Policy Paper

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From Theory to Practice: Making Carbon Pricing Work

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Carbon pricing mechanisms are central to mitigating climate change. These mechanisms work by internalizing the costs associated with greenhouse gas emissions, thus encouraging emissions reductions and promoting technological progress in favor of sustainable alternatives. However, the implementation of carbon pricing mechanisms faces numerous complexities and challenges, especially in developing countries, given the potentially regressive impact of carbon pricing on low-income groups, and the general lack of socio-political support. This policy paper offers a comparative review of two market-based carbon pricing strategies—carbon taxes and emissions trading systems (ETS)—to shed light on their effectiveness, implementation, and capacity to generate revenue. It also argues that carbon pricing should be integrated into a comprehensive policy framework that addresses both national priorities and international equity considerations, in order to effectively address global climate change. The effectiveness of these policies depends largely on their design and adaptation to the specific political and economic contexts in which they are implemented.

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POLICY PAPER

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INTRODUCTION

The global economy is currently characterized by a well-established connection between economic activities and greenhouse gas (GHG) emissions, though some advanced economies have shown some degree of decoupling. These GHG emissions have a significant impact on the global climate system. Mitigating the far-reaching effects of climate change will, thus, require comprehensive and innovative policy responses that influence decisions across different economic sectors. Several options emerge from both theoretical and practical considerations. These options include curbing energy demand and consumption, promoting technological innovation, restructuring the economy towards a more sustainable path, diversifying energy sources, subsidizing low-emission solutions, and internalizing environmental costs.

From a policy perspective, it is up to sovereign nations to implement policies that reduce GHG emissions, while meeting their domestic economic goals. Policymakers can act in three ways (Aldy and Stavins, 2012): (1) mandate firms and individuals to alter their behavior with respect to technology choices and emissions; (2) subsidize firms and individuals to invest in and use lower-emitting goods and services; (3) price the greenhouse gas externality in such a way that decisions take this external cost into account. It is important to note that whichever method is chosen, it must be dynamic and adaptable to economic and technological developments. This is because GHG emissions have long-lasting effects over several decades or even centuries.

Concurrently, as the effects of climate change transcend national boundaries, international cooperation among nations will be required to advance meaningful action to address climate change globally. This duality of national and international aspects of climate policy introduces complexities related to the costs of mitigation and the concept of a global public good. Indeed, the benefits of emissions reductions may accrue to all, regardless of individual efforts. It is therefore crucial to coordinate efforts among nations and industries, in order to prevent free-riding and to mitigate carbon leakage at the international level, while ensuring fair outcomes for developing countries.

Market-based instruments, particularly carbon pricing mechanisms, are increasingly recognized as essential policy tools to achieve this. They aim to reduce GHG emissions by passing the cost of emitting on to emitters. This approach shifts the responsibility for paying for climate-change damages from the general public to the producers of greenhouse gas emissions (Baranzini *et al*, 2017), although some costs are still passed on to consumers. Carbon pricing can thus promote cost-effective GHG reductions, provide strong incentives for innovation, and improve governments' fiscal positions by internalizing the associated externalities. However, carbon pricing is inherently complex. Inappropriate implementation can exacerbate inequality and disproportionately burden developing countries that lack the necessary infrastructure and resources to adopt carbon-pricing mechanisms. Therefore, it is essential for policymakers and stakeholders to understand different carbon-pricing mechanisms, in order to design and implement effective strategies that can drive concrete and equitable change.

This policy paper provides a comprehensive review of the various carbon-pricing mechanisms. It offers a nuanced understanding of how carbon-pricing strategies can effectively address climate-change challenges, and how developing countries can mitigate the risks they raise.

I. PUTTING A PRICE ON CARBON: HOW DOES IT WORK? WHAT ARE ITS PERCEIVED STRENGTHS AND WEAKNESSES?

Carbon pricing is a policy instrument designed to internalize the external costs associated with GHG emissions. These external costs are generally borne by the public, and may include the loss of property due to rising sea levels, damage to crops arising from changing rainfall patterns, and healthcare costs associated with heat waves and droughts.

1. The Multifaceted Benefits of Carbon Pricing

Carbon pricing serves multiple economic purposes:

First, it drives emissions reductions by encouraging a broad range of behavioral changes to reduce energy consumption and switch to low-carbon fuels (Parry *et al*, 2022). In theory, carbon pricing shifts the responsibility for paying for the damages of climate change from the public to the producers of greenhouse gas emissions, although some costs are still passed on to consumers. It encourages firms, consumers, and investors to consider in their decisions the social costs associated with emissions generated at each stage of the product life cycle, from resource to waste. In doing so, it holds them accountable for their emissions.

Consequently, the carbon price serves as an economic indicator for emitters, providing them with the autonomy to choose between modifying their practices to reduce emissions or continuing their emissions-producing activities while bearing the associated costs. Note that carbon pricing schemes are designed to keep these costs rising. It is possible to achieve the same result with non-price instruments. However, this would require the regulator to possess all pertinent information about emissions and abatement options in order to regulate in detail all polluting processes and behaviors. This would undoubtedly be challenging, entailing significant governance costs (Baranzini *et al*, 2017). Nevertheless, carbon pricing alone is likely to be insufficient to meet aggressive mitigation commitments. It must be complemented by other instruments.

Second, carbon pricing stimulates investment in clean energy. In fact, the anticipation of higher fuel costs spurs innovation and the adoption of new low-carbon technologies, especially when a clear trajectory of rising carbon prices is outlined. Econometric studies have demonstrated that when energy prices are stable, innovation tends to reduce consumer prices, while after oil price increases, innovation tends to make equipment more energy efficient (Jaffe *et al*, 1995). This suggests that carbon pricing is an essential element of a policy package aimed at steering technological change towards cleaner goods and production methods. Furthermore, a study of the European carbon market indicated that carbon pricing has led to a 10% increase in clean innovation, as measured by patents, despite relatively low carbon prices up to when the study was published (Baranzini *et al*, 2017). It is also important to consider future carbon-price expectations. A high carbon price today can act as a signal to stimulate investment and research and development (R&D) to reduce reliance on high-carbon energy across all sectors of the economy.

Third, carbon pricing generates a valuable revenue stream that can be used to achieve multiple economic and distributional goals. By understanding the fundamentals of carbon pricing, policymakers can develop effective strategies that not only reduce greenhouse gas emissions, but also promote economic growth and environmental sustainability. Furthermore, companies can utilize internal carbon pricing to assess the impact of mandatory carbon pricing on their operations, and as a tool for identifying potential climate risks and revenue opportunities. Finally, long-term

investors can employ carbon pricing to analyze the potential impact of climate policies on their investment portfolios, enabling them to reassess their investment strategies and reallocate capital to low-carbon or climate-resilient activities.

Moreover, pricing mechanisms can provide substantial domestic environmental benefits, such as better human health through diminished local air pollution. Nevertheless, comparable benefits can be attained through alternative mitigation strategies (Parry *et al*, 2022).

2. The Double-Edged Sword of Carbon Pricing

While carbon pricing is a widely advocated tool for combating climate change, it is not without weaknesses. One of the main weaknesses is its potential regressive impact on household welfare. This refers to the fact that it hits the poor relatively harder than the rich. By increasing the costs of carbon-intensive products such as energy and transport, low-income households bear a disproportionate burden of these increased costs relative to their incomes. This can exacerbate existing income inequalities and strain the finances of vulnerable groups. Even if carbon pricing is progressive, the poorest may still suffer a loss of welfare when prices rise, and their consumption basket becomes more expensive (Islam, 2022). One way around this is to provide targeted assistance to these households, but designing transfers to compensate for this loss is not straightforward. Compensation schemes may not be well developed, and it may be difficult to identify those who have suffered, and to channel funds to them.

Another weakness is the low level of socio-political support for carbon-pricing measures, due to the entrenched commercial interests of certain industrial actors who would lose out. Moreover, the implementation of some carbon-pricing mechanisms, such as carbon border tax mechanisms, faces additional difficulties. These include compliance with international trade rules and the 'common but differentiated responsibilities' principles of the Paris Agreement. As a result, developing countries may react negatively (Berahab and Dadush, 2021). This lack of general support can hinder the effective implementation and enforcement of carbon-pricing policies.

Furthermore, carbon pricing ultimately leads to the restructuring of an economy. This restructuring is not immediate but is likely to cause some short-term disruption. For instance, some of the resources generated by carbon pricing could be channeled into renewable energy, leading to lower investment in fossil fuels. If this transition is not well timed, it could lead to a short-term imbalance between energy supply and demand. Furthermore, a high degree of uncertainty persists over a number of economic variables, including the size of fuel reserves, the size of stranded assets, the future direction of climate policy, the pace of innovation in the renewables sector, and demand risk. This uncertainty is likely to amplify the likelihood of economic disruption.

Moreover, carbon pricing primarily targets carbon dioxide emissions from fossil fuels, and ignores other important sources of GHGs, such as methane from agriculture, deforestation, and waste management. These GHGs have short atmospheric lifetimes but high warming potential. This limitation necessitates the use of alternative, non-fiscal policies to effectively address emissions from these sources (Islam, 2022). Carbon pricing can also give rise to market distortions and carbon leakage, as energy-intensive industries may relocate to regions with less-stringent regulations, thereby undermining the intended emission reductions. Furthermore, businesses are concerned that carbon taxes could discourage investment and reduce profitability, particularly for those unable to switch to alternative sources, and for emerging economies.

Assessing the appropriate level of carbon pricing can be challenging due to difficulties in accurately quantifying carbon emissions. Furthermore, concerns have been raised about the potential for competition and equity issues to emerge. Critics have highlighted concerns about the inadequacy of market pricing of carbon, disparities in price levels across regions, and the disproportionate burden of carbon pricing on the poor. To enhance the efficacy of carbon pricing, it must be integrated

into a comprehensive mitigation strategy, which should encompass supportive measures including just-transition policies to assist low-income households and vulnerable workers, and international coordination through a carbon price floor, to ensure that major emitting countries enhance carbon pricing to effectively address climate change and provide assistance to developing countries in their energy transitions.

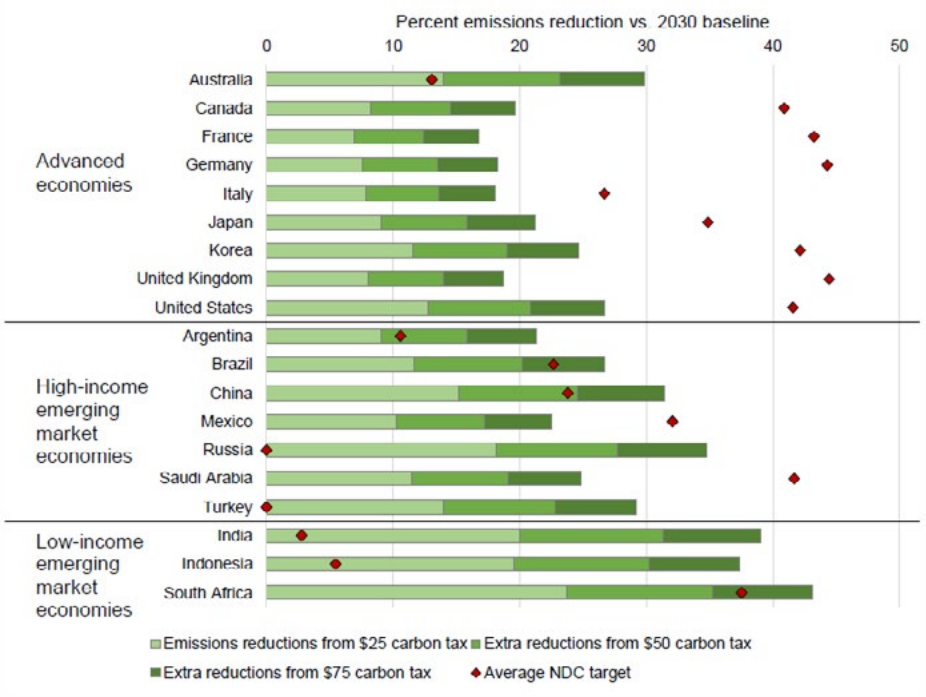
II. CARBON PRICING TOOLS: A FOCUS ON CARBON TAXES AND EMISSION TRADING SYSTEMS

Carbon pricing instruments can be divided into two categories: (i) market-based instruments, such as carbon taxes and emissions trading systems (ETS), and (ii) regulatory policies, such as emission standards and energy-efficiency standards. Policymakers have the option of selecting one of these two paths, or a combination of both. Each has advantages and disadvantages. The following section focuses on two market-based instruments: carbon taxes and emissions trading.

A carbon tax is a tax imposed by the government to reduce the use of fossil fuels and encourage a shift to less-polluting fuels. The tax can be based on the amount of CO2 emitted per ton of fuel, or on the carbon content of fossil fuels, including coal, oil products, and natural gas. The effectiveness of different levels of carbon taxes has been studied by academics and policy researchers. According to the International Monetary Fund, "*a $50 carbon price would reduce CO2 emissions in Group of Twenty (G20) countries by approximately 15-35 % below business-as-usual (BAU) levels in 2030. However, this is still below the commitments that many countries have made in their nationally determined contributions (NDCs) submitted for the 2015 Paris Agreement*" (Parry *et al*, 2022). Therefore, it is evident that carbon pricing will need to be reinforced with non-price measures (see Box 1) such as feebates, emissions standards, and so forth.

Figure 1

CO2 Reductions Below BAU for Mitigation Pledges and Carbon Pricing, G20 Countries 2030



Source: Parry et al, 2022. IMF staff using the Climate Policy Assessment Tool. Note: Pledges assume CO2 emissions are reduced proportionally to pledged GHG reductions. BAU = business as usual; NDC = nationally determined contribution.

Box 1

Overview of Selected Carbon Pricing Tools (excluding carbon taxes and cap-and-trade systems)

Carbon pricing instruments can take multiple forms. Ultimately, all approaches aim to create a price signal on GHG emissions:

Type of instrument	Description
Excise taxes	Applied to individual fuels (e.g. coal), electricity, or vehicles.
Energy efficiency standards	Applied to vehicles, these policies set minimum requirements for the average fuel economy (kilometer per liter) of vehicles sold by different companies, or a maximum rate for the average CO2 per kilometer for all vehicle sales. Companies that have difficulty meeting these standards can buy credits from companies that exceed the standards, creating a credit trading system. Standards can also be used to improve the energy efficiency of new buildings, appliances, and other durable goods that use electricity.
Emissions standards	Applied to the power sector, this policy sets a cap on the maximum amount of CO2 allowed per kilowatt-hour (kWh), averaged across each generator's facilities. Flexibility can be provided by allowing high-emitting generators to fall below the standard by purchasing credits from other generators that exceed the standard.
Incentives for renewable fuels	Policies to promote renewable energy generation include renewable portfolio standards (minimum percentages of renewable energy in a generator's fuel mix), subsidies for renewable energy generation, and feed-in tariffs (guaranteed prices for power from renewable sources).
Feebates	A policy instrument that uses both fees and rebates to encourage lower emissions: For vehicles: Cars that emit more CO2 per kilometer than a set 'pivot point' are charged a fee, while cleaner vehicles below the pivot point receive a rebate. For power generation: Generators that produce electricity with higher CO2 emissions per kWh (kilowatt-hour) are charged fees, while generators that use cleaner methods receive rebates. Feebates can be designed to raise some revenue or be revenue neutral, depending on whether the pivot point is below or at the industry average emissions rate.
Regulatory combinations	This is a set of independent regulations designed to exploit many of the emission reduction opportunities that would be exploited under comprehensive emissions pricing. For example, the combination might include an emissions standard for the power sector, and various energy-efficiency standards for vehicles and electricity-using appliances. Alternatively, the equivalent of these regulations could be combined in a policy package.

Source: Parry, 2012 (International Monetary Funds)

Emissions trading systems (ETS), also referred to as cap-and-trade systems, operate by establishing a limit, or 'cap', on the total amount of greenhouse gases that can be emitted by companies or operators (European Commission, 2024a). This cap is then converted into tradable permits or allowances. Firms subject to this system are required to hold permits for each ton of emissions they produce. The government establishes a ceiling for the total number of allowances available, thereby creating a scarcity of permits and driving up their price. Firms are then permitted to trade these allowances with each other, creating a market for emissions rights.

When carbon taxes and ETS are compared, they are often perceived as two sides of the same coin, both aimed at reducing emissions but fundamentally different in their approaches. In particular, a carbon tax sets a price on carbon dioxide emissions and allows the market to determine the amount of emissions reductions, while an ETS sets the amount of emissions reductions and allows the market to determine the price (Fank, 2014). This fundamental difference presents a challenge for policymakers when determining which approach to adopt. Carbon taxes and ETS can be compared on the basis of a number of criteria, including uncertainty, administration and coverage, revenue allocation, political economy, and competitiveness (Parry *et al*, 2022):

1. Navigating the Uncertainties of Carbon Pricing

Governments are confronted with a dilemma: they cannot simultaneously ensure certainty in pricing and emissions. This uncertainty is further compounded by the volatility of fuel prices and the availability and cost of clean technologies, affecting both current and future emission abatement costs. On the one hand, carbon taxation provides governments with certainty about future prices by setting the future trajectory of tax rates, thus allowing the market to determine emission levels (Parry, 2012; Taschini *et al*, 2014; Parry *et al*, 2022). For example, in Ireland, the carbon tax is set to increase by €7.50 annually until it reaches €100 per ton by 2030 (Parry *et al*, 2022).

In contrast, an ETS provides certainty about emission levels, making it an appealing option for policymakers committed to achieving specific emission targets. The disadvantage of such systems is that the inherent price uncertainty may deter innovation and the adoption of clean technologies. Over time, both carbon taxes and ETS can mitigate some of the uncertainty associated with emissions and pricing, potentially narrowing the differences between the two approaches. Carbon tax rates are typically established and adjusted in accordance with emission targets. In contrast, ETS may include price-stability mechanisms such as price floors and banking/borrowing features, which allow the flexibility to adjust future emission caps in order to stabilize prices, as necessary (Parry *et al*, 2022).

2. Streamlining Bureaucracy and Administration

In terms of administration, carbon taxes, which typically fall under the purview of finance ministries, are easier to administer because they can be piggybacked on existing fuel taxes (Parry *et al*, 2022; Aldy and Stavins, 2012). This is relatively straightforward in developed countries with established fuel supply monitoring and reporting systems. Even some developing countries with robust tax systems could implement carbon taxes efficiently, but this may prove challenging for most developed countries. Moreover, governments may impose carbon taxes at various stages of the fossil-fuel product cycle. These include upstream taxation at the point of extraction or import, and downstream taxation at the point of energy generation (Aldy and Stavins, 2012). The tax is typically applied at the level of fuel suppliers, which then pass it on in the form of higher prices for electricity, gasoline, and heating oil. This encourages producers and consumers alike to reduce energy use, and to shift to lower-carbon fuels or renewable energy sources through investment or behavior change (Parry, 2019).

ETS schemes, overseen by environment ministries, often require complex administration and may cover a limited range of sectors, primarily targeting large stationary sources in the power and industrial sectors. The downstream focus of ETS schemes may result from alignment with current regulations for local pollution control by regulated entities, or from requirements for free allocation of allowances. Small emitters in ETS-covered sectors are typically excluded for administrative convenience, even though their emissions contributions are small. Some ETS may extend downstream to transport, requiring additional capacity to monitor emissions and administer allowance trading (Parry *et al*, 2022). The implementation of an ETS can be challenging in countries with limited institutional capacity, which is the case for many developing countries, or in concentrated allowance trading markets. In addition, changes to ETS rules require regulatory and legislative adjustments, which can be a lengthy process, in contrast to carbon taxes, which can be changed more easily through budget and finance legislation.

Some countries have both carbon taxes and an ETS. In the European Union, domestic carbon taxes are employed in conjunction with sectors outside the EU ETS in countries including Denmark, Finland, and Sweden. In Canada, provinces such as British Columbia have carbon taxes, while Quebec has an ETS. The combination of taxes and an ETS can even reinforce price signals, as shown by the United Kingdom's price-floor tax on power-sector emissions. In other instances, the choice between a carbon tax and an ETS is determined by constitutional or legal factors. For instance, the EU is not a fiscal union, and fiscal measures require unanimity among member countries, whereas regulations such as an ETS require qualified majority voting. Consequently, the EU has a preference for an ETS. Despite differences in political structures, countries can adopt complementary carbon pricing systems tailored to their needs (Parry, 2012; Parry *et al*, 2022; Aldy and Stavins, 2012). Indeed, the flexibility of design allows ETS and taxes to be mutually compatible, with ETS schemes with price floors resembling taxes and vice versa.

3. Harnessing Carbon Pricing Revenue for Efficiency and Equity

Carbon pricing revenues are of significant importance from both efficiency and distributional perspectives. Carbon tax revenues frequently flow into general budgets, while ETS revenues are typically earmarked for environmental purposes. Revenues from carbon taxes, like those from existing fuel taxes, are typically allocated directly to ministries of finance and can therefore be used for a wide range of purposes. These include reducing other distortionary taxes, such as those on labor, financing productive public investment, or reducing deficits. However, this can result in significant political, economic, and environmental trade-offs. ETS meanwhile were designed initially on the basis of free allowances, as in the EU and Korea, in order to gain industry support. However, this can result in significant windfall profits for firms, as they may have greater scope to pass on allowance prices in the form of higher consumer prices (Parry *et al*, 2022). Currently, the practice of auctioning allowances, as seen in California and Germany, is becoming increasingly common. From an efficiency perspective, productive uses of revenues can yield substantial gains in economic efficiency that can help offset the negative effects of higher energy prices on economic activity. For instance, redirecting revenues to tax cuts or public investment can enhance efficiency. Similarly, earmarking revenues for environmental investments can be efficient, provided that such investments are fully integrated into robust public investment management systems.

The distributional aspects of carbon pricing revenues are of equal importance to efficiency (Parry, 2012; Parry *et al*, 2022). The distribution of carbon tax revenues affects different groups in different ways. Targeted support, such as means-tested transfers, benefits low-income households, compensating them for higher energy prices, while payroll/consumption tax cuts benefit the broader population. In addition, corporate tax cuts primarily benefit shareholders and employees. In an ETS, addressing distributional concerns is limited if allowances are freely allocated or auction revenues are earmarked, which affects acceptability. Windfall gains from free allowances can benefit shareholders and employees, potentially favoring higher-income households. In the German ETS, auction revenues are allocated exclusively to transition assistance, which compromises the efficiency of the program in favor of its acceptability. Whether the policy in question is a carbon tax or an ETS, an effective revenue strategy should balance provision of support to low-income households with addressing tax burdens or financing investment.

4. Addressing the Political Economy of Carbon Pricing

The choice between carbon pricing methods is contingent upon the role of political economy. While economically straightforward, carbon taxes can be politically challenging to implement (Parry, 2012; Aldy and Stavins, 2012; Parry *et al*, 2022). Therefore, it is essential to conduct a comprehensive analysis of social costs. One potential avenue for implementation is a gradual introduction, accompanied by targeted support for low-income households, trade-dependent industries, and vulnerable workers, along with transparent communication on the utilization of carbon tax revenues.

Alternatively, an ETS may offer a more politically viable approach, particularly when permits are allocated free of charge. Indeed, effective carbon pricing benefits society broadly, yet it can concentrate costs on energy-intensive sectors. Powerful companies often prioritize free permits and lobby for them. Nevertheless, some regions are reducing the number of free carbon allowance allocations.

Carbon taxes can be structured to provide relief similar to free permits. However, they require strategic communication and stakeholder engagement. Political challenges may arise from affected businesses and citizens, similar to other tax reforms. Communication and the use of revenues influence public acceptance of carbon pricing and subsidy reforms. Soft earmarking for environmental and social goals is more palatable than deficit reduction or corporate tax cuts. Consequently, it is of the utmost importance to address the concerns of those who may be negatively affected by carbon pricing, in order to gain the support of stakeholders for its implementation.

5. Bridging Carbon Pricing with Competitiveness

In terms of competitiveness, the primary challenge of introducing carbon pricing is the additional burden on a limited number of energy-intensive, trade-exposed industries with high carbon intensity, but limited ability to pass on increased production costs in the form of higher consumer prices. Unilaterally, countries can support competitiveness while also introducing carbon taxes by exempting emissions below a threshold, or providing output-based rebates to emissions-intensive industries. These measures, however, can diminish the motivation to reduce emissions, and lack resilience in scenarios requiring significant reductions in emissions. ETS schemes typically address competitiveness with free allowances, but do not address the costs of abatement.

One potential solution to the competitiveness problem associated with carbon pricing is to combine an ETS with border carbon adjustments (BCAs), which are gaining attention as another alternative that imposes charges on imported carbon, while potentially providing rebates to domestic exporters. BCAs would require importers to hold allowances for the carbon emissions embedded in their products, ensuring that they face the same regulatory costs as domestic producers. However, the implementation of such measures, whether under a cap-and-trade or a carbon tax regime, raises many concerns among developing countries (Berahab, 2023; Berahab and Dadush. 2021). There is a concern that these measures may not comply with World Trade Organization (WTO) rules, and that they may constitute trade sanctions to pressure other countries to adopt stricter emissions policies (Brainard and Sorking, 2009; Frankel, 2010).

Table 2

Summary Comparison of Carbon Taxes and ETS

Design issue	Instrument	
	Carbon tax	**ETS**
Administration	Administration is more straightforward (for example, as extension of fuel taxes)	May not be practical for capacity-constrained countries
Uncertainty: price	Price certainty can promote clean technology innovation and adoption	Price volatility can be problematic; price floors, and cap adjustments can limit price volatility
Uncertainty: emissions	Emissions uncertain but tax rate can be periodically adjusted	Certainty over emissions levels
Revenue: efficiency	Emissions uncertain but tax rate can be periodically adjusted	Free permit allocation may help with acceptability but lowers revenue; tendency for auctioned revenues to be earmarked
Revenue distribution	Revenues can be recycled to make overall policy distribution neutral or progressive	Free allowance allocation or earmarking may limit opportunity for desirable distributional outcomes
Political economy	Can be politically challenging to implement new taxes; use of revenues and communications critical	Can be more politically acceptable than taxes, especially under free allocation
Competitiveness	Border carbon adjustment more robust than other measures (for example, threshold exemptions, output-based rebates)	Free allowances effective at modest abatement level; border adjustments (especially export rebate) subject to greater legal uncertainty
Price level and emissions alignment	Need to be estimated and adjusted periodically to align with emissions goals	Alignment of prices with targets is automatic if emissions caps consistent with mitigation goals
Compatibility with other instruments	Compatible with overlapping instruments (emissions decrease more with more policies)	Overlapping instruments reduce emissions price without affecting emissions though caps can be set or adjusted accordingly
Pricing broader GHGs	Amenable to tax or proxy taxes building off business tax regimes; feebate variants are sometimes appropriate (for example, forestry)	Less amenable to ETS; incorporating other sectors through offsets may increase emissions and is not cost effective
Global coordination regimes	Most natural instrument for international carbon price floor	Can comply with international price floor; mutually advantageous trades from linking different ETS, but does not meet global emissions requirements

Source: Parry *et al* (2022), IMF staff. Note: Green indicates an advantage of the instrument; orange indicates neither an advantage nor disadvantage; red indicates a disadvantage of the instrument

In summary, while carbon taxes provide simplicity and predictability, an ETS can provide certainty of emissions abatement and flexibility. Economists suggest hybrid models that combine elements of both approaches to achieve optimal results, while acknowledging challenges such as complexity and regulatory intervention in permit markets. The choice between these mechanisms is nuanced and context-specific, requiring careful consideration of specific goals and circumstances to determine the most effective approach to reducing emissions and protecting the environment. Furthermore, the choice between these mechanisms is contingent upon factors such as the strength of the economic signal, the sectors targeted, and the use of revenues.

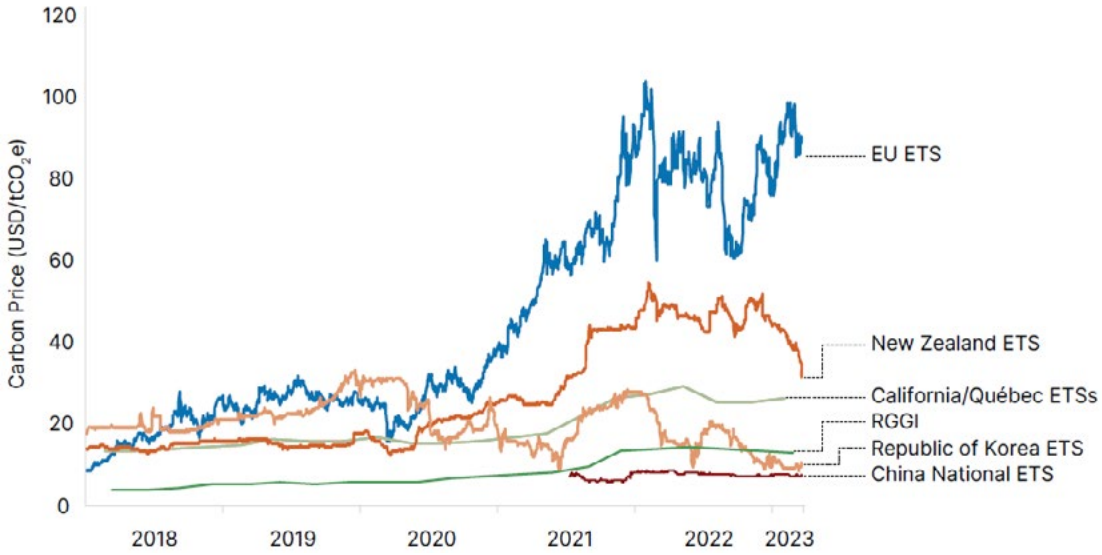
III. WHERE DOES CARBON PRICING STAND TODAY?

The global push for carbon pricing is gaining momentum, yet significant differences exist between countries in terms of coverage and price levels (Parry *et al*, 2022). As of April 2023, a total of 73 carbon taxes or ETS were actively operating (World Bank, 2023). In 2022, new carbon pricing mechanisms were introduced at the national or subnational level in a number of regions, including Austria, Washington State, Indonesia, and Mexico. While many of these initiatives were established in countries with existing carbon taxes or an ETS, their objective was to expand into new sectors or improve the effectiveness of existing pricing mechanisms.

Despite the challenges posed by the global energy crisis and rising inflation, the development of carbon taxes and ETS prices has demonstrated notable resilience. However, there has been a general slowdown in price growth following a period of rapid rises (Figure 3). In response to the energy crisis, some countries have experienced setbacks or delays in the implementation of these mechanisms. Notably, nations including Germany and South Africa have yielded to political pressures arising from high energy prices, opting to reduce carbon tax rates or defer planned increases. Conversely, other countries have taken a more aggressive stance in strengthening their carbon pricing strategies. Ireland, Luxembourg, the Netherlands, Norway, and Canada, for example, have increased their carbon tax rates by 20% or more, exceeding their national inflation rates. Moreover, the EU ETS cap continued its scheduled downward trajectory, with a reduction of 2.2% or 43 million allowances in 2022. Free allocations were similarly reduced (World Bank, 2023). This commitment reflects a broad trend among numerous governments to not only maintain, but also intensify, their efforts in carbon pricing, despite economic pressures. It underscores a global resolve to address climate change through fiscal measures.

Figure 2

Price Evolution in Selected ETS from 2018 to 2023

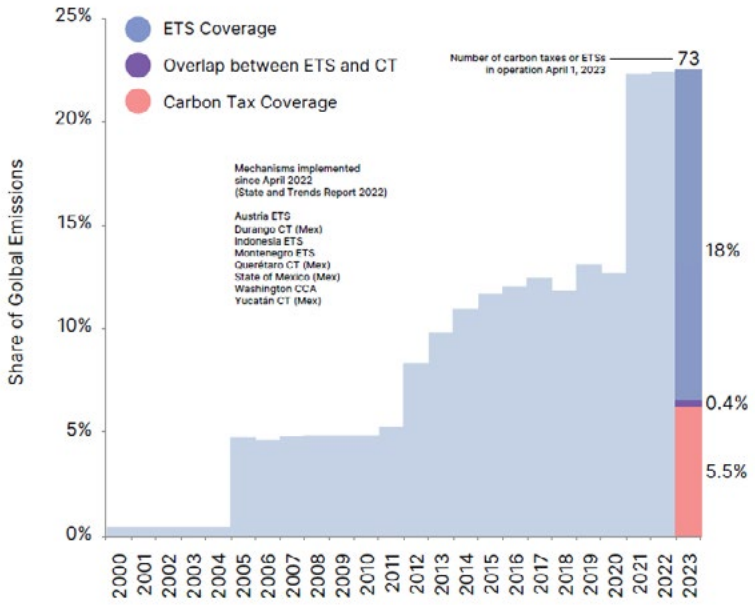


Source: World Bank.

Energy markets are the most significant factor influencing prices in the majority of ETS, surpassing policy changes. In fact, in 2023, limited gas supplies and exceptionally high gas prices made coal a more competitive option. This situation was further exacerbated by droughts in Europe, China, and the United States in 2022, which led to a temporary shortage of hydroelectric power, and caused technical and thermal problems, particularly at French nuclear power plants. Consequently, the multi-year decline in coal use observed in numerous European countries was reversed, resulting in an increase in power-sector emissions and a rise in EU ETS prices. In other economies, long-term liquefied natural gas (LNG) supply contracts provided some protection against energy price impacts. However, if high energy prices persist, they will eventually affect all markets.

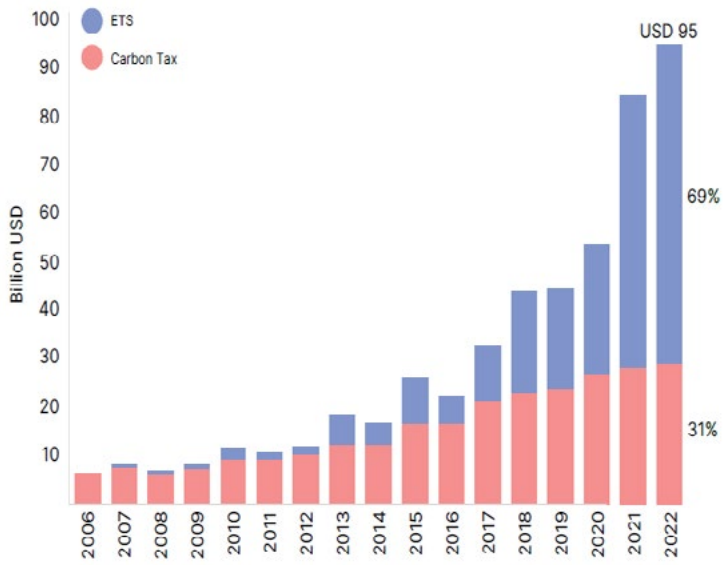
Figure 3 :

Share of Global GHG Emissions Covered by ETS And Carbon Taxes



Source: World Bank.

Evolution of Global Revenues from Carbon Taxes and ETS Over Time (Nominal)



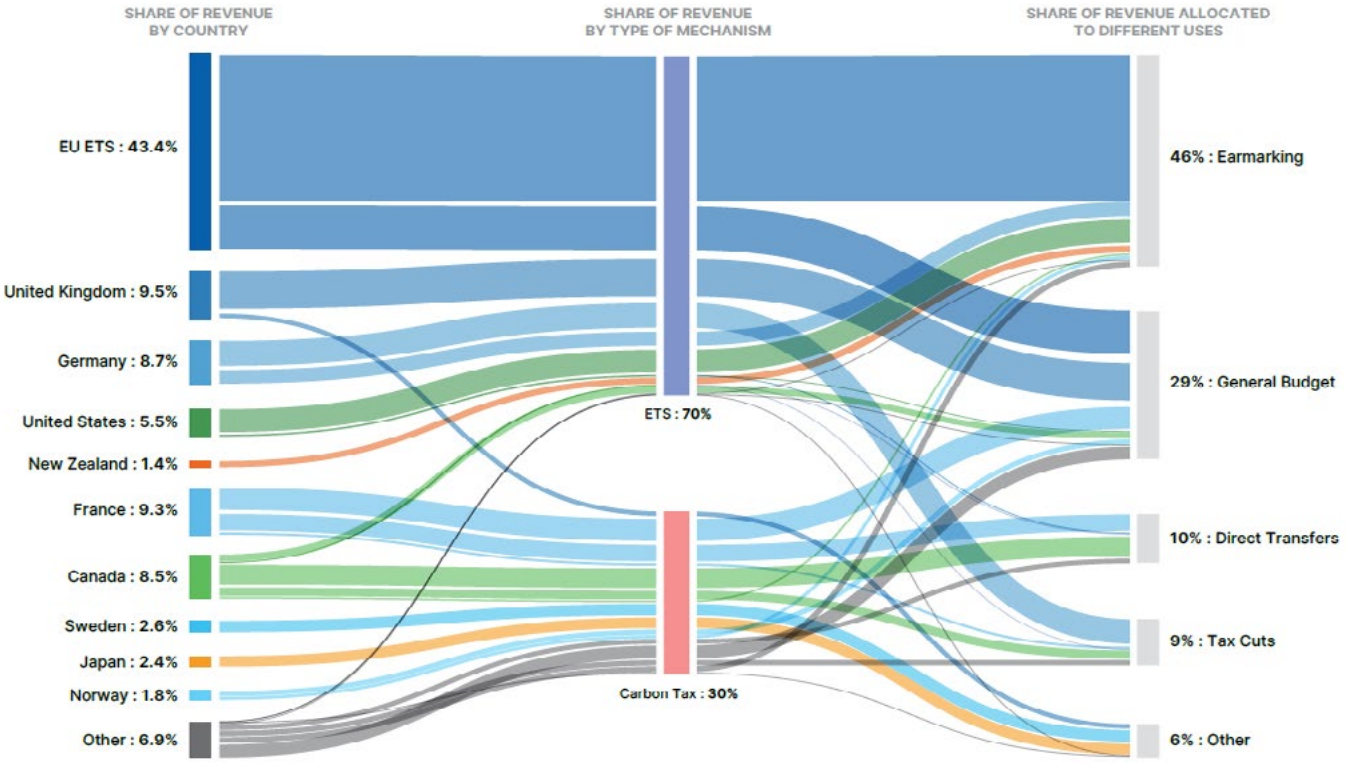
Source: World Bank.

Over the past year, there has been a slight increase in the share of GHG emissions covered by carbon taxes or emissions trading systems. In 2023, these instruments covered approximately 23% of global GHG emissions, up from 7% a decade ago (Sara, 2023; World Bank, 2023) (Figure 4). This represents an increase of less than 1% compared to 2022, taking into account the overlap between instruments and the significant differences in coverage between countries. For example, Uruguay's carbon tax applies only to gasoline, while Singapore's carbon tax covers approximately 80% of national GHG emissions. The modest increase in global coverage can be attributed to the expansion of the scope of certain policies and the introduction of new instruments, as well as the fact that GHG emissions are declining in most countries that have implemented a carbon tax or ETS. Furthermore, New Zealand is poised to become the first country to price agricultural emissions from 2025, extending carbon pricing beyond traditionally covered sectors.

In regard to the revenues generated by carbon pricing, a number of factors influence the outcome. These include the carbon price, the scope of emissions covered, and the design features of the instruments, including the methods employed for the allocation of allowances and the availability of rebates. In line with previous trends, revenues from carbon taxes and ETS increased significantly in 2022, reaching a total of nearly $95 billion globally (Figure 5). This represents an increase of more than 10% compared with 2021. The EU ETS was the largest contributor in absolute terms, generating $42 billion and accounting for over 76% of the total increase in global carbon pricing revenues. On a *per-capita* basis, Sweden's carbon tax on road transport generated the highest revenues at just over $200 per citizen. In 2022, ETSs accounted for 69% of global government revenues from direct carbon pricing, while carbon taxes accounted for the remaining 31% (World Bank, 2023).

Figure 5

Scale and Uses of Carbon Revenue In 2021



Source: World Bank. Based on 2021 data from Institute for Climate Economics.

It is often the case that ETS and carbon tax revenues are earmarked for certain purposes, which can help to mitigate political opposition (Figure 6). According to the Institute for Climate Economics, 40% of carbon tax and ETS revenues were earmarked, mainly for environmental spending, and another 10% for direct transfers to vulnerable households and firms. The remaining revenues were allocated to the general budget (20%), tax cuts (9%), and other purposes (6%) (Poupard *et al*, 2022).

IV. WHAT ARE THE IMPLICATIONS FOR DEVELOPING COUNTRIES?

Carbon tax and ETS implementation is concentrated predominantly in high-income countries, particularly in regions such as Europe and North America. All countries in the European Economic Area and North America have some level of emissions covered by these mechanisms. In the United States, such policies are primarily implemented at subnational level, while China stands out with its national ETS, which accounts for a significant share of covered emissions in East Asia and the Pacific.

Carbon tax and ETS presence in Africa and the Middle East remains low, indicating uneven implementation across income groups. In terms of pricing, carbon-tax rates and ETS prices tend to be higher in high-income countries than in middle-income countries. This disparity reflects the different economic capacities and emission profiles of these countries. Furthermore, high-income countries also lead in carbon tax and ETS revenue generation, driven by higher prices, higher emission volumes, and different policy designs.

Therefore, the implementation of carbon pricing mechanisms, such as carbon taxes and ETS, presents unique challenges for developing countries. These challenges arise from a complex interplay of social, economic, legal, and political factors. While carbon pricing incentivizes emissions reductions and promotes green economic development, it can disproportionately burden developing economies compared to advanced economies. This disparity arises because of less efficient economies and lower public willingness to pay for climate regulations in developing countries. Furthermore, developing countries may prioritize energy access and affordability, which could potentially create a conflict with carbon pricing initiatives.

Administrative Feasibility vs. Political and Social Considerations

The administrative barriers to carbon pricing are often overstated. Most countries have experience with fuel excise taxes, suggesting that the administrative feasibility of carbon pricing reforms is not as problematic as commonly assumed. However, the real challenge lies in ensuring equitable implementation aligned with national development objectives (Teusch *et al*, 2021). This alignment is crucial for garnering broad public support. For instance, Egypt's success in reforming fossil-fuel subsidies exemplifies how adverse impacts on vulnerable populations and businesses can be mitigated. Nevertheless, carbon pricing is not a standalone solution; it requires integration into a broader portfolio of climate and fiscal policies. Kenya, for instance, emphasizes affordable access to cleaner alternatives, alongside fuel excise taxes and successful fuel-subsidy elimination.

In essence, carbon pricing policies in developing countries differ from those in developed countries in several ways. The political environment in developing countries often necessitates a delicate balancing act between the need for carbon pricing and the simultaneous consideration of energy access, international competitiveness, and potential impacts on vulnerable populations.

Multiple Benefits for Developing Countries Beyond Climate-Change Mitigation

Nevertheless, well-designed carbon pricing reforms can benefit developing and emerging economies significantly by addressing pressing challenges beyond climate change. These benefits include:

- *Tackling Local Pollution:* Carbon pricing can incentivize cleaner air by reducing local air pollution associated with fossil-fuel combustion.
- *Pressuring Major Polluters:* While developing countries contribute relatively little to global emissions, their adoption of carbon pricing can exert pressure on larger polluters to step up their mitigation efforts.
- *Facilitating Global Decarbonization:* Carbon pricing can strengthen the ability of developing countries to participate successfully in a decarbonizing global economy.
- *Future-Proofing Investments:* Carbon taxes or an ETS encourage cleaner investment and consumption choices, fostering long-term economic viability and alignment with low-carbon development goals.
- *Avoiding Stranded Assets:* Without carbon pricing, individuals and companies in developing countries may invest in outdated technologies with high carbon footprints, leading to lock-in effects and higher emissions in the medium term.

Furthermore, carbon pricing offers the potential for strengthening domestic revenue mobilization in developing countries. While the revenue potential varies across nations, the OECD has suggested

that 15 developing and emerging economies could generate revenue equivalent to approximately 1% of their GDP by implementing carbon pricing on fossil fuels at a rate of €30 per ton of CO2. This represents a potential increase in average tax revenues of approximately 5% for these countries, considering their current average tax-to-GDP ratios of 19% compared to the OECD average of 34% (Teusch *et al*, 2021).

Revenue generated from carbon pricing can be strategically channeled towards improving energy access and affordability. Targeted support can, indeed, be directed at improving energy access and affordability for vulnerable populations. Furthermore, it can be directed towards enhancing social safety nets, as it can help mitigate the potential negative impacts of carbon pricing on vulnerable groups, or it can be directed to supporting economic and social priorities. Carbon pricing revenue can, in fact, be used to support a range of economic and social priorities within developing countries. This is particularly relevant in light of the particular vulnerability of many developing country citizens during the COVID-19 crisis, because of inadequate social safety nets. For instance, Egypt's successful fossil-fuel subsidy reform yielded fiscal savings that were reallocated to education, health, and economic stimulus packages to recover from the crisis.

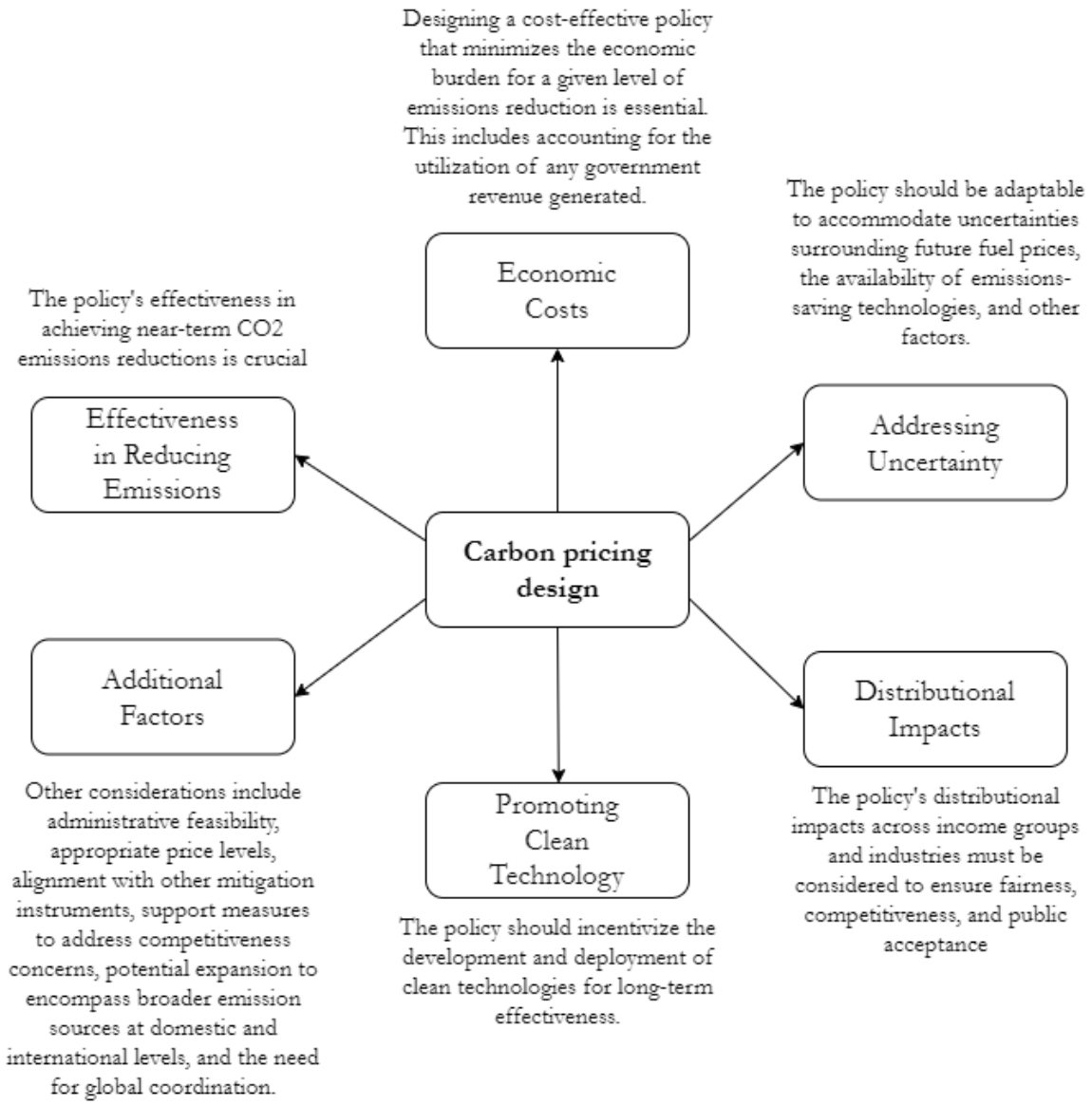
Growing Interest in Carbon Pricing Among Developing Countries Despite Challenges

Despite the aforementioned barriers, there is a growing interest in carbon pricing mechanisms in regions with historically low coverage, such as Africa. Several low- and middle-income countries are actively considering the implementation of carbon taxes or the establishment of an ETS. South Africa has taken the lead with its carbon tax, while countries including Botswana, Côte d'Ivoire, Gabon, Morocco, Nigeria, and Senegal are signaling their intentions to adopt carbon pricing measures. The implementation of feasibility studies, legal frameworks, and international support is paving the way for these countries to potentially join the global carbon pricing landscape, indicating a potential shift in the geographical distribution of carbon pricing initiatives. While carbon pricing offers a powerful signal to discourage technological lock-in and promote low-carbon investments, it requires careful consideration to mitigate potential drawbacks. It can serve as a progressive mechanism for raising tax revenue and addressing climate change risks that disproportionately affect poorer countries. Nevertheless, the implementation of carbon pricing must be accompanied by the introduction of mitigation measures to offset any potential negative consequences on energy access, international competitiveness, and vulnerable groups.

In designing carbon pricing instruments, policymakers in developing countries should consider a number of factors (Figure 6):

Figure 6 :

Carbon Pricing Design



Source: Parry et al (2012).

In addition, developing countries may initially be less inclined to undertake costly emissions reductions, despite the potential for significant long-term gains from global mitigation efforts due to their greater vulnerability to climate-change impacts. However, a more nuanced and targeted implementation of carbon pricing and border taxes can help alleviate these concerns. Identifying and implementing the 'right' carbon price differentiated by country, product, and industry is a complex task. Transfers of resources from advanced to developing countries can play a role in ensuring more equitable distribution of the burden associated with carbon border taxes (Ianchovichina *et al*, 2021). However, weak institutional structures in many developing countries necessitate alignment of trade, climate, and domestic policies to achieve positive economic and climate outcomes.

CONCLUSION

Carbon pricing mechanisms, encompassing carbon taxes and ETS initiatives, are critical tools for incentivizing GHG reductions and fostering the adoption of low-carbon technologies. The analysis underscores the potential of these mechanisms to drive substantial economic and behavioral changes across various sectors. However, the effectiveness of carbon pricing is influenced greatly by its design and the socio-economic and political context within which it is implemented.

For carbon pricing to be genuinely effective, it must be meticulously adapted to prevent the exacerbation of social inequalities, and should include compensating measures to safeguard vulnerable populations, particularly in developing countries. These regions face distinctive challenges because of their economic structures, and the urgent need for development that does not compromise environmental sustainability.

The necessity for a coordinated international response is paramount, given the transboundary nature of climate change. Policies must be crafted to minimize carbon leakage and promote fair outcomes. This means ensuring that the burdens and benefits of climate policies are shared fairly across the globe. Moreover, the integration of carbon pricing within a broader policy framework is essential. This approach should combine regulatory measures, incentives for clean energy, and international collaboration to address the comprehensive challenges posed by climate change.

In essence, carbon pricing should not be viewed in isolation, but as part of a strategic mix of interventions that aim collectively to steer the global economy towards sustainable growth. Continued research, adaptive policy frameworks, and robust international cooperation remain critical for optimizing the effectiveness of carbon pricing and achieving the broader goals of climate change mitigation and sustainable development.

REFERENCES

- Aldy, J-E. & R-N. Stavin. (2012). *The Promise and Problems of Pricing Carbon: Theory and Experience*. Journal of Environment & Development 21(2) 152– 180. SAGE Publications.
- Baranzini, A. et al. (2017). *Carbon pricing in climate policy: seven reasons, complementary instruments, and political economy considerations*, https://wires.onlinelibrary.wiley.com/doi/10.1002/wcc.462 (Consulté le 18 mars 2024).
- Berahab, R. & U. Dadush. (2021). *What will be the effect of the EU's Carbon Border Tax on Morocco, and how should Morocco react?* Policy Paper, Policy Center for the New South, https://www.policycenter.ma/index.php/publications/what-will-be-effect-eu-s-carbon-border-tax-morocco-and-how-should-morocco-react (Consulté le 20 Mars, 2024).
- Berahab, R. (2023). *Navigating the CBAM Transitional Period: Understanding the Latest Developments, and Enhancing Preparedness*. Policy Brief, Policy Center for the New South, https://www.policycenter.ma/index.php/publications/navigating-cbam-transitional-period-understanding-latest-developments-and-enhancing (Consulté le 28 Mars, 2024).
- Brainard, L. & I. Sorking. (2009). *Climate change, trade, and competitiveness: Is a collision inevitable?* Washington, DC: Brookings Institution Press.
- European Commission. (2024a). *What is the EU ETS?* https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/what-eu-ets_en (Consulté le 24 Mars, 2024).

- Frank, C. (2014). *Pricing Carbon: A Carbon Tax or Cap-And-Trade?* Commentary, Brookings, https://www.brookings.edu/articles/pricing-carbon-a-carbon-tax-or-cap-and-trade/ (Consulté le 28 Mars, 2024).
- Frankel, J. (2010). *Global environment and trade policy*. In J. E. Aldy & R. N. Stavins, Post-Kyoto international climate policy: Implementing architectures for agreement (pp. 493-529). New York, NY: Cambridge University Press.
- Islam, J. (2022). *What a carbon tax can do and why it cannot do it all*. World Bank Blogs, https://blogs.worldbank.org/en/energy/what-carbon-tax-can-do-and-why-it-cannot-do-it-all (Consulté le 20 Mars, 2024).
- Ianchovichina, E & H. Onder. (2021). *Carbon border taxes: What are their implications for developing countries?* Commentary, Brookings, https://www.brookings.edu/articles/carbon-border-taxes-what-are-their-implications-for-developing-countries/ (Consulté le 4 Avril, 2024).
- Jaffe, A. et R-N. Stavin. (1995). *Dynamic Incentives of Environmental Regulations: The Effects of Alternative Policy Instruments on Technology Diffusion*. Journal of Environmental Economics and Management Volume 29, Issue 3, November 1995, Pages S43-S63.
- Parry, I. (2012). Chapter 1. *What Is the Best Policy Instrument for Reducing CO2 Emissions?* Report- Fiscal Policy to Mitigate Climate Change: A Guide for Policymakers. International Monetary Fund.
- Parry, I. (2019). *What Is Carbon Taxation?* International Monetary Fund. https://www.imf.org/en/Publications/fandd/issues/2019/06/what-is-carbon-taxation-basics (Consulté le 28 Mars, 2024).
- Parry, I. et al. (2022). *Carbon Taxes or Emissions Trading Systems? Instrument Choice and Design*. IMF STAFF CLIMATE NOTE 2022/006, Inernational Monetary Fund.
- Poupard, A. et al. (2022). *Global Carbon Acounts In 2022*. Institute for Climate Economics, https://www.i4ce.org/wp-content/uploads/2022/09/220915-18h13-i4ce3632-ComptesMondiaux2022-VA-10p.pdf (Consulté le 4 Avril, 2024).
- Sara, J-J. (2023). *State and Trends of Carbon Pricing 2023 – Commentary*. World Bank, https://blogs.worldbank.org/en/climatechange/state-and-trends-carbon-pricing-2023 (Consulté le 4 Avril, 2024).
- Taschini, L. et al. (2014). *Which is better: carbon tax or cap-and-trade?* The Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science, https://www.lse.ac.uk/granthaminstitute/about/about-the-institute/ (Consulté le 28 Mars, 2024).
- Teusch, J. et al. (2021). *Why should developing countries implement carbon pricing when even advanced economies fall woefully short?* OECD Development Matters, https://oecd-development-matters.org/2021/02/17/why-should-developing-countries-implement-carbon-pricing-when-even-advanced-economies-fall-woefully-short/ (Consulté le 4 Avril, 2024).
- World Bank. (2023). *State and Trends of Carbon Pricing 2023*, http://hdl.handle.net/10986/39796, License: CC BY 3.0 IGO (Consulté le 4 Avril, 2024).
- World Bank. (2024). *Carbon Pricing Dashboard*, https://carbonpricingdashboard.worldbank.org/what-carbon-pricing#:~:text=Carbon%20pricing%20is%20an%20instrument,to%20their%20sources%20through%20a (Consulté le 24 mars 2024).

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