TASK FORCE ON CLIMATE, DEVELOPMENT AND THE INTERNATIONAL MONETARY FUND

OCTOBER 2022

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An Analysis of the IMF's International Carbon Price Floor Proposal

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ABSTRACT

The International Monetary Fund (IMF) proposes an International Carbon Price Floor (ICPF) arrangement to scale up global mitigation action. It shows that differentiated price floors improve the burden-sharing across the globe, compared to a uniform global carbon price. We conduct a quantitative analysis of the IMF's ICPF and find that, if compared to the nationally determined contributions (NDCs), the differentiated price floors are non-binding and thus, irrelevant for developed countries but equivalent to substantial increases in developing countries' NDCs. In other words, the ICPF would place additional responsibilities of emission reductions, as well as additional economic costs, on developing economies. A problem with the ICPF arrangement is that it implicitly assumes that carbon pricing is the only climate policy instrument, which underestimates the efforts made by many developing countries using non-price instruments to incentivize decarbonization. Therefore, we believe that the ICPF will unlikely be accepted by many developing countries in practice. We suggest that the

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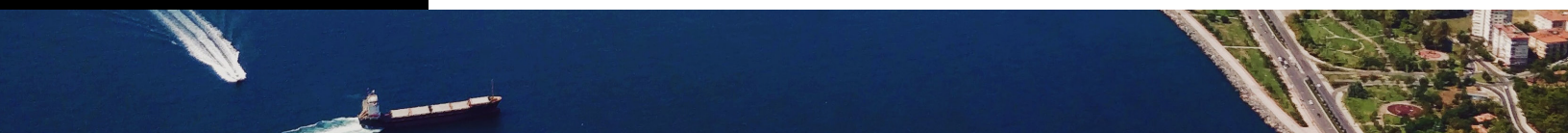


IMF devotes efforts to: 1) estimating the price-equivalents of non-price policy instruments for decarbonization; 2) re-calibrating the desirable floors for broadly defined carbon prices (inclusive of observed carbon prices and price-equivalents of non-pricing instruments) and 3) considering options to redistribute the economic benefits between advanced economies and developing countries by making climate mitigation funds and low-carbon technologies more available for developing countries.

Keywords: Climate action, international carbon price floor, burden sharing, differentiated price floors

INTRODUCTION

While international coordinated policies are needed to scale up global efforts in fighting climate change, ratcheting up ambition among all nations simultaneously is challenging. The updated nationally determined contributions (NDCs), even if fully implemented, are insufficient to meet the Paris Agreement. Against this backdrop, the International Monetary Fund (IMF) (IMF 2019a, 2019b; Black et al. 2021; Parry et al. 2021) proposes an international carbon price floor (ICPF) arrangement, developed from the idea of the global carbon price, to enhance global climate action. An ICPF arrangement is designed to complement the existing policy regimes by focusing on price floors, rather than price levels. Therefore, the ICPF accommodates countries that need to exceed the floor price to meet their NDC pledges. There are two key features of the IMF's ICPF proposal: to be arranged among a small number of large emitting countries and to have differentiated price floors for countries with different income levels. Specifically, Parry et al. (2021) propose an ICPF to be negotiated among six large emitters (the United States (US), European Union (EU), the United Kingdom (UK), Canada, China and India) or Group of 20 (G20) countries. They also propose the price floors of \$75/mtCO_2eq, \$50/mtCO_2eq and \$25/mtCO_2eq for high-income countries (HICs), middle-income countries (MICs) and low-income countries (LICs), respectively.

Parry et al. (2021) study the emission impacts of ICPFs using a reduced form model of the Carbon Pricing Assessment Tool and find that ICPFs among six big emitting countries, either a pure \$50 price floor for all six countries or a differentiated price floor of \$25, \$50 and \$75, would be sufficient to cut emissions to enter the range for 2°C if countries also meet their NDC commitments. Extending the ICPF to other G20 countries leads to a modest further reduction in G20 emissions.

To complement the work of Parry et al. (2021), a few recent studies provide quantitative analysis of the macroeconomic impacts of ICPFs. World Economic Forum (2021) uses two separate frameworks to study the macroeconomic and sectoral impacts of ICPF arrangements that are applied worldwide and only among HICs. Their results suggest that the contraction of global gross domestic product (GDP) ranges from 0.1 percent (if only HICs and high-emitting industries are included) to 0.6 percent (if all countries and all sectors are included, which are relatively small). They also find that the ICPF scenarios do not reduce emissions enough to contain global warming, but if NDCs are fulfilled, emissions are reduced by 22 percent by 2030, which enters the upper limit of the 2°C range.

Chateau et al. (2022) from the IMF conduct a comprehensive study on the macroeconomic impacts of various ICPF arrangements, including the scenario in which HICs implement both ICPFs and carbon border taxes. They suggest that an ICPF is an effective and efficient approach to scale up global mitigation action at a relatively small economic cost. More importantly, an ICPF with differentiated carbon prices improves the fairness of burden sharing across the globe by shifting part of the emission reductions and the economic cost of mitigation from LICs to HICs, if compared to a uniform global carbon price.

Theoretically, a uniform global carbon price is the most efficient form of climate change mitigation at the global level, but it has never been considered a viable option in practice. Therefore, it should not be considered as a benchmark to examine the distributions of burdens of an ICPF. A proper analysis of the distributional impacts and burden sharing is necessary to align the interests of large emitting countries and incentivize participation.

Our study contributes to the discussion by conducting an analysis of the burden-sharing effects of an ICPF arrangement with differentiated price floors as proposed by the IMF. We use a global dynamic computable general equilibrium (CGE) model to examine the interaction between the ICPF arrangement and the other international climate policy regimes, including NDCs and Carbon Border Adjustment Mechanisms (CBAM), to shed light on the design of ICPFs. Our analysis shows that the major developing countries, such as China and India, take on a large additional share of the burden of abatement under the ICPF arrangement, in comparison to their current domestic policies, as well as their NDC pledges. For major advanced economies, however, the floor prices are far lower than the carbon prices implicit in their NDC pledges, which makes the floors generally irrelevant for advanced economies with ambitious climate policies. That explains the findings from World Economic Forum (2021) and Parry et al. (2021) that an ICPF arrangement alone does not reduce global emissions sufficiently, and that it only works when countries fulfill their NDCs.

These results suggest that the ICPF arrangement proposed by the IMF creates a gap between the advanced and developing economies in their incentives to participate in such an arrangement. As the participation of large developing countries is essential for the ICPF mechanism to work effectively, it is necessary to improve the design of the price floors to provide incentives for the MICs and LICs to participate.

The paper is structured as follows. Section 2 presents the model and introduces the scenarios. Section 3 discusses the simulation results and the potential improvement in the design of an ICPF arrangement. Section 4 concludes and discusses policy implications.

MODEL AND SCENARIOS

Model

Our model builds on the dynamic CGE models of Van der Mensbrugghe (2019) and Zhai (2018) and is calibrated to GTAP database 10.0. The model assumes the carbon price is implemented as a carbon tax. We use the carbon price data from the World Bank Carbon Pricing Dashboard to characterize each country's current actual climate policy. In some

scenarios detailed below, the carbon prices implicit in countries' NDC pledges are derived endogenously under the emission caps of the NDCs. The NDCs and the carbon prices are phased in gradually between 2022 and 2030. The carbon border tax rate of a particular commodity is calculated based on the differences between the carbon price of the commodity paid in the CBAM-acting countries and the carbon price paid in the country of origin. The carbon border taxes paid by the exporting countries are calculated by multiplying the sectoral embodied carbon emissions by the tax rate of the products.

Given the importance of international trade in propagating the spillover effects of climate policies from one country to the other, we use a fully-fledged model that can capture any meaningful changes in international trade. To this end, we deviate from the Armington specification that is commonly used in CGE models, which has the effect of locking in pre-existing trade patterns and preventing the models from generating large changes in trade in sectors where little or no trade. Under this specification, if a country's imports of a product from another country are zero initially, they will always be zero, even after significant reductions in trade barriers. This "stuck on zero trade" problem makes traditional CGE models especially inappropriate for the small and low-income countries that usually have limited trade with the rest of the world. To address this problem, we follow Zhai (2008) to introduce the extensive margin to the trade sector. Specifically, we introduce the firm heterogeneity and fixed exporting costs in the trade sector to allow for extensive margin, and the patterns of trade are determined by various factors, such as market size, number of firms, technology and trade barriers, rather than the fixed "taste" parameters. Therefore, our model could generate meaningful changes in bilateral trade between regions where little bilateral trade exists initially.

The revenue from carbon pricing is assumed to be used to pay for the lump sum transfers to households.

Scenarios

We conduct the analysis under multiple policy scenarios with sub-scenarios that vary in scope. The business-as-usual (BAU) is a projection of economic development to 2030 under the assumption that all the countries limit their climate mitigation policies to the current actual climate policies, characterized by their current carbon prices.

The first policy scenario is the NDC Scenario, in which all countries meet their NDC pledges through carbon prices. Therefore, a corresponding path of carbon prices is derived endogenously for each country under this scenario. The NDC regime is considered the most relevant benchmark to be compared with the ICPF.

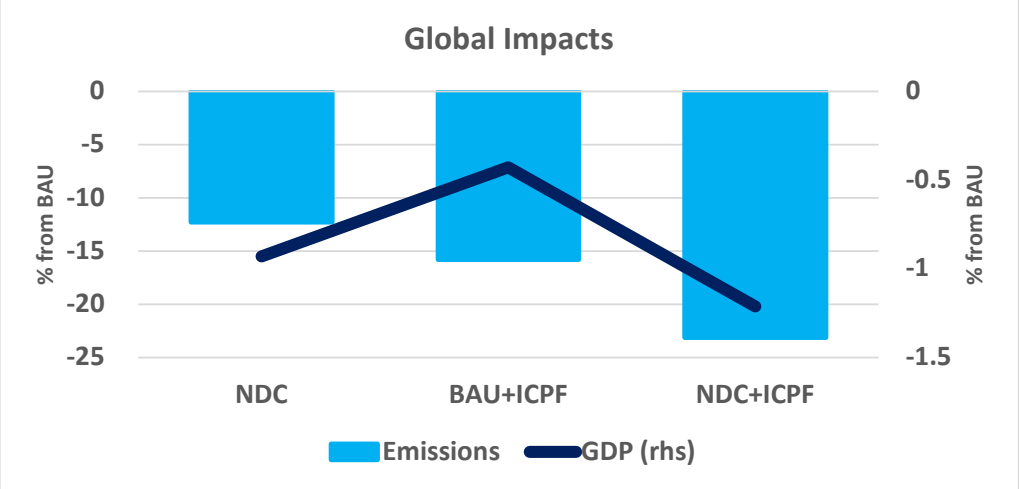
The second policy scenario is the ICPF Scenario with differentiated price floors depending on the level of development of the country. Our core scenario is an ICPF arrangement following the original proposal by Parry et al. (2021), i.e., the arrangement is among six large emitters (the US, EU, the UK, Canada, China and India), with differentiated price floors of \$75/mtCO_2eq, \$50/mtCO_2eq and \$25/mtCO_2eq for HICs, MICs and LICs, respectively. In this case, the US, the EU, the UK and Canada use the price floor of \$75, China \$50 and

India $25. We also consider a variation of the ICPF that extends the participants to all the countries.

As noted earlier, an ICPF targets a price floor rather than the price level and allows for countries with an ambitious NDC to implement carbon prices exceeding the floor price. To disentangle the effects of NDCs and the designated price floors, we consider two sub-scenarios: an ICPF introduced to the BAU scenario, labeled "BAU+ICPF Scenario", in which nonacting countries limit their climate mitigation policies to the current actual climate policy; and an ICPF introduced to the NDC scenario, labeled "NDC+ICPF", in which each country implements a carbon price that is the maximum of their carbon price floor and the implicit carbon price required to reach their NDC.

The third policy scenario is an alternative policy regime where no international coordinated policies are in place and major advanced economies adopt carbon border taxes, similar to the EU's CBAM, to protect domestic industries and reduce carbon leakage. It is a real-world relevant scenario since the EU has proposed to implement CBAM starting in 2027, initially on selected products and later to be extended to all products covered by the EU Emissions Trading System. The US, Canada and the UK are actively discussing similar measures. These measures are likely to have significant adverse impacts on developing countries that rely on carbon-intensive exports and may affect the countries' decisions in participating in an ICPF arrangement. Therefore, we consider a "CBAM Scenario" under which the EU, US, Canada and the UK implement carbon border taxes on carbon intensive and trade-exposed products[4] that are currently covered by the EU CBAM.

FIGURE 1 Global Impacts of Policy Regimes



Source: Authors' calculations.

[4] Specifically, aluminum, cement, electricity, fertilizers, iron and steel, hydrogen, organic chemicals and plastics.

SIMULATION RESULTS

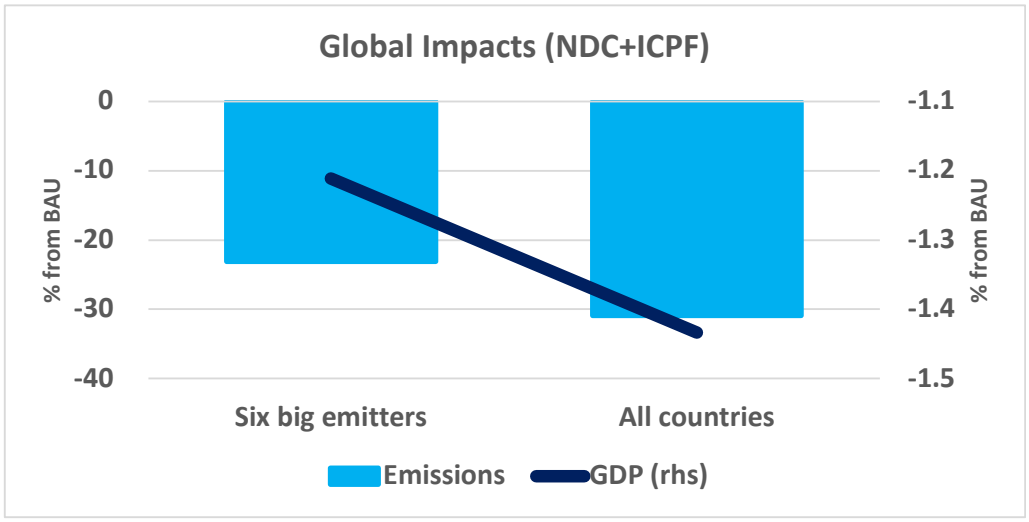
Global Impacts of ICPFs

The global emission and economic impacts of an ICPF arrangement with six participants are shown in Figure 1, with all variables being the percentage deviations from the BAU in 2030.

Under the BAU+ICPF scenario, in which the nonacting countries continue with their current actual climate policies, global emissions are reduced by 15 percent in 2030 compared to the BAU, while the economic cost is 0.4 percent of the global GDP.

Under the NDC Scenario, global emissions are reduced by 12 percent in 2030 compared to the BAU, while the economic cost is 1 percent of global GDP. When an ICPF is introduced (under the NDC+ICPF scenario), the emission reduction is 23 percent in 2030, while the economic cost is 1.2 percent. In comparison to the NDC Scenario without an ICPF, an ICPF

FIGURE 2 Global Impacts of ICPFs with Different Numbers of Participants

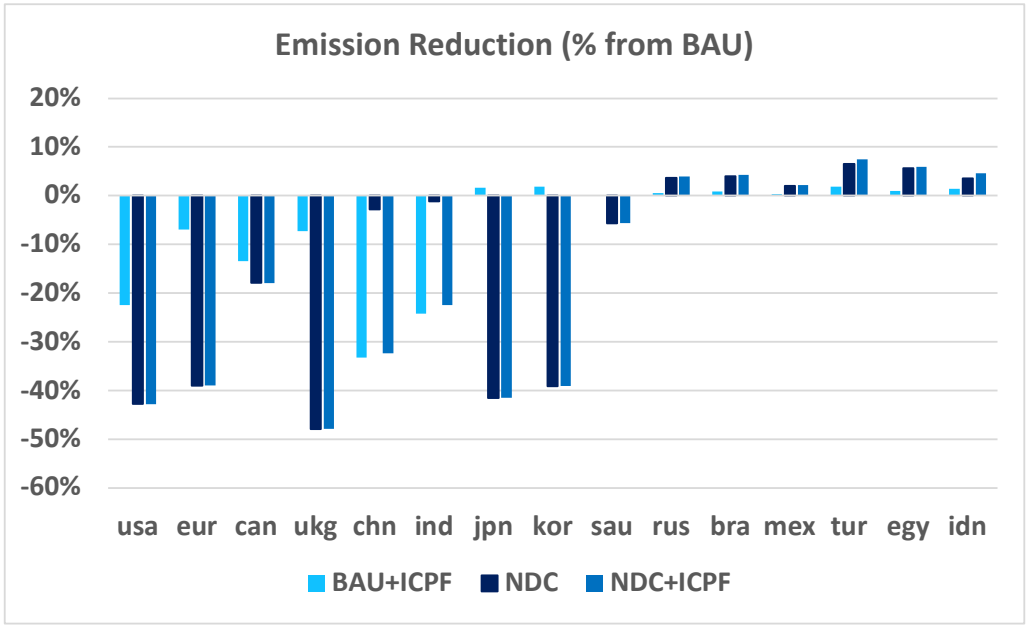


Source: Authors' calculations.

arrangement enhances global action with a relatively small economic cost. These results suggest that an ICPF arrangement, even only among six large emitters, is an efficient and effective approach to scale up action on climate mitigation globally.

Figure 2 shows the economic impact and emission impacts of the ICPF arrangements among a small number of large emitters among all nations, respectively. If the ICPF arrangement is extended to all nations, there is a further reduction in global emissions by 8 percent in 2030, at a further increase in the global GDP cost of 0.2 percent. While a broad implementation of ICPFs seems like an efficient approach, reaching an agreement among 200 nations can be much more costly, and the distributional impacts should be closely examined.

FIGURE 3 Emission Impacts of ICPFs (% from BAU)

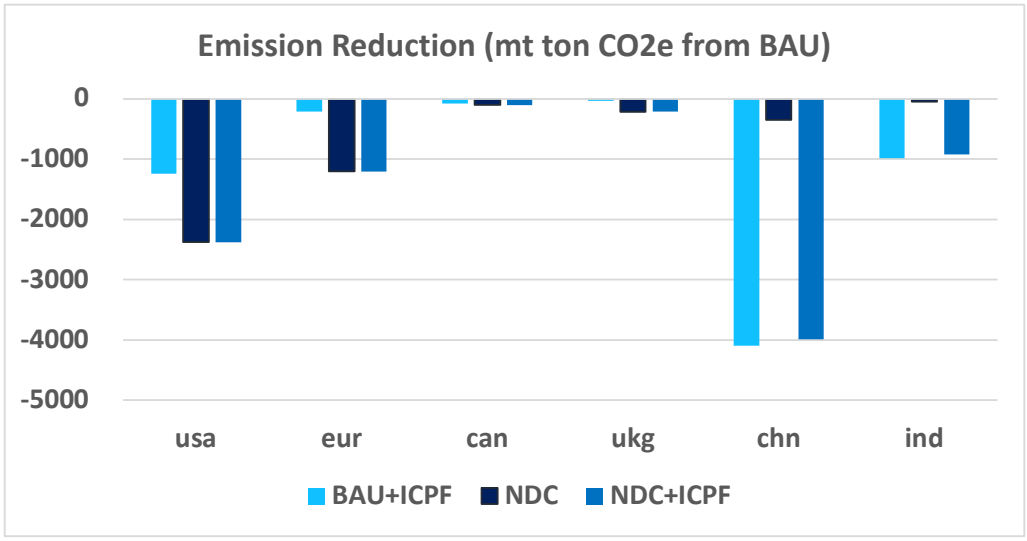


Source: Authors' calculations.

Notes: Economies shown in the Figure are the US (usa), EU (eur), Canada (can), the UK (ukg), China (chn), India (ind), Japan (jpn), Korea(kor), Saudi Arabia (sau), Russia(rus), Brazil (bra), Mexico (mex), Turkey (tur), Egypt (egy), Indonesia (idn).

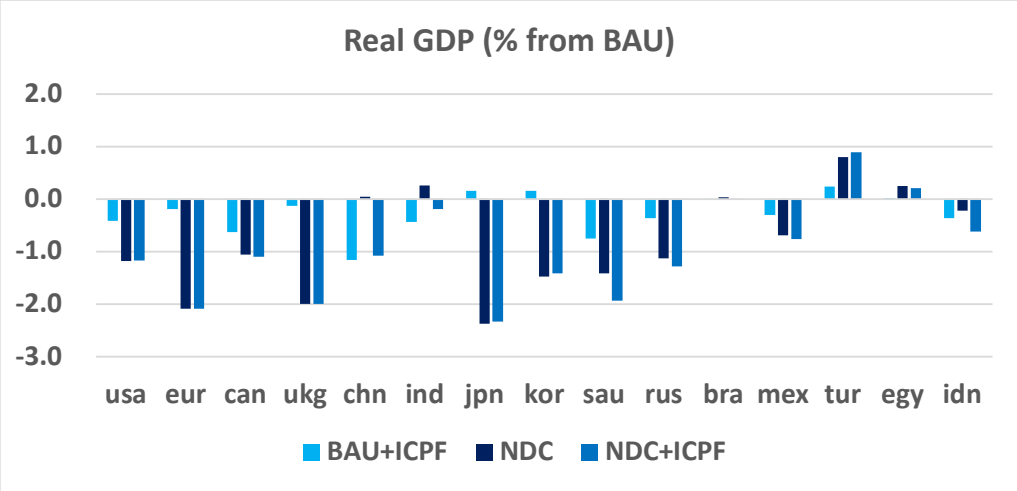
FIGURE 4 Emission Impacts of ICPFs (mt ton CO2e from BAU)

Source: Authors' calculations.



Notes: Economies shown in the Figure are the US (usa), EU (eur), Canada (can), the UK (ukg), China (chn), India (ind).

FIGURE 5 Economic Impact of ICPFs



Source: Authors' calculations.

Notes: Economies shown in the Figure are the US (usa), EU (eur), Canada (can), the UK (ukg), China (chn), India (ind), Japan (jpn), Korea(kor), Saudi Arabia (sau), Russia(rus), Brazil (bra), Mexico (mex), Turkey (tur), Egypt (egy), Indonesia (idn).

Distribution of Burdens of ICPFs

While an ICPF arrangement proves to be effective and efficient in enhancing global climate action, whether countries have the incentives to participate in such an arrangement remains unknown. This section looks closely at the distribution of responsibilities and economic costs across countries to gain an insight into whether the interests are aligned among potential participants. In this session, unless otherwise noted, an ICPF arrangement refers to ICPFs implemented by six large emitting economies.

Figures 3 through 5 show the contributions of emission reductions and burden sharing among major countries. Under the BAU+ICPF scenario, China reduces emissions by 33 percent in 2030 relative to its BAU, while the macroeconomic cost is 1.16 percent. The emission and economic impacts on the other five participating countries are milder than those on China. For example, India, the US and Canada cut emissions by 24 percent, 22 percent and 13 percent in 2030, respectively, with the GDP costs of 0.44 percent, 0.41 percent and 0.63 percent, respectively. This also reflects the fact that China is the biggest emitter globally and has the greatest abatement potential.

Under this scenario, the impacts on nonacting countries vary greatly depending on two factors. One is the reduced global demand for the nonacting countries, the other one is the higher relative prices of goods produced in participating countries that affect the terms of trade of nonacting countries. Nonacting countries can gain competitiveness in international markets or suffer from higher import prices of goods produced by participating countries. Which effect outweighs the other depends on the economic structure of the country. For

example, Japan and Korea record GDP gains under the BAU+ICPF scenario, while Saudi Arabia, Russia and Indonesia experience significant GDP losses.

If not limited to the current policy stances, each country's NDC pledge can be used as a benchmark to forecast the country's future policy path. Our simulation results suggest that, for countries with ambitious NDCs, including the US, the UK, EU and Canada, achieving NDCs with carbon prices alone requires very high carbon prices. For example, the implicit carbon prices for the EU, the US, the UK, and Canada in 2030 are $417, $244, $610 and $112. Therefore, the $75 price floor is far lower than the carbon prices implicit in the four countries' NDCs. In contrast, the NDC pledges by China and India are much less ambitious and both countries record GDP gains under the NDC Scenario. When an ICPF is introduced to the world where all countries fulfill their NDC pledges, China and India are forced to implement the floor prices. Therefore, China and India are much worse off under the NDC+ICPF Scenario compared to under the NDC Scenario, while the economic costs of the four advanced economics under the NDC+ICPF Scenario are very close to those under the NDC Scenario. That means the economic costs of ICPFs are fully absorbed by China and India.

In terms of the level of emission reductions, China and India together contribute to 80 percent of global reductions under the BAU+ICPF Scenario, and 50 percent under the NDC+ICPF Scenario. Therefore, to make the ICPFs work effectively, it is essential to have China and India participate in the arrangement.

Unilateral Climate Actions

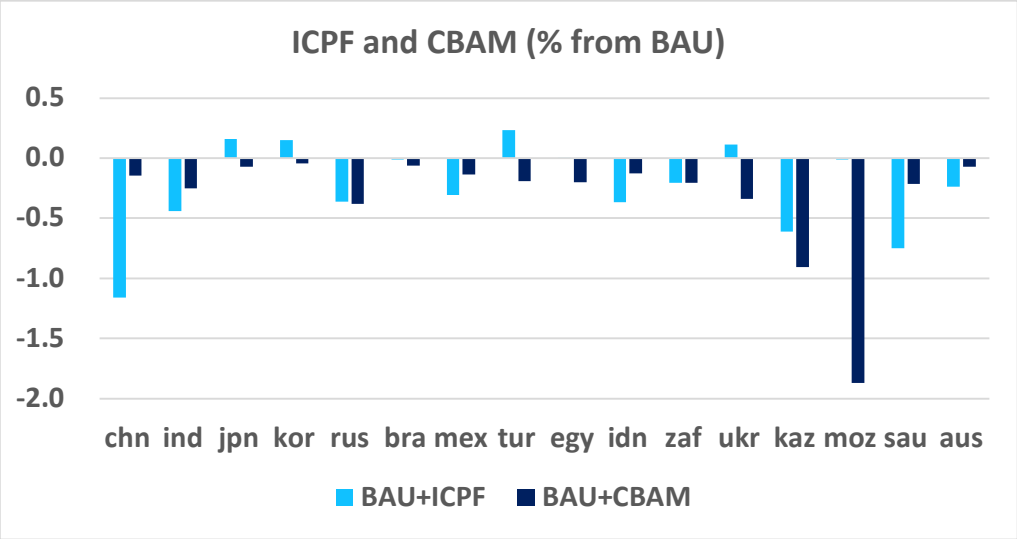
According to the analysis above, to ensure the effectiveness and efficiency of an ICPF mechanism, it is essential to include China and India in the arrangement. However, the two countries expect a high GDP cost when an ICPF is introduced. If no international policy coordination is agreed upon among large countries, countries with stringent climate policies may move ahead with unilateral carbon border taxes, both to restore the competitiveness of domestic industries and to reduce carbon leakages.

We assume that the US, the UK, Japan and Canada follow the EU to adopt carbon border adjustment taxes from 2027 on. We consider two sub-scenarios. One is that all the other countries continues with the current actual polices ("BAU+CBAM Scenario"), and the other one is that all the countries fulfill their NDC pledges ("NDC+CBAM Scenario"). We compare the GDP impacts of the CBAM to the ICPF (with six large emitters).

Our simulation results suggest that the carbon border adjustment measures by the four countries have negative spillover effects on the rest of the world. Under the BAU+CBAM Scenario, India experiences a GDP loss of 0.25 percent (Figure 5), higher than that of China (0.14 percent). This results from the fact that the carbon intensities of India's exports are higher than of China, and that the exports of those products account for a larger share of

India' economy. In this case, a broad implementation of CBAM may provide some incentives for India to participate in the ICPF, as the economic cost of the ICPF on India is not much higher than the CBAM.

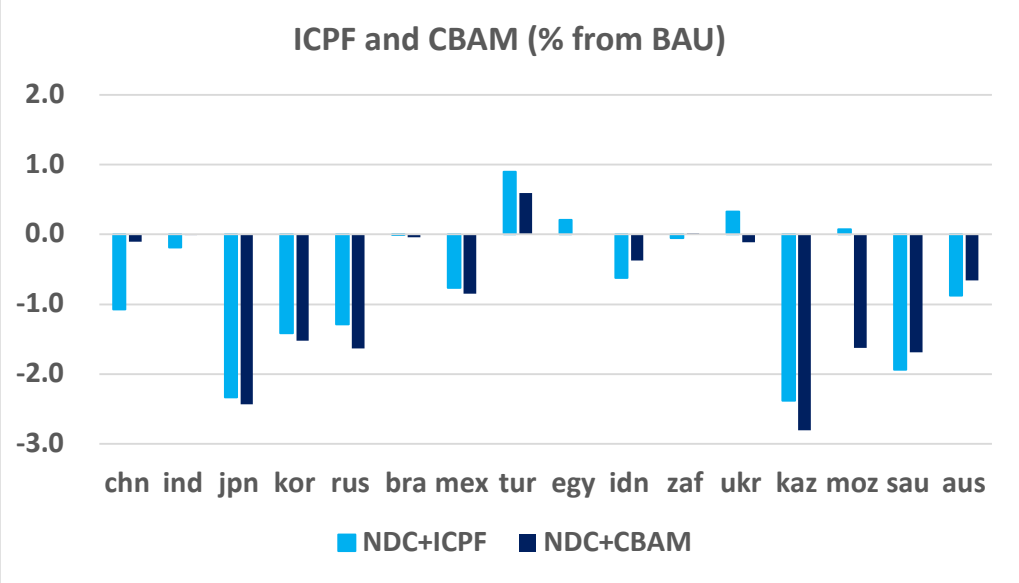
FIGURE 6 Economic Impacts of ICPF and CBAM (Current Actual Polices)



Source: Authors' calculations.

Notes: Economies shown in the Figure are China (chn), India (ind), Korea(kor), Russia(rus), Brazil (bra), Mexico (mex), Turkey (tur), Egypt (egy), Indonesia (idn), South Africa (zaf), Ukrain (ukr), Kazakhstan (kaz), Mozambique (moz), Saudi Arabia (sau) and Australia (aus).

FIGURE 7 Economic Impacts of ICPF and CBAM (NDCs)



Source: Authors' calculations.

Notes: Economies shown in the Figure are China (chn), India (ind), Korea(kor), Russia(rus), Brazil (bra), Mexico (mex), Turkey (tur), Egypt (egy), Indonesia (idn), South Africa (zaf), Ukrain (ukr), Kazakhstan (kaz), Mozambique (moz), Saudi Arabia (sau) and Australia (aus).

Under the NDC+CBAM Scenario, the economic impacts on China and India are both mild, relative to that on many other countries. This is mostly because China and India's exports gain competitiveness in the global markets when all countries meet their climate commitments, offsetting the negative impacts of the declines in carbon intensive exports. Therefore, in this case the CBAM doesn't provide much incentives for either China or India to participate in the ICPF.

CONCLUSIONS AND POLICY IMPLICATIONS

We use a dynamic global CGE model to conduct an analysis of the economic impacts of various policy regimes to inform the design of the IMF's ICPF arrangement. Our simulation results suggest that, if we assume carbon prices are the only climate policy instrument (the underlying assumption of the model), an ICPF arrangement with differentiated price floors is an effective and efficient approach to reduce carbon emissions from a global perspective. However, the ICPF has adverse distributional impacts. In comparison to the NDCs committed by each country, the differentiated price floors proposed by the IMF are non-binding and thus, irrelevant for developed countries but equivalent to substantial increases in NDCs for developing countries. In other words, the ICPF places additional burdens of emissions reductions fully on developing economies. These adverse distributional impacts may discourage developing countries from participating in the ICPF arrangement.

We believe that an ICPF arrangement that does not align the interests of major emitters will unlikely be accepted in practice. We suggest that the IMF consider the following options to mitigate the additional costs associated with ICPF on developing countries.

First, to estimate the price-equivalents of non-price policy instruments and re-calibrate the desirable floor prices for broadly defined carbon prices that are inclusive of observed carbon prices and price-equivalent of non-pricing instruments. In fact, a major problem of the ICPF proposal is that it implicitly assumes that carbon pricing is the only climate policy instrument, which underestimates the efforts made by developing countries because many developing countries use non-price instruments. For example, China uses green fiscal, financial policies and sectoral regulations to reduce carbon emissions. Those efforts should be considered as equivalents of price instruments and included in the broadly defined carbon prices.

Second, to mitigate the adverse distributional impacts by making climate mitigation funds and low-carbon technologies more available for developing countries. Advanced economies that are least affected by the ICPF can set up a fund to help developing countries decarbonize. The fund can be used as to support a credit enhancement mechanism to de-risk and mobilize private capital to invest in developing countries for climate mitigation. Advanced economies can also use the fund or via other means to provide low-carbon technologies to developing countries. The economic costs of decarbonization can be reduced if low-carbon technologies are made widely available for adoption in developing countries.

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