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Climate Policy and the Recovery

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EXECUTIVE SUMMARY

Negotiations towards a successor to the Kyoto Protocol on climate change have come to a critical point, and domestic climate policies are being developed, as the world seeks to recover from the deepest economic crisis for decades and looks for new sources of sustainable growth. This position note considers the challenge posed by these two policy imperatives: how to exit from the crisis while developing an effective response to climate change. It argues that:

- *The economic crisis does not change the basic climate challenge, or the proper response to it. Even a serious recession, with prolonged output losses, has limited implications for appropriate mitigation objectives.*

- *The crisis should not distract from efforts to address the externality that is at the heart of the climate challenge, which requires that firms and households pay for the social damage that their emissions cause (through carbon pricing).*

- *A cautious shift towards more aggressive carbon pricing (though taxation or tradable emission permits) need not impede recovery.*

- *Stronger emissions pricing could make a substantial and efficient contribution to restoring fiscal positions damaged by the crisis.*

- *Achieving such pricing requires resisting political pressures to overcompensate producers, notably by awarding them emissions permits free of charge.*

- *While carbon pricing is important,"green" stimulus measures have a useful role to play in sustaining aggregate demand and employment in the short term.*

- *Increased climate-related public spending is likely to be needed into the longer term to correct market failures (including in technological development) and reduce the adverse effects of climate change, especially on the most vulnerable.*

- *Spending policies should not substitute for more efficient pricing of pollution—especially given the intense fiscal challenges many countries now face.*

I. INTRODUCTION

The current debate on climate policy takes place amidst efforts to recover from the economic crisis and address fiscal challenges ahead. Negotiations towards a successor to the Kyoto Protocol (due to be concluded in December 2009), and reforms of climate policies at national levels, are intensifying. At the same time, countries are looking for new sources of sustainable growth and, in many cases, the means to cope with severe fiscal pressures that the crisis and responses to it have aggravated.

This note considers the interaction between these two challenges. How should the challenges of recovery affect climate policy? And how should climate concerns be reflected in macroeconomic and fiscal policies over the short and longer terms? Section II discusses the impact of the crisis and recession on emissions pricing objectives and policies. Section III considers the role of climate-related expenditure programs both as part of fiscal stimulus packages and in the longer term. Section IV concludes.

II. EMISSIONS PRICING POLICIES AND RECOVERY

A. Climate Objectives Amid Macroeconomic Weakness

While the crisis has reduced the flow of greenhouse gas emissions, and may continue to do so for some time, the effect on their accumulated stock will be modest. The International Energy Agency (IEA, 2009) forecasts that global emissions—after increasing rapidly in recent years—could fall by more than 2.5 percent in 2009. The damage from climate change, however, arises not from the *flow* of greenhouse gases but from the accumulated *stock*. And the sheer scale and very slow decay of the stock mean that even quite large reductions in the flow can make little dent in it.[1] Even a 10 percent fall in global emissions lasting two years, for example, might reduce the stock of greenhouse gases by only around 0.1 percent.[2] The crisis may have more persistent effects on output (because cyclically unemployed workers lose market attachment, for instance), feeding through to emissions. But even a permanent 10 percent cut in emissions[3]—though ultimately lowering the steady-state stock of greenhouse gases in the extremely distant future by this amount—would likely reduce the stock in 2040 (the sort of horizon mitigation with which climate policy must

[1] There may be other aspects of output reduction that ameliorate potential climate damage. Hallegatte and Ghil (2008) find that recession reduces vulnerability to natural disasters, as idle resources can be made available for reconstruction.

[2] Current concentration of greenhouse gases is about 430 parts per million (ppm) of CO_2 equivalent, to which emissions prior to the crisis were adding about 2.25 ppm per year. For the illustrative calculations in this paragraph, emissions are simply assumed proportional to output and decay to be zero.

[3] The IMF (2009a) finds that banking crises can lead to permanent output losses of this order.

concern itself) by only around 2 percent.[4] That is a small amount relative to the massive reductions that recent scientific and economic analyses suggest will be necessary.[5]

Raising the cost to firms and households of emitting greenhouse gases—central to addressing the externality problem at the heart of climate change—thus remains a priority, and the extent of desirable long-run abatement has not fallen. The fundamental nature and magnitude of the market failures underlying the climate problem—above all, that polluters do not bear the full costs of emissions—are unaffected by the economic downturn. Current mitigation efforts are now generally acknowledged to be inadequate for meeting the economic, social, and political problems that climate change can create. For example, the IEA (2009) estimates that—under current policies, and with allowance for the crisis—global emissions could rise by 40 percent from current levels by 2030. Broader and deeper international carbon pricing must therefore remain a key priority in the coming years, with leadership by advanced countries essential to this process. Reaffirming existing mitigation commitments, and actively pursuing further policy developments, will be critical.

B. Entering Carbon Pricing and Exiting Recession

In some important respects, recent developments in the macroeconomy argue for more rather than less ambitious abatement objectives. This is for two reasons.

First, there has been a marked reduction in the marginal costs of mitigation. Under the European Union (EU) Emissions Trading Scheme (ETS), for example, permit prices tumbled from €29 tCO_2 to €8 tCO_2 between July 2008 and February 2009 (recovering to €13 tCO_2 in December 2009). Similarly, credit prices under the Clean Development Mechanism (CDM) fell from €22 tCO_2 to €8 tCO_2 over the period (and now stand at roughly €12 tCO_2).[6] These price declines signal a weakening of the demand for permits, and hence in the private mitigation costs underpinning that demand—which in turn implies, in principle, that more mitigation should be undertaken.[7] But of course this demand reduction is expected to be

[4] This assumes atmospheric greenhouse gas concentrations in 2040 would otherwise have been around 525 ppm.

[5] The International Panel on Climate Change (IPCC, 2007) estimates that global emissions might need to fall by between 50 and 80 percent from current levels by mid-century in order for there to be a reasonable chance of restricting future temperature increases to less than 2° Celsius above pre-industrial levels.

[6] The CDM, a provision of the Kyoto protocol, enables industrialized countries to meet their emissions targets by financing projects that reduce emissions in developing countries.

[7] This leaves aside the question of whether the caps, and corresponding permit prices, were at appropriate levels prior to the crisis. That is not clear-cut, as estimates of optimal emissions price paths vary quite widely (partly reflecting the use of different discount rates for evaluating future damages). Estimates by Stern (2007), for example, lie somewhere above current market prices, whereas Nordhaus (2007) suggests these may in fact be too high.

short-lived (relative at least to the time horizons of climate policy), so that fine-tuning of caps (that is, the upper limits on emissions under permit trading schemes like the ETS) may be unwise. The point remains, nonetheless, that lower private costs of mitigation mean that, if anything, emission targets should be tighter rather than looser.

More important, relatively low energy prices present opportunities for fundamental pricing reform. While there will of course be opposition, even temporarily lower prices of oil and other energy sources should increase the political palatability of firmer emissions pricing. Countries with controlled fuel prices, in particular, are likely to find periods of relatively modest prices the most opportune for locking in automatic pricing mechanisms that embody an appropriate green tax element—as has been done in Pakistan, for instance.

Against this, however, the likelihood of a slow and fragile recovery warrants some caution in increasing carbon prices. There is good reason to suppose that emissions pricing, if well designed and implemented across a broad base, need impose only modest economic costs over the longer term, when the economy is able to fully adjust.[8] However, most characterizations and quantifications of optimal carbon pricing policies assume the economy is functioning well in other respects. That is not the case at present, with significant labor market and other distortions marking a weakly performing economy. The risk of further exacerbating these distortions means that the proper level of carbon pricing may differ from the "first-best" levels commonly focused on. Substantial and unanticipated carbon price increases in the midst of a recession could worsen these other distortions by, for instance, generating unwelcome pressures on production costs and household incomes, thus dampening prospects for recovery and (to the extent that labor is complementary with energy inputs) employment. The argument should not be taken too far: easing labor market conditions, for instance, is best done by removing distortions directly affecting employment decisions, not by introducing further distortions by under-pricing carbon. There is, nevertheless, a strong case for moving to more aggressive carbon pricing gradually—and pre-announced to enable firms and households to adjust[9]—so as to ease the transition to pricing that more fully reflects the underlying social cost.

The current risk, however, is of too much caution. The natural focus on recovery may weaken the prospects for the commitments to credible future emissions pricing that are critical for guiding efficient investments in long-lived capital of the type common in energy markets. It may, for instance, have strengthened the hand of industrial lobbies emphasizing the competitiveness risks to which stronger climate policy may expose them—even though there is much evidence these risks are limited for all but a handful of energy-intensive, trade-

[8] See IMF (2008a) and Stern (2007).

[9] Credible pre-announcement of environmental tax reform in the United Kingdom, for example, also stimulated investment prior to implementation. See National Audit Office (2007).

exposed sectors[10] and that current and prospective levels of compensation may, in many cases, be excessive (as discussed in Section C). Negotiations on the EU's Climate and Energy Package, for example, have seen a significant increase in the number of emissions rights proposed to be given away free to industrial producers.

Credibility of strong future carbon pricing is much needed, though hard to achieve. Showing signs of willingness to compromise climate objectives when times are hard would not be helpful. Although likely to encounter initial opposition from some interest groups, auctioning emissions rights, if these are reasonably long-lived, could ultimately create a lobby interested in preserving their value. Perhaps more fundamentally, the good that auctioning rights or imposing carbon taxes can do for the public finances given the fiscal challenges ahead—by reducing the use of more distortionary and damaging tax instruments, and helping sustain key public services—could serve to build a constituency of support both inside and outside of government.

C. Pricing Carbon and Strengthening Public Finances

The crisis, and policy responses to it, leave many countries even worse prepared for fiscal challenges ahead. The fiscal positions of many countries have been substantially weakened: by 6 percent of GDP, on average, for advanced G-20 countries in 2008–09.[11] Even more pressing, in many cases, are the challenges of financing future age- and health-related spending: the IMF (2009c) puts the net present value of future spending increases due to aging at perhaps 10 times the fiscal cost of the crisis. While significant adjustment will need to come on the spending side, in many cases, tax revenue will also have to be increased substantially—perhaps by an average of around 3 percentage points of GDP in advanced countries.[12]

More effective emissions charging can make a major contribution to restoring fiscal positions. Current draft legislative proposals for an emissions trading scheme in the United States, for example, are estimated to have revenue potential of about $870 billion over 2011–19. Relative to forecasts, this is roughly 15 percent of the cumulative fiscal deficit, more than a quarter of the total corporate income tax revenues, and around 0.5 percent of cumulative GDP.[13] By correcting an underlying resource misallocation, such levies would be less distortionary than other taxes, such as the corporate income tax and social contributions

[10] See, for example, Hourcade and others (2007).

[11] IMF (2009b). Figures do not include contingent liabilities arising from explicit or implicit guarantees to financial intermediaries or central banks, or the possible effects of further support programs.

[12] Cottarelli and Viñals (2009).

[13] Congressional Budget Office (2009a,b).

on lower-paid workers. Carbon pricing alone cannot resolve the deep fiscal problems ahead—but it can make a significant contribution.

Much of this revenue potential will be foregone, however—and the efficiency of emissions pricing potentially compromised—by awarding permits free of charge and in a way that reflects firms' current emissions. Such "grandfathering" does not in itself diminish the incentive to reduce emissions, since the possibility of selling permits creates an opportunity cost to polluting. But the potential revenue dissipated by not auctioning rights can be very large: the grandfathering envisaged in emerging drafts of U.S. climate legislation would effectively lose $700 billion of the $870 billion in revenues otherwise projected.[14] Moreover, any expectation that future permits will also be grandfathered reduces incentives to move to cleaner technologies and processes (because higher current emissions are then expected to attract higher future permit awards). The Commission of the European Communities (2008a) estimates that auctioning permits rather than grandfathering them could reduce the consumption costs of the Climate and Energy Package by around 30 percent in 2020.

Current levels of grandfathering likely create windfall profits for firms, and do little to either protect consumers or address competitive concerns. Some initial grandfathering may be reasonable to compensate for investments sunk when substantive emissions charges were unforeseeable. With the climate debate now far from new, however, the force of such considerations has diminished. Current and prospective levels of grandfathering are likely to create windfall profits, because the opportunity cost of using rather then selling permits means that firms awarded free rights have an incentive to substitute away from carbon-use and raise output prices.[15] They may also benefit from induced growth in other sectors: many utilities, for example, have direct commercial interests in renewables. Burtraw and Palmer (2008) estimate that the free transfer of just 6 percent of emissions rights would be sufficient to fully compensate electricity producers for any resulting reductions in their value (although other studies put the figure somewhat higher—perhaps on the order of 25–30 percent). Free allocation of rights in itself does nothing, on the other hand, to shield consumers from increased prices of energy-intensive products: profit-maximizing firms have an incentive to raise prices to cover the opportunity cost of the permits even if they received them free of charge. For the poorest consumers, targeted compensation may be desirable,[16] though of course this also undercuts the net revenue gain. Grandfathering is also, at best, a crude means of managing competitive risks to trade-exposed firms, since the implicit subsidy is not targeted at exports and does not countervail any under-pricing of greenhouse gases in other countries.

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[14] Congressional Budget Office (2009b).

[15] Rate-of-return regulations, as for some utility companies in the United States, may limit such windfalls.

[16] For the United States, Metcalf (2007) shows how income-support measures can protect the poorest.

Transition to full auctioning of emission rights is thus critical. Where substantial grandfathering is politically unavoidable, at least initially, policymakers should commit to phasing it out. The EU aims to do just this: 80 percent of rights for regulated firms outside the power sector are currently proposed to be grandfathered in 2013, falling to 30 percent by 2020. However, experiences in the EU, and from ongoing legislative processes in the United States and Australia, for example, highlight the political difficulties of limiting grandfathering. In the event that international implementation of carbon pricing remains incomplete, these are likely to be most significant in the case of industries that are both energy-intensive and trade-exposed. It is better, however, to address any valid concerns by targeted support rather than general subsidies: possible trade measures are discussed below.[17] In all cases, the value of grandfathered rights should be quantified and reported as a tax expenditure, opening the issue to public debate.

There remains scope in many emerging and developing countries for reducing energy subsidies, with sizable benefits for both public finances and efforts to reduce greenhouse gas emissions. Fuel subsidies, valued at over $300 billion per annum, continue to create significant macroeconomic and fiscal vulnerabilities, particularly in low- and middle-income countries.[18] They are widely recognized to be a badly targeted way of helping the poor: one recent review estimates that over 80 percent of the benefits from fuel subsidies commonly goes to the top three income quintiles.[19] Such subsidies clearly create incentives for emissions-intensive energy use: the IEA (2009) estimates that their elimination could reduce greenhouse gas emissions by around 12 percent by 2050. The recent commitment by G-20 members to eliminate subsidies is an important step, both in itself and as an example for others.

D. Lessons for Instrument Design

Recent experiences may also carry lessons for the choice of carbon pricing instrument—tending to reinforce arguments for emissions taxation over cap-and-trade. The marked downward shift in the demand for emissions rights noted above is a powerful reminder that policy must be set with imperfect knowledge of future mitigation costs—an uncertainty that creates important differences between, on the one hand, setting a carbon tax and, on the other, issuing a fixed volume of tradable emissions permits and letting their price vary to clear the market. Had a carbon tax rather than the ETS been in place in the EU, for instance, the recent reduction in abatement costs would not have brought about a fall in carbon prices but instead have led to a larger reduction in emissions. The relative merits of

[17] Heightened profitability in power generation markets arising from excessive levels of compensation has prompted discussion in Ireland, for example, of possible windfall taxes. Rather than risk compromising the credibility of tax policy, however, it would be better to correct the underlying policy error.

[18] See IMF (2008b,c) and IEA (2008).

[19] Arze del Granado, Coady, and Gillingham (forthcoming).

taxation and cap-and-trade in the face of such uncertainties have been widely debated, with some consensus among economists in favor of the former: this is because marginal costs rise rapidly as abatement levels increase (so that not allowing emissions to adjust to shocks is quite costly), but emissions over any short interval make little difference to the accumulated stock (so that, as noted earlier, temporary variations in emissions have little impact on the damage from climate change).[20] Recent experiences may thus highlight the potential gains from taxation over cap-and-trade. They also illustrate the potential volatility of carbon prices under cap-and-trade. While this may have some desirable properties in terms of automatic stabilization—the carbon charge falling in bad times, rising in good—volatility discourages mitigation-related investments, as risk-averse investors will likely require higher expected rates of return (particularly where investment cannot easily be reversed).[21] Moreover, although experience is not uniformly encouraging, taxation may be less vulnerable to the revenue dissipation problem that has been associated with cap-and-trade.

Where emissions trading is chosen, measures to ensure greater market stability are desirable. Schemes that let the carbon price vary (like cap-and-trade) but also allow some flexibility in aggregate emissions (like a tax) can, in principle, improve on either a simple tax or cap-and-trade.[22] This can be achieved by modifying cap-and-trade schemes to provide, for example, a price floor (or allowing the "banking" of emission rights for future use) and/or price ceilings (through a willingness to auction unlimited rights at a given price). Such measures are not without difficulty, however: ceilings and floors could be vulnerable to speculation, for instance.[23] This makes it important to address the underlying causes of volatility—not only those relating to the current financial crisis, but also, and more importantly, by improving the depth, liquidity, and transparency surrounding these markets (for example, by expanding their sectoral and geographic coverage).

The crisis, and search for recovery, brings the risk of a slide toward protectionism, highlighting issues in the use of border tariff adjustments. Remitting the burden of emissions pricing on exports, and imposing corresponding charges on imports, is attractive in principle: it is one of few potential measures available for both managing competitiveness risks and encouraging broader international cooperation in carbon pricing. But border tax adjustments risk being misused to hide tariffs or export subsidies. Border tax adjustments are an important potential component of an international greenhouse gas pricing regime, and some domestic proposals, such as in the United States, include provisions for them (although their enactment is not expected initially). Careful consideration of detailed design issues

[20] For more detail on this argument, see IMF (2008d).

[21] See Dixit and Pindyck (1994).

[22] The point is elaborated in Roberts and Spence (1976) and Pizer (2002).

[23] As discussed in Newbury and Stiglitz (1981). They may also require difficult judgments regarding future prices.

affecting, for example, the potential WTO consistency of any future border tax adjustment regime—[24]potentially easier for carbon taxes than for emissions trading schemes (as the appropriate price adjustment is harder to determine under the latter)—will be needed. So too will renewed efforts to coordinate reduced trade barriers for environmental goods and services.

III. Stimulating a Lasting and "Green" Recovery

A. Green Spending,[25] Stimulus, and the Recovery

Environmental measures have been a valuable part of fiscal stimulus packages, and will continue to be so as enhanced public spending continues. Although their effects are uncertain and design-dependent, environmental support programs can have strong multiplier effects, and may have particular appeal to policymakers in likely fostering domestic demand more than would, for example, general consumption or income support.[26] A review of the recovery plans of 20 countries identified more than $430 billion (roughly 15 percent of the additional aggregate expenditure) as allocated to climate-related investment themes—although the United Nations Environment Programme (UNEP, 2009a) suggests that very little of this has so far been spent.[27]

A substantial part of stimulus spending, however, is on "dirty" investments, with a risk of entrenching inefficiencies from the under-pricing of emissions. Around $270 billion, for example, may have been allocated to road building projects in the G-20. While these (and other) expenditures may deliver strong nonenvironmental benefits—such as by increasing access to power or transport services in lower-income areas—they risk perpetuating inefficiencies (such as excessive use of motor fuels) arising from the absence of proper carbon pricing. This can be especially costly given the long-lived nature of many such investments, and their potentially large effects on future emissions.

Some climate-related stimulus spending not only helps short-run recovery but also reduces exposure to future energy or emissions price shocks. Subsidies for better building insulation, for instance, may be warranted to overcome informational and other market

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[24] See WTO-UNEP (2009) for a discussion of these issues.

[25] While useful as broad labels, terms like "green spending" and "green investment" are hard to define with any precision. For example, some investments (such as in some sea rise protection, for example) may be clearly "green" in the sense that they would not be worthwhile were in not for their climate implications; others (such as in improved energy efficiency of buildings) have desirable climate implications, and are in that sense "green", but would be worthwhile even in the absence of climate concerns.

[26] Houser and Heilmayr (2009) estimate that a "green" stimulus package in the United States could produce roughly four times more jobs than revenue-equivalent temporary tax rebates.

[27] Robbins, Clover, and Singh (2009).

failures, such as the possibility of incomplete capitalization of energy-saving investments in property prices (due to their hidden nature). These not only support aggregate demand but, by making households and firms more energy efficient, also reduce vulnerability to future energy or emissions price increases. Such benefits can be particularly important in countries rendered more vulnerable by large accumulated debts, or inflexible product or labor markets (and so less able to adjust to price shocks efficiently). However, trade-offs may also be common: many investments likely to deliver long-term environmental benefits—such as in public transport infrastructure—could have a limited short-term impact on demand (due, for instance, to long project lead times).

B. Supporting Greener Growth: Climate-Related Spending in the Longer Term

The implementation, and withdrawal, of environmental stimulus measures should reflect their likely contribution to sustained growth and employment. Full implementation of stimulus spending toward environmental and other objectives will likely be needed to avoid a stalled recovery. But the environmental benefits of many programs alone are unlikely to warrant their continued support once demand conditions are restored: the "Cash for Clunkers" programs, for example—subsidies for the purchase of new cars (such as those implemented in the United States, France, and Germany)—have done much to reinvigorate the hard-hit automotive sector, but are not a good way of realizing fuel efficiency savings. Higher fuel taxes would be more effective in encouraging fewer vehicle miles, and in fostering advancements in "hybrids" and other fuel-efficient technologies.[28]

Careful monitoring and evaluation of such spending programs, including those in the form of tax breaks, is needed. Ongoing evaluation of the contribution of major expenditure programs (environmental or otherwise) to sustaining demand is key. Shadow pricing of the environmental impacts of public investment choices in, for example, energy and transport infrastructure—including the indirect effects on private patterns of consumption, such as car use—can improve resource efficiency. Best practice in this area is to undertake environmental assessments of both policies and major projects: EU guidance on structural funding, for example, incorporates such assessments into cost-benefit analysis.[29] Importantly, long-term spending decisions need to factor in what, it is to be hoped, will be more efficient carbon pricing in coming years.

It is important to guard against spending measures substituting for more efficient emissions pricing—especially given the intense fiscal challenges in many countries. The risk is of an inefficient policy mix, with too much public spending to address problems

[28] Fuel pricing policies have accelerated past technological development. For example, energy intensity of production decreased significantly in the wake of the 1970s oil crises.

[29] Commission of the European Communities (2008b).

caused by under-charging polluters.[30] Not the least of the consequences of such inefficiencies is a weakening of countries' fundamental fiscal positions, already in many cases stressed. Mistakes in this area can be hard to reverse. Many spending measures risk becoming entrenched as political lobbies form around them, even though they may often lack a clear rationale as a permanent policy.

For the development of renewables, in particular, spending support is likely to be less important than credible carbon pricing. Spending on renewables could have some attractions as a stimulus measure, to the extent these activities tend to be relatively labor-intensive (particularly likely during their development phase).[31] But public support in many advanced countries was already high—perhaps too high—before the crisis. The Organization for Economic Cooperation and Development (OECD, 2008) estimates that support for biofuels in the United States, Canada, and the European Union, amounting to around $11 billion in 2006, returned emissions at a cost of between $960 to $1,700 per tCO_2—which is around 70 to 130 times the current EU ETS price.[32] While such low returns might be expected in the early stages of developing new technologies, there is little obvious sign here of under-spending. What is critical for the efficient development of renewables, given the long pay-back periods typical of projects in this area and the potential importance of learning-by-doing, is the assurance of strong pricing of carbon emissions into the future.

Experience suggests a number of areas in which public spending can have a useful role beyond the stimulus horizon:

- ***Reducing market barriers***. Energy efficiency in buildings, discussed above, is a prime example, with limited subsidies having some potential to help reduce the costs of emissions pricing policies (though they are subject to targeting and other problems that may be a greater concern when stimulus needs have subsided).[33] There may also be scope for spending measures to foster the development of private insurance against climate-related risks, which, particularly in developing countries, is often scant—through support for such efforts as developing reliable data on weather patterns.

[30] Regulatory controls (such as urban planning measures) also have an important role, addressing activities that create uninsurable risks or are subject to coordination failures.

[31] Fankhauser, Sehlleier, and Stern (2008). However, renewables are generally more expensive than fossil fuels. Thus, to the extent that public support does not cover the full incremental costs of shifting to cleaner energy mix, this could reduce aggregate income.

[32] See also Anderson (2006).

[33] Joskow and Marron (1992) stress the difficulty of targeting such spending on households and firms that would not have made such investments even in the absence of support.

- ***Supporting new markets for reducing deforestation***. Deforestation accounts for an estimated 17 percent of global emissions,[34] and its avoidance is often likely to be cheaper than mitigation in energy markets.[35] While most resource needs for this could be met privately, given the right incentive structure, significant public investment will likely be required, for example, to develop robust monitoring and verification arrangements, and to compensate affected individuals and communities.[36]

- ***Financing low carbon energy infrastructure.*** Massive investment in energy infrastructure is required, particularly in developing countries: the IEA (2008) estimates that around 1.6 billion people (mostly in sub-Saharan Africa and southern Asia), currently do not have access to electricity. Capital replacement needs are also growing in many advanced countries.[37] Expenditures that might cushion the environmental burden of these future energy needs include more advanced electricity transmission grids (facilitating supply from renewable sources) and enhanced public transit systems.[38]

- ***Investment in adaptation***. Some adverse impacts of climate change are unavoidable. Part of the response, particularly in low-income countries, is likely to be in improving provision of key public goods and services, both those specifically related to climate and those driven by other concerns. The UNEP (2009b) recommends that developing countries allocate around 1 percent of GDP to improving health, education, water, and sanitation services as part of stimulus packages—all of which may have beneficial effects on adaptive capacity. However, while stimulus needs may provide a short-term opportunity to bring forward some expenditures, the challenge of meeting such development gaps is likely to be sustained. In this, as in other areas, advanced country support can play an important role.[39]

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[34] IPCC (2007).

[35] Eliasch (2008) estimates that incentives for forest protection—excluded from the Kyoto Protocol, and a key focus for reform as part of the next international agreement—could reduce the cost of halving global carbon emissions from 1990 levels by up to 50 percent.

[36] McQueen and Vermeulen (2006). Eliasch (2008), for example, estimates that around $4 billion could be needed to build the necessary market and institutional capacity across 40 forest nations.

[37] The U.K. Department for Trade and Industry (2007), for example, suggests that around 30 percent of currently installed electricity generation capacity needs to be retired by 2020.

[38] UNEP (2009). However, available analysis of the fiscal implications of cleaner infrastructure (such as electricity transmission and distribution, and improved public transit provision), is often patchy or inconclusive.

[39] World Bank (2009). Zoellick (2009) recommends that advanced countries allocate 0.7 percent of stimulus packages to a "Vulnerability Fund" for poor countries suffering in the global downturn.

- ***Energy research and development.*** Increased public spending on basic energy research and development (R&D) is essential to reducing future mitigation costs: well-known failures in technology markets, including weak intellectual property rights and the strong spillovers from basic innovation, are likely to lead to too little spending of this kind. Reversing significant declines in public support to basic energy R&D since the 1980s, and shifting its composition away from conventional energy technologies, would likely be beneficial. Determining the proper extent of such support is difficult. But as an indication of possible orders of magnitudes, Newell (2008) recommends roughly a doubling of U.S. energy R&D to $8 billion per year by 2016.

- ***Development of renewables and other new technologies***. Some public spending is clearly needed to promote rapid diffusion of these technologies; for example, to demonstrate technologies that confer knowledge spillovers (as with support for carbon capture and storage by the United States), or overcome barriers to greater renewables diffusion (such as weak capacity of electricity grids to cope with intermittent sources of supply). Stern (2008), for example, advocates $5 billion per year to help support commercialization of 30 CCS plants in the coming years.

Public support will also be needed to deal with the particular challenges faced in developing countries, including through transfers from advanced economies. Around $115 billion of additional energy investment to mitigate the extent of climate change could be needed, annually, over the coming decades in developing countries.[40] The proper balance between public and private contributions to meet these resource needs remains unclear. By way of a crude indication, however, governments currently account for about 15 percent of global investment, mostly in infrastructure, which suggests additional revenue needs of the order of $15 billion to $20 billion per year. This compares with official support for mitigation (both donor-based and via the CDM) in developing countries that is projected to average less than $8 billion per annum year over 2008–12 (although typically leveraging private financing).[41] Some argue, on the basis of this large financing gap, that significant proportions of national stimulus packages should be allocated to support mitigation.[42] This, however, risks confounding policy objectives—stimulating short-term aggregate demand, and securing longer-term growth—that may call for quite different levels and composition of public spending.

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[40] IEA (2008). Figures relate to 550 ppm CO_2 stabilization goal. The World Bank (2009) estimates mitigation costs of around $140 to $175 billion a year over the next 20 years for a 450 ppm CO_2 objective.

[41] World Bank (2009).

[42] For example, Bowen and others (2009) recommends 20 percent, while Mabey (2009) argues for 50 percent.

IV. CONCLUSIONS

Blending the objectives of a sustained recovery and effective climate policies presents both challenges and opportunities. While there are potential "win-win" spending measures conducive to both, the more fundamental linkages and synergies lie in the broader strategies adopted towards each. Greater climate resilience can promote macroeconomic stability and alleviate poverty; and carbon pricing, essential for mitigation, can contribute to the strengthening of fiscal positions that will be needed in many countries (but will require, as with other financial markets, careful regulation and supervision). Even temporarily lower energy prices, reflecting current macroeconomic weaknesses, present some early opportunities in this regard. There are, nevertheless, also difficult trade-offs to face, notably in the somewhat greater caution now warranted in moving to more aggressive emissions pricing.

But the simple policy guidelines for addressing climate issues remain fundamentally unchanged; the need to deploy a range of regulatory, spending, and—very far from least—emissions pricing measures.

References

Anderson, Dennis, 2006, "Cost and Finance of Abating Carbon in the Energy Sector," background paper for the *Stern Review* (London: Imperial College).

Arze del Granado, Javier, David Coady, and Robert Gillingham, forthcoming, "The Welfare Impact of Fuel Subsidy Reform in Developing Countries: A Review of Cross-Country Empirical Evidence", Fiscal Affairs Department, (Washington: International Monetary Fund).

Bowen, Alex, Sam Fankhauser, Nicholas Stern, and Dimitri Zenghelis, 2009, "An Outline of the Case for a Green Stimulus" (London: Grantham Research Institute on Climate Change and the Environment).

Burtraw, Dallas, and Karen Palmer, 2008, "Compensation Rules for Climate Policy in the Electricity Sector," *Journal of Policy Analysis and Management,* Vol. 27, No. 4, pp. 819–47.

Commission of the European Communities, 2008a, "Package of Implementation Measures for the EU's Objectives on Climate Change and Renewable Energy for 2020: Impact Assessment," Commission Staff Working Document, Brussels, January 23.

———, 2008b, "EU Regional Policy Guide to Cost Benefit Analysis of Investment Projects" (Brussels: European Commission).

Congressional Budget Office (CBO), 2009a, "The Budget and Economic Outlook: An Update August" (Washington: U.S. Government Printing Office).

———, 2009b, "Cost Estimate for H.R. 2998 American Clean Energy and Security Act as amended and reported by the House Committee on Rules on June 26" (Washington: U.S. Government Printing Office).

Cottarelli, Carlo, and Jose Viñals, 2009, "A Strategy for Renormalizing Fiscal and Monetary Policies in Advanced Economies," IMF Staff Position Note 09/22 (Washington: International Monetary Fund).

Dixit, Avinash, and Robert Pindyck, 1994, *Investment under Uncertainty* (Princeton: Princeton University Press).

Eliasch, Johan, 2008, *Climate Change: Financing Global Forests: The Eliasch Review,* (London: Earthscan Publications Ltd.).

Fankhauser, Sam, Friedel Sehlleier, and Nicholas Stern, 2008, "Climate Change, Innovation and Jobs," *Climate Policy,* Vol. 8, No. 4, pp. 421–29.

Furman, Jason, Jason Bordoff, Manasi Deshpande, and Pascal Noel, 2007, *An Economic Strategy to Address Climate Change and Promote Energy Security* (Washington: The Brookings Institution).

Hallegatte, Stéphane, and Michael Ghil, 2008, "Natural Disasters Impacting a Macroeconomic Model with Endogenous Dynamics," *Ecological Economics,* Vol. 68, No. 1–2, pp. 582–92

Hourcade Jean-Charles, Damien Demaill, Karsten Neuhoff, and Sato Misato, 2007, *Differentiation and Dynamics of EU Industrial Competitiveness* (Cambridge: Climate Strategies).

Houser, Mohan, and Robert Heilmayr, 2009, *A Green Global Recovery? Assessing U.S. Economic Stimulus and Prospects for International Cooperation* (Washington: Peterson Institute for International Economics and World Resource Institute).

International Energy Agency (IEA), 2008, *World Energy Outlook 2008* (Paris: IEA).

———, 2009, *World Energy Outlook 2009* (Paris: IEA).

International Monetary Fund, 2008a, *World Economic Outlook*, *April 2008* (Washington).

———, 2008b, "Food and Fuel Prices—Recent Developments, Macroeconomic Impact, and Policy Responses," June 30 (Washington). Available via the Internet: www.imf.org/external/np/pp/eng/2008/063008.pdf.

———, 2008c, Food and Fuel Prices—Recent Developments, Macroeconomic Impact, and Policy Responses, An Update," September 19 (Washington). Available via the Internet: www.imf.org/external/np/pp/eng/2008/091908.pdf.

———, 2008d, The Fiscal Implications of Climate Change," February 22 (Washington). Available via the Internet: www.imf.org/external/np/pp/eng/2008/022208.pdf.

———, 2009a, "Contractionary Forces Receding But Weak Recovery Ahead" *World Economic Outlook Update*, July 2009 (Washington). Available via the Internet: http://www.imf.org/external/pubs/ft/weo/2009/update/02/index.htm.

———, 2009b, "The State of Public Finances: A Cross-Country Fiscal Monitor," IMF Staff Position Note 09/21 (Washington).

———, 2009c, "The State of Public Finances: Outlook and Medium-Term Policies After the 2008 Crisis," March 6 (Washington). Available via the Internet: www.imf.org/external/np/pp/eng/2009/030609.pdf

Intergovernmental Panel on Climate Change (IPCC), 2007, *Fourth Assessment Report, Climate Change 2007: Synthesis Report* (Geneva: IPCC).

Joskow, Paul, and Donald Marron, 1992, "What Does a Negawatt Really Cost? Evidence from Utility Conservation Programs," *The Energy Journal*, Vol. 13, No. 4, pp. 41–74.

Mabey, Nicholas, 2009, *Delivering a Sustainable Low Carbon Recovery* (London: E3G).

McQueen, Duncan, and Sonja Vermeulen, 2006, *Climate Change and Forest Resilience* (London: International Institute for Environment and Development).

Metcalf, Gilbert, 2007, "A Proposal for a U.S. Carbon Tax Swap: An Equitable Tax Reform to Address Climate Change" (Washington: The Brookings Institution).

National Audit Office (NAO), 2007, *Climate Change Levy and Climate Change Agreements: A Review by the National Audit Office* (London: NAO).

Newbery, David, and Joseph Stiglitz, 1981, *The Theory of Commodity Price Stabilization: A Study in the Economics of Risk* (Oxford: Clarendon Press).

Newell, Richard, 2008, *A U.S. Innovation Strategy for Climate Change Mitigation* (Washington: The Brookings Institution).

Nordhaus, William, 2007, "To Tax or Not to Tax: Alternative Approaches to Slowing Global Warming," *Review of Environmental Economics and Policy*, Vol. 1, No. 1, pp. 26–44.

Organization for Economic Cooperation and Development (OECD), 2008, *Biofuel Support Policies: An Economic Assessment* (Paris: OECD).

Pizer, William, 2002, "Combining Price and Quantity Control to Mitigate Global Climate Change," *Journal of Public Economics,* Vol. 85, No. 3, pp. 409–34.

Robbins, Nicholas, Robert Clover, and Charanjit Singh, 2009, "A Climate for Recovery: the Colour of the Stimulus Goes Green" (London: HSBC).

Roberts, Marc, and Michael Spence, 1976, "Effluent Charges and Licenses under Uncertainty," *Journal of Public Economics*, Vol. 5, No. 3–4, pp. 193–208.

Stern, Nicholas, and others 2007, *The Economics of Climate Change,* "The Stern Review" (Cambridge: Cambridge University Press).

Stern, Nicholas, 2008, "The Economics of Climate Change," *American Economic Review: Papers & Proceedings,* Vol. 98, pp.2–37.

U.K. Department for Trade and Industry, 2007, *Meeting the Energy Challenge: A White Paper on Energy* (London: Her Majesty's Government).

United Nations Environment Programme (UNEP), 2009a, *A Global Green New Deal*: *An Update for the G-20 Pittsburgh Summit* (New York: United Nations).

———, 2009b, *A Global Green New Deal* (New York: United Nations).

World Bank, 2009, *World Development Report 2010: Development and Climate Change* (Washington: World Bank).

World Trade Organization (WTO) and the United Nations Environment Programme (UNEP), 2009, *Trade and Climate Change* (Geneva: UNEP).

Zoellick Robert, 2009, "A Stimulus Package for the World," *New York Times*, January 22.