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Sovereign Climate-Contingent Convertible Bond (S-CloCo)

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Abstract

In this note, we expand upon our previous introduction of the Climate Contingent Convertible Bond, the CloCo, specifically focusing on developing a set of mechanisms for sovereign nations. A CloCo bond allows the issuer to convert the remaining value of the bond (or a portion of the outstanding value) to equity contingent on an acceleration (or deceleration) of climate policy. For the cases we consider for a sovereign state, we introduce the concept of the sovereign CloCo (S-CloCo) to provide a strategic national-level mechanism to enhance climate funding to ensure or accelerate climate transitions. Such a mechanism can be applied across the wide range of challenges posed by a changing climate, from enhanced adaption spending to improved low-emission industry and enhancing the natural environment. In particular, the instrument and mechanisms have been designed to assist in reducing public debt burdens and operate alongside privately issued CloCos as part of a nation's strategy to meet its climate- (and nature-)linked goals. In this note, we introduce two S-CloCo mechanisms: (i) the sovereign influence mechanism designed to leverage opportunities from the private sector CloCo issuance utilising a sovereign wealth fund (SWF) and (ii) the direct SWF mechanism that is underwritten by equity holdings in a nations sovereign wealth fund. Within the influence mechanism, sovereign nations would actively encourage the issuance of private CloCos as part of a coordinated strategy with the firms and private asset managers alongside creating and utilising existing tax-efficient structures and government subsidies to enhance domestic investments. Within the sovereign wealth fund mechanism, governments would utilise their SWF holding as a source of underlying equity, whereby on the conversion of the S-CloCo stock from the fund is used to pay to investors. In such a mechanism, governments are able to remove the bond liability from their balance sheets and rebalance sovereign wealth fund holdings. The creation of such a mechanisms provides a direct means for governments to accelerate their climate transitions, limit sovereign funding costs and provide an enhanced structure for both domestic and foreign investment.

1 Introduction

The desire by international governments to reach net-zero greenhouse gas (GHG) emissions by 2050 has initiated a significant change in corporate business strategies whilst driving increased capital expenditure into new technologies and business processes. This move to a lower-emissions economy has created a change in business models that may impact energy security and prices, strain supply chains, and have the potential to impact significantly the wider macro-economy. The ability or otherwise for firms to affect a change in their business models to address decarbonisation policies creates an economic uncertainty termed transition risk. These risks manifest themselves through several mechanisms, for example, reduced revenues from restrictions to carbon-intensive products, impacts on pricing through taxation/tariffs, supply and demand adjustments, and direct emissions policy-driven impacts. Furthermore, there are many uncertainties related to climate impacts: increased physical damage and associated effects of second-order effects from economic migration and the accelerated degradation of the natural environment.

These wider risks and their impacts on national economies have yet to be fully quantified. Consequently, current firm- and national-level economic assessments face a challenge in their robustness and sufficiency in understanding uncertainty across market, policy, and physical dimensions over time. Firms and governments will look to address this forward-looking uncertainty to mitigate future reductions in economic growth and heightened volatility regimes. However, such mechanisms to address the financial risks to firms and governments are limited to the current set of market-based instruments that do not specifically address these climate-linked risks. This paper introduces financial structures for sovereign nations to utilise convertible bonds [1] to address and mitigate such uncertainties.

In Cormack and Macrina, 2024, the concept of the CloCo bond is introduced, which provides the issuer of the bond the ability to convert the remaining value of the bond to equity in the issuing firm in the event of a notable change to a national decarbonisation-policy or the firm's goal to accelerate its decarbonisation priorities. The bond is specifically designed to reduce the debt liability of a firm in the event of a nation's (or group of nations) priorities to accelerate its decarbonisation policies.

The CloCo is designed to facilitate a firm's ability to decarbonise within the jurisdictions it conducts its business operations. Here, we extend some of these concepts and introduce the idea of the sovereign CloCo , which we term the S-CloCo. This is a complementary mechanism to encourage national and potentially international use of CloCo bonds. In particular, we explore means to enable governments to improve the likelihood of success and robustness of climate policies (i.e., the ability to increase the likelihood of maintaining their decarbonisation plans in light of future uncertainties).

1.1 Motivation for application of CloCos at sovereign level

Sovereign nations such as the United Kingdom (UK Government, 2008) have signed into law policy-driven transition objectives designed to set targets to reduce emissions across all economic activities. As it stands, it is unclear how such a policies would be enforced at a national or international level and, hence, any direct public or private liability. However, the implications of failure would result in a clear impact and cost to nations from the disruption and degradation caused by the increase of systemic physical risks and by the impact of emissions-linked export tariffs (such as the CBAM, see Europen Commission, 2023). Hence, there is an incentive to provide a set of cost-effective mechanisms to reduce this future public liability.

In this paper, we highlight how national governments may be able to influence national and international firms by applying instruments such as the CloCo on a large scale alongside the use of strategic investments within sovereign wealth funds. This is explored in detail in Section 3.

Extending these concepts further, we explore another mechanism of how sovereign nations can help reducing potential future public liabilities directly as part of their climate change funding mechanisms. This is explored in Section 4 where we introduce the concept of S-CloCos backed by a conversion option to stock in a sovereign wealth fund. Such a mechanism provides a clear means to reduce public liabilities at a point in time in a transition, hence freeing national balance sheets, so to invest in further decarbonisation and adaptation mechanisms.

The model presented in Section 4, utilising sovereign wealth funds, also highlights several mechanisms for nations to entice international firms to decarbonise (faster). We further explore enhancing domestic investment through a number of tax-efficient structures, which can improve the use of CloCos and S-CloCos.

Before exploring these structures in detail, we summarise other instruments that have been developed to address climate change.

1.2 Survey of sovereign-linked climate bonds

Instruments such as the CloCo have been specifically designed to reduce the risk of diminished returns for (or even default of) firms, contingent upon a change in transition plans or policy. The instrument's conversion trigger can be defined explicitly by a communicated policy change by governments or implicitly whereby a nation's rate of decarbonisation is slower than expected. [2] Such instruments are designed to improve the robustness of firms and, hence, the wider economy to climate transition risks. Other financial instruments exist, such as the sustainability-linked bond (SLB) Stephanie Mielnik and Ulf Erlandsson, 2022, which firms have issued specifically linked to achieving their sustainability goals.

Sustainability-linked bonds represent a growing segment within the green finance market ICMA, 2024, designed to incorporate broader sustainability goals into financial instruments. Unlike traditional green bonds, which are earmarked for specific environmentally beneficial projects, SLBs are tied to the issuer's overall sustainability performance, measured against predefined key performance indicators (KPIs) and sustainability performance targets (SPTs). Next, we discuss a few features of SLBs:

1. *Structure and mechanism.* The fundamental structure of SLBs revolves around their performance-based nature. Issuers commit to achieving specific sustainability targets, and the bond's financial characteristics, such as coupon rates, are linked to these targets. Penalties such as increased coupon rates are activated if the issuer fails to meet the predefined KPIs. This structure incentivises issuers to adhere to and achieve their sustainability goals, integrating financial and environmental performance.

2. *Market growth and demand.* The SLB market has witnessed substantial growth since its inception. This growth is fueled by increased investor demand for sustainable investments and corporate commitments to environmental, social, and governance (ESG) criteria.

[1] Bonds with features that enable them to convert from fixed-income securities to equity.

[2] Further variants can be specified that are linked to a firm's direct strategy and realised rates of decarbonisation.

SLBs' flexibility, allowing for a wide range of sustainability targets beyond just environmental projects, makes them attractive to diverse industries. This broad applicability has enabled SLBs to expand rapidly, particularly in sectors where specific environmental projects might be limited, but overall sustainability goals are critical.

3. *Benefits, impact, and enhanced accountability and transparency.* SLBs promote greater accountability as issuers are required to disclose their progress towards achieving sustainability targets. Regular reporting and third-party verification of performance enhance transparency and build investor trust.

4. *Broader sustainability goals.* By linking financial terms to various sustainability KPIs, SLBs allow issuers to address multiple aspects of their ESG strategies. This flexibility supports a more comprehensive approach to sustainability, encompassing social and governance targets as well as environmental ones.

5. *Corporate behaviour incentives.* The potential financial penalties for failing to meet sustainability targets creates an incentive for issuers to follow through on their commitments. This alignment of financial and sustainability interests helps drive corporate behaviour towards achieving long-term sustainability objectives.

6. *Challenges and criticisms.* Despite their benefits, SLBs also face several challenges. One significant issue is the establishment of credible and ambitious KPIs. If targets are too low, the bond's effectiveness in driving real sustainability improvements may be undermined. Conversely, overly ambitious targets may discourage issuers due to the risk of financial penalties. Moreover, robust standardization and verification frameworks are needed to ensure the reliability of reported data and to prevent "greenwashing." Developing clear guidelines and standards by regulatory bodies and industry groups is crucial to address such concerns and to maintain market integrity. Some have questioned the strength of the SLB incentives if the firm "defaults" on its sustainability goals, its liabilities (and effective leverage) increase thus reducing the likelihood of accelerating the transition. Whilst the current SLB market may be small relative to total bond issuance, widespread use of such an instrument may create adverse incentives for investors who may seek to benefit from a failure of transition from the increased coupons, to a potential increase in public liabilities in addressing the implicit funding gap required to accelerate a "failing" transition. Furthermore, it has been argued that impacts to executive remuneration would likely have a greater impact on the firm than a firm-wide increase in tax-deductible expenses.

7. *Outlook on climate and sustainability-linked bonds.* The future of more general climate and sustainability-linked bonds (GCSB) appears promising, with increasing integration of ESG criteria into investment decisions and growing regulatory support for sustainable finance. Innovations in sustainability measurement and reporting, and enhanced regulatory frameworks are expected to drive the adoption and effectiveness of GCSBs, further. As issuers and investors become more sophisticated in understanding and implementing sustainability-linked financial products, the GCSB market is poised to play a critical role in transitioning to a sustainable global economy.

In the remaining sections, we highlight several mechanisms that would enable nation-states to engage and enhance the opportunities presented by CloCos and address the criticisms of SLBs. In section 2, we highlight the role of sovereign wealth funds and their current applications for adaptation and climate finance. In section 3.2, we introduce the first two mechanisms for sovereign wealth funds to engage with the CloCo market—the so-called sovereign wealth fund influence model. In section 4, we provide a fully integrated solution for sovereign wealth funds to engage with governments as part of a wider strategic climate and sustainability programme to enhance investment. In section 6, we conclude with a summary of the potential impact of CloCos and the S-CloCo mechanisms.

2 Review of climate investments at sovereign level

Since 2017, there has been a five-fold increase in the total market value of government-issued green bonds, as seen in Figure 1, c.f., MSCI, 2023.

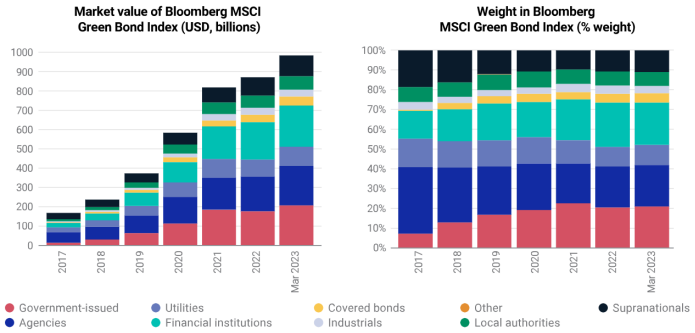


Figure 1: *Sovereign green bond issuance. Source: MSCI, 2023).*

The total value of sovereign green bond issuances as of March 31, 2023, is USD 986 billions. The issuance of the bonds has been linked to new public green infrastructure projects and covers projects to improve flood defences, resilience spending for public infrastructure, and projects to maintain/improve biodiversity. The size of the market is growing, with over 20 nations issuing green bonds. Furthermore, some nation-states with sovereign wealth funds have increased their investments in "green" technologies relative to their investments linked to fossil fuel, see Visual Capitalist, 2024.

Country	Fund	Assets (USD billion)	Origin
Norway	Government Pension Fund Global	1631	Oil & Gas
China	China Investment Corporation	1350	Non-commodity
China	SAFE Investment Company	1090	Non-commodity
United Arab Emirates	Abu Dhabi Investment Authority	993	Oil & Gas
Kuwait	Kuwait Investment Authority	980	Oil & Gas
Saudi Arabia	Public Investment Fund	925	Oil & Gas
Singapore	GIC Private Limited	770	Non-commodity
Qatar	Qatar Investment Authority	526	Oil & Gas
Hong Kong	Exchange Fund (Hong Kong)	514	Non-commodity
China	National Council for Social Security Fund of China	414	Non-commodity
United Arab Emirates	Investment Corporation of Dubai	341	Oil & Gas
United Arab Emirates	Mubadala Investment Company	302	Oil & Gas
Singapore	Temasek Holdings	287	Non-commodity
Turkey	Turkey Wealth Fund	279.3	Non-commodity
United Arab Emirates	Abu Dhabi Developmental Holding Company	196	Non-commodity
South Korea	Korea Investment Corporation	189	Non-commodity
Iran	National Development Fund	156	Oil & Gas
Australia	Future Fund	145	Non-commodity
Russia	Russian National Wealth Fund	133	Oil & Gas
Canada	The Province Of Alberta	123	Non-commodity

Table 1: *Top 20 largest Sovereign Wealth Funds by Country (Wikipedia).*

2.1 Role and risk appetite of sovereign wealth funds

Sovereign wealth funds, as highlighted in Table 1, have grown from the increased wealth generated by their host nations. A large fraction of the funds have been built from proceeds generated through fossil fuel, mineral extraction, and other sources derived from public land wealth and surplus government income as shown in Figure 2.

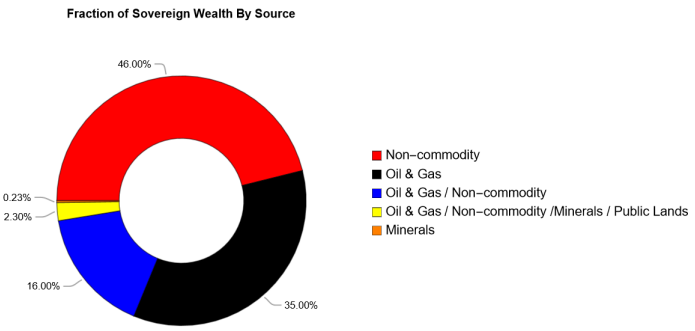


Figure 2: *Source of Sovereign Wealth Funds (Wikipedia). Wikipedia, 2024).*

As of July 2023, the total wealth in sovereign wealth funds is estimated to be USD 13.8 trillion. This constitutes a sizeable portion ($\sim 5\%$) of the total global investment market, where the total fixed income market amounts to around USD 140 trillion, and the equity market capitalisation is worth around USD 115 trillion.

For investors, the desire to hold corporate bonds and/or equities reflects their risk/return portfolio preference. Equities are regarded as a riskier investment compared to fixed-income investments. However, the expected long-term returns for equity investments have outperformed fixed-income investments. Firms that engage in CloCo issuance strategies would need to engage their current investors and communicate the clear risks of future climate policies (or realised de-carbonisation trajectories). For firms issuing CloCos the option to convert to equity in a transparent way, in the sense that the trigger for the issuance of new equity is contractually pre-determined and hence visible to investors. This clarifies future changes in their current share price and provides a means for equity investors to assess future returns post-conversion. These risks are discussed qualitatively in Section 5.1, and the full quantitative study is planned to be part of an updated version of the paper Cormack and Macrina, 2024.

2.1.1 Sovereign wealth fund objectives

SWFs serve several functions worldwide. The primary purpose for commodity-based funds, especially in the energy sector, has been to create a funding source to diversify away from finite natural resources for short-term and longer-term funding stability. This has been used to address factors such as potential government pension shortfalls, create investments in local infrastructure, stimulate innovation, and subsidise early-stage industrial development. The other major category of SWF investment is to address the impacts of excess currency appreciation by holding strategic investments in foreign assets, or direct currency control through holdings in foreign sovereign debt. SWFs have been used to help with financial stability with strategic investments in failing commercial and nationalised banks, thus assisting with reducing public debt liability. With the expected reduction in demand for fossil fuels, there is a desire for sovereign wealth funds to rebalance their holdings during the current climate transition. For example, SWF investments have been directed towards

infrastructure projects to improve climate resilience and to invest in renewable industries IFSWF, 2023. The role of a SWF as a mechanism for strategic investment in domestic projects and companies directly impacts their nation's growth potential. Furthermore, cross-border securities holdings can be influential in attracting foreign investment and shareholder influence [3] and enable national wealth to be drawn from non-domestic assets.

3 Influence of sovereign climate investment

The introduction of CloCos across the private sector provides a novel means for nation-states to influence and accelerate investments for firms within its jurisdiction. Within this section, we highlight several structures sovereign states can deploy to support the use of CloCos.

3.1 CloCos benefit firms and investors exposed to national transition risk

In clarifying why a nation-state may wish to engage in the systematic adoption of the use of CloCos, it is worth highlighting the comparative advantages of the CloCo bond in any economy where transition plans are uncertain. [4] The CloCo is designed for firms to mitigate their transition risks, that is, the economic risk that they may suffer due to the introduction of a decarbonisation policy or a change in such a policy that may cause a disadvantage to their economic performance. Whilst it is anticipated that the bond would be utilised by firms with a legacy business model that relies on fossil fuels, it also enables firms that may be early adopters of more capital-intensive low-emissions technologies to convert the debt to equity should they desire to adopt new low-cost technologies.

Investors are explicitly rewarded for compensating the transition risk of the firm, for a CloCo bond can be structured to provide a higher coupon (see Cormack and Macrina, 2024) than conventional bonds of the same debt seniority. Upon bond conversion to equity, the CloCo holder becomes a shareholder of the firm. They then have the ability to sell the shares and reinvest in securities that meet their risk preferences or hold on to all or some of the equity in anticipation of further enhanced growth. Of course, one can expect that the conversion process has an impact on the firm's equity value. In assessing this impact, one observes that if the firm has $N_s(T^{*-})$ shares at a time T^{*-} just before conversion with a price $S(T^{*-})$, then at conversion time T^* the outstanding value of the bond $V_{\mathbf{CloCo}}(T^*)$ is converted to new equity at a share price of $S(T^*)$, where the number of new shares issued is

$$N_s(T^*) = \frac{V_{\mathbf{CloCo}}(T^*)}{S^*(T^*)} \tag{1}$$

It follows that the value of the firm is given by

$$N_s(T^{*-})S(T^{*-}) = [N_s(T^{*-}) + N_s(T^*)]S(T^*), \tag{2}$$

and therefore, the expected price impact for shareholders is given by

$$S(T^*) = \frac{N_s(T^{*-})S(T^{*-}) - V_{\mathbf{CloCo}}(T^*)}{N_s(T^{*-})}. \tag{3}$$

This valuation can be taken further to assess the impact on the share price contingent on conversion. For issuing firms, the impact on the equity forward value and its implied volatility can be estimated and will be impacted by the conversion window and terms of the CloCo. By issuing a CloCo the factors that determine the time of the conversion event are contractually defined, and hence, equity holders will have a clear view of the impact of CloCos providing a means to manage such a conversion risk. This is to be contrasted with an equivalent firm that has not issued any CloCos—these are exposed to a potential reduction in earnings from the inability to issue further debt in the event of a policy acceleration. It is evident that a firm that has the ability to raise funding would be able to out-compete from the point of conversion. The economic scenarios shall be explored as part of the update to the CloCo paper by Cormack and Macrina, 2024.

It is worth exploring an estimate of the total size of CloCo issuance that would impact the firm's competitiveness, meet the risk appetite for equity holders, and influence decarbonisation plans and policies. A hybrid instrument, such as the CloCo can be engineered to provide attractive returns and a favourable risk profile that would prove appealing to equity holders looking to invest over the time horizon of the firm's transition. The detailed preferences may be explored as part of the update to Cormack and Macrina, 2024. Still, considering an issuance of around 5-10% of a firm's debt value, the impact on equity valuations would be limited and in line with typical annual debt issuance. This would constitute $\sim USD11$ trillion in extra funding after conversion. The size of such an impact would constitute a further enhancement of 1-2 years of accelerated transition where the benchmark for funding expectations is based on the report by McKinsey and Company, 2022.

3.2 Sovereign wealth fund influence in CloCo markets

Sovereign wealth funds can play a direct role in the markets for CloCos by encouraging the active purchase of the bonds within a jurisdiction. The benefits, as highlighted earlier, involve the increased yield from the bond. Also, it is likely that SWFs could encourage national strategic investment in critical industries. As a consequence, a SWF's holding of CloCos and the SWF's wider influence on national pension funds, will reflect a risk appetite to provide investors with fixed-income and equity returns. Nation-states, for example, could encourage firms to issue CloCos where there may be a strategic need.

[3] Though SWFs have typically been restricted in their sizes of shareholdings in foreign firms, this has not precluded some foreign investment.

[4] Arguably intrinsically all transition plans face uncertainty, though some face enhanced political event risk factors.

3.2.1 Implications of SWF CloCo investments

The strategic engagement of a sovereign wealth fund in the CloCo market is anticipated to have a notable impact on the bond's liquidity, therefore providing a market mechanism to communicate timing and the price/cost of transition risk. This is valuable information to help both, prudential regulation and guide national planning on policy transitions. At a national level, the transparency from increased liquidity and ownership provides a means to reduce potential expensive and disruptive firm failures and the public cost of government bail-outs. This enhances a nation's ability to fund a transition and provides a mechanism to improve financial stability. This in turn helps drive further investment. A nation that is successful in its implementation of a CloCo investment strategy has a mechanism to reduce the need for further public debt raising to maintain or accelerate the rate of climate transition. Aside from the domestic market, sovereign wealth funds can influence international investment, notably within a nation's global supply chain, influencing foreign nations' ability to mitigate climate transition risks.Governments may seek to further support investments through new or existing tax-efficient investment scheme—this is highlighted in the next section.

4 Sovereign wealth fund mechanism for S-CloCo bonds

In exploring further options for sovereign wealth funds to engage with CloCo structures, we propose a novel mechanism that national governments may adopt to utilise state funds. Alongside the SWF influence model described in section 3.2, governments may issue sovereign debt as a CloCo to drive further climate change transition policies, including mitigation and adaptation priorities. We call this instrument S-CloCo. The S-CloCo differs notably from a standard private company CloCo, especially in its contingent conversion mechanism. In the same way as a firm-issued CloCo, nations issuing an S-CloCo would issue directly sovereign coupon-paying debt with a contingent clause to convert to equity. However, the equity component would generally consist of an option to convert to a basket of other bonds or equity from securities held in a sovereign wealth fund , or potentially in other government securities. Such a mechanism would enable governments to free up their net debt by releasing equity from the fund to the bondholders.

4.1 Integration in a national strategy of investment

Several strategies exist for nation-states to leverage their SWF to protect or enhance climate transition plans. The issuance of sovereign debt with the embedded CloCo provides the benefits of lower default risk and a more attractive risk profile for institutional investors. We emphasize a few aspects:

1. *Pension funds* could find the government-backed debt an attractive means to hold higher coupon-paying instruments and could be encouraged to support national climate transitions priorities, further.

2. *Increasing liquidity and financial hedging* in S-CloCos provides several benefits to nation-states, including a mechanism to hedge direct transition risk exposures. Such a hedging instrument allows financial institutions to reduce their exposure to transition risk at national level.

3. *National transition savings bond* schemes could be used to issue S-CloCos as savings bonds as part of a public issuance. Upon conversion, the S-CloCo would be converted into equity drawn from a suitable SWF. S-CloCosissued via such a scheme may require a refinement of the equity conversion mechanism so that there is minimal impact on equity markets. Managing this process and the markets' expectation on the underlying individual stocks should be considered in advance. The expected returns of the underlying equities can be defined at the point of conversion to avoid adverse impacts from the potential offloading of converted shares. Furthermore, governments may create special tax exemptions for S-CloCo savings schemes, providing a special exemption from capital gains tax on future equity sales or the ability for holders to reclaim or offset the value of the non-paid coupons upon conversion or provide direct access through tax-exempt savings schemes such as the UK ISA system.

Governments looking to set up tax-effective mechanisms for *National Transition Savings S-CloCo Bonds* could achieve such a structure with reduced administrative costs by engaging current pension funds, other asset managers and banks (private or state-managed) to add investment funds or securities custodial accounts in the S-CloCo . The objective being to improve traded liquidity in the instruments' secondary market and services to manage the equity conversion within their funds.

5 Impact of S-CloCo bonds on the climate transition

As a strategic instrument, the use of S-CloCo bonds can be optimised to meet the climate change objectives of the issuing government. Here, we highlight in qualitative terms the impacts to firms that issue CloCoscompared to a peer group of firms that compete for customers for similar goods.

5.1 S-CloCo strategic management

A financial instrument has a set of associated risks for the issuing firms, their investors and economic stakeholders. Except for the impact of the climate transition policy trigger, the risk to investors from market factors such as interest rates, credit spreads, and equity volatility is common to other investors in firm securities. [5] Future work on CloCoswill consider the

[5]The impact of CloCos on reducing broader market factor risks will form part of a more comprehensive study in a future papers.

broader strategic planning and risk management strategies. The policies introduced to drive the transition are at the core of the risks for sovereign states committed to climate change. Fiscal policies such as carbon and nature-linked taxes and tariffs provide a mechanism to affect change, but they may result in adverse growth, stifling further investment. At a national level, governments that wish to accelerate their sustainability transition may find that further public debt issuance could result in a degradation of credit quality, further hampering private investment. From Sections 3 and 4, that the set of S-CloCo mechanisms can reduce a fraction of the public debt burden that may otherwise have been directed to increasing public funding.

5.2 CloCo issuance strategy risk

Since the CloCo conversion mechanism is designed to permit firms to accelerate their asset holdings and convert part of their investment base from bondholders to equity holders, this may impact overall levels of investment within a nation. For firms issuing CloCos there will be several investment strategies within each industry group (with similar capital structures). Such an impact arises from the view on the total return on firm's assets that the conversion of a CloCo can generate. Firms issuing CloCos will be able to increase investment when compared with their non-CloCo-issuing competitors.

Firms anticipating future risks linked to climate transition would be aware of the likely economic drivers that may make their businesses non-competitive. For example, the primary risk is the acceleration of the reduction in technology capital costs. The availability of such solutions would increase the likelihood for governments to accelerate decarbonisation policy action, which. Outside of economic drivers, direct political choices motivated by a change in public sentiment to physical risks.

It's worth considering several scenarios that firms (or nations) may wish to explore when issuing CloCos. It may be the case that the impact of CloCo issuance provides only a marginal return on assets relative to its peer group, hence limiting the competitive impact of CloCoconversion for the firms (nation). Firms risk diluting equity holders for little benefit. Such a scenario would occur if, for example, the expected capital costs of new or competitive low emissions (or less sustainable) technologies are comparable to today's technology. In this circumstance, firms gain little competitive benefit from enhancing returns on assets as the incremental increase in demand driven by the price differential is marginal. Conversely, the impact on a firm's competitive position from CloCo issuance, if the expected range of technology capital costs may be considerably lower than today, provides a clear opportunity for firms to enhance their competitive position relative to their peer group. Firms that can reduce their debt burden efficiently and transparently for investors can further accelerate investments in new, likely lower-cost technology. As a consequence, CloCo issuing firms have a competitive ability to adjust product pricing to secure increased market share.

For the peer group of firms that may look to exploit new lower-cost technologies but have not engaged in the issuance of CloCos to remain competitive, they would need to raise funding, diluting their stock by issuing further equity. As a strategy, waiting may be appealing, but it can be risky. Firstly, shareholder approval may not be achieved, and delays may occur. Secondly, a firm looking to raise funding from equity in this manner would likely have incurred comparatively adverse equity market moves relative to their CloCo issuing peers. Firms that adopt a wait-and-see strategy and decide not to issue equity at an acceleration of climate policy would likely suffer an adverse impact on their competitive position in the market and, hence, suffer a reduction in equity value and ability to serve their existing debt.

Such notions of competitive opportunities can be extended to sovereign-level strategies, where the use of the two S-CloCo mechanisms can further enhance a nation's growth and competitive position. At a national level, the S-CloCo mechanisms provide several means to access lower-cost goods, thus reducing inflationary pressures. Diminishing the need to raise further public finance reduces economy-wide capital costs. Indeed, the S-CloCo can be used as an alternative mechanism to aid quantitative easing, providing an extra mechanism alongside central bank interventions on monetary policy.

Since a CloCo is a hybrid instruments with its respective risk and returns over the lifetime of the instrument, this creates a differentiated instrument to be considered by asset managers as part of their portfolio allocation. Given the risk and return profiles, it can potentially engage both equity and fixed-income investors. Its unique features of the potential higher returns from the coupon and its potential conversion to equity ensure that holders of CloCos are not subjected to the dilution effect. Hence, its investor risk preference may be closer to longer-term equity holders (asset managers). This is an important consideration for firms as they gauge their engagement with both bondholders and equity investors. Other sustainability-linked bonds, such as step-up-coupon SLB bonds, are explicitly targeted at fixed-income investors, where they may tolerate reduced yields but are compensated with a higher coupon for the firm's failure in its ESG-linked objectives. However, considerations of a firm's post-conversion leverage, competitiveness and impact on credit quality have yet to be investigated in the commercial or academic literature.

For the viewpoint of investor risk preferences, the hybrid nature of the CloCo has been designed to be attractive across a range of investor types, with a specific view that the instrument should appeal to longer-term equity investors. The implications of the instrument's success in attracting such investors provide an interesting mechanism to enhance the capital formation process for the transition.

Strategic risk-taking and optimal issuance may be explored as a next step while highlighting optimal criteria and risk mitigation. Such concepts can then be extended to portfolio construction with CloCosto emphasize how the hybrid nature of CloCoscan enhance overall risk and returns profiles of investments linked to climate policies. For nation-states, such a portfolio view can help guide both S-CloCo issuance mechanisms.

We conclude with a remark concerning the risk management of the wealth fund model for S-CloCos. Where a government chooses to issue an S-CloCo backed by equity in the

sovereign wealth fund, there is a need to ensure that there is sufficient equity in the fund to cover the conversion. This risk can be readily assessed in a managed wealth fund, and the fraction of the fund allocated is fixed, a characteristic that should reassure investors. At the time of conversion, the sovereign wealth fund can determine which basket of equities to release from the fund. This divestment can reflect the natural re-balancing of the fund and provide ownership in other assets of the fund.

6 Summary

A number of concepts have been introduced for sovereign states to enhance their financing strategies in the face of climate change challenges.

The introduction of the S-CloCo *influence* mechanism and *sovereign wealth fund* structure provide a novel approach to drive climate transition plans while mitigating transition risk.

The two mechanisms we introduce allow sovereign nations to grow capital formation at a point in their climate transition planning when further capital may be required to accelerate decarbonisation and improve adaptation funding. These two mechanisms have been designed to enhance the use of CloCos where we highlight their potential to attract capital from long-term equity investors (asset managers), accelerating capital formation for climate transition investors.

In the case of the *influence* model, nations explicitly encourage the use of privately issued CloCos by domestic firms—asset management firms and pension funds. Nations engaging in such a mechanism can further encourage uptake by utilising or creating tax-efficient schemes for domestic investors in CloCos and leverage the application of sovereign wealth fund direct investment to stimulate liquidity in the CloCo markets. Regarding the potential fraction of debt issued in the form of CloCos one could expect that firms may issue 5-10% of the value of their current equity [6] in this form. This could amount to around USD 5-10 trillion in privately issued CloCos. The SWF-linked S-CloCo has a further potential to raise an extra USD 1 trillion on 10% of the current wealth held in SWFs. The timely use of such a mechanism to accelerate climate transition priorities could give those nation-states a considerable advantage. The hybrid nature of the CloCo (and S-CloCo) has been explicitly designed to be attractive to a wide range of investors, both equity and fixed-income investors. Notably the structuring and issuance of the CloCo can engage current long-term equity investors with attractive returns. The impact to investment portfolios and the optimal rationale for firms will be explored in a future publication.

For the case of the *sovereign wealth fund* mechanism, we extend the sovereign nations' engagement in CloCos further to create the S-CloCo bond, whereupon conversion of the bond, investors receive stocks from the nations sovereign wealth fund. This mechanism provides a direct means for governments to reduce the national debt burden at a strategically critical point, providing a competitive advantage. This way, governments could stimulate the economy via sovereign wealth funds and provide a further lever outside of monetary and fiscal policy to drive the climate transition commitments.

[6] Which is approximately 5 - 10% of the current debt.

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