facility's 3-year life (World Bank 2020). Since a pandemic did occur, the facility achieved a net transfer from private investors to the public sector. Holders of the Class A bond earned 3.57% compared to the 6.9% promised if a pandemic did not occur. Holders of the Class B bond (which was higher risk and unlike the Class A bond would also have paid out for pandemics of filovirus, Lassa fever, Rift Valley fever, and Crimean Congo Hemorrhagic fevers) earned a -32.96% return compared to the 11.5% promised if a pandemic did not occur

¹⁵ For example, in 2007 donors committed \$1.5 billion to an advance market commitment (AMC) facility that would help purchase pneumococcal vaccine for low-income countries. These resources would be drawn down by Gavi in accordance with the terms of the AMC and were eventually used to procure and deliver 3 vaccines, saving an estimated 700,000 lives (Kremer, Levin, and Snyder 2020). The World Bank used its own balance sheet to provide a backstop against donor commitments. Should a donor fail to pay, the World Bank committed to pay the shortfall. For this commitment, the World Bank charged an annual 30 basis point premium on outstanding grant payments not yet paid by donors (World Bank 2014, pg. 113).

¹⁶ This benchmark can be used to evaluate other proposals that development banks contribute resources from their balance sheets to finance global public goods.

- Managing legal risk to the financier: A financier may not wish to finance procurement of vaccines in advance of approval by a stringent regulatory authority, to avoid liability for delivering ineffective or unsafe vaccine. To avoid this liability, the financier could finance the acquisition of health products through advance purchase agreements with some pre-payment and a commitment to procure only after emergency use authorization (see note 3).
- Independent management with collective oversight: Participating countries would ideally delegate operations of the Facility during a pandemic to an independent management team, to avoid delays in action and avoid conflicts of interest that could arise if the Facility competes with individual countries when making purchase orders. The rules by which management operates however should be governed by a Board with representatives from low- and middle-income countries, who would be the direct beneficiaries, and donors, in the event they contribute funds, and the financier.
- Scope of mandated transactions: The Facility would be primarily mandated to commit to purchase vaccines, tests, treatments, and PPE on behalf of low- and middle-income countries, with the allocation across products informed by advice from an independent panel of experts. Beyond advance purchase agreements, the Facility could also make investments in research, development, and scaling production capacity for health products, if these investments provide it with guarantees and priority access to guard against ending up at the back of the line.^{17 18}

¹⁷ The R&D support could be more prominent in a pandemic that primarily affects developing countries, which may not lead to a repeat of the unprecedented R&D response seen during COVID-19 (Agarwal and Gaule, 2022).

¹⁸ There may be need for complementary financing for other public goods such as financing the deployment of human resources, essential and critical lifesaving medical equipment, logistics and supply chain management, non-medical equipment, essential life-saving goods, minor civil works, etc.

Table 3: Indicative features of a pandemic Advance Commitment Facility with contingent financing for rapid pandemic response in low- and middle-income countries

Credit line size	<ul style="list-style-type: none"> • About \$20 billion in 2020 dollars (comparable to the amount raised by the ACT-A)
Credit risk management	<ul style="list-style-type: none"> • Option A: Donors assume the risk through legally binding pledges • Option B: Low- and middle-income countries assume the credit risk by jointly guarantee the credit line • Option C: The private sector assumes the risk via pandemic-linked bonds, with the excess interest differential financed by donors and/or low- and middle-income countries • Option D: The financier (and its shareholders) assumes the risk
Legal liability for financier	<ul style="list-style-type: none"> • To avoid liability for procurement of unsafe or ineffective vaccines, the financier clarifies they will finance acquisition of health products through advance purchase agreements with some pre-payment and a commitment to procure only after emergency use listing by the WHO.
Independent management, with collective oversight	<ul style="list-style-type: none"> • Management team is free to make transactions without interference from political leaders, including those that may compete for the same commodities • Board provides oversight with representation from low- and middle-income countries, donors, and the financier
Scope of mandated transactions	<ul style="list-style-type: none"> • Transactions limited to vaccines, tests, treatments, and PPE, with the allocation across products guided by independent panel of experts, based on nature of the pathogen: <ul style="list-style-type: none"> – R&D investments in broad portfolio of candidates, with option to purchase with guaranteed place in line (e.g., at pre-clinical phase) – Support to scale up manufacturing capacity, with option to purchase with guaranteed place in line (e.g., after Phase 1/2 trials) – Advance purchase agreements, with guaranteed place in line (e.g., after Phase 2/3 trials)
Access eligibility and subsidy coverage	<ul style="list-style-type: none"> • Low- and middle-income countries are eligible to receive products, with <ul style="list-style-type: none"> – Free universal coverage in low-income economies – Partial free coverage (e.g., for vulnerable populations) and/or subsidized coverage for middle-income countries • The Facility announces coverage targets prior to pandemic, so that countries ineligible for free or subsidized products do not delay purchases using their own resources based on the expectation that they may receive free or subsidized products in the future
Diversification of supply across countries	<ul style="list-style-type: none"> • To guard against the risk of export restrictions on supply, the Facility would prioritize contracts with producers in smaller countries that can satisfy domestic demand quickly and in countries with a history of not restricting exports in previous pandemics
Trigger for use of funds	<ul style="list-style-type: none"> • Credit line is activated when both or either of the two conditions are met: <ul style="list-style-type: none"> – WHO declares a global pandemic (e.g., March 11, 2020 for COVID-19) – Pre-agreed number of deaths in multiple countries, to guard against moral hazard • <u>Credit line is deactivated when daily/weekly deaths fall below a pre-agreed threshold</u>

- Diversification of supply across countries: A cause of delay in deliveries by the COVAX AMC was that its pre-purchase agreements were initially concentrated in India, which in 2021, like some other countries, directed its manufacturers to serve domestic orders first, effectively restricting exports (Murthi and Reed 2021). Part of the motivation to rely on Indian manufacturers was that they offered a uniquely low cost of production and were established suppliers (outside pandemics). But in pursuing the lower costs, the COVAX AMC did not sufficiently diversify its initial vaccine procurements. In this context, the Facility should have sufficient room not to be as price sensitive and should aim to achieve diversification by purchasing from countries that are most likely to allow free flows of exports (e.g., smaller countries that can satisfy domestic demand more quickly and so have less reason to restrict exports, those that did not restrict exports during the COVID-19 pandemic).
- Trigger for use of funds: Though the intention is for the credit line to activate as soon as WHO declares a global pandemic, one may worry that such a rule could create an incentive to declare emergencies more often, since doing so would unlock the credit line. An approach to guard against such moral hazard—if indeed present—would be to establish an objective trigger (e.g., based on a pre-agreed number of deaths in multiple countries). This was the approach taken by the PEF.¹⁹ The facility would also have to establish a trigger to deactivate the credit line when the acute phase of the pandemic is over (e.g., based on daily deaths in multiple countries falling below a certain threshold).

Beyond the indicative features discussed above, further thinking is needed on several design issues for the Facility (representation, accountability, composition and voting rules of the Board, etc.), which we hope future researchers will examine.

¹⁹ In 2020, some criticized the PEF because its criteria for release of funds were not met at the same time the WHO declared COVID-19 a pandemic. However, the facility did release funds on April 27, 2020, within two months, which was rapid compared to many other facilities. At the time, the number of COVID-19 cases recorded in all countries eligible to receive funds from the PEF was less than 5,000, representing 0.62% of confirmed cases globally.

4. Conclusions

Fundraising for a future event like a global pandemic is difficult, especially for governments facing trade-offs and elections. Yet, when a pandemic is ongoing and the benefit of response is salient, countries are willing to commit substantial resources. In the COVID-19 pandemic, donors committed about \$20 billion to ACT-A to secure vaccines, tests, treatments, and PPE for low- and middle-income countries, though the full amount of these funds was available only two years after the pandemic started.

An innovative financier could establish a credit line to an Advance Commitment Facility today, which would allow a more rapid and equitable response to the next pandemic, reducing its human and economic cost. Concrete options exist to manage the risk associated with that credit line.

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