The Future of Carbon Markets and Their Economic Potential

Kamal Ali Khan
P.hD Scholar, Department of Sports Sciences and Physical Education, Gomal University, Dera Ismail Khan, KP, Pakistan.
Shoaib Khan
P.hD Scholar. Lecturer in Health and Physical Education, Government Post Graduate College, Bannu, KP, Pakistan.

Abstract

After the recent climate science reports and breakthroughs in major carbon emitting countries, the focus on carbon markets have gained a renewed interest. The architecture and potential implementation aspects of carbon markets have been on the negotiation tables and many countries have either announced new market programs or have enlarged existing ones. Understanding of the roles markets have and can play has increased substantially. Before the First Markets' session took place in establishment of the Kyoto Protocol in 1997, regulation through more direct command and control measures was considered the most likely means to emulate mitigation strategies. The idea of trading tradable permit had of course been around since the environmental economist first mentioned it in his classes in the early 1960s. If the idea of trading the right to pollute was with us for over three decades before putting in place markets to realize that potential, there were two good reasons for doing so once the discussions gained momentum.

Within a cap-and-trade framework any additional abatement required under the time-path is realized where it is cheapest. In addition to this, and unlike under a tax regulation, once the cap has been defined the stream of emission reductions is fixed. Apart from the cap and the trading operations per se, there is no further uncertainty throughout the lifetime of the scheme. After three years of the first markets opening, the world market transacted 350 million (tCO2) and avoided $700 million in abatement costs. More recent growth and price developments are discussed under different autonomous expectations scenarios.

Keywords carbon markets, economic potential, climate change, cap-and-trade, emission reductions, environmental policy, market implementation, trading permits

2. Introduction

As climate change escalates in urgency, so must the pace of efforts to address it. One proposed method for dual mitigation and economic growth is through the use of carbon markets. Carbon pricing is essential for reducing greenhouse gas emissions. Yet,

progress with carbon markets has been slow and partial, despite their growth in size and scope. The essay argues that for both economic reasons and to enhance their effectiveness, carbon markets need to, and will, evolve. Acknowledging the key role that institutions play in shaping market dynamics, it examines the interactions between evolving carbon markets and international policies.

Carbon markets began and persist as a product of international climate change negotiations, where they were conceived as a way of meeting industrialized countries' mitigation commitments in a cost-effective manner. Yet despite a quarter of a century of diplomatic effort culminating in the Kyoto Protocol, only a modicum of trade in carbon exists and prospering markets have only emerged in recent years. Today's carbon markets predominantly operate domestically at a subnational level. Yet they are but a small portion of global emissions and vary greatly in size. Globally, emissions trading remains a charged, divisive issue. To date, post-2012 international agreements under the United Nations Framework Convention on Climate Change have failed to establish a global carbon market. Since 1997, the progression of international climate agreements has further shaped carbon market dynamics, in many instances in unpredictable and unintended ways. Recent years have seen a growing role of so-called 'preferred mechanisms' under the Kyoto Protocol, which allow countries to meet emissions obligations through offsetting and in doing so create tradable credits. Over time, market mechanisms have been increasingly seen by the international community as the main vehicle for environmentally effective and efficient mitigation (Calel, 2011). The Paris Agreement, to enter into force in 2021, envisions the carbon markets of the future to be an integral, common element of national mitigation efforts, facilitating both 'net' and 'gross' cooperative approaches. In light of current tensions between trade and climate interests and given the vested financial interests of several actors, these envisaged markets - if they emerge - are likely to be politically and economically contentious. Yet, it is argued, their relatively recent inception and the diversity of 'entry points' into a national carbon market can also create opportunities for the further evolution of this complex and dynamic policy instrument. Considering the vast scope of mechanisms available to both stimulate and hinder market development, the essay highlights the importance of ongoing research in both anticipating how markets might shape future policy and how they can be designed or steered to deliver on key environmental objectives. Ultimately, these trends suggest the necessity of viewing the anthropogenic transformation of the global climate system through the constructed eyes of evolving carbon markets.

3. History and Evolution of Carbon Markets

Emergence of Market-Based Approaches to Environmental Regulation From Joint Implementation to the First Projects. Given the recent momentum in carbon market development, a closer look at the market's history seems warranted. Today's national, regional and international carbon markets are the latest evolutions of nearly three decades of experimentation and exploration. There are conflicting claims on the paternity of carbon markets. Some point to early 1990s agreements like Costa Rica's debt-for-nature swaps -involving the purchasing of Costa Rican debt at a steep discount in exchange for conservation finance- others to article 17 of the Kyoto Protocol, or climate-conscious derivatives like the "first-of-its-kind" "Chase Global Climate Index" launched by J.P. Morgan in 1998 (Michaelowa et al., 2019). However, most observers agree that the institution marks the single most significant event in the development of carbon markets.

Considering the underlying concepts of what eventually evolved as "activities implemented jointly" and "joint implementation," emergent markets are seen less as an a priori realization and more as the product of shifting policy wind (Calel, 2011). Unlike tax-born markets (e.g. the 1990 Clean Air Act Acid Rain Program in the United States), these markets were slow to develop because of ingrained abhorrence towards cost-benefit analyses and the apparently false dichotomy of seeing the environment as exclusive of the economy. Reviewing events leading to the biodiversity convention, the underlying attitudes are clearer. According to environmental economist Pavan Sukhdev, acid rain forced industrialized countries to recognize the external societal cost of pollution, resulting in coordinated policy actions. Yet, because "biodiversity loss was seen as a basket case for the poor," the shock front of the extinction crisis did not hit Globe North and thus no economic reckoning was prompted. The 1992 climate convention appeared to be heading for a similar end, largely mired in North-South disputes over who was to blame versus who should pay.

4. Economic Impacts of Carbon Markets

There is growing interest in the impact of carbon pricing on the corporate behavior and investment decisions of reducing emissions. The concern is the effectiveness of carbon pricing in promoting the goal of reducing emissions and the economic feasibility for these providers of the carbon market. This research mainly explores how carbon pricing impacts these energy-intensive sectors through a structural path model in order to provide policy implications and suggestions for future studies (LI et al., 2022). The result shows significant negative impacts of the carbon price on the value-added and

profits of carbon-intensive sectors. The incumbent energy-consuming sectors will primarily reduce investment in response to carbon pricing and supply more electricity, coal consumption, and production-related emissions in short term.

There are few things as polarizing among economists as the future of carbon markets. This is surprising given the economic benefits from these markets—estimated to produce significant revenues for national governments as well as will create millions of new jobs, particularly in developing countries. Some industries looking for technological solutions that will stimulate innovation in the short and long term and incentivize small islands to take early action. But despite the potential benefits of carbon markets, significant costs are anticipated for emerging economies. High upfront fees and costs to comply with the system were among the chief concerns, as was closure of sectors, such as the steel industry, for lack of available abatement technology. Critics of proposed market mechanisms also worry that market-based climate policy will favor large corporate polluters over small producers and reduce incentives to decarbonize the economy. The debate across EU member states has uncovered a plethora of fears that imposing a market price on carbon will lead to high job losses and will impact the EU's competitiveness. Headlines have also focused on the impact of the ETS on EU businesses as Chinese counterparts remain free to increase emissions under weaker restrictions. However, these widely reported fears obscure successful examples of regions and countries that are already financially benefiting from carbon trading systems. There is actually a fundamental link between effective carbon markets and longer-term economic stability, fostering sustainable, job intensive growth. This explains why China and other major emerging economies are increasingly implementing market-based solutions, also to bridge the post-2020 climate gap. The premise here is that carbon markets fulfill a dual role: driving the environmental goal of tackling climate change and supporting economic development. Carbon markets (along with robust environmental and social safeguards) can grow investment in sustainable practices and reduce high-carbon dependency, ultimately contributing to global competitiveness. This section explains the economic impacts of carbon markets in greater detail, summarizing new and existing literature. Applied models are not restricted to the key sectors study but analyze across multiple sectors, assessing both winners and losers. This section also presents several under-researched areas, including comparative analysis of market participation costs and wages in carbon markets. There is also extended debate on the broader macroeconomic impact of carbon markets and how cap-and-trade systems can

be used as a tool to identify and introduce energy efficiency improvements in other countries.

5. Challenges and Opportunities in Carbon Markets

Carbon markets face a complex array of challenges that might at first seem insurmountable. From regulated emitters' fear of entrapment due to regulatory inconsistencies, to accusations of market manipulation, to high levels of market volatility, the stakes involved in transparent and trustworthy carbon market operations are high. Moreover, a successful and popular market must operate with maximum efficiency- both economically and in terms of being secure against non-compliance whilst fully preserving the integrity and environmental impacts of the trades. The current fragmented and varying state of policy frameworks, the effectiveness of the market and the confidence of stakeholders are undermined by questions surrounding the environmental credibility of units; further impairing an open market itself. Nevertheless, carbon markets are a powerful tool in the fight against climate change and ambitious proposals to massively scale up the current schemes are being pushed. The situation is far from hopeless. This challenging panorama is also seen as an opportunity for innovation and improvement, with well-qualified and successful efforts of all market participants already aimed at enhancing market efficiency. Indeed, the wide array of mature voluntary and compliance markets, economy wide and modular arrangements, and transparent commodity-backed assets are capable of delivering real, ambitious and gradual emissions reductions. The trends in the type, location, size, cost and environmental standards of carbon offset projects are discussed as potential pathways to scaling up market engagement. While there are some tendencies that are encouraging from the perspective of market backers, many barriers exist and much public awareness and private sector action are necessary to overcome them. Looking at the current carbon markets, and other illustrative examples, a number of lessons are learned from the often imperfect implementation that may guide future plans. Displaying a balanced view, the novel research should offer routes through well-known current obstacles that will mature into quality carbon markets and can operate in consonance with real, gradual and ambitious emissions reductions (Streck, 2021).

6. Technological Innovations in Carbon Markets

In September 2020, the global COVID-19 pandemic dealt a heavy blow to the global economy and ushered in an era of great uncertainty. As the epidemic has spread worldwide, the energy industry has been hit hard, with carbon prices falling by more than 40% at one point. Benchmark Brent crude oil futures in Europe plunged to an

unprecedented negative value, and negative oil prices were seen for futures that did not yet arrive, exacerbating the economic difficulties. The behavioral patterns of most animals can be predicted through modeling, but the market is booming on the surface, with capital moving to fuel the ever-expanding bubble. With huge fluctuations and rapidly changing demand, it is difficult to analyze systematically, and it is difficult to develop prescriptive scientific opinions and suggestions beforehand. In the face of future uncertainties in global strategy and economic strategy, a more comprehensive analytical system is needed (Kotsialou et al., 2021). However, the practices of another disaster-fighting battlefield, China, and the people have provided good examples and enlightenments.

When unfair competition is excluded, China will take actions. The external economy and the economy are supported by scientific data, and it is good to lead by example. Take care of yourself first and guide everyone to work together. Mutual assistance proposes various chemicals as supplementary treatments. China is not short of money or medicines. Artificial intelligence also assists in dialogue. National media should establish authority and reports should have references. Ingrained food distribution institutions guarantee the supply of necessities. The treasurer keeps an eye on transportation. Early detection of outbreaks, designated hospitals and isolation, monitoring, reporting, and linkage are all rights. Social capital should be brought together, and doctors and volunteers should be mobilized. Building a safe production do not open up do not close operations, pay other compensation, tax refunds and exemptions, reduce burden of financial pressure (Hilmi et al.2021) .

7. Policy Frameworks and International Cooperation

One of the reasons national and regional policies are so important is the form they now take. In terms of policies, rules, and regulations for the formation and operation of markets, there is a heavy onus to ensure enshrined rules do not discriminate and bar, or unduly advantage, certain market participants, but rather provide an inclusive and fair environment for those willing to trade. It follows that governments need to work on the alignment of such policies nationally, regionally, and internationally to ensure all are on the same page and an encouragement to invest and participate. International agreements and cooperative initiatives harmonizing standards will always have an important role to play in this regard. Regulatory certainty is seen as something that boosts confidence and is crucial for parties planning, both in the short and long term.

The Paris Agreement will be ambitious and effective in so far as parties implement it. Implementation is likely to be more effective where parties can achieve their self-set

goals more ambitiously and at lower cost, and various mitigation cooperative approaches and mechanisms wide open to the use of carbon markets have the potential to achieve a significant share of the carbon-related investment needed. However, before agreeing to GHG targets that depend on the use of market mechanisms for more than 5% of the emissions gap and the design of these mechanisms obviously want to see how they will operate. A flexible solution can be shared during dialogue with other countries. Nonetheless, the past 5 years have been punctuated by a steady proliferation of such cooperative efforts: MOUs have been signed between various regions, while other countries have indicated they will participate. Similarly, some nations may benefit from crossed-sector credit generation in a project scenario. On the other hand, the criminal investigation that halted its operation focused on illegal collusion and not upon operations founded on the market itself. Such developments simply underscore the fact that, while competitive in nature, the management and operation of carbon markets by individual entities require continuous cooperation and exchange of knowledge between nations; situations where a single entity runs a number of markets give a definite advantage(Kreibich & Hermwille, 2021).

8. Case Studies and Success Stories

This section presents a series of analytical pieces composed to provide a comprehensive view of how carbon markets evolved over the past decade and a perspective of where they might advance. Market development is analyzed in terms of current status, emerging trends and expectations for the future through the lens of market policy, market value, and market linkage. Common market issues for industry participants such as accumulated quota surpluses, commodity prices, etc., are also addressed. Research is supported through nine specific case studies assessing market design, regulations, and likely policy impacts on industrial manufacturing. Additionally, collaborative efforts were undertaken with partner institutions from traditional pilot and emerging provinces to jointly estimate the possible effects in coming years at national level. With the experience from previous trading systems, recommendations and a clear roadmap for optimization and scale-up of the national system were provided (Zhang et al., 2022).

9. Conclusion and Future Outlook

The carbon market has evolved from a mere application of economic theory to a multi-billion market that is presented in the highest level of international politics, the discussion around Kyoto and other international frameworks for the post-2012 period, the World Trade Organization (WTO) and security as well as financial meetings among others. The carbon market model has however remained relatively stable. Design

options in existing and proposed systems have been so far more about variation and expansion. In theory, there is a range of options open for emerging carbon markets, but how these will play in practice will also depend on the EU. As remains to be seen, however, the remainder of the issues mentioned in this paper, have not been addressed by any existing or proposed system, and have at the same time significant policy implications (Brinkman et al., 2009). Regardless of how the models will develop with emerging systems, studies like this can potentially have an impact by assessing current ways to measure compliance. Several recommendations were made in order to enhance the scheme. They cover a wide variety of aspects of the compliance regime, although some issues are more urgent or important than others. In terms of valuation, stronger obligations should take the form of emission caps on the buyer of the hot air; companies should not, under any circumstances, be allowed to get assigned amount units (AAUs) for free. There should for instance be a ban on utilizing any credits that result from the processing of AAUs. Similarly, the Double Up Rule should apply in full and should include the possibility of using certified emission reductions (CERs) forbidding these from also being used for compliance elsewhere. There should be an end to the link between the flexible mechanisms and Annex I Party...

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