Why carbon prices should and will be different across countries

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Standfirst (25 to 30 words): With country-specific development objectives and constraints, multiple market failures, and limited international transfers, carbon prices do not need to be uniform, but have to be part of broader policy packages.

There is broad agreement that achieving the objectives of the Paris Agreement and limiting warming to below 2°C in an efficient manner will require the implementation of national carbon prices that increase throughout the 21st century.[1] According to the High-Level Commission on Carbon Prices, the explicit carbon-price level consistent with achieving this target, assuming a supportive policy environment, is at least US$40–80/t$CO_2$ by 2020 and $50–100/t$CO_2$ by 2030.[1]

The Commission's report recommends carbon price levels tailored to a country's characteristics, including its income level, the quality of its institutions, its endowment in renewable energy and other key resources, its economic structure, its social protection systems, its political situation, and many other factors. This is at odds with basic economic theory, which argues that an equal price for all regions and sectors, whether through a tax or cap-and-trade, is the most effective and efficient tool to reduce emissions.

This paper discusses three reasons why – consistent with the Commission's recommendation – carbon prices should and will differ across countries. First, political limits to financial transfers between countries as well as differing national contexts and development levels justify lower carbon prices in developing countries. Second, multiple market failures, such as those regarding innovation, mean that carbon pricing needs to be complemented with other policies, and their nature and ambition impact the final carbon price to achieve a given objective. Third, non-climate development objectives (and the policies to achieve them) interact with climate goals, and influence the adequate carbon price level.

We conclude that nations, when designing climate policy packages, should not start with a carbon price level. They should instead begin by defining their emissions objective in context of their other goals, and design comprehensive and integrated strategies to achieve these goals. Carbon pricing would be a key component of the policy package to implement these strategies, but its incidence and stringency would be tailored to the national context and objectives.

Carbon pricing and geographic, economic, and social context

The standard conclusion that optimal climate policy implies a unique carbon price around the globe is valid only if unlimited transfers among countries were possible to compensate for abatement costs and welfare effects.[2,3] In the presence of limits to international transfers, limits that are well illustrated by tensions on Official Development Aid (ODA), the optimal distribution of efforts implies different price levels across countries.

These levels depend on preferences regarding global inequality and how well-being depends on consumption levels (the social welfare function in economic jargon) and multiple country characteristics. Countries differ by size, weather, intra- and inter-urban density, renewable energy endowment (e.g. hydropower, geothermal energy, solar and wind), potential for geological storage of CO_2, capacity to employ nuclear power, economic structure (including the importance and mix of energy-intensive industries), and social preferences, all of which can affect GHG intensity and the marginal cost of abatement.[4]

At the country level, the price of carbon needed to achieve a given national objective – for instance as defined by Nationally Determined Contributions to the Paris Agreement, or a longer objective for 2050 and beyond – will be lower when the marginal cost of abatement is lower. In particular, many developing countries with large endowments of solar, hydropower, or geothermal energy may find it possible to achieve large emission reductions with lower carbon prices than other countries.

Developing countries also have different cost structures: poorer countries have larger shares of energy costs, and lower shares of labor costs, making their productivity more vulnerable to increases in energy prices and correspondingly higher macroeconomic effects.[5] In addition, poorer people, especially when they are close to subsistence level, lose a lot of welfare when their consumption is reduced or grows more slowly. The high economic vulnerability of poor people to increases in energy prices could justify implementing lower carbon prices, unless one can assure that these populations are compensated and protected through social protection, cash transfers, or reductions in other taxes.[6]

Complementary policies to address carbon pricing failures

There are well-known market failures and political constraints that restrict the efficiency and feasibility of carbon pricing and require complementary policies.[7,8,9,10]

Coverage failures exist where it is difficult to measure or price GHG emissions (e.g. fugitive emissions due to pipeline leaks, emissions fluxes related to land-use management). Network failures can exist where a physical or institutional infrastructure must already exist to allow discrete mitigation systems to operate (e.g. land-use and transport-oriented urban planning and investment to facilitate mode shifting[11]; electricity grid planning, market design and transmission investment to facilitate electrification and intermittent renewables). Knowledge spill-overs occur when private investors cannot capture all the benefits of early R&D and commercialization investment in mitigation technologies, and therefore underinvest from a public point of view.[12] Failures can also occur where behavior makes carbon pricing ineffective, or when people fail to anticipate the long-term carbon-price pathways, decades in advance. In the personal transport and housing sectors a myriad of factors swamp the information on the GHG intensity of mode choices or personal investment in appliance or building efficiency.[13]

Addressing these issues requires the construction of packages of complementary policies. These policies can contribute to reducing emissions, but also improve the political acceptability of carbon pricing by reducing the carbon price needed to achieve climate objectives.

Market imperfections are particularly large in developing countries, which will affect the balance between pricing and non-pricing instruments.[14] Carbon price signals may be swamped in a myriad of contradictory signals and incentives in the presence of incomplete markets, informal exchanges, lack of regulatory enforcement, instability of institutions, and fast evolving infrastructures affecting access to information and foresight stability. For instance, in some countries energy markets do not dispatch power generation options based on cost. In this case, a carbon price, while it reduces the relative cost of renewables, would not necessarily lead to a reduced use of fossil fuels. All the above may lead policy-makers, especially in low-income and weak-institution contexts, to using easier to implement and to enforce non-price instruments, at least over the short term.

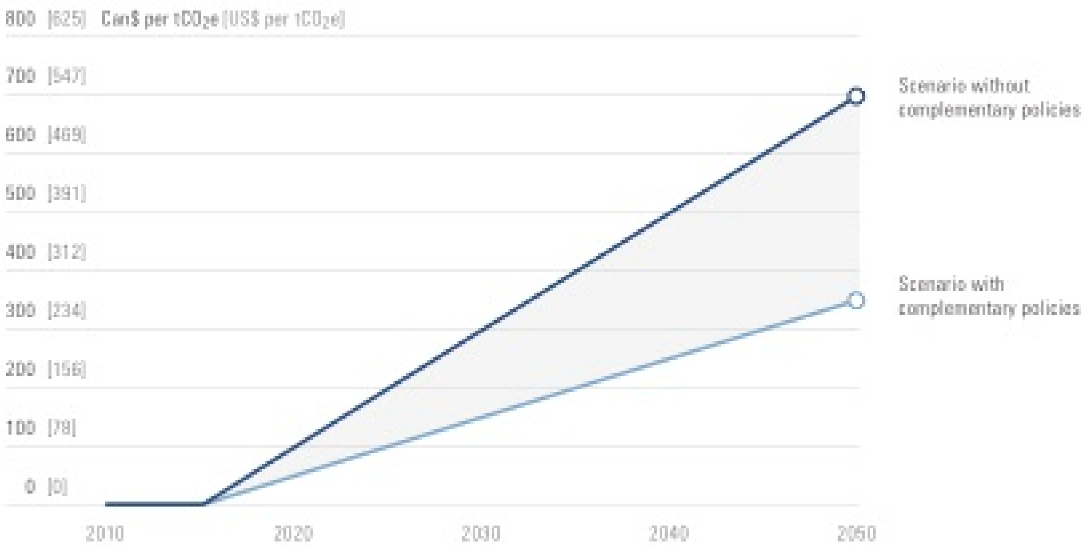
Countries differ by social and political circumstances which affect the political economy of carbon pricing, like income levels, poverty incidence, agreement on the distribution of efforts over time (i.e. the discount rate), and the ability of government to protect and support the transition for vulnerable populations and industries. Because there are many market and government failures, externalities, and biases in behaviors, climate mitigation will involve multiple instruments in all countries, including carbon pricing, innovation policies, regulations and performance standards, targeted subsidies, and education and training. The balance between these instruments will depend on the local political economy and the social and political acceptability of these instruments. Some countries – especially at low income levels – will have a lower explicit carbon price, because that is what is realistically possible, and may have to do more using other tools.

These dynamics can be illustrated by 2°C scenarios developed for the Canadian DDPP[15] to limit GHG emissions to 1.7 tonnes CO_2 per capita by 2050 (Figure 1). These scenarios use either solely a carbon price or a package of carbon pricing and complementary policies to achieve the same ends. The latter uses roughly half the carbon price, but increases short and long run political and social acceptability while addressing coverage and behavior failures in land use, fugitives, transport and buildings.

The policy package included: (i) economy-wide carbon pricing starting at $10/ t$CO_2$e (in 2015 Canadian dollars) and rising by $10 per year steadily through time, recycled to reduce equally corporate and income taxes; (ii) sector-specific performance standards that fall to net-zero emissions by 2025–40 for new investments in personal transport, freight transport, residential buildings, and commercial buildings; (iii) an intensity-based, tradable performance standard for large emitters using output based allocations which falls to 90% below 2015 GHG intensity per unit gross output by 2050 and could potentially be linked to other regional cap and trade systems[16]; and (iv) methane and land-use regulations.

This policy package was included in a submission[15] to the 2015 Alberta climate policy process and cited in its deliberations[17]. This supported the development of recognizably similar policy in Alberta, and the overall structure of the policy package also helped inform carbon pricing policy at the Canadian federal level, as part of the Pan-Canadian Framework on Clean Growth and Climate.[18]

Figure 1: Carbon pricing with and without complementary policies to trigger a transition toward deep decarbonization in Canada. tCO_2e = tonnes of carbon dioxide equivalent. Prices are given in Canadian dollars (CDN$) and United States dollars (USD$), based on the average rate for 2015. Source: *Report of the High-Level Commission on Carbon Prices*, based on the Canadian DDPP Report.

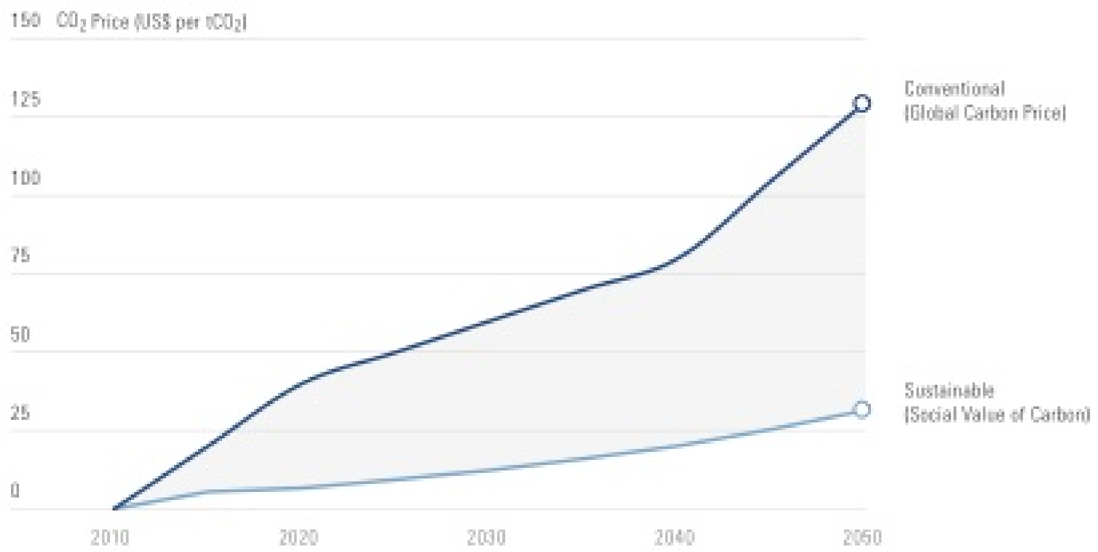


Non-climate development objectives and carbon pricing

Every country, developed or developing, has a host of societal development goals (e.g., economic growth, equity, access to services, health and air quality, education). Climate is one amongst many policy goals, with strong interactions with energy supply and demand and land use. Policies to achieve any development goal can have consequences on GHG emissions; and *vice versa* for climate mitigation policies.

For example, the Indian Deep Decarbonization Pathway Project[19] looked at two scenarios with the same cumulative emissions targets. One is "climate centric" and considers only a carbon price rising roughly linearly to $130 USD per tonne CO_2e by 2050. The other scenario is a scenario covering broader development goals, e.g. local air pollution, energy security, urban planning, decentralized energy for rural areas, and water management. It achieves those objectives with a stronger emphasis on the demand side, through behavioral change and infrastructure measures. While a carbon price is part of the portfolio of instruments, it is only part of it. The final carbon price in 2050 in this scenario needs to reach only $35 USD per tonne CO_2e, instead of $130, thanks to the benefits of other non-price policies (Figure 2).

Figure 2: Social Value of Carbon in Indian DDPP scenarios. Source: Indian DDPP Report**.**



Similar insights can be drawn from global Integrated Assessment Models[20], and particularly from a comparison of scenarios with similar climate outcomes but varying underlying socioeconomic assumptions (i.e. similar climate objectives with different Shared Socioeconomic Pathways, or SSPs[21]). Carbon prices needed to achieve a 2°C-consistent pathway are about 15-80% lower under sustainable development assumptions compared to middle-of-the-road assumptions (SSP1 vs. SSP2), with most scenarios showing at least a 50% decrease in price. Similarly, the carbon prices needed to achieve a 2°C target are projected to be 5 to 70% higher when assuming a world with high technological development but a strong focus on fossil-fuel exploitation (SSP5 vs. SSP2). This example illustrates the important effect other societal objectives and policies can have on carbon prices consistent with a climate target like 2°C. For instance, climate policies do not need to be as stringent (and carbon price as high) in a world where environmental conservation is high on the agenda as in a world that prioritizes material consumption.

Carbon prices, policy packages and low-emission strategies

Carbon pricing will not be enough to trigger an efficient, just and acceptable decarbonization transition. Successful climate policies will most likely take the form of nationally-designed climate-policy packages, including both carbon prices and complementary climate and non-climate policies tailored to national circumstances.

These packages can be designed to increase predictability and stability, which is important to trigger private-sector investment, and to reduce the needed explicit price signal, making them easier to implement and sustain. These packages can be implemented by reforming existing domestic fuel tax systems such that they are based on carbon intensity, as done by the Scandinavian countries starting in the 1990s. Complementary policies would address energy efficiency, coverage gaps, network effects, generate innovation, and help meet other development goals.

The design of these packages cannot start with a carbon price level as the only entry point. Instead, it should start from the definition of a national climate goal (e.g. net-zero GHG emissions by 2070 or some other year[22,23], with sector specific interim and long-term targets[24]) alongside a nation's other development objectives, for which comprehensive and integrated strategies can be developed.[24] These strategies can be physically grounded on four pillars of action: (1) efficiency, (2) fuel switching, (3) decarbonized energy carriers; and (4) direct emissions reductions and offsets through land-use management and carbon dioxide removal. National stakeholders and policymakers can then consider the multiple relevant dimensions in their entirety, to allow the design of a policy package that is internally consistent, addresses the many obstacles to emission reductions, and considers the carbon price schedule that is needed as one component of this package.

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