EDITORIAL

Green Fiscal Reform: A Brief Introduction

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Introduction

Pressure to progress on greenhouse gas (GHG) emission mitigation pledges submitted for the 2015 Paris Agreement on climate change, growing alarm about air pollution and other local environmental threats, recognition of the limitations of traditional environmental regulations, a preference for revenue-raising instruments given historically high fiscal pressures, and the window of opportunity created by lower energy prices, have all heightened the interest in green fiscal reforms. Although it could be defined more broadly, for the purposes of this editors' essay, 'green fiscal reform' refers to pricing policies—fuel taxes, emissions trading systems (ETS), targeted subsidies, removal of inefficient subsidies, etc.—that can achieve environmental goals while also having important revenue implications.

The essay proceeds as follows. We begin with some general context for green fiscal reform from an environmental, fiscal, and recent policy perspective. Next we briefly take stock of the general rationale for, and appropriate design of, green fiscal instruments. Following that, we briefly introduce the papers in this special issue. The essay finishes with some concluding thoughts.

Policy Context

Environmental Background

Green fiscal reform has a potentially critical role to play in addressing a wide range of negative externalities in the energy and industrial systems.

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Global climate change, caused by atmospheric accumulation of GHGs, is the central environmental problem. Global temperatures are projected to rise, in the absence of mitigating measures, by about 3–4 ˚C over pre-industrial levels by 2100, but with high tail risks (IPCC 2014). At the 21st Conference of the Parties (COP21), over 190 countries submitted (voluntary) GHG reduction pledges for the Paris Agreement, covering over 96 per cent of global emissions, and parties agreed on (legally binding) procedures for evaluating progress on, and updating, these pledges. A typical commitment is to reduce emissions in the order of 30 per cent by 2030, below emissions in some baseline year (see Table 1). Subsequently, on April 22, 2016 in New York, 175 Parties to the United Nations Framework Convention on Climate Change (UNFCCC) signed the Paris agreement. Among them were all key emitters, such as the United States, China, the European Union, Russia, India, Japan, and a wide number of developing nations, reaching a record for support in the history of international treaties. The remaining 22 countries have time until April 21, 2017, to sign the agreement. More importantly, 15 States also deposited their instruments of ratification during the signing ceremony, whereas two others did it in the following days.

The key practical challenge, however, is to analyse which policies are best suited for implementing mitigation pledges, as there is a general acceptance that ideally carbon pricing should be front and center.[2] The transition to a low carbon energy system cannot occur without a clear and stable long-term price signal, even though other fiscal instruments have proved to be quite effective in accelerating decarbonization of the global economy. For example, feed-in tariffs and similar support mechanisms have been the primary driver in boosting the market growth of renewable energy and are now used in 98 states, provinces, and countries worldwide.

At a more local level, outdoor air pollution—caused in part by fossil fuel combustion—causes estimated damages of about 1 per cent to the gross domestic product (GDP) of the United States and almost 4 per cent to GDP of China.[3] By far the main damage component is elevated risks of premature human mortality from exposure to fine particulates small enough to penetrate the lungs and bloodstream.

Premature deaths from outdoor air pollution were estimated at about 3.2 million worldwide in 2010 (Figure 1)[4], concentrated especially in East Asia (about 1.3 million) and South Asia (about 0.8 million). Again, fiscal policies can play a key role in ensuring that prices fully reflect both the supply and environmental and social costs of fuel use.

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2 See <www.carbonpricingleadership.org/carbon-pricing-panel>.

3 See NRC (2009), Muller and Mendelsohn (2012), and World Bank and State Environmental Protection Agency of China (2007).

4 Estimated deaths from indoor air pollution in developing countries are even greater (3.8 million), though the scope for the use of fiscal policies is more limited here given the impracticality of taxing some of the fuels (e.g., biomass) and that even for coal, taxes may cause switching towards (equally harmful) biomass, at least until cleaner energy sources (e.g., charcoal, natural gas, electricity, or even processed coal that burns more cleanly), and better technologies, such as better ventilated stoves, are available.

Table 1: Mitigation pledges submitted for the Paris Agreement, selected large emitters

Country	Main mitigation pledge	Share of global emission, 2012[a]
China	CO_2 peaking around 2030, lower CO_2 intensity of GDP 60-65%.	25.9
US	Reduce GHGs to 26-28% below 2005 levels by 2025.	16.0
EU	Reduce GHGs 40% below 1990 levels by 2030.	11.9
India	Reduce GHG intensity of GDP 33-35% below 2005 level by 2030.	6.2
Russia	Reduce GHGs 25-30% below 1990 levels by 2030.	5.2
Japan	Reduce GHGs 25% below 2005 levels by 2030.	3.9
Korea	Reduce GHGs 37% below BAU in 2030.	1.9
Canada	Reduce GHGs 30% below 2005 levels by 2030.	1.7
Brazil	Reduce GHGs 37% below 2005 levels by 2025.	1.4
Mexico	Reduce GHGs 25% below BAU in 2030.	1.4
Indonesia	Reduce GHGs 29% below BAU in 2030.	1.4
Australia	Reduce GHGs 26-28% below 2005 levels by 2030	1.2

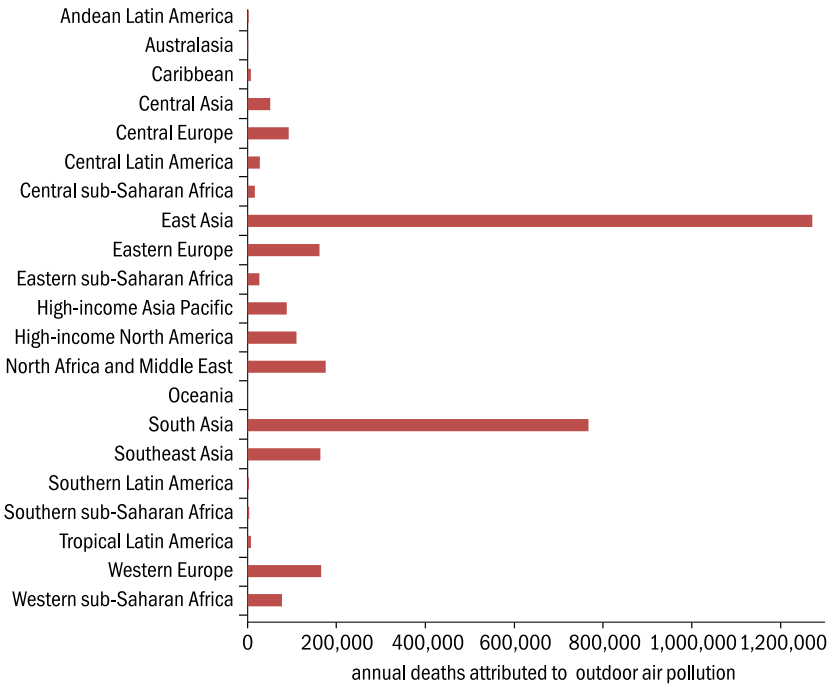
Source: UNFCCC (2015); EIA (2015)

Notes: [a] Refers to energy-related CO_2

Fiscal policies can be applied to a wide range of other environmental problems. For instance, the most effective way to manage urban traffic congestion is to charge motorists' fee (rising and falling during the course of the rush hour) for using busy roads (e.g., London, Milan, Singapore, and Stockholm have taken steps in this direction). Taxes or tradable quotas that charge fishermen for their catch (as pioneered in New Zealand) have proved effective in addressing overfishing and are far more efficient than regulatory approaches (e.g., restrictions on gear, the number of vessels, or fishing seasons). Payments for ecosystems services (as pioneered in Costa Rica) can target preservation or expansion of forestland in areas where environmental benefits (e.g., enhanced biodiversity, water protection) are greatest. And fiscal instruments are commonly used to charge for solid waste disposal and promote conservation and recycling of packaging materials and hazardous products.[5]

[5] For a discussion of country experiences see, for example, Ecotec Research and Consulting (2010), ch 12.

Figure 1: Premature deaths from exposure to outdoor air pollution, 2010



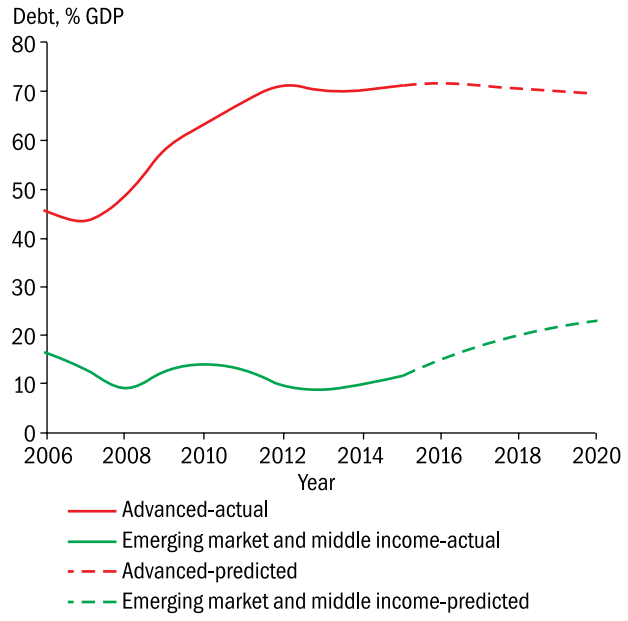
Source: Burnett *et al*. (2014)

Broader Fiscal Background

Broader fiscal pressures remain at historically high levels. General government debt for advanced countries as a group is predicted to hover around 70 per cent of the GDP when compared with levels prior to the 2008 fiscal crisis of below 50 per cent of GDP, while average debt levels in emerging market and middle income countries are projected to double over the next five years, albeit from a much lower base (Figure 2).

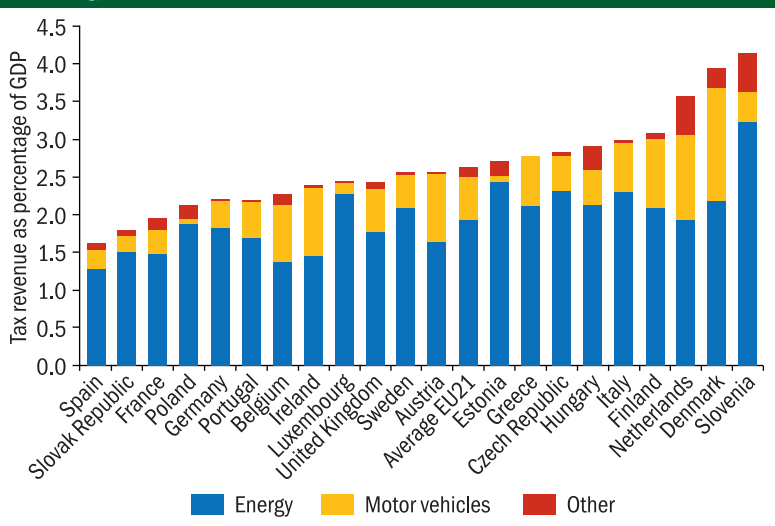
Given this backdrop, green taxes may be especially timely from a finance ministry perspective. In fact, many countries already raise substantial revenues from energy and related taxes. For instance, on an average these taxes raise revenues of 2.6 per cent of GDP across the selected EU countries as shown in Figure 3, varying from about 1.5 per cent of GDP in Spain to about 4 per cent in Slovenia. The biggest component is energy taxes, meaning taxes levied on road fuels, heating oils, and (largely residential) electricity consumption accounting, on average, for almost 2 per cent of GDP, followed by vehicle taxes (0.6 per cent), and other sources, such as taxes levied on waste or water (0.1 per cent).

Figure 2: General government net debt



Source: IMF (2015), Tables A8, A16

Figure 3: Energy and related tax revenues, selected EU countries, 2012



Source: OECD (2015)

However, these taxes are generally not well targeted from an environmental perspective. For example, coal is the dirtiest fuel from both a global warming and local air pollution perspective, yet (unlike road fuels) it has rarely been taxed.[6] While taxes levied on vehicle ownership often promote low CO_2 emission vehicles, they are less effective at reducing fuel use and emissions than fuel taxes, as the latter also encourage less driving. And even road fuel taxes are a very blunt instrument for addressing broader externalities from vehicle use, most notably traffic congestion, which is highly sensitive to where driving occurs and what time of day. Nationwide distance-based charging systems have been introduced in some European countries for trucks, and they have been considered (e.g., in the Netherlands and the UK) but not yet implemented, for light-duty vehicles.

Recent Policy Developments

As indicated in Figure 4, about 40 national governments and more than 20 sub-national governments have introduced (or have legislated to introduce) some form of carbon pricing. Most of these schemes are emissions trading systems (ETSs) (e.g., in the EU scheme covering 31 countries, Korea, California, and some provinces in China) though 15 national and sub-national governments now have explicit carbon taxes (recent examples include Chile, France, Ireland, Mexico, and the UK). But this is only the beginning of a very long process—only 12 per cent of global GHGs are currently priced, reflecting the lack of national schemes in many large emitters, and limited sectoral coverage of existing schemes.[7] And current prices—often below $10 per tonne of CO_2—are well below those that will ultimately eventually be needed if the emission pledges for Paris are to be honoured.[8]

Another notable policy development, in many energy-producing countries, is the reform of energy subsidies traditionally arising from regulated prices (Table 2). These reforms have been facilitated by international price reductions (which have not been fully passed forward in lower domestic prices) and pressures (due to lower revenues from petroleum exports) to reduce the fiscal costs of domestic energy subsidies. For example, India has liberalized road fuel prices, Indonesia has abolished gasoline subsidies and capped diesel subsidies, Mexico will fully liberalize domestic fuel prices by 2018, and Saudi Arabia is substantially increasing domestic prices for road fuels, natural gas, and electricity. These reforms represent a welcome step in the direction of fully recovering supply costs in energy prices, though an even bigger challenge will be to go beyond this to factoring environmental costs into energy prices. Reforms of subsidy schemes

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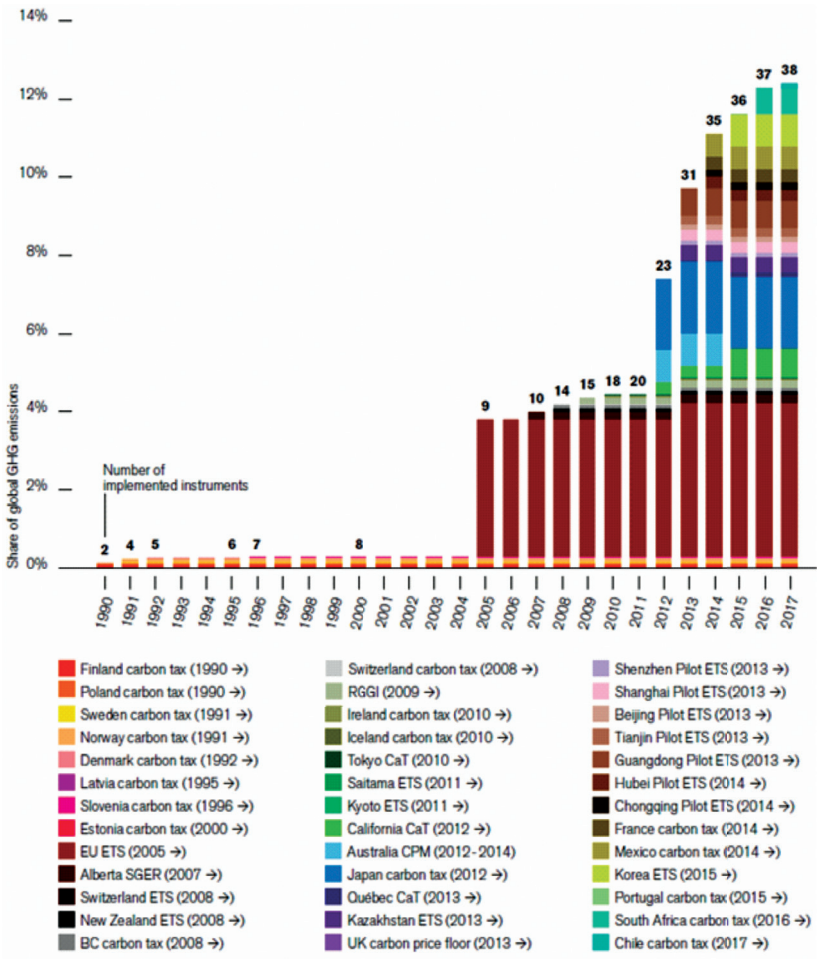
[6] India, for example, has recently introduced a coal tax, though at relatively modest levels from an environmental perspective.

[7] Coverage will roughly double, if China makes good on its pledge to implement an ETS on industrial emissions in 2017.

[8] Meeting the Paris mitigation pledges through carbon pricing alone will likely require emissions prices in the order of $50-100 per tonne of CO_2 or more by 2030 (Parry 2016).

Figure 4: Carbon pricing: existing and soon to be implemented policies



Source: WBG (2015), pp. 12

also free resources to be used to address human development priorities, such as health and education. In Kenya, for example, the government was able to improve the country's electricity network, crucial to improving both health and education conditions, due to the increased resources from subsidy removals.

Rationale and Design Basics for Green Fiscal Reform

Policy instruments for addressing environmental externalities fall into two main categories. The first consists of more traditional 'command and control' regulations

Table 2: Energy pricing reform: some recent examples

Angola	Liberalize domestic fuel prices by 2020
Egypt	Fuel and gas prices increased 40-78%, electricity prices 20-50% in 2014
Ghana	Petroleum prices liberalized 2015
Haiti	Gasoline, diesel, kerosene prices increased 6-896 in 2014, 9-1196 in 2015
India	Gasoline prices liberalized in 2010 and diesel prices in 2014
Indonesia	Abolished gasoline subsidies and capped diesel subsidies in 2015
Jordan	Automatic pricing mechanism in 2012, fuel subsidies zero in 2014
Kuwait	Raised diesel and kerosene prices 210% in 2015 (partially reversed)
Madagascar	Eliminating fuel subsidies and implementing automatic pricing in 2016
Malaysia	Prices for gasoline and diesel set monthly to reflect international prices
Mexico	Domestic fuel prices to be liberalized in 2018
Morocco	Gasoline, diesel, industrial fuel oil and LPG subsidies eliminated
Saudi Arabia	Gasoline price increased 50% in 2015, planned increases for diesel, gas, electricity
Sudan	Plan to eliminate fuel subsidies by 2019 (but fuel price riots in 2013)
UAE	Fuel price mechanism in 2015 and gasoline/diesel prices increased 25-30%
Yemen	Gasoline, diesel, kerosene prices increased 20, 50, 100% respectively in 2014

Source: International Monetary Fund (internal sources)

which might, for example, specify which technologies are to be used to reduce pollution. The second consists of the fiscal or market-based instruments, which are the focus here.

There are three main rationales for using fiscal instruments as the centerpiece of environmental policy, so long as—in each case—the design basics are right. In particular, these instruments:

- Are the most effective policies for exploiting opportunities for mitigating environmental externalities—so long as they are targeted at the right base;
- Achieve environmental protection at lowest overall cost to the economy—so long as the potential revenues are used productively; and
- Strike the right balance between environmental benefits and economic costs—so long as prices are aligned with marginal environmental damages.

We elaborate a bit on these basic, but nonetheless very important, points.

Environmental Effectiveness

Table 3 illustrates the effectiveness of different environmental policy instruments,

Table 3: Comparing CO_2 mitigation opportunities provided by alternative policies

	Power generation						
	lowering CO_2 per kWh		Reducing electricity use		Transportation		Homes/ industry
Policy Instrument	Shift to renewables	Shift from coal to gas and from these fuels to nuclear	higher efficiency	reduced product use	Higher fuel economy	Reduced driving	Reduced fuel demand
(1) Carbon tax (or emissions trading equivalent)	√	√	√	√	√	√	√
(2) Renewable subsidy	√	–	–	–	–	–	–
(3) CO_2 per kWh standard	√	√	(√)	(√)	–	–	–
(4) Efficiency standards for buildings, appliances, etc.	–	–	√	x	–	–	–
(5) Vehicle fuel efficiency standard	–	–	–	–	√	x	–
(6) Combination of (3), (4), (5)	√	√	√	x	√	x	–
(7) Electricity tax	–	–	√	√	–	–	–
(8) Motor fuel tax	–	–	–	–	√	√	–
(9) Simple vehicle ownership tax	–	–	–	–	–	(√)	–

Source*:* Authors

Note: √ denotes an emissions reduction opportunity exploited by a particular policy; (√) denotes where an opportunity is only partially exploited by the policy; – denotes an opportunity not exploited; and × denotes where a policy increases rather than reduces emissions (through the rebound effect).

using the example of (energy-related) CO_2 mitigation. As indicated by the column headings, the major (near term) possibilities for reducing emissions from a typically large CO_2 emitting country can be categorized as: (i) Switching from fossil fuels to renewables in power generation; (ii) Shifting from coal to natural gas in power generation, and from these fuels to nuclear; (iii) Reducing electricity demand by increasing efficiency of products, reducing the capital that use electricity (lighting, space heating and cooling, household appliances, industrial machinery, etc.), and by reducing use of these products; (iv) Reducing transportation fuel use through higher fuel economy and less vehicle use; and (v) Reducing direct use of fuels (e.g., natural gas, home heating oil) by firms and industry.[9]

A tax on the carbon content of fossil fuels promotes all seven of these responses—indicated by the seven √s in the first row of Table 3—as the tax is passed forward into higher prices for fossil fuels, electricity, and so on. A subsidy for renewable power generation fuels, in contrast, promotes only one of the responses.

A CO_2 per kilowatt hour (kWh) standard for the power sector promotes all responses for lowering the emissions intensity of power generation (though it has a relatively weak impact on electricity demand as there is no pass through of tax revenues into prices). Efficiency standards for electricity-using products and capital promote only one response, while slightly offsetting these gains through lowering unit energy costs and increasing product usage—the 'rebound effect'. A combination of regulations is more effective—for example, a CO_2 per kWh standard for power generation and comprehensive efficiency standards for electricity using products and vehicles would promote four responses in Table 3, though this package still misses some opportunities, and perversely affects others through rebound effects.

The superior effectiveness of carbon taxes or tax-like policies over other instruments hinges critically on directly, and comprehensively, targeting the source of the externality, in this case emissions, or carbon content of fuels. If, for example, the tax is levied on electricity consumption, or a subset of fossil fuels, many of the key behavioural responses for reducing emissions are not exploited (Table 3).

Fortunately, directly taxing the source of the externality is administratively quite feasible, at least for some of the major environmental problems. Carbon taxes can be imposed upstream in the fossil fuel supply chain in proportion to carbon content—a straightforward extension of road fuel excises, which are well established in most countries and among the easiest of all taxes to administer. Similarly, the practicalities of taxing local air pollution from coal (the most polluting fuel) are manageable—either through charging for emissions out of the smokestack or through upfront taxes on coal use combined with rebates for firms demonstrating use of mitigating technologies (e.g., flue gas

[9] Another possibility, though more for the medium to longer term, is capture and storage of carbon emissions at large industrial sources, which might be promoted through rebates.

desulphurization technologies). And to take another example, road congestion taxes can be collected electronically, through debiting of on-board smart cards or home billing based on driving patters tracked by Global Positioning Systems.

Cost Effectiveness and Fiscal Considerations

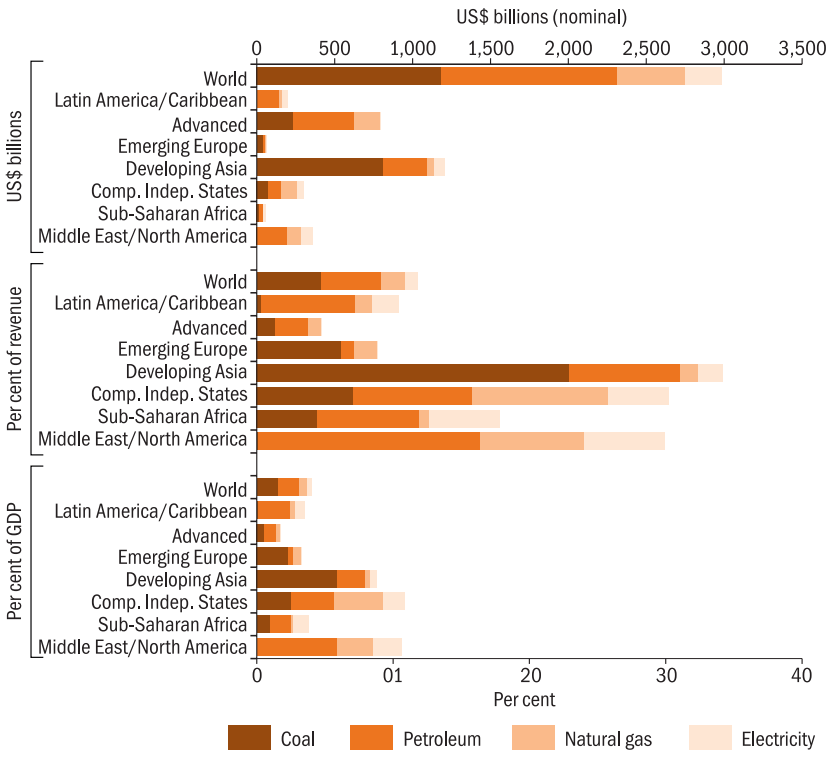
As regards cost effectiveness, it was traditionally thought that, by providing all sources with the same incremental incentive to reduce environmental harm, fiscal instruments would achieve a given level of environmental protection at lowest cost to the economy (e.g., Baumol and Oates 1971; Kneese and Bower 1968)—in contrast, regulatory approaches typically violate least cost principles to the extent they result in differential incremental incentives for mitigation across different firms, sectors, and programmes.

However, matters are more complicated because environmental policies also interact with pre-existing sources of distortion in the economy, most importantly distortions created by the broader fiscal system.[10] Taxes on labour and capital distort economies by discouraging work effort, discouraging investments in human and physical capital, shifting economic activity to the informal sector, encouraging excessive spending on tax-preferred goods, such as housing and fringe benefits, and so on. To the extent that environmental policies contract economic activity (e.g., through raising energy costs) they tend to reduce the overall level of employment, investment, and so on, which results (given large tax wedges) in significant additional efficiency costs in factor markets. However, using environmental tax revenues to lower the burden of taxes on labour and capital produces offsetting economic efficiency benefits. In fact fiscal considerations can, up to a point, reinforce the case for green taxes, if the revenues cut an especially distortive tax. But the most important point is that if revenues are not used efficiently this can increase, quite considerably, the overall costs of environmental taxes for the economy, undermining the case for green fiscal instruments. If revenues are used for additional (general or environmental) spending this should, therefore, generate comparable economic efficiency benefits to those from cutting distortionary taxes.

Efficient revenue use is obviously very important when a large amount of revenues are at stake, which is clearly the case for energy price reform. At a global level, revenue gains from 'getting energy prices right'—that is, moving from existing prices to prices that fully cover supply costs, environmental costs (e.g., air pollution and global warming), and taxes applied to general consumer goods—have been estimated at about $3.0 trillion (4 per cent of global GDP) for 2013 (Figure 5). Revenue gains are particularly large in Emerging and Developing Asia and the Commonwealth of Independent States (where health problems from local air pollution are especially severe) and the Middle East and North Africa where petroleum, natural gas, and electricity prices are well below efficient levels.

[10] See, for example, Goulder *et al*. (1999), Parry and Bento (2000).

Figure 5: Revenue gains from getting energy prices right, 2013



Source: Coady *et al.* (2015)

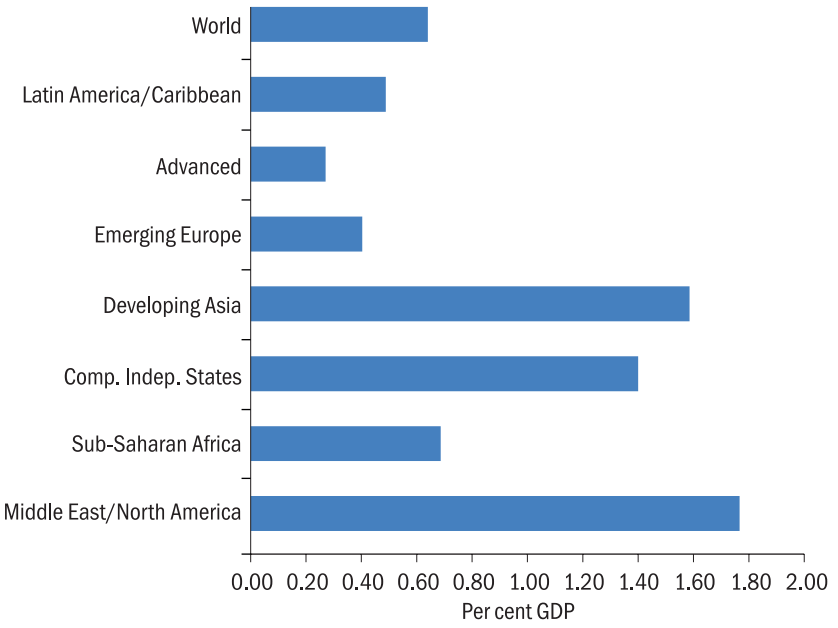
Notes: Figure shows revenues gains due to raising energy prices from current levels to levels that cover supply costs, environmental costs, and taxes applied to general consumer goods (where current prices already exceeding this level revenue gains are set to zero). Commonwealth of Independent States comprises certain former Soviet Union republics. Middle East and North Africa includes Afghanistan and Pakistan.

Potential revenues from other applications of green fiscal instruments can be significant, but are not on the same scale as those from full reform of energy pricing. For example, just like energy, water is pervasively mispriced, though usually the main issue is undercharging for supply costs, depreciation, and maintenance of infrastructure, rather than undercharging for environmental costs. Figure 6 shows recent estimates of water subsidies, which totaled $456 billion worldwide in 2012, or about 0.6 per cent of global GDP, with subsidies varying across regions by between 0.3 and 1.8 per cent.

Balancing Benefits and Costs

According to the traditional analysis of efficient environmental taxation, the tax level that maximizes environmental benefits net of mitigation costs equals

Figure 6: Public water subsidies by region, 2012



Source: Kochhar *et al*. (2015)

(marginal) environmental damages—the 'Pigouvian Rule'. As just noted, fiscal considerations may enhance the case for green taxes, though for practical purposes this may not warrant setting higher tax rates given uncertainty over the fiscal parameters needed for this adjustment, that any mark-up above the Pigouvian rule declines with the level of mitigation (due to erosion of the tax base), and the difficulty of conveying the technicalities to policymakers and stakeholders.

The Pigouvian rule is more naturally implemented under a tax than a regulatory approach or ETS (which impose prices implicitly or indirectly). And for some problems, such as global warming and air pollution, it seems reasonable to measure Pigouvian taxes assuming constant marginal damages (estimated at current tax levels).[11]

Apart from global warming, country-specific data is needed to quantify Pigouvian tax levels. For example, the efficient charge for local air pollution

[11] For air pollution, the relation between fatalities and pollution concentrations appears to be approximately linear in the relevant range for corrective taxes (Parry *et al*. 2014), pp. 38–39. For global warming, damages depend on the accumulated stock of greenhouse gases in the atmosphere and one country's emissions in one year add a negligible amount to this stock (Pizer 2002).

damages varies considerably across countries with local emission rates (which depend on fuel quality and deployment of control technologies), population density in proximity to emissions sources, the health status of exposed populations, and the valuation of health risk (the latter varies considerably with per capita income).

Figure 7 illustrates some estimates of Pigouvian taxes on coal for selected countries in 2010, expressed in $ per gigajoule (GJ) of energy. The orange bars indicate carbon damages (based on a CO_2 damage value of $35 per tonne) which amount to $3.3 per GJ, or about two-thirds of the average world coal price in 2010. The blue bars are the air pollution damages which can greatly exceed (at current air emissions rates) the carbon damages in some cases (e.g., densely populated countries like China) though in other cases (e.g., Australia) air pollution damages are far more moderate. The black diamonds in the figure indicate current taxes which are essentially zero or slightly negative in some cases.[12] Therefore, the overall pattern is one of pervasive and substantial undercharging for coal use.

Key Themes of Papers from the Special Issue

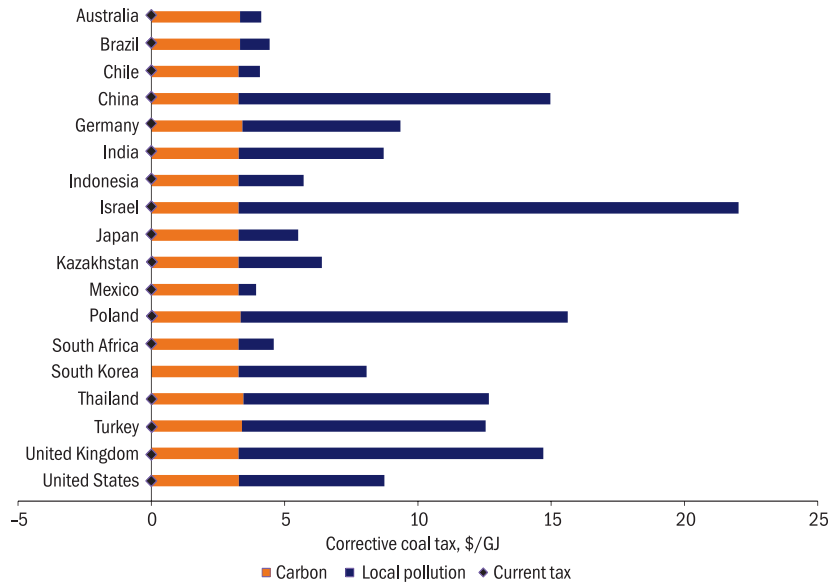
Most of the issues and themes discussed in the previous sections of this introductory paper are further analysed and deepened in the articles of this special issue. The paper by Gilbert Metcalf, develops a template for assessing the effectiveness (strengths and weaknesses) of green fiscal reform and suggests that policy choices should be assessed based on their: (i) Fiscal potential; (ii) Opportunities for economic efficiency gains; (iii) Distributional impacts; (iv) Macroeconomic impacts; and (v) Political economy concerns. The template is applied to various case studies from developed and developing countries. One notable theme from these studies in the macroeconomic context is that environmental improvement need not come at a high cost to economic growth.

In the first paper, Gunnar S Eskeland and Haakon Lindstad demonstrate the use of imperfect, though powerful, instruments (e.g., fuel taxes, tax/subsidy schemes or 'feebates', emission standards, congestion tolls) in managing air quality, greenhouse gases, and congestion from transport systems requires carefully designed combinations of policy instruments. With examples from cars to maritime shipping, the paper highlights common themes in environmental improvements beyond technology improvements, such as larger shipments and higher utilization of network capacity.

Rita Pandey and Meeta Keswani Mehra review the best practices associated with the choice and design of fiscal policy instruments in the context of promoting renewable energy technologies. The paper outlines an analytical framework identifying the characteristics of drivers and barriers in innovation of renewable

[12] The EU ETS, which implicitly prices coal emissions at about $1 per GJ is not included here, nor is the UK carbon tax floor.

Figure 7: Corrective taxes on coal use, selected countries, 2010



Source: Parry *et al*. (2014)

technologies; sequencing of various steps involved in promoting innovation; and various policy tools in the context of each barrier that accelerate the process and enhance the outcomes. The paper identifies main lessons from some country cases for future design and implementation of renewables policies.

Sirini Withana examines how obstacles to green fiscal reforms, such as concerns about economic and social impacts, might be overcome through targeted measures for vulnerable groups, use of revenues, and complementary tools, drawing on lessons from a wide variety of experiences in both advanced and developing countries. The article highlights the potential importance of a comprehensive, consultative, pragmatic approach to green fiscal reforms, and to build broad political and public support to ensure success.

The paper by Kai Schlegelmilch and Amani Joas develop a conceptual framework for understanding the revenue potential of green fiscal instruments and central to this is the tax base, tax rate, and the price responsiveness of the tax base. The study further examines the effect of green fiscal instruments on general revenues, the administrative costs of green fiscal reforms, compensatory spending, and use of revenues for cutting broader taxes and funding environmentally related public goods.

Some Final Thoughts

It is an exciting time to study green fiscal reform, given the diverse range of pressing environmental problems where fiscal incentives can play a key role, including biodiversity loss, excessive exploitation of forests and fisheries, allocation of scarce water resources, air and water pollution, climate change, crowding of transportation infrastructure, disposal of solid and municipal waste, and so on. Moreover, there is growing interest in green fiscal reform among environmental, finance, and other ministries, across advanced and emerging market countries alike.

The principles of sound policy responses are increasingly accepted, most importantly ensuring that environmental costs are appropriately priced for market and non-market goods. The challenges lie in the practicalities of getting it done: assessing the efficient level of environmental charges; evaluating policies in terms of their effectiveness, fiscal impacts, and economic impacts; accompanying measures for related market failures, such as inadequate innovation; the next best alternatives when fully efficient pricing is not viable; and so on.

Successful fiscal policy reforms also often require adequate complementary measures due to their potential distributional and macro-economic impacts particularly on certain segments of society, such as businesses in carbon-intensive industries and low-income households. Removing government subsidies on fossil fuels, for example, could lead to higher energy prices and weaker purchasing power for households. Therefore, complementary measures to offset negative distributional impacts are often needed.

We hope this special issue stimulates further discussion and study of green fiscal reforms, which are central for addressing some of key challenges facing policymakers in the 21st century.

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