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Linking the EU ETS with California's Cap-and-Trade Program: A law and economics assessment

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Abstract:

Aim: This paper aims to evaluate the legal barriers and policy obstacles to linking the European Union Emissions Trading System (EU ETS) with California's Cap-and-Trade Program in the United States, and to identify potential legal solutions to overcome them, by taking a law and economics perspective.

Design / research methods: A qualitative law and economics analysis is performed by combining the legal-dogmatic method with insights from economic theory. Primary sources are the respective legal frameworks, ETS regulations, past linking agreements and relevant case law. Secondary sources include the relevant legal and economic literature, as well as policy documents, reports and press releases.

Conclusions / findings: An EU-California linkage of emissions trading systems (ETSs) is legally feasible on the basis of an informal agreement, through reciprocal amendments to the respective ETS-regulations. Potential barriers could emerge, in particular from misaligned provisions regarding price containment measures and offsets. A gradual implementation of certain mutually beneficial ETS reforms, possibly in conjunction with initially restricted linkage, can provide momentum for transcending these barriers.

Originality / value of the article: To date, no linking has taken place between emissions trading systems from different continents. This paper contributes to the legal-economic literature on linking the EU ETS with California's Cap-and-Trade Program by performing an up-to-date analysis of its associated barriers and by providing concrete legal suggestions to possibly overcome them. Such a transatlantic linkage could enhance the cost-effectiveness of climate policy and contribute to the bottom-up expansion of carbon markets worldwide.

Keywords: EU ETS, California's Cap-and-Trade Program, Linking, Emissions Trading, Climate Change, Law and Economics.

JEL: K32, Q54, Q48

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1. Introduction

In 2020, one out of six people in the world live in a jurisdiction that operates a cap-and-trade program to curb climate change (ICAP 2020a: 26). This means that carbon pricing has been expanding since the launch of the European Union (EU) Emissions Trading System (ETS) in 2005, the first multi-country cap-and-trade program for greenhouse gases (GHGs). On the other side of the Atlantic, attempts were made in the United States (US) to implement a federal ETS through the American Clean Energy and Security Act of 2009 (the Waxman-Markey Bill), but this legislative proposal was eventually withdrawn due to a lack of political support. In the same year, however, ten states in the Northeast of the US succeeded in implementing the Regional Greenhouse Gas Initiative (RGGI), an ETS covering power plant emissions (Schmalensee, Stavins 2019). Subsequently, California – the largest economy of the US, located in the West – became the first state in America to launch its own Cap-and-Trade Program in 2012 (Hsia-Kiung et al. 2014: vi).

A cap-and-trade program is a market-based legal instrument that requires participating entities to cover their emissions with a corresponding number of emission allowances (Woerdman et al. 2015). These allowances may be allocated for free or auctioned. By progressively reducing the number of allowances issued each year while cancelling the surrendered ones, the competent authority can impose an annually declining cap on total covered emissions. Because allowances are freely tradable, emissions can be abated cost-effectively. Covered entities will seek the option with the lowest compliance cost: buying allowances (allowance cost), selling/banking allowances (abatement cost), or using allowances (opportunity cost) (Beuermann et al. 2017: 8). In this way, an ETS internalizes the externality of GHGs at a price determined by supply and demand in the market.

A direct linkage is established between cap-and-trade programs when the competent authorities accept each other's allowances as compliance instruments. Linking creates a larger allowance market, which offers a wider spectrum of emissions abatement opportunities so as to meet the overall emissions target at a lower cost. Furthermore, a larger volume of trade increases liquidity and renders the linked market less vulnerable to sudden price fluctuations (Haites 2016: 248). In

addition, linking may help to stimulate a bottom-up expansion of climate policy at an international level (Jaffe et al. 2009: 804).

In 2018, the Governor of California and the EU Climate Action and Energy Commissioner expressed their mutual political will to deepen their collaboration on emissions trading and align their carbon markets (European Commission 2018). Both jurisdictions have acquired experience with linking, since they have implemented and are currently operating linkages with Switzerland and Québec respectively. Linking the EU ETS with California's Cap-and-Trade Program would not only open up cost-effective abatement opportunities in both jurisdictions, but would also resonate a significant message of international climate cooperation, as it could mark the first intercontinental ETS linkage in history.

Zetterberg (2012) examined this prospect in light of the design differences between the two programs, but in the meantime both have undergone significant reforms. An even earlier paper by Mehling (2007) studied the procedural aspects of linking the EU ETS with regional ETSs in the US, while Santikarn (2014) and Unger (2016) focused on the governance and policy aspects of an EU-California linkage. Our paper contributes to the literature (a) by examining the options and barriers to linking the EU ETS with California's Cap-and-Trade Program from a law and economics perspective, (b) by exploring possible legal solutions to the identified impediments, (c) by incorporating both programs' main design features for the coming 2021-2030 period and (d) by including the latest developments, such as the EU-Switzerland linkage and the recent litigation against California's linkage with Québec by the US government.

This paper is organized as follows. Section 2 compares the EU ETS and California's Cap-and-Trade Program by concentrating on their legal design. Section 3 examines potential legal barriers to their transatlantic linkage at three levels: domestic ETS legislation, existing linking agreements and constitutional constraints. Section 4 focuses on the policy barriers that could emerge from misaligned design features between the two programs. Section 5 explores legal solutions to alleviate these differences. Finally, section 6 concludes.

2. Legal comparison of ETS design features

The EU ETS is currently the largest operating cap-and-trade program in the world in terms of absolute emissions coverage, regulating 45% of the EU's GHG emissions (ICAP 2020a: 37). It commenced its operation in 2005 pursuant to Directive 2003/87/EC (the ETS Directive, recently amended by Directive [EU] 2018/410) as a prominent instrument of EU climate policy. The EU aims to reduce GHG emissions by 40% below 1990 levels in 2030 (European Council 2014) or even by 55% as recently proposed by the European Commission (2020a). On 1 January 2020 the EU ETS was linked to the Swiss ETS, marking its first completed linkage with another cap-and-trade program (ICAP 2020a: 46). Earlier linking negotiations between the EU and Australia were well advanced, until the latter's ETS was repealed in 2014 after a change in government (Haites 2014: 24).

California's 2030 emissions reduction target of 40% below 1990 levels is currently aligned with the EU's, in terms of target year, base year and reduction percentage (California Health and Safety Code [CHSC], s. 38566). Its cap-and-trade program functions on the basis of the California Code of Regulations (CCR) (ss. 95801-96022) and covers 80% of the state's emissions (ICAP 2020a: 59). One year after it became fully operational, in 2014, the program was internationally linked with Québec's ETS in Canada. They were designed collaboratively under the Western Climate Initiative, a forum of cooperation that currently provides administrative services to the linkage (WCI 2020). In 2017, Ontario concluded a linking agreement with California and Québec, but six months after it came into force, its new government fulfilled their election promise and repealed Ontario's ETS (CBC 2018).

Both the EU and the US State of California are advanced economies with effective institutions to adequately monitor emissions and enforce non-compliance measures, which is a prerequisite for the proper functioning of (also linked) cap-and-trade systems (Woerdman, Zeng 2020; WJP Rule of Law Index 2020). However, the options and barriers for an EU-California ETS linkage cannot be assessed without a prior overview of their climate goals and their programs' main design features for the 2021-2030 period. The comparative tables 1 and 2 below provide this necessary

context. The relevant legal provisions of the respective regulations are also included, with the aim to facilitate the work of future researchers and practitioners. Subsequently, observations are formulated on the similarities and differences between the two emissions trading systems.

Table 1. Comparison of climate targets and economies of the EU and California

	European Union	**California**
GHG reduction targets	2030: 40% below 1990 levels New target proposal: at least 55% by 2030 (European Commission 2020) 2050: Net-zero (European Commission 2019)	2030: 40% below 1990 levels 2045: Net-zero electricity production (California Public Utilities Code, s. 454.53) 2050: 80% below 1990 levels (California Executive Order S-3-05 2005)
Population	513.5 million (Eurostat 2019)	40 million (US Census 2019)
GDP	18.29 trillion USD (IMF 2019)	3.13 trillion USD (State of California 2019)

The tables 1 and 2 make clear that the two ETSs are similar in many ways, but also show some differences.

On the one hand, the EU and California are two advanced economies that demonstrate equivalently ambitious medium and long-term climate goals. They both operate cap-and-trade schemes with absolute caps, in which each allowance corresponds to one ton of GHG emissions. In both ETSs allowances are distributed to participants with (albeit different) combinations of auctioning and free allocation. In addition, the respective regulations exclude the possibility of using allowances from future allocation years (borrowing), but allow their banking for future use (unlimited in the EU, but under a general limit in California). The two programs also feature comparable Monitoring, Reporting and Verification (MRV) frameworks and registries, while they both ensure high levels of compliance through dissuasive penalties and effective enforcement mechanisms.

Table 2. Comparison of ETS design in the EU and California for 2021-2030

Design Features	EU Emissions Trading System	California's Cap-And-Trade Program
Emissions cap	Absolute cap: 1,816 MtCO2e (2020) ~ 45% of the EU's GHG emissions (ICAP 2020a: 37) Linear reduction factor, 2.2% from 2021 (ETS Directive, art. 9)	Absolute cap: 334.2 MtCO2e (2020) ~ 80% of California's GHG emissions (ICAP 2020a: 59) Non-linear reduction factor, ~ 5% average for 2021-2030 (CCR, s. 95841)
Covered sectors	~ 11,000 participants (ICAP 2020a: 37) Mandatory participation above inclusion thresholds (downstream point of regulation): - Power and heat plants - Energy-intensive industries - Commercial aviation (within EEA) (ETS Directive, art. 2 and Annex I)	~ 500 participants (ICAP 2020a: 59) Mandatory participation above inclusion thresholds (mixed upstream and downstream point of regulation): - Power and heat plants - Industrial installations - Fuel supply (CCR, ss. 95811 and 95812)
Covered GHGs	- Carbon dioxide (CO2) - Methane (CH4) - Nitrous oxide (N2O) - Hydrofluorocarbons (HFCs) - Perfluorocarbons (PFCs) - Sulphur Hexafluoride (SF6) (ETS Directive, Annex II)	- Carbon dioxide (CO2) - Methane (CH4) - Nitrous oxide (N2O) - Hydrofluorocarbons (HFCs) - Perfluorocarbons (PFCs) - Sulfur Hexafluoride (SF6) - Nitrogen trifluoride (NF3) and other fluorinated GHGs (CCR, s. 95810)
Allowance	European Union Allowance (EUA) Allowance to emit one ton of CO2 or equivalent GHGs (ETS Directive, art. 3[a]) Price: €29.69 (December 2020 Auctions) (EEX 2020)	California Carbon Allowance (CCA) Allowance to emit one ton of CO2 or equivalent GHGs (CCR, s. 95802[a]) Price: $16.93 (November 2020 Auction) (CARB 2020)

Table 2. Cont.

Allocation methods	Mix of auctioning and free allocation (ETS Directive, arts. 10-11) Auctioning: ~ 57% Free allocation: ~ 43% (ETS Directive, art. 10[a])	Mix of auctioning and free allocation (CCR, ss. 95890-95910) Auctioning: ~ 45% Free allocation: ~ 55% (CARB n.d.-c; CCR, s. 95841)
Banking	Allowed, unlimited (ETS Directive, art. 13)	Allowed, under general holding limit (CCR, ss. 95922 and 95920)
Borrowing	Not allowed (ETS Directive, arts. 11[2], 12[3])	Not allowed (CCR, ss. 95856[b][2], 95910[c][2])
Offsets	<u>International Offsets</u> No longer allowed from 2021 (Regulation [EU] 2019/1122, preamble, recital 8) <u>Domestic (EU) Offsets</u> Not allowed, but possible in the future The Commission can adopt measures for issuing ETS allowances or offset credits from emissions reduction projects not covered by the EU ETS within Member States (ETS Directive, art. 24a). This provision has not been initiated so far by the Member States or the Commission.	<u>International Offsets</u> Not allowed, but possible in the future CARB can approve sector-based programs in developing countries that reduce emissions from Deforestation and Forest Degradation (REDD) Plans (CCR, ss. 95991-95995). Quantitative usage limit of 2% for 2021-2025 and 3% thereafter (CCR, s. 95854[d]). CARB has not approved any such programs to date (CARB, n.d.-a). <u>Domestic (US) Offsets</u> Allowed under restrictions Qualitative limits: Only from the following offset project types located in the US: 1. Ozone Depleting Substances (ODS), 2. Livestock, 3. Urban Forests, 4. US Forests, 5. Mine Methane Capture (MMC), 6. Rice Cultivation (CCR, s. 95975[e]) Quantitative limits: - Offset use for compliance up to 4% (2021-2025) and 6% thereafter (CCR, s. 95854[b]) - Usage limit of 2% for 2021-2025 and 3% thereafter for offsets that do not provide Direct Environmental Benefits (DEBs) to California (CCR, s. 95854[e]).

Table 2. Cont.

Cost containment and market stability	No price floor or ceiling Market Stability Reserve (MSR) Addresses allowance supply/demand imbalances by automatically withdrawing or releasing fixed percentages of EUAs from/to auction budgets based on the total number of allowances in circulation. From 2023, the amount of allowances in the MSR that exceeds the previous year's total auction volume will be cancelled (Decision (EU) 2015/1814, art. 1[5a], as amended by Directive [EU] 2018/410). Excessive price fluctuations measure If the EUA price exceeds the two preceding years' average price by more than three times for more than six consecutive months, the Commission can allow Member States to auction part of future auction quantities and up to one fourth of the reserve for new entrants (ETS Directive, art. 29a).	Price floor, hard ceiling and soft ceilings Auction Reserve Price (Price floor) USD 16.68 (2020) Precludes bids below this price from the sale of allowances at auction. (CCR, s. 95911[b]) Hard Price Ceiling USD 65.00 (from 2021) If the allowance price reaches this ceiling, an unlimited amount of price ceiling units becomes available for sale to participants. (CCR, s. 95915) Price Tiers (Soft Price Ceilings) USD 41.40 and USD 53.20 (from 2021) If the allowance price reaches these thresholds, allowances are released from a reserve under the emissions cap. (CCR, s. 95913[h]) The thresholds of the floor, the hard price ceiling and the price tiers increase at an annual rate of 5% plus inflation
Compliance period	Annual (ETS Directive, art. 12[3])	Biennial or triennial (CCR, s. 95840)

Table 2. Cont.

Monitoring, Reporting, Verification (MRV)	Universal annual emissions reporting obligation based on approved monitoring plan (ETS Directive, arts. 6 and 14[3], Regulation [EU] 601/2012 [Monitoring and Reporting Regulation]) Mandatory verification of reports by independent accredited verifiers (ETS Directive, art. 15, Regulation [EU] 2018/2067 and Regulation [EC] 765/2008)	Universal annual emissions reporting obligation based on approved monitoring plan (CCR, ss. 95852[a][1], 95100-95163 [Mandatory Reporting Regulation]) Mandatory verification of reports by independent accredited verifiers (CCR, ss. 95130-95135) Dedicated MRV framework for offsets, which aims to ensure that credits reflect real, additional, quantifiable, permanent, verifiable and enforceable emissions reductions (CCR, ss. 95970-95989)
Registry	Union Registry, supported by the European Union Transaction Log (Regulation [EU] 2019/1122)	Joint registry with Québec, supported by the Compliance Instrument Tracking System Service (WCI 2020)
Penalties and enforcement	- €100 penalty for each ton of GHG emitted without allowance, to increase according to the European index of consumer prices - Obligation to surrender the allowances remains, and the non-compliant entity's name is published (ETS Directive, art. 16) Compliance rate > 99% (European Commission 2020b)	- Obligation to surrender four compliance instruments for each ton of GHG emitted without allowances (CCR, s. 95857[b][2]) - Failure to fulfill the obligation above promptly constitutes a separate violation subject to heavy penalties (civil action, fines and/or imprisonment) (CCR, ss. 95857[c], 96013, 96014; CHSC ss. 41513, 42400-42411) Compliance rate > 99% (CARB 2019)

On the other hand, unlike the EU ETS, California's economy-wide program covers fuel supply (upstream) in addition to direct emitters (downstream), and regulates a slightly broader range of GHGs. Moreover, compliance periods in the two programs are different in duration and, thus, unsynchronized. Another difference emerges in the provisions for offsets. Offsets are credits that result from emissions reductions achieved at uncapped sources, either within the jurisdiction or

elsewhere. The EU has abolished international offsets from its ETS, but has not excluded the possibility for domestic (EU) offsets in the coming years. Conversely, California only accepts domestic (US) offsets under strict limitations, but could, potentially, allow restricted use of certain international credits from developing countries in the future. Lastly, the respective jurisdictions have adopted considerably different regulatory approaches regarding cost containment and market stability. Before scrutinizing these design differences and assessing how they can affect the prospects of linking the two ETSs, it should first be examined whether the linkage is obstructed by potential legal barriers.

3. Legal barriers to ETS linking

This section identifies the provisions in European and Californian legislation that prescribe requirements for ETS linkage, and aims to assess whether these conditions are fulfilled in such a scenario. Subsequently, potential legal constraints are explored within the existing linking agreements concluded by the respective jurisdictions with Switzerland and Québec. Lastly, California's ability to conclude international linking agreements as a sub-national jurisdiction is considered, in light of potential restrictions imposed by the Constitution of the United States of America.

3.1. Linking requirements in European and Californian legislation

The EU ETS can be linked with other programs that meet the criteria set out by the EU ETS Directive. Article 25(1a) explicitly permits the conclusion of linking agreements with sub-federal or regional entities which operate ETSs that are mandatory, feature absolute caps, and are compatible with the EU ETS. California's Cap-and-Trade Program seems to fulfill the first and second criteria, since it is mandatory to the entities included under its scope and it contains their emissions with an absolute cap.

However, the design of California's hard price ceiling may be considered to collide with the EU's absolute emissions cap requirement. It allows California Air

Resources Board (CARB) to sell an unlimited amount of compliance instruments ("price ceiling units") additional to the cap, although the authority is also obliged to spend the revenues on emissions reductions on a "ton-for-ton" basis (CCR, s. 95915[h]). Whether such a design raises a legal barrier to linkage would depend on whether it can actually lead to emissions additional to the cap. Since California's hard price ceiling will come into force in 2021, there is no empirical evidence from its implementation yet. The functioning of this feature is further examined below in the next section.

The third criterion of "compatibility" is not defined in EU legislation. The amending Directive 2009/29/EC, which introduced these requirements to the ETS Directive, notes in recital 42 of the preamble that the candidate ETS must be "compatible with the Community scheme taking into account the level of environmental ambition and the presence of a robust and comparable emissions monitoring, reporting and verification mechanism and compliance system". California's program would likely fulfill these criteria. However, the wording in this provision is not exhaustive, while it should be kept in mind that Directive recitals are not *per se* legally binding in European law (ECJ C-136/04 2005: para. 32).

The absence of binding or exhaustive statutory specifications of "compatibility" suggests that the Commission and the Council have a wide discretion in determining it. Also Mehling (2009: 132) observes that this assessment is "inherently political in nature, not legal". This is confirmed by the Council of the European Union's (2010: para 3[1]) guidelines to the Commission regarding the linking negotiations with Switzerland, which also refrained from specifying absolute criteria about the "compatibility" of the two programs. The ability of assessing this requirement on a case-by-case basis provides EU negotiators with some room for decision-making manoeuvre. Any politically undesirable design misalignment identified by the EU could also be deemed to constitute a legal barrier to linkage, under the justification that it renders the two programs "incompatible".

On the other side of the Atlantic, California's Cap-and-Trade Regulation allows the linkage with an "external ETS" if four requirements are fulfilled, which will be discussed below (CCR, s. 95941; Government Code of California [GOV], s. 12894[f]). The Governor of California is required to make this determination after

considering the advice of the state's Attorney General (GOV, s. 12894[g]). The Governor's findings and the Attorney General's advice prior to California's linkages with Québec (2013) and Ontario (2017) provide valuable insights about the application of the prescribed criteria.

The first requirement is that the candidate linking partner must have established "program requirements for greenhouse gas reductions, including, but not limited to, requirements for offsets, that are equivalent to or stricter" than those in California. Emphasis is put on the overall environmental ambition of the counterparty, as well as the stringency of its MRV framework, registry and offset provisions (Governor 2013: 1-2; 2017: 1-3). The EU features similar levels of climate ambition to California, with comparable MRV mechanisms and registries. In addition, since it currently completely excludes the use of offsets, its offset provisions are stricter than California's. Therefore, the EU ETS would likely satisfy California's first statutory requirement.

The second requirement stipulates that the State of California must be able to enforce its climate legislation "against any entity subject to regulation under those statutes, and against any entity located within the linking jurisdiction to the maximum extent permitted under the United States and California Constitutions". The first part refers to whether covered entities registered in California will remain subject to its full authority and the state's enforcement agencies (Attorney General 2013: 4; 2017: 6-7). A linkage with the EU ETS would not impose any limitations to such authority. The second part refers to whether a linkage will impact California's – constitutionally limited – ability "to extend the reach of its law enforcement beyond its border". This outreach of state jurisdiction is constitutionally permitted only in exceptional cases where an alien entity explicitly consents to the state's jurisdiction or has "certain minimum contacts" within California (such as substantial business activity, or cause of injury) (Attorney General 2013: 4-5; 2017: 7). A linking agreement with the EU does not infringe upon this ability in any manner.

According to the third requirement, the enforcement of laws and regulations by the linking candidate must be "equivalent to or stricter" than in California. In the previous linkages with Québec and Ontario, the state's Governor highlighted the importance of dissuasive penalties for non-compliance and effective enforcement

mechanisms (Governor 2013: 2-3; 2017: 3-4). Since the EU ETS features comparably stringent – if not stricter – penalties and effective enforcement mechanisms, as well as equivalent compliance levels to California's, it meets these conditions.

Lastly, the fourth requirement is that no "significant liability" should be imposed "on the state or any state agency for any failure associated with the linkage." This refers to the risk of legal liability, on the one hand, and security-related liability, on the other (Attorney General 2013: 5-6; 2017: 8-9). The potential of legal liability is unlikely to constitute a barrier to linkage for California. A decision for linkage is a discretionary policy action and, therefore, in case of litigation against any linking decision, the state and its employees are protected by immunities and limitations of liability (Attorney General 2013: 5-6; 2017: 8). The other type of liability is connected with security failures and, particularly, with cybercrime-related risks. The evaluation of the counterparty's security level is based on qualitative observations, without involving a formal liability risk assessment (Governor Brown 2013: 3; 2017: 4). After the lessons learned from fraud and allowance theft in the EU ETS in 2009-2012 (Nield, Pereira 2016), the upgraded, centralized Union Registry of the European program has prevented similar incidents, by offering a high level of protection for data exchange and for transactions (Regulation [EU] 2019/1122). Therefore, the EU ETS is likely to fulfill these liability risk criteria established by California's Regulation.

Since the findings are solely based on qualitative assessments and are not subject to judicial review (GOV, s. 12894[g]), California's Governor has considerable discretion in evaluating whether the linking candidate meets the legal requirements. Like in the EU Directive, California's Regulation refrains from specifying exhaustive sub-criteria or strict methodologies for the findings. In both jurisdictions, the legislation only establishes minimum conditions as safeguards (Governor 2014: 3) and effectively bestows the final judgment to the political and administrative authorities. As a consequence, the answer to whether the respective statutory requirements raise legal barriers to an EU-California ETS linkage is – indeed – more political than legal in nature.

3.2. Existing linking agreements

Besides the mutual recognition and acceptance of allowances, linkages are usually formalized with the conclusion of a linking agreement. Because a new linkage can produce considerable effects across the linked market, a linking agreement may *inter alia* define the conditions under which a linking partner can conclude a linkage with a third jurisdiction.

The 2013 agreement between California and Québec stipulated in article 17 that a linkage with a third party requires the other partner's consent, and that the agreement must be amended to include the new partner. As a result, the 2013 agreement was replaced by the 2017 agreement between California, Québec and Ontario, which is still in force despite Ontario's withdrawal. The third party's ETS must be "harmonized and […] integrated" with both programs (art. 19). If Québec does not consent to an EU-California linkage, both California and Québec have the option to withdraw from the agreement by providing 12 months prior written notice to the other partner (art. 17).

Likewise, the linking agreement between the EU and Switzerland requires a partner to notify their intention to link with a third ETS and to regularly inform their counterparty about the progress of the linking negotiations (art. 18[2]). In a linkage scenario between the EU and California, once notified, Switzerland would reserve the right to temporarily suspend the acceptance of EU allowances (art. 15[1][b]). Before the new linkage is implemented, the Swiss may either accept it and cancel the suspension, or terminate their linkage with the EU (art. 18[3]). The termination takes effect six months after it is notified to the other partner (art. 16[1]).

In sum, both existing linking agreements stipulate that the new linkage must be approved by the current linking partners. Their potential refusal would place the EU or California in the position of choosing between terminating their respective existing linkages, or maintaining them and postponing (or even blocking) the transatlantic linkage. Ideally, though, all jurisdictions should engage in a multilateral dialogue with the aim to address any potential linking concerns. This would increase the chances of establishing a wider ETS linkage, which would magnify the associated economic and political benefits for all jurisdictions involved and provide momentum for further expansion.

3.3. International linking agreements and constitutional constraints

From an international law perspective, linking agreements can be either formal or informal in nature. Formal international agreements, also known as "treaties", can generally provide legal certainty and predictability for the linking relationship. The linking partners are mutually obliged to apply, interpret and enforce them according to international law, under the compliance principle of *pacta sunt servanda* (Shaw 2003: 97). However, treaties often involve a laborious ratification process and burdensome amending procedures, while their conclusion by subnational entities may be subject to constitutional limitations (Mehling 2016: 268-269).

In contrast, informal linking agreements, in the form of memoranda of understanding (MoU) or joint statements at a regulatory-political level, do not generate legal obligations under international law. The agreed terms can be easily implemented (and modified) by mutual reciprocal amendments to the regulatory frameworks of the two jurisdictions. Compared to treaties, these agreements offer more flexibility, albeit with lower legal certainty for the linkage conditions (Mehling 2009: 121-122). Their unilateral termination without sufficient notice does not breach international law, but is deterred by the fact that it can inflict considerable reputational damage to the responsible jurisdiction, while it is also likely to harm the covered entities of its own ETS (Mace et. al 2008: 74-75).

The EU can conclude treaties as an international organization with legal personality, according to the procedure set out in article 218 of the Treaty on the Functioning of the European Union (TFEU). However, California's international personality and treaty-making capacity as a sub-federal state is determined by the US Constitution (Shaw 2003: 196). The Treaty Clause of the Constitution explicitly deprives states from the capacity to conclude international treaties and confers this exclusive power to the President and the Senate (art. I s. 10 cl. 1; art II s. 2 cl. 2). Nevertheless, the Compact Clause allows states to "enter into any Agreement or Compact […] with a foreign Power" with the consent of Congress (art. I s. 10 cl. 3).

The terms "Agreement" and "Compact" are used here interchangeably, as they are legally identical within the meaning of the Compact Clause (Glennon, Sloane 2016: 278, 284). What matters is not the nomenclature, but that congressional consent is required only for state agreements that "may encroach upon or interfere

with the just supremacy of the United States" (Virginia v. Tennessee 1893: 519; Henkin 1996: 155). Congressional approval effectively transforms the compact into federal law (New Jersey v. New York 1998: 811), which can render it legally binding (depending on the provisions therein) both to the state and to the United States under international law (Glennon, Sloane 2016: 278). Congress reserves the right to withdraw its consent at any time, while the President retains the ability to veto the approval (Mace et al. 2008: 102).

Interestingly, the linking agreement between California and Québec has not been submitted for congressional approval, as it stipulates in the preamble that it does not "restrict […] each Party's sovereign right and authority to adopt, maintain, modify or repeal any of their respective program regulations". Nevertheless, the agreement was recently challenged in court. In 2019 the US government filed a civil complaint against California before the federal district court, seeking its permanent injunction (USA v. California 2020). The plaintiff contended *inter alia* that, in absence of congressional consent, the agreement violates the Treaty and Compact Clauses of the Constitution, and that it preempts federal power.

The Court ruled in favor of the defendants that the state did not "delegate any sovereign power" and that the non-binding agreement is neither a (categorically prohibited) treaty nor a compact that requires congressional approval (Memorandum and Order March 2020: 24, 33). The Court finally rejected the United States' remaining claim about federal preemption, noting that "the United States has failed to identify a clear and express foreign policy that directly conflicts with California's cap-and-trade program" (Memorandum and Order July 2020: 18), and entered judgment in favor of the defendants. On 14 September 2020, however, the United States appealed to the U.S. Court of Appeals for the Ninth Circuit.

Thus far, this litigation suggests that an informal, non-legally binding linking agreement between the EU and California would probably be the most successful recourse. A formal international linking treaty would be prohibited altogether by the US Constitution. A linking agreement of less formal nature, but with binding characteristics such as mandatory language and compliance or accountability provisions (Bodansky et al. 2017: 18-19), would be susceptible to legal challenges if not approved by Congress. Lawsuits could be brought against it by the US

government, Congress or any other public or private entity with legitimate interest (Glennon, Sloane 2016: 284-285). Compared to an explicitly non-binding agreement, a compact that imposes legal obligations to California would provide potential plaintiffs with ampler grounds to contest that it "encroaches upon federal sovereignty" (Memorandum and Order March 2020: 20, 24). Yet, even if such compact received congressional approval, it would still be subject to the risks of presidential veto and Congress withdrawing its consent. Therefore, a non-binding linking agreement, such as a memorandum of understanding (MoU), would not only provide more flexibility to the parties, but would also be a legally safer option compared to a binding compact.

An informal linking agreement can be implemented through the adoption of reciprocal provisions by both parties. For the EU, this means amending the EU ETS Directive with the ordinary legislative procedure (TFEU, art. 294) on the basis of article 192(1) TFEU on environmental EU legislation (Mehling 2009: 132). This requires a proposal from the European Commission and a qualified majority vote by the Council, in co-decision with the Parliament. In California, the linkage must be proposed by CARB to the Governor, who must issue the findings regarding the statutory requirements within 45 days and submit them to the state's Legislature (GOV, s. 12894 [g]). Subsequently, the Cap-and-Trade Regulation can be amended by CARB and the link may become operational at any time (CCR, s. 95942).

4. Policy barriers from ETS design differences

Besides the legal requirements for ETS linkage agreements, a linkage may be obstructed by ETS design differences, which – in certain cases – may produce undesirable policy effects of environmental, economic or political nature. The first can undermine the achievement of a jurisdiction's (or the aggregate) emissions reduction targets. Economic barriers can arise from negative economic effects to the linked market, such as price instability, increased mitigation costs or competitive distortions. Other implications can render the linkage politically unacceptable, and

are connected with the levels of public and stakeholder support to the linkage (Beuermann et al. 2017: 17-19).

As a solution for dealing with undesirable ETS design differences, the literature on linking has employed the concept of harmonization, which is the process of aligning legal rules (Mace et al. 2008; ICAP 2018). Nevertheless, harmonization also comes at the cost of annulling any advantages of differentiation (Faure 1998: 171). Domestic regulation tends to create efficiencies when it is tailor-made both to the preferences of voters and to the special needs of the regulated entities (Tiebout 1956; Van Den Bergh 2000). Harmonization also potentially involves considerable switching costs, as well as transaction costs related to the negotiation process between the respective authorities prior to its implementation (Carbonara, Parisi 2007: 33).

Therefore, a careful analysis should be made to what ETS design features should be harmonized and how alignment can be achieved. The application of (preferably formal) cost-benefit analyses would be particularly useful in such an endeavor (Sinden 2015). With that in mind, a closer look is taken hereafter at the design differences between the EU ETS and California's Cap-and-Trade Program.

4.1. Market size

Due to their differences in size, the EU ETS features a larger emissions cap and more market participants than California's program. Harmonization of these differences is infeasible if not impossible, while market size differences have not proven to be an impediment in other linkages. An example can be found in the linkages between the ETSs of California and Québec (with cap sizes of 334.2 and 54.7 MtCO2e respectively), and between the EU ETS and the Swiss ETS (1,816 and 4.9 MtCO2e respectively) (ICAP 2020a: 64, 43). Smaller jurisdictions are incentivized to link with bigger ETSs, as they are likely to reap greater benefits from the creation of a larger linked market (Umweltbundesamt 2018: 155). The relative ETS sizes are nevertheless influencing factors for a linkage, since the design features of the larger program economically (and politically) affect the smaller ETS to a greater degree than *vice versa* (Beuermann et al. 2017: 26).

4.2. Cap stringency

Linking two ETSs with emissions caps of significantly different stringency would lead to a transfer of financial flows to the jurisdiction with the comparatively lenient cap. This can raise equity concerns and render the linkage politically unacceptable (Mace et al. 2008: 60). The fact that the EU and California aim for equivalently ambitious emissions reductions does not necessarily mean that the caps of their programs are comparably stringent. The absolute levels and reduction rates of the emissions caps are not sufficient for evaluating cap stringency. Additional factors must be taken into account as well, which include the respective magnitudes of population size and economic growth, the interaction of the ETS with companion (climate and energy) policies in each jurisdiction, and the respective emissions abatement opportunities (Burtraw et al. 2013: 18-19; Zetterberg 2012: 32).

An economic method for approximating comparative cap stringency is to determine the marginal abatement costs (MAC) for achieving the required reductions in each ETS (Burtraw et al. 2013: 18). Assuming that there is adequate scarcity of allowances, the respective allowance prices can be utilized as "proxies" for assessing the MAC curves and, thus, for evaluating comparative cap stringency (Zetterberg 2012: 32; Umweltbundesamt 2018: 27). The allowance price in the EU ETS is currently higher, but California's emissions cap is declining at a rate twice as fast. California's ETS also features a progressively increasing auction price floor, which could distort the relationship between price and cost.

A large pre-link price difference between the two allowance markets would trigger wealth transfers after linkage from the one with the higher price (allowance importer) to the other (allowance exporter), until prices would eventually converge (Tuerk et al. 2009: 343). Convergence would probably occur at a point closer to the EUA price, since the EU ETS is a larger market (Haites 2014: 7). While these foreseen effects can face political opposition, especially by those participants who will be worse-off after a linkage (e.g. net allowance buyers in the ETS with the lower pre-link price, and *vice versa*), a larger difference between the pre-link prices also brings greater overall post-linkage economic gains (Zetterberg 2012: 23). Additional quantitative analysis will be essential for determining the comparative

cap stringency between the EU ETS and California's program with more precision (Umweltbundesamt 2018: 16, 108).

4.3. Sectoral and GHG coverage

California's broader coverage of economic sectors offers a greater range and diversity of emissions mitigation opportunities under the linked ETS, which can further reduce overall compliance costs (ICAP 2015: 5). Also a broader scope of covered GHGs can improve cost-effectiveness in the linked ETS. These differences can give rise to competitive distortions, which would however be present regardless of the linkage (Umweltbundesamt 2018: 150-151). In any case, regulatory choices about sectoral and GHG coverage are often connected with the particular circumstances within each jurisdiction. Their harmonization may be cumbersome and collide with the legitimate expectations of stakeholders (ICAP 2018: 50).

Efforts should be made to avoid double-counting of emissions, as a side-effect of mixed points of regulation. For instance, it has to be prevented that an industry in Europe surrenders allowances for burning LNG produced in California, which has also been covered with allowances under California's program. Carefully coordinated MRV provisions can prevent miscalculation, for instance by exempting imported Californian fuels from compliance obligations in the EU, or by accompanying the hydrocarbon exports with an equivalent quantity of special compliance credits (Mace et al. 2008: 71).

4.4. Compliance periods

Synchronization of compliance periods between ETSs is not a necessary precondition for linking (ICAP 2018: 57). Conversely, it has been argued that misaligned compliance periods are actually beneficial for the liquidity of the linked market (Tuerk et al. 2009: 347). Temporary allowance shortages may occur at the end of an ETS's compliance period, when its covered entities must surrender their allowances. These shortages can be mitigated through trading with the participants in the linked jurisdiction, whose divergent compliance period will be at a different stage.

4.5. Offsets

Offsets can reduce compliance costs by allowing participants to make use of cheaper emissions mitigation opportunities at uncapped sources. Nevertheless, if offsets do not reflect real, permanent and additional emissions reductions, they can compromise a program's environmental integrity (Mace et al. 2008: 62). Offsets in one ETS indirectly propagate throughout the linked market, as the allowances that remain unused (due to the use of cheaper credits) become available for purchase to all participants. An increased supply of "freed-up" allowances may postpone decarbonization efforts and can, arguably, reduce the converged allowance price to an undesirably low level (Umweltbundesamt 2018: 145).

International offsets have been phased out from the EU ETS and are not currently envisaged for the future. The use of cheap credits from the Kyoto Protocol's Clean Development Mechanism (CDM) proved to be among the major drivers for the accumulation of a substantial allowance surplus in the EU ETS (European Commission 2012: 9), while a flawed MRV framework for international projects eroded confidence in their environmental integrity (Öko-Institut 2016: 11). On the other hand, California's Regulation currently allows participants to use offsets exclusively from domestic projects under various qualitative and quantitative limitations, without ruling out the future possibility of CARB approving a restricted use of international credits from Deforestation and Forest Degradation (REDD) projects in developing countries. The vast majority of Californian offsets so far come from US Forests projects, while no credits from Urban Forests and Rice Cultivation have been issued yet (CARB n.d.-b).

California has established a stringent MRV framework with the aim to ensure that all credits reflect genuine emissions reductions. Nonetheless, a recent study shows that there is methodological uncertainty in determining baseline emissions and additionality of GHG reductions in Mine Methane Capture (MMC) and Rice Cultivation projects (Haya et al. 2020). These projects may even provide perverse economic incentives for the perpetuation of coal mining and for switching from crop to rice production, which could lead to increased GHG emissions in the long run. Moreover, evidence suggests that the current design of MRV methodologies for

California's forest carbon offsets cannot sufficiently prevent over-crediting (Marino et al. 2019).

Such environmental considerations may be regarded as an impediment by EU linking negotiators, who have refused to acknowledge certain offset credits in the past, such as credits generated from land use, land use change and forestry (LULUCF) projects due to concerns about the permanency of their emissions reductions (Beuermann et al. 2017: 34). By linking with California's program, which could potentially include a limited use of international sector-based credits in the future, European policymakers may also perceive that their political decision to abolish international offsets from the EU ETS would be circumvented (Zetterberg 2012: 23). As a result, misaligned offset provisions can potentially raise barriers to linking the two ETSs.

4.6. Banking

Both programs allow banking of allowances, as it can strengthen the price signal and contribute to price stability. Banking enables the regulated entities to manage the risk of excessive future compliance costs, while it can even accelerate emissions reductions by incentivizing mitigation early on (ICAP 2015: 8). Unlimited banking in the EU ETS could perpetuate its historical allowance surplus (Umweltbundesamt 2018: 142), but the Market Stability Reserve (MSR) that began operating in 2019 aims to reduce this surplus without trading-off the benefits of banking. California also does not significantly constrain banking, as the holding limit is currently set at a high threshold (Inman 2018), while participants are also allowed to exempt the allowances they need for compliance from their holding limit (CCR, s. 95920[d][2]).

Even with a tighter limit, the EU's comparatively generous banking provisions would effectively spread throughout the linked market by means of proxy arrangements between participants in the respective ETSs (Mace et al. 2008: 61). This means that Californian firms could transfer their excess allowances to their European counterparts, who could bank them on their behalf at an agreed price. Harmonization of banking provisions can eliminate transaction costs and equity concerns associated with such arrangements, but their misalignment has limited implications for the performance of the linked market (Burtraw et al. 2013: 23).

4.7. Cost containment measures

4.7.1. California's price floor

California's program precludes bids below an Auction Reserve Price from the sale of allowances at auction (CCR, s. 95911[b]). This price floor can mitigate price drops and provide incentives for low-carbon investments by contributing to a minimum allowance price in the secondary market (Wood, Jotzo 2011: 1747). In a linkage with the EU ETS, which does not contain such a minimum price, California's price floor may be rendered ineffective if a large supply of cheaper European allowances is available to California's entities (Tiche et al. 2016: 16). Not only would this lead to a (politically contentious) transfer of funds to the EU, but it could even annul the benefits of the Auction Reserve Price for California. A converged price below the floor would also reduce California's expected auction revenues and frustrate the legitimate expectations of investors in low-carbon technologies, who made their investment decisions based on the premise that the carbon price trajectory would remain above certain levels. Therefore, the lack of a price floor in the EU ETS may constitute a barrier to linkage for California.

4.7.2. California's hard price ceiling

A hard price ceiling was introduced in California's program by the latest 2017 reform and will take effect from 2021 (CCR, s. 95915). If the allowance price reaches this ceiling (set at $65 for 2021), an unlimited amount of "price ceiling units" becomes available for sale to California's ETS participants. These compliance instruments are non-transferable and non-bankable, and cannot be purchased by participants of a linked jurisdiction. The eligible entities can buy only as many as they need to surrender in the following compliance deadline, after demonstrating an insufficient quantity of allowances in their holding and compliance accounts. Revenues from price ceiling sales will be earmarked and will be expended for real, permanent and additional emissions reductions on a "ton-for-ton" basis.

In a linkage scenario, California's hard price ceiling may find opposition by the EU negotiators, who had maintained the position in the past that price ceilings are unacceptable, as they can lead to emissions additional to the aggregate emissions cap (Flachsland et al. 2008: 16). Such a possibility would also conflict with the EU's

statutory requirement for an absolute emissions limit. CARB tries to avoid that by securing that ceiling auction money is translated into emissions abatement on a "ton-for-ton" basis. However, the lack of a general limit to the issuance of price ceiling units can lead to an unpredictable amount of excess emissions – and of corresponding funds. If the abatement cost to offset these excess emissions would be higher than the ceiling price, would CARB have to use additional funds from a different budget? The Regulation also does not specify the time when these emissions reductions should be performed. It remains to be seen how California's authorities will address these issues.

Moreover, the fact that the price ceiling units are available exclusively to California's entities may be perceived as inequitable by European participants and raise competitiveness concerns, which would nonetheless exist independently of the linkage. The ceiling could, however, affect the converged allowance price, since the demand by California's entities for allowances above the ceiling price would be zero. Although the potential economic implications of this particular ceiling design to a linked market require further research, the environmental uncertainty introduced by California's hard price ceiling may potentially constitute a barrier to linkage for the EU.

4.7.3. The EU's MSR and California's price tiers

The Market Stability Reserve (MSR), in operation since 2019, is a supply-based mechanism that aims to mitigate the historical allowance surplus and induce price stability in the EU ETS. It operates based on non-discretionary, predetermined parameters. Its existence could be perceived as beneficial to linkage, in the sense that it mitigates EUA price volatility, which would be exported to the linked jurisdiction (ICAP 2018: 29) and which has deterred California's officials to consider linking their program with the EU ETS in the past (Ranson, Stavins 2016: 293). Nonetheless, the MSR's effect on the supply of EUAs and, therefore, the converged price should be considered prior to linking (Galdi et al. 2020: 22).

California's two price tiers (soft price ceilings) have been established below the hard price ceiling with the purpose of functioning as "speed bumps" for the allowance price (CCR, s. 95913[h]; ICAP 2018: 59). The sale of allowances at the

tier prices (again, exclusively) to California's participants introduces elasticity into the allowance supply and can temporarily mitigate price spikes (Perkis et al. 2016: 705). These allowances come from the Allowance Price Containment Reserve (APCR), which has been withdrawing fixed percentages of allowances from all budget years since the program was launched (CCR, s. 95870[a]). California's tiers do not pose environmental concerns, since their allowances come from within the cap, while their economic implications in a linkage are limited as well as more predictable compared to the hard price ceiling (Zetterberg 2012: 42).

There has been little research and experience from past linkages with regard to how price-based mechanisms, such as the tiers, and supply-based mechanisms, such as the MSR, interact with each other (Beuermann et al. 2017: 30). The price mitigation capacity of California's tiers would likely be compromised due to the increased size of the linked market. Both authorities should consider harmonizing the triggers and parameters of the MSR with the price tiers, in order to avoid negative implications from their interplay (Vivid Economics 2020: 9). For instance, if allowances are simultaneously released by California's reserve and withdrawn by the MSR, both mechanisms' effectiveness would be compromised. Nonetheless, as demonstrated in the linkage with Switzerland, the MSR can apply exclusively to EUAs without affecting the quotas of a linking partner's allowances (ICAP 2020a: 40).

5. Can ETS design differences be overcome?

The analysis above indicates that California's offset provisions and hard price ceiling on the one hand, and the absence of a price floor in the EU ETS on the other, can potentially raise barriers to a linkage between the two programs. This section aims to evaluate the gravity of these impediments and provides some suggestions for alleviating them.

5.1. Offsets

California's policymakers are probably not willing to abolish the use of offsets from their program any time soon. While no international sector-based offset programs have been approved by CARB so far, California's domestic offset framework was extended throughout the 2021-2030 period as an "important cost-containment element" within the ETS. Also, the incentive for the use of offsets with Direct Environmental Benefits to California is expected to encourage investments within the state and improve local air and water quality (CARB n.d.-b).

The potential economic impact of domestic or international offsets on the EU ETS is significantly restrained by California's strict quantitative usage limits (Burtraw et al. 2013: 24-25), while the size difference of the two programs further limits the degree by which freed-up CCAs can affect the converged price (Beuermann et. al 2017: 26). Moreover, although not perfect, California's MRV procedures for offsets were developed based on the European experience and the lessons learned from the implementation of Kyoto Protocol's Clean Development Mechanism (CDM) (Narassimhan et al. 2018: 984; Haya et al. 2020: 1113). These Californian parameters, in combination with the MSR's demonstrated potential to address EU allowance oversupply, may encourage European policymakers to alleviate their potential concerns about California's offsets.

To that end, certain improvements to California's MRV framework for offsets can enhance its acceptability by the EU and, simultaneously, augment its environmental stringency. For instance, CARB has been advised to update and strengthen the methodology for calculating emissions reductions from forest offset programs (Marino et al. 2019). The Californian authorities should also assess and mitigate the risk of perverse incentives within eligible project types, as well as consider reinforcing the assessment of project additionality, narrowing down project eligibility criteria and conducting systematic analyses to diminish the risk of over-crediting (Haya et al. 2020).

Moreover, the introduction of innovative monitoring methods, such as technologies that apply artificial intelligence (AI) to analyze satellite images, could help to mitigate uncertainty about the environmental integrity of forestry project credits (Temple 2019). Technical cooperation between the EU and California in this

area could accelerate developments through the exchange of knowledge and adoption of best practices. Our observations above suggest that barriers to linkage due to different offset provisions between the two jurisdictions are not insurmountable.

5.2. Price floor

It is doubtful that California would proceed to link with the EU ETS without a safeguard against harmful allowance price drops, especially in times of increasing economic uncertainty, for instance due to the Covid-19 pandemic. This protection could be provided by the establishment of an Auction Reserve Price in the EU ETS. Allowances that would remain unsold at auction could then be transferred into the MSR with the potential of eventually being cancelled. A price floor can signal the EU's commitment to incentivize long-term green investment plans, by increasing certainty about the future price pathway (Edenhofer et al. 2017: 11).

The introduction of a price floor to the EU ETS has been advocated by a number of academics and is supported by several EU Member States to stimulate investments in climate-friendly technologies (e.g. Flachsland et al. 2020: 140). Imposing a price floor also has economic drawbacks, because a low allowance price under a declining emissions cap is a signal that technical progress succeeds in keeping marginal abatement costs low (e.g. Woerdman 2019). Nevertheless, politically speaking, potential linking negotiations with California could provide the momentum required for its implementation, which can be achieved through the ordinary legislative procedure (TFEU, art. 194[3]; Flachsland et al. 2020: 139). Before linkage, the EU ETS's Auction Reserve Price should be placed at a level equal to – or higher than – California's price floor, in order not to undermine the latter's effectiveness (Vivid Economics 2020: 9). The harmonization of price floors should be evaluated in conjunction with potential options regarding California's hard price ceiling, which will be discussed hereafter.

5.3. Hard price ceiling

The hard price ceiling, which will become effective from 2021 onwards, is a recent addition to California's ETS. When the program was still being developed,

the state's Market Advisory Committee strongly advised against the implementation of a hard price ceiling (CARB 2007: 67-68). In the experts' view, such a design could jeopardize the program's environmental legitimacy and diminish the prospects of linkage with other ETSs. Nonetheless, California's industry had been pressing for reforms that would provide absolute certainty regarding the maximum carbon price (CARB 2018: 149). In order to ensure political support for the extension of the program through 2030, the hard price ceiling was finally included in the 2017 legislative proposal (Busch 2017; Roberts 2018). The bill (AB-398) was passed with supermajority and bipartisan support in both houses. This indicates that the price ceiling is the outcome of a broad political compromise and is not expected to be abolished soon by California's legislature.

The hard price ceiling is currently set at a high level compared to both past and present EUA and CCA prices. However, the unpredictable scale of its potential impact on the environmental integrity of the linked ETS and the fact that it may contradict with the EU's requirement of an absolute emissions cap are likely to impede the prospects of a linkage. While the diametrically opposed policy choices of the EU and California on this feature cannot be easily bridged, middle ground could be pursued in reciprocal reforms.

On the one hand, the EU can consider introducing both a price floor and a soft price ceiling ("price collar") to the EU ETS. A price floor could help to stimulate investments in low-carbon technologies, but could also raise the allowance price above marginal abatement costs. To implement a soft price ceiling, the MSR could undertake a function similar to California's Allowance Price Containment Reserve (APCR) by making (a portion of) the allowances that remained unsold at auction available for sale at the level of the soft ceiling. Some have argued that such a "symmetric safety valve" can bring significant welfare gains and may enhance the program's functioning, while increasing confidence to make low-carbon investments (Burtraw et al. 2010: 4931). In addition, the price collar can attenuate the risk of excessive future compliance costs and perhaps it could help to increase the acceptability of more ambitious reforms to the industry (such as more stringent annual targets), while maintaining an absolute cap on emissions (ICAP 2020b: 16).

On the other hand, California could apply a maximum limit to its price ceiling units. The exact threshold can be determined on the basis of comprehensive economic analysis and stakeholder input. The operation of soft price collars in both linked ETSs could enhance the allocative efficiency of the common market by increasing the responsiveness of allowance supply to changes in demand (Galdi et al. 2020: 6). The coordination between the respective price collars and reserves, in combination with the benefits of a larger linked market, could strengthen price stability without sacrificing the absolute aggregate emissions cap. This prospect could potentially satisfy the policy objectives of both jurisdictions, while providing a predictable price trajectory for the industry.

The materialization of such bold reciprocal adjustments would require mutual compromises and extensive cooperation between the respective authorities prior to a linkage. Incremental steps, such as the implementation of stricter eligibility criteria for projects in California's offset framework and the introduction of an Auction Reserve Price to the EU ETS, could strengthen confidence between the jurisdictions (Burtraw et al. 2013). On these grounds, the EU and California could first attempt a restricted linkage, with a limitation on the number of imported allowances accepted for compliance. This "safe option" would constrain any significant (positive or negative) effect to the respective ETSs (Haites 2014: 15). A nascent linking relationship can then provide momentum for further reforms, while the restriction can be gradually lifted once California imposes a clear limit to the availability of price ceiling units.

6. Conclusion

The EU and the US State of California share a common vision for a decarbonized future and each has developed an Emissions Trading System (ETS) to help achieve it. Both jurisdictions have effective institutions to adequately monitor emissions and enforce non-compliance measures, which is a prerequisite for successfully linking carbon markets. A legal linkage between both programs is therefore not just a theoretical thought experiment, but a tangible prospect that can

provide a range of economic and political benefits to both advanced jurisdictions. It can be established on the basis of an informal agreement, due to constitutional constraints for California, and can take effect through reciprocal amendments of the regulatory frameworks of each ETS. This requires a majority approval via the ordinary legislative procedure in the EU and the approval of the Governor in California. The consent of their current linking partners, Switzerland and Québec respectively, is also needed.

Potential barriers can emerge from different design choices regarding offset provisions and, especially, price containment measures. Strengthening California's MRV framework for offsets, potentially accompanied by the cooperative application of advanced monitoring technologies, can help alleviate this obstacle. The misalignment of price containment measures may present a greater challenge. California's hard price ceiling may be considered to contradict with the EU's political desire and legal requirement for an absolute emissions cap, as it can potentially lead to excess emissions. The absence of a minimum auction price in the EU ETS, on the other hand, could undermine the functioning of California's allowance price floor.

Reforms in each ETS can be considered, which come at a cost but will also generate benefits, including the prospect of a linked and thus larger ETS market with more abatement opportunities. Such reforms may include the introduction of a price collar in the EU ETS and the application of a maximum limit to California's hard price ceiling. Their gradual implementation, possibly in conjunction with the initial establishment of a restricted linkage, could provide the required impetus for transcending these barriers. Its prospect largely depends on the political determination of both jurisdictions to accrue the expected advantages of a linkage by aligning their ETS design differences. If successful, this achievement would constitute an example for future linking endeavors and would help to inspire the bottom-up expansion of climate policy through carbon markets worldwide.

More economic research is needed to quantitatively assess the comparative emissions cap stringency of the respective programs through the 2021-2030 period. Future research should also investigate the interaction between supply-based mechanisms, such as the EU's MSR, and price-based measures, such as California's

price tiers. Finally, further legal considerations could be explored, for instance by comparing the two ETSs with regard to additional design features and by including the Swiss and Québécois programs in a comparative assessment.

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