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IT TAKES TWO TO TANGO

THE ROLE OF MINISTRIES OF FINANCE IN DESIGNING PRICING AND NON-PRICING CLIMATE ACTIONS

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ABBREVIATIONS

CAPMF: Climate Actions and Policies Measurement Framework
CFMCA: Coalition of Finance Ministers for Climate Action
CO2: Carbon dioxide
EPS: Environment Protection Stringency
ETS: Emission Trading System
EV: Electric Vehicle
GEC: Global Economic and Climate
GHG: Greenhouse gas
IEA: International Energy Agency
IMF: International Monetary Fund
IRA: Inflation Reduction Act
kWh: Kilowatt-hour
LED: Light-emitting diode
NDC: Nationally Determined Contribution
OECD: Organisation for Economic Cooperation and Development
REGEN: Regional Economy, Greenhouse Gas, and Energy
RTE: Réseau de Transport de l'Electricité
VAT: Value Added Tax

SUMMARY

- **Carbon pricing has long been considered as a key policy tool to advance climate action.** Putting a price on carbon emissions sends a strong signal that encourages saving energy and shifting to clean energy. Also, it generates government revenue that can be used to support the low-carbon economy. However, carbon pricing remains absent or incomplete in many sectors and countries. Worsening the situation, many fossil fuel subsidies remain, sending conflicting signals about policy consistency. This frequently reflects concern about the negative social effects of carbon pricing. Policymakers are also worried about issues of carbon leakage and waterbed effects.
- **Non-pricing measures are moving up policy agendas.** Policymakers therefore increasingly focus on non-pricing interventions to unleash the low-carbon economy. This includes regulations such as bans, limits, standards, and fiscal measures such as green subsidies and tax expenditures. However, like for carbon pricing, these policies may have unwelcome effects on income distribution. Furthermore, their impact on emissions is often reduced by the rebound effect.
- **Instead of stand-alone policies, governments increasingly seek to design packages of complementary pricing and non-pricing policies.** Recent climate initiatives combine carbon pricing with non-pricing actions to formulate coherent packages with limited side effects. Examples include the EU's Fit-for-55 package, the UK's Net Zero Strategy, the US Inflation Reduction Act, and China's decarbonization plans. Some policy packages have proved to be effective, with relatively few adverse side effects. However, other packages are poorly designed and thus come with an unwarranted burden. As the government agency typically in charge of economic prosperity, Ministries of Finance need to ensure that climate policy packages are appropriately designed.
- **A better understanding of climate action packages is essential.** More research is urgently needed on the appropriate design of coherent packages mixing pricing and non-pricing actions. This requires more data, especially on non-pricing actions. Progress is being made with the compilation of cross-country information on climate policies, though with significant gaps in developing countries. Progress is also made with analytical tools that can simulate the impact of complex policy packages.
- **Researchers take advantage of micro data to evaluate the impact of climate actions.** Micro data such as tax statements, regulatory filings, energy bills and administrative records contain a wealth of data that can be used to evaluate whether policy packages are effective in unlocking a low-carbon economy. Ministries of Finance should play a key role in opening access to such data and in supporting the development of research using micro data on climate actions.

IT TAKES TWO TO TANGO

The Role of Ministries of Finance in Designing Pricing and Non-Pricing Climate Actions

Although carbon pricing is a key policy for fostering a low-carbon economy, it remains absent or incomplete in many sectors and countries. Non-pricing actions are often more popular, but their effectiveness can be uneven. Instead of relying on stand-alone policies, governments have recently begun to design packages that combine complementary pricing and non-pricing actions. Research suggests that these packages can be highly effective, though poorly designed ones may have adverse consequences. The following Policy Brief examines the recent emergence of climate policy packages and their impact on climate, social, financial, and fiscal outcomes. It also recommends steps that Ministries of Finance can take to better understand how to design coherent climate policy packages and facilitate the sharing of best practices across countries.

1. GOVERNMENTS INCREASINGLY DEPLOY PACKAGES COMBINING PRICING AND NON-PRICING CLIMATE ACTIONS

Carbon pricing is making progress, but much remains to be done to unlock a low-carbon economy. When fossil fuels are available at a lower cost than cleaner energies, putting a price on the GHG emissions they generate encourages a shift to low-carbon alternatives. Progress is made around the world to implement carbon taxes, emission permits, and fuel excise duties. Whilst these pricing interventions have taken hold in a number of countries, their deployment remains insufficient globally to secure a pathway of deep decarbonisation. Entire sectors remain uncovered or insufficiently covered -- such as agriculture, aviation, buildings, manufacturing and shipping. Significant subsidies encourage the production and use of fossil fuels, including direct budget subsidies, sending misleading price signals. These large gaps in carbon pricing make it impossible to achieve the climate targets adopted by governments. In addition, they prevent ministries of finance from collecting carbon-related revenues that could be used to finance new climate actions.

The deployment of carbon pricing is held back by various concerns and often faces significant political pushback. This reflects the perception that such policies have a regressive impact on income distribution, making it excessively costly for low-income and middle-class households to access energy for housing and transportation needs. Another concern is that carbon pricing comes with undesired effects such as carbon leakage (where emission sources are relocated to jurisdictions with less stringent regulations) and waterbed effects (where emission sources shift to other locations within the same regulatory market). Reflecting these concerns, there is no consensus among academics and policymakers on the appropriate levels of carbon pricing that governments should target.

Non-pricing measures are therefore moving up policy agendas. To move ahead with their climate plans, policymakers are increasingly focusing on non-pricing instruments such as bans, limits, standards, energy regulations, subsidies, and tax expenditures. These actions are perceived in parliament and public opinion as less likely to have negative social effects. Some, such as direct subsidies, are politically welcomed. They are seen as useful tools to

address obstacles standing in the way of clean technology adoption. They are used to unleash green finance, ease workforce shortages, remove bottlenecks in networks, and encourage the supply of goods required by the low-carbon economy. These policies, referred to in this paper as "non-pricing policies", are increasingly seen as essential to observe climate commitments.

A first category of non-pricing policies is based on fiscal tools. This includes direct government subsidies, tax expenditures, public investment, public procurement, and concessional financing that make it cheaper to adopt clean energies. The U.S. Inflation Reduction Act (IRA) is a recent illustration of a package of non-pricing policies. Like carbon pricing, these tools aim to make clean energy more attractive than fossil fuels. However, they operate differently and can have undesirable side effects. Because they lower the cost of using clean energy, they do not encourage energy conservation and may even increase energy demand through a rebound effect ("Jevons Paradox"). Additionally, several of these tools, such as direct subsidies and tax credits, can have a significant fiscal cost and therefore increase budget deficits.

A second category of non-pricing policies is based on regulations. This involves, inter alia, renewable energy targets for electric utilities, emission limits for coal-fired power plants, fuel efficiency standards for cars, bans of the sale of new fossil fuel cars, and bans on the installation of new gas boilers. These policies do not have an explicit price tag, but the required abatement of emissions comes at a cost for energy users. When the abatement cost is excessive, these regulations can have a negative impact on productivity, output, and employment.

Instead of pursuing stand-alone policies, governments increasingly favour packages combining complementary policies. When introduced without complementary measures, stand-alone carbon pricing and non-pricing policies can have negative side effects. In contrast, when combined in packages, pricing and non-pricing policies can complement each other, achieving the desired impact on emissions with fewer negative effects. Across the world, governments increasingly seek to design such packages of policies. The EU Fit-for-55 package combines carbon pricing through the EU Emission Trading Scheme (ETS) with non-pricing measures, such as state aid for batteries and hydrogen and the 2035 clean vehicle mandate. The UK Net Zero Strategy also mixes pricing (UK ETS and carbon tax) with fiscal support (e.g., aid to replace gas boilers with heat pumps) and regulation (2035 zero emission vehicle mandate). China is developing an ETS that adds a carbon price to its traditional tools. The U.S. IRA is almost entirely based on non-pricing measures (apart from a methane emissions charge), but at the subnational level several U.S. states, including California, combine non-pricing measures with a cap-and-trade programme and additional car fuel taxes.

Research suggests that policy packages can effectively reduce emissions, but this requires careful design. Research suggests that packages of policies can unlock low-carbon technologies more effectively than stand-alone policies (Anadon et al., 2022; Blanchard, Gollier and Tirole, 2022; Fries, 2021; Stechemesser et al., 2024). Policy complementarity is particularly important in the sectors of buildings and transportation, where adoption of green technologies is a slow process that requires both "carrots" (subsidies and tax credits) and "sticks" (taxes, permits, bans, and other stringent regulations). As an illustration, high car fuel taxes encourage reduced use of fossil fuel vehicles, while scrapping incentives promote their replacement, and EV incentives encourage the adoption of cleaner cars. Working together, these measures can effectively promote the decarbonisation of national car fleets.

Research finds that packages of policies have helped the emergence of solar photovoltaics, lithium batteries, LED bulbs, and electric cars (Anadon et al., 2022). The successful rollout of wind energy has been found to stem from both supply-pushed and demand-driven policies leading to "learning-by-deployment" and rapid cost reduction (Elia et al., 2020). Not only have policy packages helped put these technologies on the market, but they have also contributed to their scaling up, thus leading to plummeting prices and making them more cost effective than fossil fuels.

Ensuring that packages of policies are well designed should be a priority for ministries of finance. While some policy packages have been effective in reducing emissions with few unwanted side effects, this does not mean that all are equally successful. Policy packages with overlapping climate actions have been criticized for their costly impact on emission abatement (Böhringer et al. 2016). Subsidies and tax credits included in policy packages can also be wasteful, for instance when they target corporations or households that would have made the switch to low-carbon technologies even without fiscal support. As the main government agencies in charge of delivering sustainable and inclusive economic growth, Ministries of Finance must therefore play a central role in the design and implementation of effective transformation packages, for instance with new departments exercising leadership. As an illustration, the Inflation Reduction Act Program Office within the U.S. Department of the Treasury serves as a hub for the IRA implementation.

2. CLIMATE PACKAGES SHOULD ENSURE AFFORDABLE ACCESS TO ENERGY

Climate policy packages should ensure that access to energy remains affordable for all citizens. Research shows that carbon pricing policies often comes with socially regressive effects, although this is not always the case in developing countries where energy is mostly used by high-income households (Shang, 2021; D'Arcangelo et al., 2022). When the impact on access to energy is negative, this discourages policymakers and lawmakers from approving significant increases in carbon prices. By combining carbon pricing with complementary non-pricing measures, policymakers can avoid such unwanted effects. Actions that help vulnerable households in their shift to clean technologies – such as energy efficient homes and clean transportation -- can deliver significant social benefits and thus increase political acceptance. Well-designed packages should also pay attention to local communities that are adversely affected by transformational changes, such as workers in the coal, oil sectors and farming sectors. Some countries, such as Denmark, have built consensus among social partners and stakeholders to support such measures, and they have introduced means-tested support to facilitate the transition.

Non-pricing policies can also be regressive. Because non-pricing measures often take the form of explicit subsidies to consumers, they are often perceived as not being socially regressive. As such, they receive more political support than policies that raise energy prices. Fiscal support to renewable electricity, home improvements, and fuel-efficient vehicles frequently receive widespread approval in parliaments. Notwithstanding this support, there is no guarantee that these fiscal incentives will specifically help the most vulnerable households. Non-refundable tax credits without income caps primarily benefit high-income households, who use them to reduce their tax liabilities and who likely would have switched

to green technologies even without these incentives. In addition, the financing of these fiscal incentives can have a regressive impact if they are funded, for example, by higher indirect taxes paid by consumers, such as higher excise duties or increased VAT rates. Regulations can also be detrimental to affordability, for example, when automakers pass upfront costs of fuel efficiency standards to consumers, potentially making the purchase of clean cars more difficult for low-income households.

As for any policy, Ministries of Finance must combine various climate actions to avoid unwelcome social effects. The experience shows that policy packages disregarding social aspects face strong resistance in parliament and in the street. Examples of climate reforms with poor regards for social repercussions include France's 2019 planned increase in carbon taxes that led to the "gilets jaunes" social unrest and the annulment of the planned tax rise. Learning from this experience, subsequent policy packages for climate action have featured prominent non-pricing measures to offset adverse distributional effects. This includes, for example, the French means-tested energy cheques, "chéques énergie", to help 5.6 million households pay their home energy bills, thus addressing potential vulnerabilities from rising energy taxes (Lenain, 2024). Additionally, France has established a "social leasing" scheme to help low-wage commuters acquire electric cars, making them more resilient to car fuel price hikes. Such policies have a fiscal cost, which needs to be funded, but they can be important to safeguard affordability and security as countries advance their energy transformation.

3. MEETING THE FISCAL COST OF ENERGY TRANSFORMATION

While carbon pricing raises fiscal revenue, other fiscal measures can come at a budgetary cost. The World Bank (2024) estimates that direct carbon pricing generated government revenue of US$104 billion in 2023, an amount likely to increase as countries phase in higher carbon taxes and more ambitious ETS. No comprehensive data are available globally on the budgetary resources allocated to non-pricing policies, but partial data suggest that their fiscal cost far have exceeded these carbon pricing receipts. The Oxford Global Recovery Observatory and International Energy Agency estimate global fiscal commitments on green measures between $1 trillion and $1.2 trillion during 2020 and 2021. The OECD Green Recovery Database estimates a roughly similar amount of €1.1 trillion in government spending allocated to environmentally positive measures during the period January 2020 to April 2022. Just for electric vehicles, the IEA estimates that governments spent about US$40 billion worldwide to promote their sales in 2022.

In times of limited fiscal space, government spending of this magnitude needs to be financed. Apart from funding from general government revenue, several financing channels are used to cover the cost of fiscal support measures:

- Carbon pricing revenue can pay for fiscal support measures. As an illustration, the EU ETS Directive requires that 50% of the revenue generated by the EU ETS auctioning of emission allowances is to be used to support the achievement of climate and energy objectives.
- Revenue generated from the removal of fossil fuel subsidies can be earmarked to support the transition to green energy. This approach also helps prevent the shift to other polluting energy sources, such as households replacing natural gas with coal or wood fire. For

instance, Bassi et al. (2024) report that emissions in China can be reduced by an additional 15-19% when the proceeds from fossil fuel subsidy removal are recycled to support green energy initiatives.

- Feebates are another financing option: they consist in imposing a fee (or tax) on activities producing high levels of pollution and using the revenue collected to fund rebates for activities that are environmentally friendly. For instance, France taxes high-emission vehicles ("malus automobile") and use the proceeds to subsize low-emission vehicles ("bonus écologique").
- Dedicated excise duties can be levied to channel funding to low-carbon activities. For instance, France established the "*Contribution au Service Public de l'Électricité*" to cover the cost of feed-in tariffs paid to renewable energy providers.
- Further fiscal measures can be used to fund policy packages. For example, the U.S. IRA includes a mix of tax increases that fund support for energy-related investments through, inter alia, reforms of the corporate minimum tax and a tax on stock buybacks, as well as a reform to reduce drug spending by the federal government.

Ministries of Finance need strong analytical capabilities to project the fiscal impact of climate action and inaction. Recent experience shows the uncertainty in projecting the budgetary impact of complex policy packages. The climate-related provisions of the U.S. IRA were estimated by the U.S. Congressional Budget Office to cost US$392 billion over 10 years. However, Goldman Sachs projected that the fiscal costs could reach US$1 trillion, with a variety of other estimates falling in between (Bistline et al. 2022). The large range of estimates reflects the design of several of its provisions, in particular the uncapped tax credits offered to renewable energy producers and to buyers of electric vehicles. Tax and spending provisions written in law without a budget cap mean that the fiscal costs will ultimately depend on the uptake of these provisions – e.g., the magnitude of new renewable energy capacity and the interest of car buyers for new electric vehicles. When climate-related provisions are subject to a budget cap, they can be projected with more certainty, but this may unduly restrain the switch to low-carbon technologies as happened in France when the "social leasing" 2024 budget allowance was exhausted after only two months, thus preventing many low-income households from making the transition to clean surface transport.

4. MAKING THE LOW-CARBON ECONOMY MORE BANKABLE

Low-carbon projects often require relatively more upfront financing compared to fossil fuel-based technologies. The bulk of costs for wind farms and solar photovoltaic panels, for example, are the initial capital expenditures. The costs to operate and maintain them are relatively small. Long-term financing is thus critical for low-carbon investments. However, the future earnings of renewable electricity investments are subject to uncertainties such as unpredictable regulatory approvals, legal challenges, policy reversals, intermittent weather, and volatile spot electricity markets. Hence, their earnings may not be considered as sufficiently steady by financial institutions. With uncertainties about the long-term income stream and the commitment of future governments to green policies, these projects are scrutinized by creditors.

Predictable government support makes low-carbon projects more "bankable." To reduce uncertainties about debt service sustainability, creditors often look for government backing to consider green investments as "viable investment propositions with an acceptable level of risk"—in short, to make them bankable (Christophers, 2024). Credible long-term policies can be critical to improve the predictability of future income streams from clean energy projects and, therefore, their bankability. Feed-in-tariffs set the price of future sales of electricity and thus provide guaranteed returns; contracts for difference reduce uncertainties resulting from electricity spot market volatility; investment tax credits and production tax credits reduce the total costs of renewable investments and secure future earnings. All these non-pricing policies can play a key role in improving the bankability of green projects and unlock the low-carbon economy.

Ministries of Finance should investigate the levels and most effective types of government support to enhance bankability. In 2023, total energy investments amounted to just over US$3 trillion, with clean energy accounting for US$2 trillion. The IEA estimates that investments in renewables need to double and energy efficiency investments need to triple by 2030 to meet the goals in its Net Zero Emissions by 2050 scenario. Ministries of Finance need to analyse the optimal form of government intervention to unleash private-sector financing, such as market mechanisms (feed-in tariffs and contracts for difference), concessional financing (such as subsidized interest rates and development bank lending), public-sector equity participation, or other mechanisms. Financial analysis and cooperation with market participants can help these investigations.

5. ANALYTICAL CHALLENGES FOR MINISTRIES OF FINANCE

New analytical frameworks are needed to assess policy packages. The increasing complexity of policy packages – with macroeconomic, energy, fiscal, climate, technological, social and financial dimensions – requires strengthened research capabilities in Ministries of Finance. This effort is already underway in some jurisdictions. New research units are staffed with experts and provided with analytical resources. Examples of reports testifying of this deployment include:

- The UK Treasury "Net Zero Review" published in 2021;
- France's Treasury interim report on the "Economic Challenges of the Net Zero Transition" published in 2023;
- Switzerland's Federal Department of Finance's fiscal sustainability report published annually since 2020.

Such reports cover multiple dimensions and draw their analysis from model-based projections and other statistical analysis. Other Ministries of Finance are building similar capabilities or consider doing so.

Going forward, three analytical challenges need to be addressed.

a. International benchmarking

International benchmarking of carbon pricing should be extended to keep track of broad packages of pricing and non-pricing policies. As governments are increasingly

focusing on policies for climate action other than carbon pricing, the international system of benchmarking needs to evolve. Cross-country comparisons of carbon pricing are now widely available thanks to work by the IMF, OECD and World Bank and several think-tanks (list in annex). Comprehensive information is also available on fossil fuel subsidies. Similar datasets are gradually emerging for non-pricing policies, thanks to the inventories of climate measures maintained by the OECD. To allow comparisons of different non-pricing policies in various institutional contexts, the OECD attributes scores to characterize the potential impact on climate outcomes of each policy. These scores are then aggregated into composite indexes that allow making comparisons across countries and monitoring across time. The OECD maintains two sets of such indexes.

- The OECD Environmental Policy Stringency (EPS) index is "an internationally comparable composite index of different environmental policy instruments, focussing primarily on climate change and air pollution policies" (Kruse et al., 2022). It keeps track of 13 policy instruments grouped into market-based policies, non-market-based instruments, and technology support measures. The EPS index covers policies such as carbon taxes, carbon markets, renewable energy certificates, diesel fuel excise duties, emission limit standards, green R&D fiscal support, feed-in tariffs and renewable energy auctions. The information is organised to identify the stringency of these policies, which is defined as their capacity to deter environmental damages. For this purpose, policies measured in different units - e.g. US$/tCO2 for carbon taxes and US$/kWh for feed-in tariffs – are converted into scores ranging from zero to six, and then aggregated into the composite EPS index. The results are made available and discussed in the framework of OECD committees, including the Economic Policy Committee (EPC) and its Working Party 1, where delegates from Ministries of Finance of member countries and key partner countries can exchange views and share information on good practices.
- The OECD Climate Actions and Policies Measurement Framework (CAPMF) is an inventory of 128 climate action variables, grouped into 56 policy instruments and other climate actions, covering 52 countries (Nachtigall et al., 2024). It aims at supporting the efforts made by governments to implement their nationally determined contributions (NDCs) and advancing on paths of deep decarbonisation toward carbon neutrality by the mid-century. The range of mitigation policies covered is coherent with the UNFCCC and IPCC frameworks, making it a useful instrument in inter-governmental discussions. To build its database of CAPMF policies, the OECD interacts closely with experts in national governments, in the framework of OECD committees and its dedicated climate action programme (IPAC). In addition to policies putting a price on air emissions, it covers a wide range of regulatory tools (e.g., emission limits, bans, mandates), it takes account of green R&D public expenditure, and it keeps track of international actions such as participation in international climate treaties and climate data reporting. Like the EPS, the CAPMF seeks to characterize the stringency of each mitigation policy, which is defined as "the degree to which climate actions and policies incentivise or enable GHG emissions mitigation at home or abroad". Each policy variable is normalized, making it possible to categorize the stringency in each country, with a value of zero when no policy is in place and a value of ten attributed to the most stringent value.

  Both the EPS and CAPMF can be used to monitor policy implementation across time and countries. Researchers are using them to assess the responsiveness of GHG emissions to various policies. Boxes 1 and 2 are examples of benchmarking using the CAPMF in Nordic countries and a group of emerging market economies.

  These are important advances made in building inventories of comprehensive transformation packages and in characterizing the strength of policies both across countries

and across time. As government agencies with leadership to steer national economies toward sustainable prosperity and to foster international cooperation, Ministries of Finance can leverage these indicators to inform their analytical work and feed into national debates.

b. Modelling tools

Large integrated macroeconomy-fiscal-energy-climate models are useful but face criticisms regarding their forecasting track record. Large-scale models are useful to design multiannual energy transformation strategies supported by comprehensive policy packages. A well-established practice is to use computable general equilibrium (CGE) models to simulate alternative policy scenarios and assess their impact on a set of sector variables (notably energy prices and carbon emissions) and macroeconomic indicators (such as GDP, inflation, employment, and fiscal positions). The most advanced models examine the impact not only of carbon pricing, but also of non-pricing policies, though this is often limited to the power sector. Some models cover the tradeable sector and investigate possible carbon leakage effects, but the sectors of transport and buildings are rarely covered. The fiscal aspects are often focused on carbon pricing receipts and subsidies. The most recent models also investigate the social dimension of the transition. Financial constraints and bankability challenges are rarely addressed. These models make it possible to compare different policy options that policymakers can chose from. Examples of such model-based policy analysis include the following:

- Using the IMF ENV dynamic computable general equilibrium (CGE) model, Chateau et al. (2022) explore alternative policy options to decarbonize: carbon taxes, feebates, subsidies and regulation. They find that, in the electricity sector, the different policy instruments generate similar outcomes because power generation technologies are very substitutable.
- Using the U.S. Regional Economy, Greenhouse Gas, and Energy (US-REGEN) model, Bistline et al. (2023) highlight the very large uncertainties surrounding the fiscal cost of the IRA as this cost is highly dependent on the demand for new tax credits from renewable energy investors and electric vehicle buyers. They also find that the average abatement cost resulting from the IRA is US$83 per tCO_2, which is below recent estimates of the social cost of carbon.
- Using its Global Energy and Climate (GEC) model, the International Energy Agency (IEA) explores every year, in its World Energy Outlook publication, three different global energy scenarios based on stated policies (STEPS), announced pledges (APS), and Net Zero Emissions by 2050 (NZE). GEC is a highly detailed model of energy supply and demand, and the corresponding emissions. It covers multiple sectors (power, buildings, transport, industry, hydrogen, critical materials) as well as employment in various energy activities. The fiscal aspects are taken into account not only through carbon pricing policies, but also government funding for clean energy investment support and energy affordability for consumers.
- Using a large-scale model of the European electricity system, with detailed results at hourly intervals over 30 years, Réseau de transport de l'électricité (RTE) explores different electricity mixes taking into account the transportation, distribution and flexibility costs in each mix, allowing the results to go beyond those of simpler levelized cost of energy.

These models are most frequently used to analyse the impact of different policy scenarios. Results are presented as deviations from a baseline projection, rather than medium-term forecasts. However, the baseline projection itself is important for policymakers who need to make decisions in terms of economic, fiscal, social, and environmental outcomes.

Unfortunately, some of these models have a weak forecasting track record, which undermines their usefulness to guide policymaking.

As an illustration, the IEA's Global Energy and Climate Model has been repeatedly criticized for underestimating the sudden surge in renewable investments, notably because it has not foreseen the rapid rate at which renewable costs have declined. Energy-climate models are often not dynamic and therefore do not take account of the long-term impacts of policies supporting innovation, investment and transformative changes. The IEA updates and improves its models on a regular basis, in a relationship with the global modelling community, with likely benefits in terms of forecasting track record. A good practice for all institutions would be to regularly review and evaluate their forecasts retrospectively, as is done annually by the U.S. Energy Information Administration and is a common practice among macroeconomic forecasters.

c. *Evaluating policy with micro data*

A recent strand of evaluation studies using micro data provides important information to Ministries of Finance. A recent strand of the literature takes advantage of available micro data to conduct ex-post evaluation studies of government programmes seeking to foster change in energy usages and green technology adoption. These studies seek to provide a rigorous ex-post evaluation of government incentives such as home retrofit subsidies, electric vehicles tax credits, or regulations favouring clean transport. This can take the form of research evaluating programmes already well underway, with researchers getting access to anonymized data from government subsidies, tax filings, bank statements, electricity bills, energy efficiency administrative records, vehicle registration records – among others – to evaluate the effects of government climate-related initiatives. Another approach takes the form of randomized control trials (RCT), where researchers design experiments akin to government programmes, and select a population treated with the experiment, while another control group is not, thus allowing to infer robustly the causal effect of the policy intervention on outcomes such as energy consumption.

Together with fiscal data on budgetary costs, researchers conducting these micro studies can identify the cost effectiveness of alternative policy options, for instance in terms of monetary units per tonne of CO2 abated. With micro data, it is possible to take into account the heterogeneity among firms and households and thus – through micro simulation models – evaluate the distributional impact of pricing and non-pricing policies. This new strand of research is promising to deliver new findings rich in terms of heterogeneity, causality, and robustness. As an illustration, research using micro-data in China, Norway and the United States finds that EV fiscal incentives tend to encourage the replacement of combustion engine vehicles with cleaner cars, although attention needs to be paid to possible regressive income distribution effects (Sheldon and Dua; 2019; Xing et al., 2021; Lévay et al., 2017). For home retrofitting, research based on French administrative data and randomized experiments in the United States finds that home improvements supported by government subsidies result in lower energy consumption, even though the energy saving is often less than predicted (Wald and Glachant, 2023; Fack and Giraudet, 2024; Fowlie, Greenston and Wolfram, 2018).

Ministries of Finance should encourage this strand of research. First, they should adopt open data policies regarding access to tax administrative data on climate actions. Except for a few exceptions, Ministries of Finance do not give access to data and do not use the data they hold in their records. Improving existing practices with more open access, taking into account data confidentiality, would make a large difference in terms of having more and

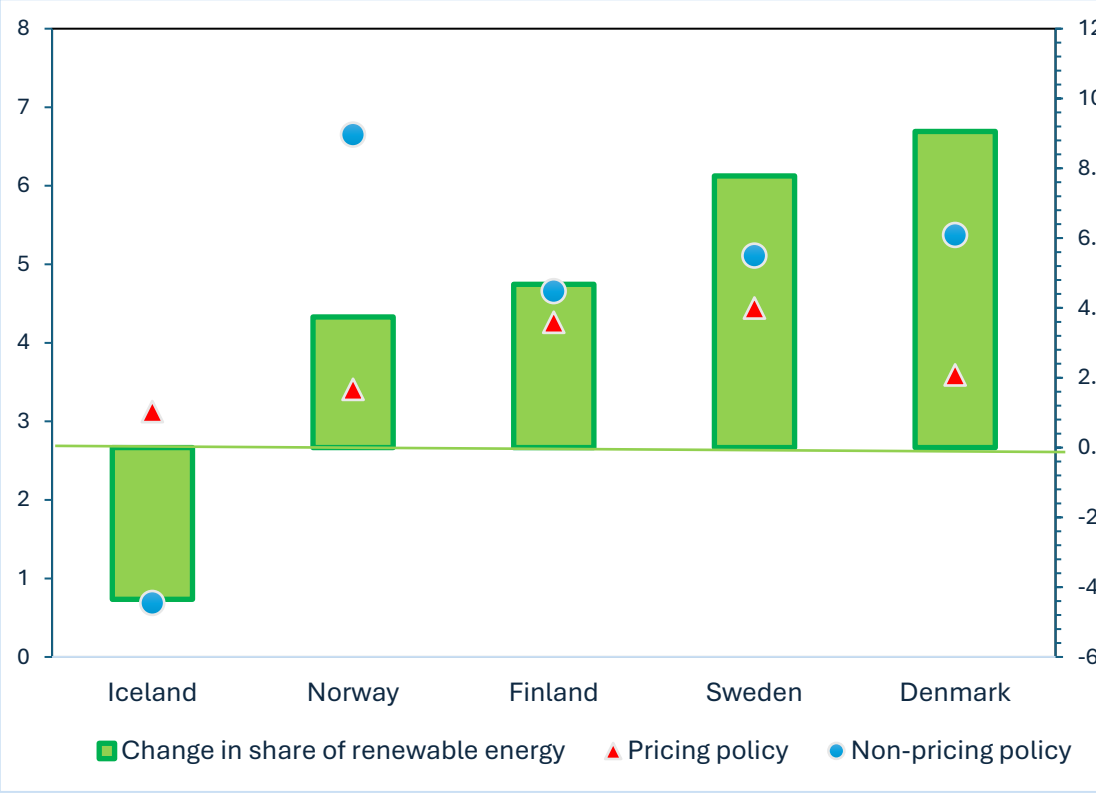
better evaluations that should ultimately improve evidence-based policy making. Second, Ministries of Finance could support the establishment of a repository of such micro data and invite researchers to use them in their work. This could prompt regular exchanges among policymakers, researchers, regulators and other stakeholders. Shared knowledge on good practices would be a useful outcome of this initiative.

Box 1 – Pricing and non-pricing policies in Nordic countries

Denmark, Finland, Norway, Sweden and (to a lesser extent) Iceland are particularly successful in containing their overall energy consumption and increasing the consumption share of renewable energy resources (Grosjean and Duédal, 2021). High taxes on carbon emissions and car fuels are key drivers in their transformation, but not only. The countries also use a variety of non-pricing interventions.

For instance, Denmark has strongly supported the development of offshore wind power with fiscal incentives for innovation and research, as well as feed-in tariffs to encourage investment in the sector (Barker et al., 2022). In Norway, the fast adoption of EVs has been spurred by generous tax incentives, free public parking and road tolls, as well as regulatory exceptions such as the use of bus lanes (Benoit and Lenain, 2023). Iceland has implemented a narrower and less ambitious mix of policies than the previous four countries, which results in less remarkable achievements, although the policy momentum has accelerated recently. For example, Iceland has decided to ban the sales of new diesel and gasoline car sales by 2030. Figure 1 shows that a combination of pricing and non-pricing policies is associated with the unlocking of low-carbon investments (e.g. Sweden), while less stringent policies result in weaker decarbonisation (Iceland).

Figure 1 – Changes in the share of renewable energy (2019-2023, right axis) is associated with packages of stringent climate policies and actions (average of 2019 to 2022, left axis)



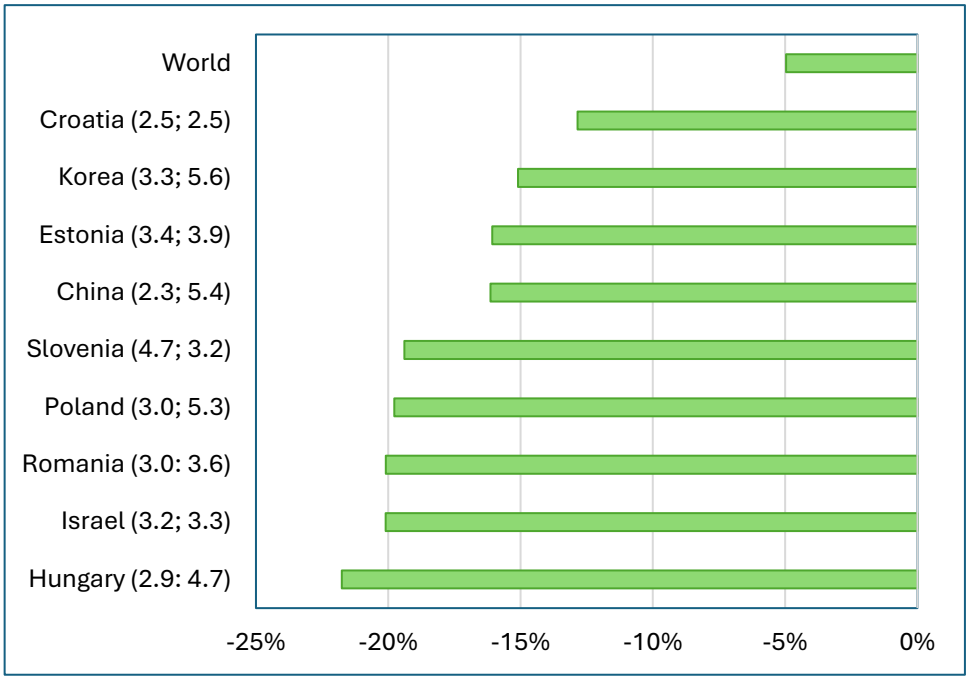
Note: Pricing policy is the unweighted average of carbon taxes, energy excise taxes and ETS; non-pricing policies includes fossil fuels subsidies, feed-in tariffs, renewables auctions and certificates, and non-market interventions. The policy stringency indicator varies from 0 (no policy) to 10 (most stringent policy).

Sources: Energy Institute (2024) Statistical Review of World Energy and OECD Climate actions and policies measurement framework (CAPMF).

Box 2 – Pricing and non-pricing policies in emerging market economies

Many emerging market economies have begun to use packages of pricing and non-pricing policies to progress toward a low-carbon economy and their emission abatement targets, in coherence with their nationally determined contributions (NDC) to the Paris Climate Agreements. Several of these countries use non-pricing policies that are more stringent than pricing policies. In many countries, energy consumption is being gradually decarbonised (Figure 2) with the help of subsidies and concessional finance, often by switching from coal to biomass and wind power. Households receive subsidies to retrofit their homes and reduce their demand for heating energy. In China, for example, the government is actively supporting the development of renewable energy with packages of policy tools including soft loans, subsidies, and tax expenditures exempting investment in wind and solar equipment from VAT and import duties. China has also offered significant tax incentives for the purchase of electric vehicles (Lenain, 2023) and is developing its emission trading system.

Figure 2 – Emission intensity is declining thanks to stringent policies ($MTCO_2$/GDP) during 2000-23 (in %)



Sources: Same as Figure 1. Numbers next to country names correspond to OECD CAPMF stringency indexes value of 2022 ranked from 0 to 10, with the first index referring to pricing policies and the second to non-pricing policies.

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