IMPLICATIONS OF THE FRTB FOR CARBON CERTIFICATES

INTERNATIONAL SWAPS AND DERIVATIVES ASSOCIATION
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PREFACE

The Fundamental Review of the Trading Book (FRTB) includes higher capital charges for carbon trading under the standardized approach to market risk, which has implications for banks in their role as intermediaries in the emissions trading system (ETS).

ISDA believes it is important the regulatory treatment of assets is justified from a risk perspective. This is particularly important for carbon certificates, as inappropriate levels of capital would impact the functioning of this market and also affect the willingness of institutions to invest in the transformation to a green economy.

This paper investigates whether the more conservative treatment of carbon credit trading in the FRTB is justified from a risk perspective.

MAIN FINDINGS AND RECOMMENDATIONS

Key Conclusions

The results of ISDA's analysis suggest the FRTB in its current form unduly penalizes carbon credit trading. In particular, the FRTB treatment of carbon certificates appears out of sync with underlying risks in two key areas. This is problematic as it could impair the ability of banks to act as intermediaries in the ETS market globally, hampering a key tool for policy-makers to ensure a cost-effective transition to a carbon-neutral economy. The two aspects are:

- **Risk weight of carbon certificates:** The results of ISDA's analysis suggest the risk weight for carbon certificates under the standardized approach to market risk is set too high. Based on the estimated stressed-period volatilities of carbon certificates, ISDA believes a risk weight of around 37% would be more appropriate. This is less than two-thirds the 60% risk weight currently prescribed by the FRTB framework. Viewed in isolation (disregarding spillover effects to other parts of the portfolio), this would imply a lower capital charge of close to 40%.

- **The FRTB penalizes carry positions:** This might be appropriate for commodities with physical storage costs, as fluctuations in such costs imply a carry position is not a perfect hedge. Consequently, the FRTB imposes a correlation of 0.99 between spot and forward positions. However, carbon certificates are not typical commodities as there are no physical storage costs. Therefore, a much higher correlation for carbon certificates is appropriate. In fact, data on EU allowance (EUA) spot and forward trades shows a correlation of around 0.996 between returns for spot and future carbon certificates. Including this correlation in a simplified example of a typical carry position implies an almost 40% reduction in the capital charge of carbon certificates. ISDA recommends setting a tenor correlation parameter (medium correlation scenario) for carbon certificates of 0.995-0.999, reflecting empirical observations. This is a conservative approach: low and high correlation scenarios are calculated based on this parameter, with the largest capital requirement taken from the three scenarios.

  An alternative to updating the tenor correlation parameter could be to extend the exemption for pure stock financing from the simplified standardized approach to the standardized approach. This would result in positions where a physical stock has been sold forward being excluded from the commodities risk calculation, which would function as an exemption for carry positions of carbon emission certificates (ie, certificates bought and sold at a fixed price).

The analysis suggests that including both the lower risk weight of 37% and the higher tenor correlation of 0.996 would result in a 60% reduction in capital requirements, based on the simplified example for a typical carry position of a bank.

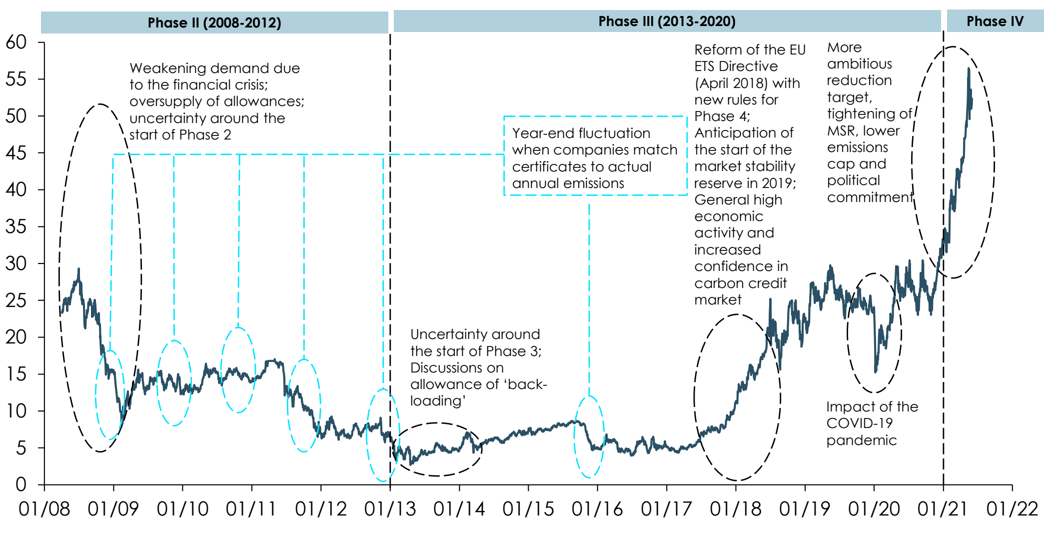
Emission Trading is a Central Tool in the Transition to a Carbon-neutral Economy

ETSs have become a central tool in the transition to a carbon-neutral economy for governments around the globe. This type of system is favored for two key reasons:

1) An ETS allows governments to set a cap on the level of greenhouse gas emissions that matches their climate goals;
2) An ETS enables the reduction in greenhouse gasses to be realized efficiently (ie, with the lowest possible economic costs) through the trading of carbon certificates.

An example of an ETS is the EUA market, which is one the most mature and active markets transacting carbon certificates. The market now works as intended after several periods of instability primarily caused by oversupply and the global financial crisis, with a de-facto price for carbon emissions set at approximately €50/tCO_2e for energy producers and heavy industry (see Figure 1). In total, the EU ETS covers about 40% of the EU greenhouse gas emissions.

Figure 1
Price Development of EUA Futures (2008-2021)
€ per tCO2e



Note: ICE ECX continuous one-month future prices
Source: Refinitiv Datastream

The previous instabilities in the EUA market do not reflect its revamped design. Three key changes in the functioning of the market make the instability observed before 2013 unlikely to be repeated:

1. The introduction of a market stability reserve (MSR) will continue to stabilize prices as it allows the EU to restrict and (from 2023 onwards) remove allowances from the carbon market in times of excess supply (see Documentation Section 1);
2. The declining cap on emission allowances will contribute to stable prices at a sufficiently high level;

3. Ongoing political engagement to achieve a carbon-neutral economy suggests prices should remain stable in the future.

Although most developed in the EU ETS, carbon credit markets are appearing globally as an economically efficient way of reducing greenhouse gas emissions. California established an ETS in 2013, with a current price of approximately €15/tCO_2e. New Zealand also implemented an ETS in 2008. Similar to the European market, it experienced low prices and confidence initially, but carbon certificate prices are now steadily increasing to the EU level. Most recently, China launched the world's largest scheme in 2021. Efforts are also under way to establish so-called voluntary carbon credits, which enable
governments and companies to voluntarily offset their emissions outside of compliance schemes.

ETSs Will Grow in Importance

Implied carbon prices in different jurisdictions have increased over the past decade to reach a level that reflects a significant cost of emissions. However, there is still some way to go to reach the level required to meet the temperature target of the Paris Agreement. Prices in many jurisdictions remain low, with half of the emissions covered by carbon pricing initiatives priced at $10 per metric ton or less (World Bank, 2020). As acknowledged by the Franco-German Council of Economic Experts in April 2021, carbon prices will have to rise steeply over time in order to meet the more ambitious European climate targets by 2030[1]. The exact expected costs are heavily debated in climate economic research, but the High-Level Commission on Carbon Prices estimates that carbon prices might have to reach up to $100/$tCO_2e$ (€84/tCO_2e) by 2030.

The ongoing political commitment combined with the right incentives will help the developing ETS markets to mature and achieve a steady price for carbon emissions.

Banks are Key to an Effective Carbon Certificate Market

Banks play an important role in facilitating an effective ETS. Typically, they are counterparties to utilities or industrial companies in selling forward carbon certificates. Banks then hedge their exposure with spot EUAs bought in the market and through auctions. In other words, they alleviate any mismatch between spot supply (eg, auctions) and forward demand (power hedging or strategic purchases), which helps minimize the transaction costs of ETS compliance for utilities and industrial installations. This increases market liquidity and stabilizes carbon certificate prices. A functioning forward carbon certificate market provides certainty about the future costs of emissions, allowing companies to plan ahead (eg, on the benefits of strategic investment in carbon emission reduction technologies).

The FRTB will Increase Capital Charges for Carbon Certificates

The FRTB will increase the capital costs for banks participating in the carbon certificate market. In particular, two aspects of the FRTB are expected to increase capital costs:

1) **High risk weights**: Under the FRTB, carbon certificates have been allocated a risk weight bucket of 60% – among the highest of all commodities (eg, twice that of crude oil);
2) **Penalization of carry positions**: In contrast to Basel 2.5, netting is not possible, meaning buying spot and selling forward entails a capital charge.

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[1] https://www.bmwi.de/Redaktion/DE/Downloads/Stellungnahmen/Stellungnahmen-des-Rates-der-Wirtschaftsexperten/Stellungnahmen-des-Rates-der-Wirtschaftsexperten-carbon-pricing.pdf?__blob=publicationFile&v=4

As well as affecting compulsory schemes, this punitive regulatory treatment could hamper the development of the voluntary carbon market. This is still small compared to compulsory schemes, but has been growing in recent years and is expected to become increasingly important.

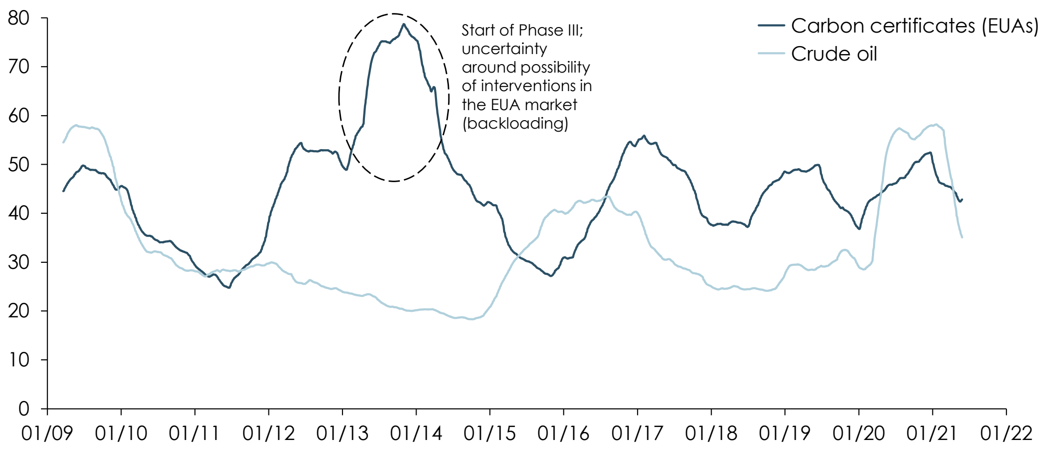
The critical question is whether the tightening of market risk regulation for carbon certificates is justified from a risk perspective. ISDA believes it is important that financial regulation is proportionate to underlying risks. In terms of carbon certificates, this is particularly crucial as inappropriate regulation could impede the ability of banks to act as intermediaries in the ETS market.

1) Risk Weights of Carbon Certificates

The designated risk weights – and therefore the capital charge – of securities are closely related to the implied volatility. The rationale is that the higher the volatility of the security, the higher the capital charge to cover losses in a market downturn. As a simple example, if it is estimated that a security will lose 30% of its value in a severe market downturn before a dealer can liquidate the asset, the capital charge should be equivalent to that 30%. This expected shortfall depends on the volatility of the asset – higher volatility implies a higher capital charge.

In assessing the volatility, it is important to recognize that carbon certificates are not like other financial instruments. The volatility of the asset is heavily linked to the design of the ETS and the political capital invested in it. For example, there is increased political commitment in the EU to ensure confidence and stability in the EUA market, which means the relatively high volatility in the early 2010s is unlikely to be repeated (see Figure 2).

Figure 2
Rolling Yearly Average Volatilities for Crude Oil and EUAs
Percent



Note: The volatility estimations are based on the following daily data series: EUAs: ICE ECX continuous one-month future price series from Refinitiv; Crude oil: ICE continuous one-month future price series. Volatilities are illustrated as a yearly moving average of the estimated volatilities

Source: Refinitiv Datastream and own estimations

An example of this political commitment is the MSR, first established in 2019 and further enhanced in 2021. The MSR is a policy tool that allows the EU to remove allowances from the carbon market in times of excess supply, which helps prevent a collapse of the EUA price. This is important as it allows for more stable prices that are less vulnerable to idiosyncratic shocks and result in a less volatile market. (see Section 2.1 below).

To assess the appropriate level of risk weights, average estimated GARCH volatilities for carbon certificates (in the EU ETS) are used over a one-year period. To account for the higher volatilities during stressed periods, the highest average volatility over a continuous one-year window is calculated. Due to the developments in the EUA market, volatilities before mid-2013 are discarded, as these are not reflective of the current ETS market design and maturity. This suggests volatility in the EUA market was highest between February 2016 and February 2017, resulting in a stressed period volatility for carbon certificates (in the EU ETS) of around 56%.

Under the FRTB framework, banks should be able to cover losses in an extreme market downturn in the period that it typically takes to sell or hedge a position (known as the liquidity horizon). For carbon certificates, a 20-day liquidity horizon is prescribed for the internal model approach.

The appropriate level of risk-weights for carbon certificates can be assessed using a value-at-risk (VaR) approach. The estimated stressed period volatility (adjusted for the liquidity horizon) can be translated into an implied risk weight. Based on an estimated volatility of 56%, the risk weight would be around 37% (see Documentation Section 2). That is less than two-thirds the risk weight of 60% that is currently prescribed.

A risk weight of 37% would significantly reduce capital charges for banks operating as intermediaries in the ETS market. Specifically, the 23 percentage-point risk-weight reduction would imply a drop in the capital charge of close to 40% (disregarding spillover effects to other parts of the portfolio).

2) Penalization of Carry Positions

An appropriate risk weight for carbon certificates is particularly relevant in combination with the penalization of carry positions under the FRTB. The framework introduces a correlation factor less than one for positions of different maturities, meaning market participants cannot offset opposite spot and forward positions of the same commodity. This has implications for banks as they carry out their role as intermediaries in the carbon certificate market by taking carry positions (ie, buying spot and selling forward).

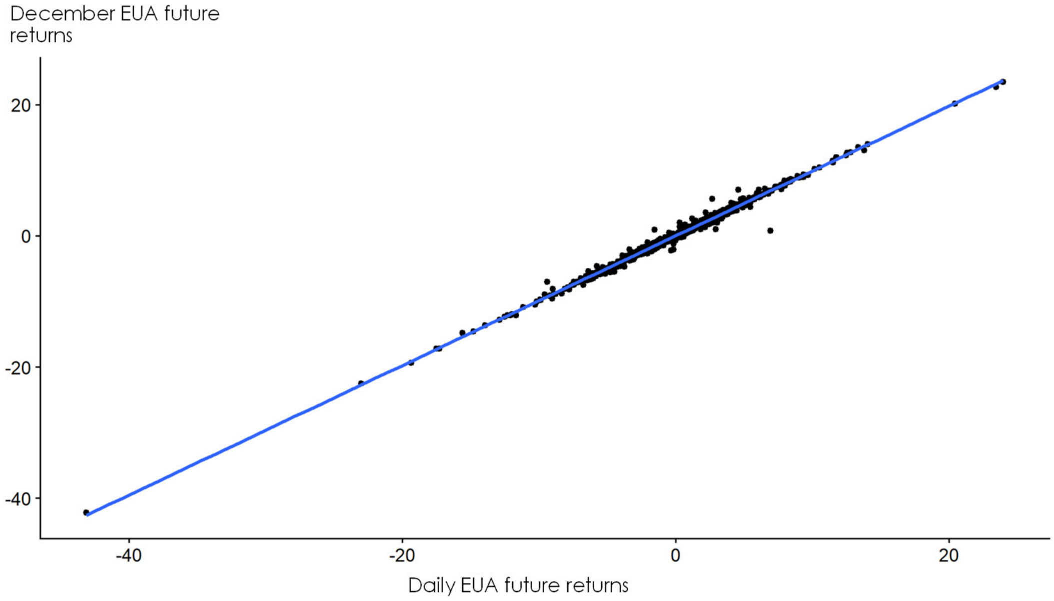
The fact that carry positions for commodities are generally subject to a capital charge seems reasonable. Most commodities are physical, meaning carry positions entail storage costs. These storage costs can fluctuate, meaning spot and forward positions are not perfectly correlated. Therefore, buying spot and selling forward is not a perfect hedge for most commodities. Under the FRTB, a correlation of 0.99 between spot and forward for commodities is assumed as a result.

However, carbon certificates are not typical commodities as there are no physical storage costs, meaning spot and futures positions should be more closely correlated than other commodities. In other words, a position where a bank has bought spot and sold forward is a stronger hedge for carbon certificates than for other commodities.

The hypothesis is confirmed empirically: an academic study from 2020[2] that examined the correlation between EUA spot and future markets between 2013 and 2018 found the correlation to be 0.9999.

The fact the correlation between spot and future should be higher than 0.99 is corroborated in this study. Analysis of the returns of spot and future EUA contracts found a correlation of approximately 0.996, also higher than the one stipulated in the FRTB (see Figure 3). Under the FRTB, a slightly higher correlation makes a big difference. Assuming a typical carry position, the implied capital charge will decline by almost 40% when assuming a correlation of 0.996 in the 'medium correlations' scenario compared to the 0.99 correlation prescribed in the FRTB[3].

Figure 3
Correlation Between Returns for Daily and December EUA Futures



Note: The estimation period for the analysis of the correlation between spot and future EUA returns is shorter (mid-2013 until June 2021) due to limited data availability
Source: Own calculation based on data on daily and December EUA futures from Bloomberg

Discussion on the correct correlation parameter should be seen in light of the simplified standardized approach, where full offsetting for stock financing (physical stock being sold forward with the cost of funding locked in) is allowed for commodities (ie, there is no capital charge for carry positions for carbon credit trading)[4]. However, an equivalent approach is not allowed for the standardized approach.

[2] Chen et al. (2020) *The Linkages of Carbon Spot-Futures: Evidence from EU-ETS in the Third Phase*
[3] Note that when aggregating the sensitivities-based method capital requirement, the 'low correlations' scenario has been applied (resulting in the largest capital requirement)
[4] See MAR40.65, footnote 25

Outside of the FRTB framework, the new standardized approach to counterparty credit risk (SA-CCR) might increase capital charges for carbon credit trading further. This is because the exposure value calculated under SA-CCR uses so-called supervisory factors determined by the regulator. These factors depend on the volatility assumed by the regulator. The higher the supervisory factor, the higher the exposure value and therefore the capital requirement.

The supervisory factor for carbon certificates is currently set at 18%. However, using the estimated stressed-period volatility results in a supervisory factor of only 15% – three percentage points below the factor set by the regulator. The underlying volatility assumed by the regulator therefore seems too high for a maturing carbon certificates market and will further increase the capital charge for carbon certificate trading.

1 EMISSION TRADING SCHEMES

ETSs are one of the main tools in the transition to a greener economy. By allowing governments to set limits on total greenhouse gas emissions, they are central to reaching the climate goals set by countries across the world. This is why several nations and regions have implemented different versions of ETSs to combat climate change.

1.1 HOW EMISSION TRADING SCHEMES WORK

ETSs are an economic cap-and-trade instrument to control the reduction of greenhouse gas emissions[5]. A governmental body first decides on the level of greenhouse gas emissions that matches climate goals, then issues allowances per unit of greenhouse gas emissions (eg, per ton) on a separate market.

The EU ETS market can be used to illustrate this process. In the EU ETS, the main instrument for allocating allowances in phase 4 (2021–2030) is auctioning. This works in the following way:

- The EU sets an EU-wide target and a number of allowances;
- The EU-wide target is distributed to each member state following historical emissions and fixed burden-sharing decisions and indicators;
- The countries are then allocated allowances to businesses within the covered sectors;
- The allocation mainly occurs through auctioning (70% as of 2020). The share of auctioned allowances will be increased to 100% in 2030 for businesses less at risk of carbon leakage.

In every ETS, those emitters covered by the scheme need to match their emissions with equivalent allowances that can be purchased in the allowances market. Hence, by lowering the number of allowances in the market, the level of emitted greenhouse gases can be reduced, whether these allowances are free or are auctioned.

The need to match emissions with equivalent allowances means the covered sectors and businesses must report and document their emissions and turn in a number of allowances matching these emissions each year. These allowances are subsequently cancelled, ensuring an allowance covering one unit of carbon emissions can only be used once.

Different ETSs are scoped differently in terms of the sectors covered. Certain industries might either be excluded or receive a higher share of free allowances (rather than buying them through an auction) to avoid so-called carbon leakage, where companies resettle to jurisdictions without carbon prices to save costs. For instance, businesses in sectors covered by the EU ETS that are deemed at high risk of carbon leakage can receive 100% of the allowances for free.

Emission Trading Schemes are an Efficient Way of Reducing Emissions

ETSs are efficient in the sense that emissions are cut however it is cheapest to do so. If it is more expensive for an emitter to reduce emissions than to buy certificates, it will buy certificates to surrender at the end of the year. If it is easy and cheap for an emitter to reduce emissions, it will save costs by having to match fewer emissions using allowances. The price of the allowances is therefore a key determinant in the transition to a greener economy.

[5] See, for example, the OECD, available at https://www.oecd.org/env/tools-evaluation/emissiontradingsystems.htm (accessed June 15, 2021)

1.2 ETS MARKETS AROUND THE WORLD ARE MATURING

There are currently 29 ETSs across the globe. Well-developed schemes exist in California and the eastern states of the US (RGGI), Québec and Alberta, New Zealand and South Korea. China launched the world's largest scheme in 2021, and the UK has established a UK ETS to replace its participation in the EU ETS following the end of the Brexit transition period. Germany has also introduced a national scheme in parallel to its participation in the EU ETS. This illustrates the increasing significance of ETSs around the world.

ETSs Experienced Price Instabilities in the Early Phases

It can take time for an ETS to function properly and produce stable prices. For instance, the EU ETS[6] experienced a collapse in allowance prices several times before mechanisms were introduced to create stability. The New Zealand ETS, which started in 2008[7], saw allowance prices drop to below €5/tCO_2e between 2013 and 2016.

The price of allowances in an ETS depends heavily on the regulatory design of the scheme, which influences stakeholders' confidence in the functioning of the scheme[8]. As the price in carbon credit markets is determined by demand and supply, the chosen level of allowed greenhouse gas emissions (and therefore allowances) has a large impact on price.

Prices can therefore fluctuate substantially, especially if the design of the ETS does not counteract this. Since its implementation in 2005, prices for EUAs collapsed several times, mainly due to flaws in the design of the scheme. Following the launch of the pilot Phase I (2005-2007), the price of allowances in the EU ETS dropped from around €30 to almost €0/tCO_2e, primarily because all industries received allowances for free and they could not be carried into subsequent phases.

In the early stages of Phase II (2008-2012), EUA prices fell from approximately €30 to less than €10/tCO_2e (see Figure 1). This price collapse was, again, mainly driven by oversupply due to the inflow of allowances from outside the EU as a result of the Clean Development Mechanism, an offset scheme introduced and run by the UN that allows the funding of emission-reduction projects elsewhere to count towards domestic carbon credits. Combined with reduced demand due to lower economic activity after the global financial crisis, this had large price effects. The price impact from reduced demand is important to understand the fluctuations in ETS prices. As the supply curve in each ETS phase is vertical (a fixed number of allowances is allocated to the market), even small changes in demand can have drastic price effects.

The allowance price stayed low (between around €5 and €15/tCO_2e) throughout much of Phase III (2013-2020) due to a continuing inflow of allowances from outside the EU and an ongoing oversupply of allowances *within* the ETS due to lower demand after the global financial crisis.

Adjustments to the ETS Design can Counteract Initial Price Instabilities

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[6] https://ec.europa.eu/clima/policies/ets_en (accessed June 15, 2021)
[7] https://icapcarbonaction.com/en/ets-prices (accessed June 15, 2021)
[8] Christiansen et al. (2011), *Price determinants in the EU emissions trading scheme*, available at https://www.tandfonline.com/doi/abs/10.1080/14693062.2005.9685538 (accessed June 15, 2021)

As an ETS matures, adjustments to its design can stabilize prices. For example, the EU adjusted its ETS at the end of Phase III to reduce design flaws, and allowance prices subsequently rose to above €25/tCO_2e in 2020 and as high as €50/tCO_2e in 2021.

Several factors have driven the positive price development of EUAs. Arguably the most important is the introduction of the MSR. After the EU initially held back significant amounts of EUAs (via so-called backloading) from 2017, the MSR was implemented as a means to control the number of allowances and alleviate the impact of demand effects on the price.

The MSR allows the EU to remove allowances from the carbon market in times of excess supply, which helps to stabilize prices in the allowance market (see Figure 4). The MSR has now been amended to allow the EU to not only hold back (store) excess allowances but also to cancel excess allowances from 2023, which will lead to a lower overall cap (supply) to the market. This will further strengthen and stabilize EUA prices.

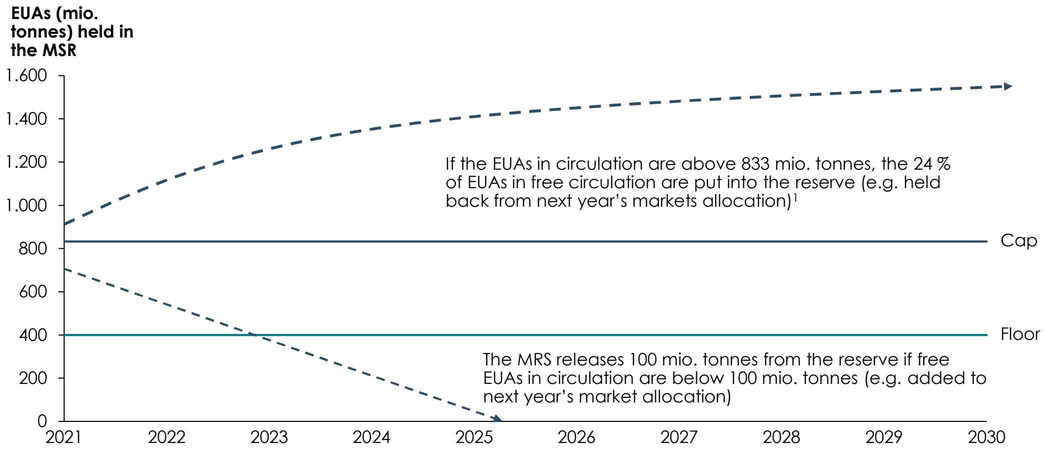
Another reason for the strong price development since 2021 is the steadily declining cap on allowances. The emission cap will now be reduced by 2.2% per year (instead of 1.73% between 2013-2020). As less and less allowances are allocated to the market each year, the covered sectors need to make deeper and more costly emission cuts. This is driving up ETS prices, as covered businesses are willing to pay more for allowances.

The establishment of the MSR and its reform to allow the cancellation of allowances will affect the number of allowances supplied to the market, which will further stabilize prices. Given the higher speed at which allowances are decreased per year, this suggests large drops in prices for EUAs are highly unlikely.

ETSs in other parts of the world can learn from these examples and produce a well-functioning scheme with stable prices more quickly. For instance, the Californian cap-and-trade scheme only started in 2013[9]. With established stabilization mechanisms in place, such as a minimum price, the price of allowances in the Californian scheme have increased from around €8 to over €15/tCO_2e.

[9] https://icapcarbonaction.com/en/ets-prices (accessed June 15, 2021)

Figure 4
How the MSR Contributes to Stabilizing EUA Prices
EUAs (million tons)



Note: The 24% is reduced to 12% from 2024 onwards
Source: EU Commission, Market Stability Reserve and Institute for Climate Economics, *EU ETS - Last call before the doors close on the negotiations for the post-2020 reform*

1.3 POLITICAL COMMITMENT REINFORCES THE STABILITY OF ETS IN THE FUTURE

The political commitment to climate goals worldwide mean ETSs will continue to gain significance globally and carbon credits will become a more standard trading instrument. The reliance on ETSs to fulfil climate goals also means prices for carbon allowances are likely to become more stable as markets around the world mature, become deeper and cover more of the economy.

The EU's reforms to its ETS, for instance, represent a clear political commitment to the scheme: The European Commission's latest revision proposal published in July 2021 aims to strengthen the EU ETS and provide a consistent carbon price signal across the EU's single market. It is proposed this will be achieved by ensuring steadily increasing prices and taking action if prices decline or collapse (eg. by reducing the cap on allowances, increasing the annual reduction in allowances allocated to the market or, extending the EU ETS to non-covered sectors, along with other measures).

The political commitment is further demonstrated by the fact that the EU has increased its emission reduction target to 55 % in 2030 – a change that is reflected in the sharp increase in EU ETS prices recently. The modified EU ETS is intended to reflect the revised EU emission reduction target for 2030, as part of the European Green Deal[10].

[10] European Commission, Climate change – updating the EU emissions trading system (ETS), public consultation, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12660-Climate-change-updating-the-EU-emissions-trading-system-ETS-_en

The ETS revision proposal also includes the first review of the MSR, meant to take place three years after the date of its operation. The review examines possible changes to the MSR's rules and design features, and analyzes whether the rules governing its operation remain appropriate in the context of the higher climate target and expanded ETS scope.

With more ETSs being established worldwide and the existing schemes maturing, ETSs are developing from being an experimental instrument to being a well-established economic tool to control greenhouse gas emissions. Learning from the early teething troubles, political commitment and adjustments to ETS designs will further stabilize the price of allowances.

1.4 THE VOLUNTARY CARBON MARKET

Besides compliance schemes, private companies are showing increasing interest in voluntary carbon credits to offset their emissions. The market is currently small compared to the compulsory carbon credit schemes, but it has been growing in recent years and is likely to gain importance in the future, further contributing to the transition to a carbon-neutral economy[11].

Voluntary carbon credits enable companies and governments to offset emissions they cannot otherwise avoid – particularly relevant for market participants that are not covered by any compulsory scheme. Given the increasing focus on climate change, voluntary carbon certificates provide a way for market participants to both contribute to a carbon-neutral economy and meet their corporate social responsibility strategies[12].

Voluntary carbon credits are issued by projects that avoid, reduce or remove greenhouse gas emissions from the atmosphere. As a result, they can encourage funding to green projects and support innovation in green technologies, helping to further drive the transition to a green economy[13].

A punitive treatment of carbon credit trading could have implications for the voluntary carbon credit market – inappropriately high capital charges on carbon certificates could hamper the development of this market as well. Given its large potential for growth[14] in the future, this could affect the global transition to a carbon-neutral economy.

2 REGULATORY TREATMENT OF CARBON CERTIFICATES

The FRTB represents an overhaul of the market risk framework. Among other things, it revises the standardized approach to market risk that banks use to calculate their capital requirements.

This paper analyzes the treatment of carbon certificates under the FRTB from two perspectives:

1) The FRTB prescribes certain risk weights for trading different commodities;

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11 See, for instance, McKinsey (2021) *A blueprint for scaling voluntary carbon markets to meet the climate* challenge and Poolen & Ryszka (2021) *Can voluntary carbon markets change the game for climate change*

12 See, for example, https://www.ecosystemmarketplace.com/articles/demand-for-voluntary-carbon-offsets-holds-strong-as-corporates-stick-with-climate-commitments/ (accessed June 15, 2021)

13 McKinsey (2021) *A blueprint for scaling voluntary carbon markets to meet the climate* challenge

14 McKinsey (2021), for instance, estimates that global demand for voluntary carbon credits could increase by a factor of 15 by 2030

2) It also sets correlations that must be applied between opposite positions of different maturities and when aggregating capital requirements across commodities.

These prescribed risk weights and correlations under the standardized approach both have the potential to penalize carbon credit trading.

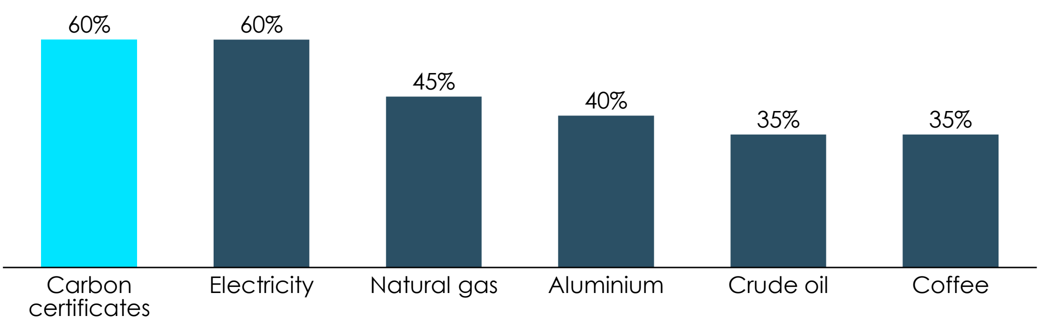
The impact can be assessed by considering a simplified example of a carry position of a bank. In this example, the bank buys spot carbon certificates to hedge against the sale of carbon certificates one year and two years forward. The impact is viewed in isolation of other potential commodities and assumes the bank only has a position in carbon certificates.

2.1 THE RISK WEIGHT BUCKET FOR CARBON CERTIFICATES

The FRTB framework allocates commodities with similar characteristics into one of 11 different risk weight buckets. Each of these buckets is assigned a risk weight, ranging from 20% to 80% (see Figure 5 for selected commodities). In general, the higher the risk weight, the more capital banks have to set aside when trading in that commodity.

Carbon credit trading is subject to a risk weight of 60%, meaning that whenever a bank holds a position in carbon certificates, it must set aside capital corresponding to the risk weight of 60%[15] of the sensitivity to the commodity[16].

Figure 5
Risk Weight Buckets for Different Commodities
Percent



Source: BCBS (2019) *Minimum capital requirements for market risk*

2.1.1 Appropriate Risk Weight Implied by Estimated Volatility

The basic rationale behind risk weights is tied to the principles of the Basel framework – ie, risk weights should be set to ensure banks can cover unexpected losses in the vast majority of negative

15 The risk weight is not the only parameter determining capital requirements in the FRTB framework (see Section 2.2)

16 The relevant sensitivity is the delta sensitivity, which measures the change in the market value of the instrument following a 1 percentage point change in the underlying commodity's spot price. If a 1 percentage point change in the spot price of the commodity leads to the same change in the instrument, the delta sensitivity will just be equal to the instrument's market value

events. That means the risk weight is determined in principle by the level of unexpected losses in an extremely negative event. The more risk involved in trading a commodity, the larger the risk weight.

To estimate the unexpected losses in an extreme negative event, the expected shortfall (ES) is determined by applying a VaR approach. VaR calculates losses due to general market movements over a given holding period at a single cut-off point in the distribution. ES[17] has to be used in the internal model approach in the FRTB and calculates the average of any loss exceeding the cut-off point in the distribution. This implies the value of ES will be higher than the value of VaR if the same cut-off point in the distribution is used.

The Basel III framework stipulates that risk weights in the standardized approach should be in line with the stressed ES calibration, ensuring a closer connection between the standardized approach and the more complex internal model approach. The ES and VaR measures can be approximately mapped to each other, which can be used to calculate ES. This is because the 97.5th percentile used when calculating ES is roughly equivalent to the 99th percentile VaR used in Basel 2.5[18] assuming a normal distribution.

To determine the 99th percentile VaR, the return volatility of carbon certificates is estimated. To do so, a GARCH model is applied over the sample period from mid-2013 (after EUA prices recovered (see Section 1)) to June 2021. From the resulting estimation of daily annualized conditional volatilities, the highest average volatility over a continuous yearly period can be extracted. In that way, stressed-period volatilities for carbon certificates can be estimated, which can be used to approximate an implied risk weight.

The estimated return volatilities also depend on the price level for carbon certificates. In low-price phases, small absolute fluctuations in the allowance price entail a large volatility of returns. This is because a small absolute price change leads to a larger change in returns if prices are small and therefore a higher risk of trading in that commodity (see Figure 2). As the EU has achieved its goal of stabilizing EUA prices at a higher level, EUAs are therefore less sensitive to idiosyncratic shocks.

This analysis uses a price series for contracts that are commonly traded. This differs from the FRTB framework, which requires the use of spot prices with only a few exceptions. By looking at common commodity contracts, the aim is to ensure the volatility is estimated on a market that is liquid enough to provide a realistic and representative estimate of the volatility. Specifically, prices for monthly EUA futures from Refinitiv Datastream are used for carbon certificates, as the spot market for EUAs is less relevant than the forward market[19].The concept of varying liquidity horizons has been incorporated into the revised framework as well[20]. The liquidity horizon measures how long it takes in a stressed period to close a position. The FRTB sets the liquidity horizon for the risk factor category labelled ‘energy and carbon emissions trading price’ at 20 days, implying it takes up to 20 days to close out positions in carbon credits during a shock.

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17 Expected shortfall is a measure of the average of all potential losses exceeding VaR at a given confidence level, which makes up for VaR’s shortcomings in capturing the risk of extreme losses (ie, tail risk)

18 See section 3.2 in BCBS (2019) *Explanatory note on the minimum capital requirements for market risk*

19 See, for instance, German Environment Agency (2020) *German Auctioning of Emission Allowances*, p. 12

20 BIS (2019), *Minimum capital requirements for market risk*, p. 92

The estimate of the risk weight implied by the stressed-period volatility is based on the 99th percentile VaR approach to calibrate it to the ES[21]. The 99th percentile VaR measures a loss that is only expected to be exceeded 1% of the time within a given period. Assuming a normal distribution of returns, the 99th percentile is 2.33 standard deviations away from the mean. Combining the two gives the following:

$$Risk\ weight \approx 2.33 * \sigma_{LH}$$

where σ_{LH} is the volatility of risk factors in a bucket over the prescribed ES liquidity horizon.

To account for the fact that the estimated volatility is based on yearly averages, the formula can be adjusted to reflect the volatility over the respective liquidity horizon. The assessed risk weight is calculated based on the approximate number of trading days (250), the liquidity horizon set by the Basel Committee (20 days)[22], the annualized estimated return volatility of carbon certificates (56%) and the 99th percentile for a normal distribution (2.33):

$$Risk\ weight \approx 2.33 * \sigma_{250} * \sqrt{\frac{LH}{250}} = 2.33 * 56\% * \sqrt{\frac{20}{250}} \approx 37\%$$

The yearly volatility is adjusted to the liquidity horizon by dividing by the square root of 250 and multiplying by the liquidity horizon of 20.

The resulting risk weight corresponding to the estimated volatility for carbon certificates is around 37% (see Figure 6). This is significantly lower than the risk weight of 60% under the current FRTB framework. The current risk weight would imply an underlying volatility of more than 90%.

A risk weight that is inappropriately high results in excessive capital requirements for banks that engage in carbon credit trading. This makes it more costly both for banks and for customers that rely on banks to facilitate their activities in the carbon credit market. Using a risk weight of 37% instead of the 60% prescribed by the FRTB could reduce capital charges for EUA positions by almost 40%.

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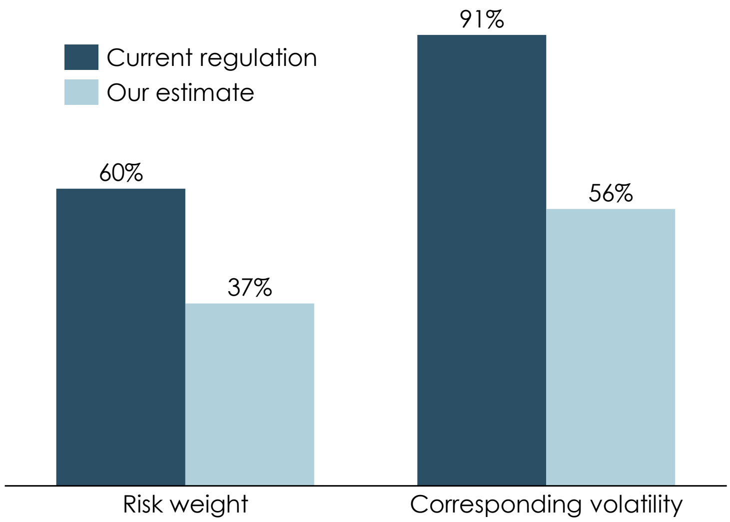
[21] BIS (2019), *Market risk*, p. 72

[22] EBA (2017), *Discussion paper - Implementation in the European Union of the revised market risk and counterparty credit risk frameworks* also uses a liquidity horizon on 20 days for carbon certificates trading

Figure 6
Assessed Appropriate and Actual Risk Weight for Carbon Certificates and Corresponding Volatility
Percent



Note: The volatility corresponding to the current risk weight of 60% is calculated based on the formula outlined in Section 2.1.1
Source: BCBS (2019), *Minimum capital requirements for market risk* and own calculations

2.2 CORRELATION BETWEEN SPOT AND FORWARD PRICES

The risk weight prescribed by the FRTB framework for carbon credit trading is just one of the parameters that impact capital requirements. Capital levels are also affected by the correlation requirements under the standardized approach for spot and future positions of the same commodity. The FRTB stipulates a correlation of 0.99 for exposures to commodities that do not have exactly the same tenor (ie, time until the contract expires).

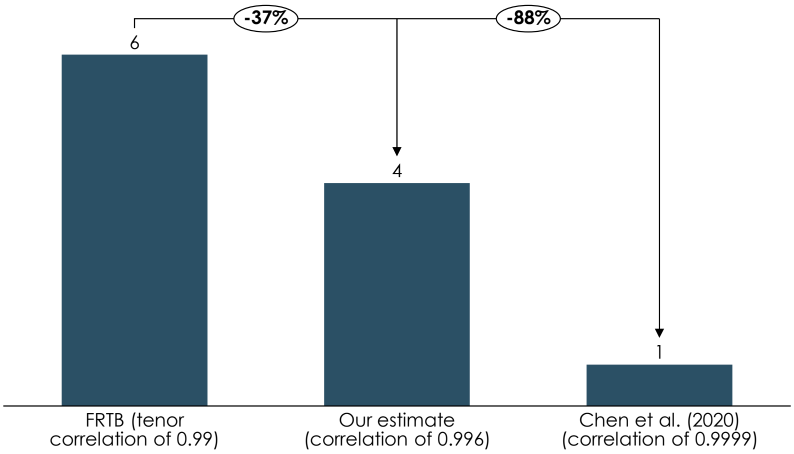
A correlation of below one means that banks cannot fully net positions. In other words, the typical intermediary role that banks take in carbon credit trading (buying spot and selling forward to companies trying to cover their EUA need) involves capital charge.

The correlation between spot and forward carbon certificates markets can be estimated using returns on daily EUA futures and end-of-year futures. This can be achieved by regressing returns on daily EUA futures on yearly EUA futures returns. Both time series are stationary and exhibit no trends. This means any correlation between the series is not due to an unobserved common time trend or unit root. The estimation period runs from mid-2013 until June 2021.

The resulting regression coefficient is close to one and the intercept is close to zero. The explained variance (R-squared) of this regression is around 0.992. As a linear regression with only one explanatory variable is calculated, the correlation coefficient is estimated as the square root of the R-squared. This results in an estimated correlation between spot and forward EUA returns of 0.996.

The capital charge is very sensitive to small changes in the correlation. In an illustrative example of a bank holding a €60 million spot position to hedge the sale of one-year and two-year forward positions of €30 million, capital requirements decrease by almost 40% when using the estimated correlation of 0.996 and by almost 90% when using the correlation of 0.9999 instead of the prescribed 0.99 (see Figure 7).

Figure 7
Illustrative Example of the Impact on Capital Requirements from Different Tenor Correlations
EUR million



Note: The example assumes a bank that has bought EUAs worth €60 million spot to hedge two forward positions of €30 million each. The assumed risk weight in the calculation is 60% as prescribed in the FRTB
Source: Own calculations based on a simplified FRTB model provided by the International Swaps and Derivatives Association

2.3 THE IMPACT ON SA-CCR

The punitive regulatory treatment might also extend to SA-CCR. The prescribed supervisory factors (SF) in this approach are used to calculate the add-on for the potential future exposure (PFE). The PFE is one part of the calculation of the total exposure at default, which determines the capital charge under the SA-CCR.

The SF for carbon certificates (currently set at 18%) can be inferred from the estimated stressed-period volatility according to the following formula set out in the Basel III framework[23]:

$$SF = \frac{\sigma}{\left(\frac{3}{2} * \sqrt{2\pi}\right)}$$

[23] BCBS (2017), *Foundations of the standardised approach for measuring counterparty credit risk exposures*

Using the estimated stressed-period volatility of 56%, the resulting supervisory factor for carbon certificates is around 15%.

ISDA RISK & CAPITAL CONTACTS

Panayiotis Dionysopoulos
Head of Capital
International Swaps and Derivatives Association, Inc. (ISDA)
25 Copthall Avenue, 3rd floor, London EC2R 7BP
DD: +44 (0)20 3808 9729
Main: +44 (0)20 3808 9700
pdionysopoulos@isda.org

Gregg Jones
Director, Risk and Capital
International Swaps and Derivatives Association, Inc. (ISDA)
25 Copthall Avenue, 3rd floor, London EC2R 7BP
DD: +44 (0)20 3808 9746
Main: +44 (0)20 3808 9700
gjones@isda.org

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In this note, we have supported ISDA by providing the analytical foundation of the findings, including the impact of the FRTB regulation, functioning of the carbon credit market as well as the volatility and correlation estimations.

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