THE WORLD BANK GROUP

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Green Growth Report

Office of the Chief Economist, Sustainable Development Network

This document contains an Executive Summary and the Overview Chapter of the forthcoming Flagship Report on Green Growth. It has been prepared for an Executive Directors' Seminar to be held February 23, 2012.

Executive Summary

Overview. Current growth patterns are not just unsustainable, they are also inefficient. Therein lies the potential for green growth—growth that is efficient, clean and resilient. Greening our growth patterns is neither very difficult technically nor likely to be excessively costly. Much of it, in fact, entails good growth policy. However, key obstacles exist in the form of weak governance, deeply entrenched behaviors and social norms, and upfront financing constraints. Moreover, there is urgency to green growth; business-as-usual economic activity will irreversibly deplete critical resources and lock communities and countries into unsustainable and inefficient socio-economic systems that will be either impossible or prohibitively costly to reverse. Avoiding these outcomes is key to reconciling economic growth and environmental sustainability and getting on a path to achieve sustainable development.

Chapter 1 – An Analytical Framework for Green Growth. Green policies can contribute to economic growth by correcting market failures that reduce economic efficiency. The extent to which they do so depends on country-specific conditions, and policy design. The balance between costs and benefits depends on the scope of the policies and the extent to which they are sequenced appropriately. Priority should be given to policies that help prevent the world from getting locked into settlement and production patterns that would be prohibitively expensive and complex to modify.

Chapter 2 – Fostering Environment-Friendly Behavioral Change through Market and Non-market Mechanisms. Green growth requires the classical tools of economics (valuation of environmental assets and incentive-based instruments). For a variety of reasons, including market failures, behavioral biases and political economy, however, these tools cannot induce all of the changes need to protect the environment. Other devices, such as measures to supplement incomplete markets, policies designed to address cognitive biases and a judicious use of information to influence economic actors, are needed as well.

Chapter 3 – Innovation and Other Industrial Policies. Green industrial policies, whose main objective is to transform economic structures and help green technologies enter the market, are critical instruments for green growth. However, they should be deployed with caution, heeding the lessons of the past and the need to account for both market and governance failures. This chapter reviews the usual justifications for industrial policies, addresses the extent to which they extend to green growth strategies, and discusses the policy implications for the design of effective green innovation and other industrial policies. To promote green growth, industrial and environmental policies work best in tandem, with a mix of policy instruments to address the complementary industrial (including knowledge) and environment-related market failures, depending on the local environmental, technological, and implementation context.

Chapter 4 – Human Capital: Implications of Green Growth Policies for Labor Markets and Job Creation. The concept of “green jobs” still lacks a clear definition. Many studies claim large green jobs creation but greater scrutiny is warranted. The net impact depends on the characteristics of labor markets, the nature of the policy intervention and the extent of adjustment needed. Policy makers need to tackle potential skills shortages which can limit job creation, as well as learn from the lessons of trade adjustment that increases worker mobility.

Chapter 5 – Natural Capital. Green growth strategies can be deployed in sectors that are intensive in "natural capital." For extractable but renewable resources (capture fisheries, natural forests, soil, and water), policy should center on defining property rights and helping firms move up the value chain. For cultivated renewable resources (crops, livestock, aquaculture, and forest plantations), innovation needs to be harnessed to manage tradeoffs between growth and the environment. For "nonprovisioning services" (biodiversity, watershed services, and climate regulating services), efforts should concentrate on creating knowledge and incorporating economic values of these services in policy decisions. For nonrenewable resources (oil, gas, coal, and minerals), the focus should be on rent recovery and reinvestment.

Chapter 6 – Physical Capital: The Role of Infrastructure in Green Growth Strategies. Infrastructure policies are central to green growth strategies, because of their unique characteristics, namely the large potential for regret (due to the large inertia embodied in infrastructure investments) and the substantial potential for co-benefits (linked to the current gap in infrastructure service provision). The infrastructure gap is both an opportunity—the fact that much remains to be built makes it possible to build right—but also a challenge. Huge unmet needs imply difficult trade-offs between "building right" and "building more" particularly given the context of frequently binding financing and fiscal constraints. A framework for green infrastructure must build on efforts to address overall constraints on infrastructure finance, and develop strategies to minimize the potential for regrets and maximize short-term co-benefits to address social and political acceptability constraints.

Chapter 7 – Crafting a Green Growth Strategy. Green growth strategies reflect tradeoffs—between predictability and flexibility and between relevance and enforceability. All strategies must be customized to specific situations and account for uncertainty. But step-by-step guidelines, including a checklist, can help analysts and decision makers structure the process and craft strategies based on multicriteria analysis and robust decision making.

Overview

***Abstract**: Current growth patterns are not just unsustainable, they are also inefficient. Therein lies the potential for green growth—growth that is efficient, clean and resilient. Greening our growth patterns is neither very difficult technically nor likely to be excessively costly. Much of it, in fact, entails good growth policy. However, key obstacles exist in the form of weak governance, deeply entrenched behaviors and social norms, and upfront financing constraints. Moreover, there is urgency to green growth; business-as-usual economic activity will irreversibly deplete critical resources and lock communities and countries into unsustainable and inefficient socio-economic systems that will be either impossible or prohibitively costly to reverse. Avoiding these outcomes is key to reconciling economic growth and environmental sustainability and getting on a path to achieve sustainable development.*

Contents

Our current growth patterns are not just unsustainable. They are deeply inefficient. Both economic theory and ample empirical evidence support the notion that it is possible to grow cleaner without necessarily growing slower by addressing the many market and governance failures that plague our economic systems. There are trade-offs and upfront costs, but there are also plenty of co-benefits to be reaped and waste to be eliminated. Tackling these can reduce the costs of achieving more sustainable growth and allow for higher long-term welfare.

Current growth patterns stand in the way of sustainable development and its objectives of social, environmental and economic sustainability. The last twenty years have shown that the economic and social pillars are not just highly compatible, they are largely complementary. Growth drives poverty reduction (though the extent to which it does so depends on the degree of inequality), and improved social outcomes, such as better health and education and greater equality of opportunity, are good for growth. Not so with the economic and environment pillars: for the last 250 years growth has largely come at the expense of the environment. And environmental damages are reaching a scale at which they are beginning to threaten both growth prospects and the progress achieved in social indicators.

There is a need for rapid action to keep the costs of greening growth manageable and avoid irreversible losses: rapid action in developing countries, who will account for the vast majority of global growth in income, infrastructure, and population in the coming decades and who need to chose whether to build right or potentially face the need for costly policy reversals in the future; and rapid action in high-income countries, who, with 16 percent of world population, still account for more than three quarters of global consumption and 41 percent of global emissions. Changing consumption and production patterns in high-income countries is also key to creating the scale of demand for green technologies that will stimulate technological changes and the scale of production necessary for prices to drop and green technologies to become competitive.

The approach of this report is largely an economic one, with some foray into what social psychology can tell us about the determinants of human behavior. No doubt it could be enriched by inputs from other social sciences and the natural sciences. However, this report was motivated by the desire to understand whether there is economic legitimacy to the notion of green growth, or whether it is an aspirational goal—something desirable from an environmental and ethical point of view, but unachievable given competing economic needs. So we examine green growth using the standard tools of mainstream growth and environmental economics.

Fortunately, much of green growth policy is good growth policy. It is about getting prices right and fixing markets, addressing coordination failures and knowledge externalities, and assigning property rights. As “natural capital”, the environment is an input into our production function. Like other forms of capital, it requires investment, maintenance and good management if it is to be productive and fully contribute to growing output and prosperity. There are plenty of ethical and cultural reasons to protect our environment. But it is also good economics.

Conversely green growth policies are no substitute for good growth policies. A recent study of South Africa looked at the potential of green growth policies to create jobs. The conclusion was that while the

idea of developing green industries (e.g. solar power) was appealing, it had little chance of succeeding unless structural problems such as the regulatory obstacles to the creation of small enterprises and the lack of skilled workers were addressed. Similarly, investments to promote R&D in green industries will do little for countries with educational and financial systems that produce few skilled workers and little risk capital.

The key challenges for green growth stem not from the perceived additional costs of growing clean, but from market and governance failures and deeply entrenched behaviors and social norms. Macro estimates of the investments needed to manage climate change are relatively modest (some 0.5 percent of global GDP, less than annual global fossil fuel subsidies and one-eighth to one-sixth of what developing countries need to invest anyway in infrastructure), but these additional costs are still problematic in the broader context of a global shortfall in infrastructure financing. Micro estimates of the impact on firms of more stringent environmental regulation show their impact on productivity and competitiveness to be modest and sometimes even positive, thanks to innovation (Ambec and others 2010).

As to *how* to green growth, textbooks going back at least to the 1950s have offered the basic instruments, with environmental taxation, norms, and regulations being the main tools of a green growth strategy. Today, technology is making it easier to implement these measures and monitor their impacts. But making these measures work is complex in real world settings plagued with governance failures, market failures over and above those related to environmental issues, and entrenched behaviors. It requires complementary policies—public investments, innovation and other industrial policies, education, training and other labor market reforms, communication campaigns and much else.

Success requires designing efficient environmental policies in ways that are sensitive to the political economy of reform and support social development. It requires social and political acceptability. Most if not all green policies incur short-term economic costs, such as higher investment or operational costs, or involve redistribution from one group to another. Green growth strategies, therefore, should strive to reconcile the short and long term by focusing on measures with potential synergies and economic benefits, such as increased efficiency, job creation, and poverty alleviation, and by mitigating trade-offs across both space and time.

Success also requires addressing upfront financing constraints, which can be binding in developing countries. China's cities are developing in a sprawling fashion because sale of land at their peripheries is the only source of revenue available to city governments. While such sales enable municipalities to finance the construction of much needed urban infrastructure, it also locks cities into inefficient and environmentally costly patterns of development. So sustainable urban planning in China is conditional upon fixing the local government revenue system and allowing cities to borrow responsibly. The stakes are high: by 2025 China will be home to 10 of the world's 40 megacities according to UN projections, Capital constraints can similarly constrain otherwise attractive investments in energy efficiency and renewables. Both require upfront financing even if much of the initial cost is offset by subsequent savings.

Green growth approaches should thus be understood as a way of operationalizing sustainable development by aligning economic and environmental goals and balancing urgent social and growth needs with the risk of irreversibility and lock-in. As such, they should focus on what is required in the next 5 to 10 years to sustain robust growth while avoiding locking economies into unsustainable patterns and reducing the potential for regret.

These messages are developed throughout this report. Chapter 1 lays out an analytical framework for the economics of green growth to make the case that our current system is inefficient thereby offering opportunities for cleaner (and not necessarily slower) growth; chapters 2 and 3 discuss how much of green growth is really good growth, with a need to fix prices and markets but with careful attention to how people react to these signals (chapter 2) and the need to rectify market and governance failures through the careful use of innovation and other types of industrial policies (chapter 3).

Chapters 4, 5, and 6 focus on human, natural, and physical capital, respectively, and their roles in a greener production function model. Chapter 4 reviews the debate on green jobs and points out that green policies are no substitute to fixing labor market and the business environment. Chapter 5 discusses what we have learned over the last 20 years about how to manage natural capital and the many externalities and market failures that plague it. Chapter 6 argues that infrastructure is at the core of green growth policies because it contains a high potential for both regret (given the tremendous inertia built into infrastructure investments) and co-benefits. It notes the challenges posed by financing constraints and limited planning capacity to our ability to build the infrastructure needed for green growth.

Chapter 7 then filters the key lessons through a political economy lens. It provides a framework for building a green growth strategy given the technical tools available, the need to navigate between the twin risks of market and governance failures, and the uncertainties that prevail about the future climate, its impacts, and the technologies and policies (e.g. carbon prices) that will be available to cope with it. It emphasizes the need for country-specific policies and argues that countries will differ as to both the potential for greening growth and the proper mix of policy tools to do so.

The conclusion is clear: like others we find greening growth is neither unaffordable nor technically unmanageable (Box 0.1). Moreover, it is desirable given its welfare implications. There are plenty of co-benefits between green and growth which can help offset some of the very real trade-offs that do exist. But greening growth requires carefully designed policies that navigate market and governance failures and tackle long-standing challenges such as upfront financing constraints, behavioral patterns and the political economy of reforms. Feasible, clearly. But challenging, particularly given the urgency.

Box 0.1 Green growth and green economy

OECD (2011) defines green growth as "*fostering economic growth and development, while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies.*" UNEP defines a green economy as "*one that results in improved human well-being and social equity, while significantly reducing*

environmental risks and ecological scarcities" (UNEP 2011). Like the approach promoted in the present report, these definitions are consistent with sustainable development as an ultimate objective, and green growth/economy as a mean to reconcile its economic and environmental pillars, without ignoring social aspects.

These reports are fully consistent in terms of policy advice: all stress the need for policy action to correct environmental and non-environmental market failures and the importance of a policy mix that includes but is not restricted to price instruments. And all believe in the necessity of greening our economies and in the possibility of making growth more efficient, resilient and cleaner without necessarily slowing it.

This common vision shared by UNEP, OECD and the World Bank will be further developed in the context of the Green Growth Knowledge Platform, a partnership of the three institutions and the Global Green Growth Institute. The GGKP, which was launched in Mexico City in January 2011, is a global network of researchers and development experts that seeks to identify and address major knowledge gaps in green growth theory and practice. Through widespread consultation and world-class research, the GGKP hopes to provide practitioners and policymakers with better tools to foster economic growth and implement sustainable development (www.ggkp.org).

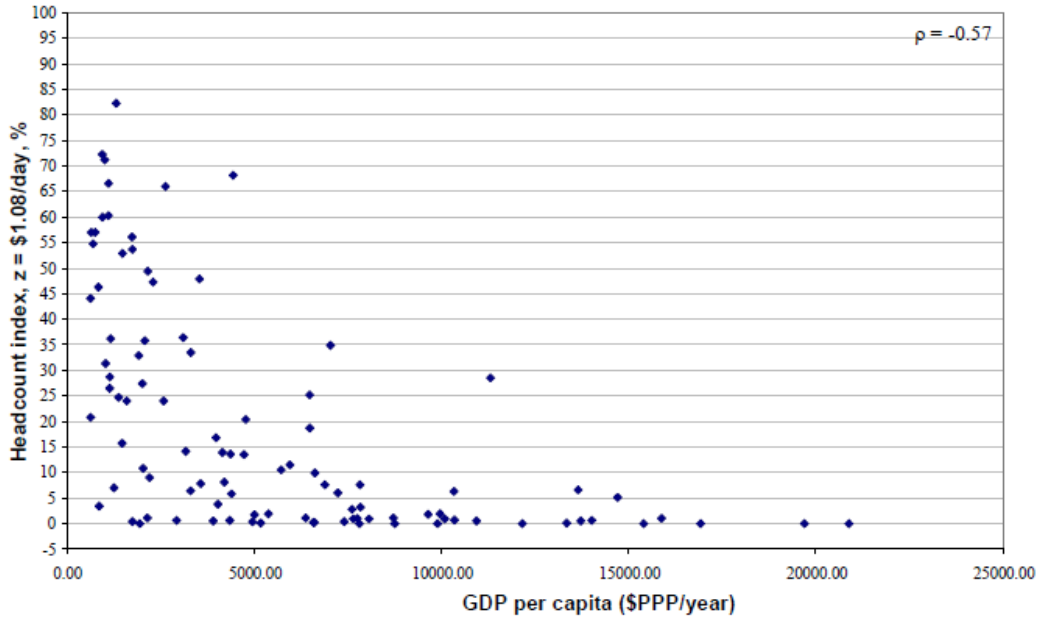
What follows summarizes the five messages of this report.

Message 1. Making development sustainable requires greening growth

The perception of the importance of growth as a driver for development has changed since the 1992 Rio convention endorsed the notion that, to be sustainable, development had to be balanced across its social, economic and environmental pillars.

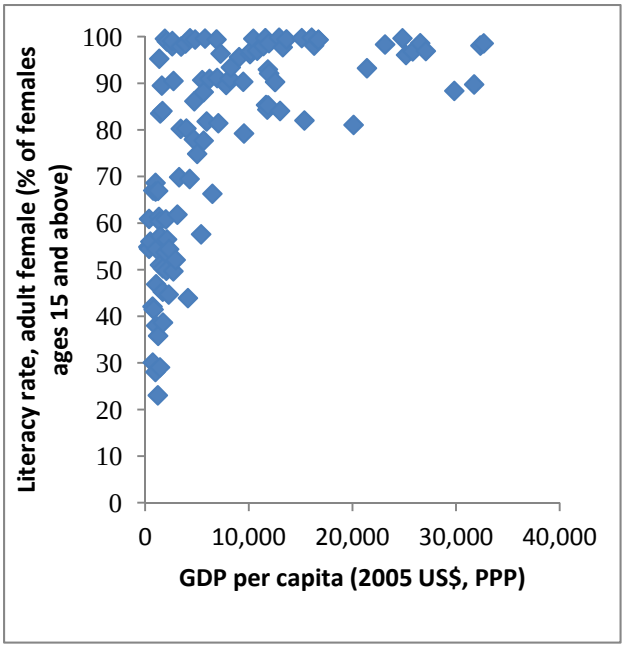
Growth—even measured with such an imperfect metric as GDP—is now recognized as a critical driver of poverty reduction (Ferreira and Ravallion 2008). It has resulted in an 80 percent increase in GDP per capita in developing countries over the last 20 years despite substantial increases in population. Living standards have improved for many, with more than 500 million rising out of poverty and remarkable progress in literacy and education, life expectancy, infant, child and maternal mortality and malnutrition indicators. And while much of the global poverty reduction has been driven by China, other countries that experienced growth also saw rapid poverty reduction. Ghana for example grew much faster than the African average and managed to reduce its poverty rate from 51 to 30 percent between 1990 and 2005 (World Development Indicators 2011).

Figure O.1a: Poverty levels drop as income increases (poverty headcount and GDP per capita)



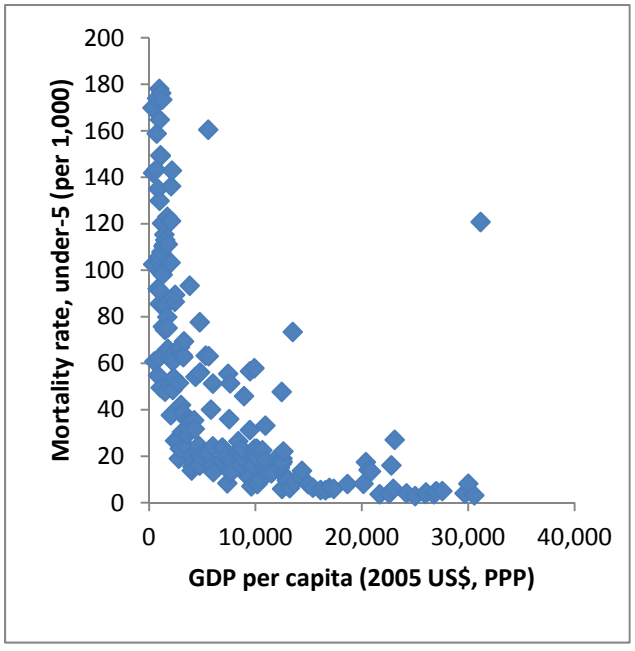
Source: Ferreira and Ravallion (2008)

Figure O.1b: Female literacy rate and income per capita, 2009.



Source: World Development Indicators.

Figure O.1c: Mortality rate for children under 5 and income per capita, 2009.



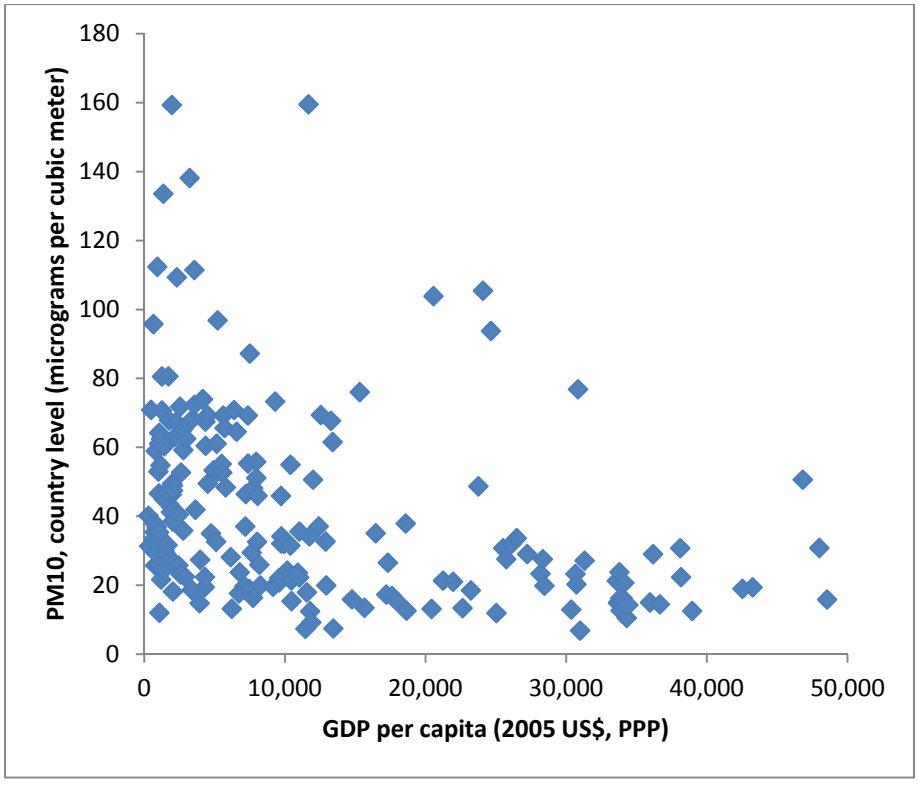
Source: World Development Indicators.

It also turns out that growth needs not cause income inequality. The famous Kuznets curve argument that posits that inequality would first increase and then decrease with income is not supported by the evidence. Inequality increased substantially in recent decades in China (as suggested by the Kuznets hypothesis), but also in the United States and most of Europe. And it declined in much of Latin America (Milanovic forthcoming). Some countries reduce inequality as they grow; others let it increase.

The implication then is that the links between the economic and social pillars of sustainable development are generally self-reinforcing. Economic and social improvements tend to go hand in hand, and even more so in the presence of policies to reduce inequality. At the very least, there is now broad consensus that worsening social indicators or inequality are not some inevitable consequences of early growth processes. Indeed, there is much to suggest that improvements in human capital and the quality of life of poor people contribute to subsequent economic growth (World Bank 2006g).

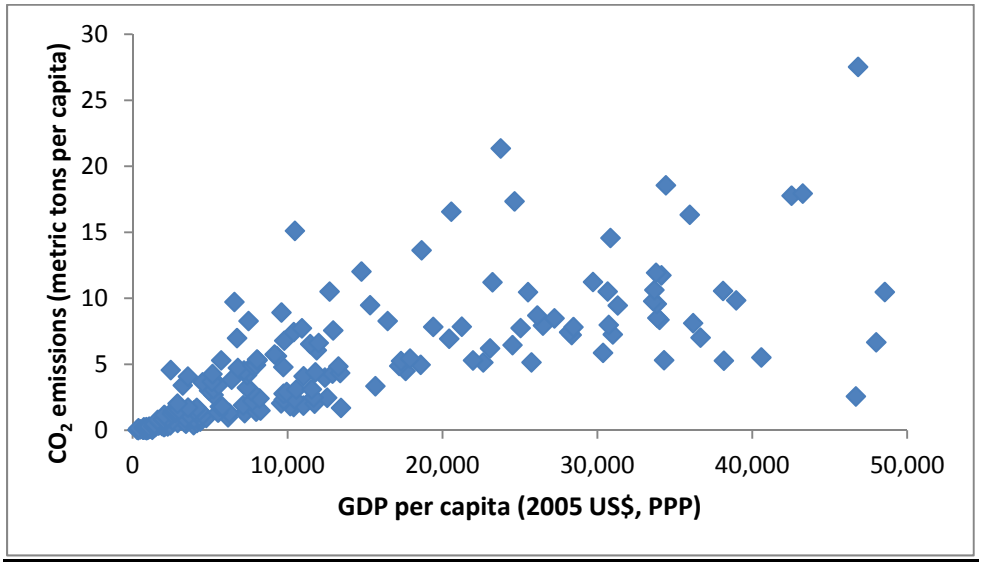
The story is not so simple when it comes to the economic and environmental pillars, though there are some parallels. In particular, just as with inequality, overall environmental performance does not first get worse and then improve with income—no Kuznets curve here either. Of course, a number of local and visible environmental public goods do worsen at first and eventually improve with income—typically local air quality. But this is not true of local pollutants with invisible or long term impacts (e.g. water quality, pesticide accumulation), or global pollutants (e.g. greenhouse gases). These get worse with higher income.

Figure O.2a PM10 tends to decline with income (PM10 concentration and income per capita 2008).



Source: World Development Indicators.

Figure O.2b: …while CO2 emissions tend to increase with income (CO_2 emissions and income per capita, 2008).



Source: World Development Indicators.

So economic growth causes environmental degradation—or has for much of the last 250 years. Yet continued growth will be needed to address the remaining development challenges. Even with the rapid decline in the share of people living in poverty, close to 1 billion could still be living on 1.25 USD per day in 2015. Some 1.3 billion people have no access to electricity, 900 billion do not have access to clean water and around 800 million rural dwellers do not have access to an all-weather road and are cut off from the world in the rainy season (Fay and others 2010).

In the face of this degradation, many in high-income countries have argued against the need for more growth, pointing out that what is needed is greater prosperity rather than higher GDP (Marglin 2010, Victor 2008). They point to the happiness literature that suggests that above 10,000 USD to 15,000 USD per capita, further growth does not translate into greater well being (Easterlin 1995, Layard 2005) and conclude that redistribution of wealth should be prioritized over growth.

While this argument has value—particularly its emphasis on prosperity rather than growth—it remains more relevant for high-income countries, where average annual incomes hover around 36,000 USD. Developing countries are still far from the point at which more wealth will bring decreasing returns to well-being: average income is around 5,600 USD per capita—1,200 USD among low-income countries (World Development Indicators 2011). A redistribution of world income across rich and poor countries—even if it were politically feasible—would leave all with an income of about 8,000 USD per person per year.

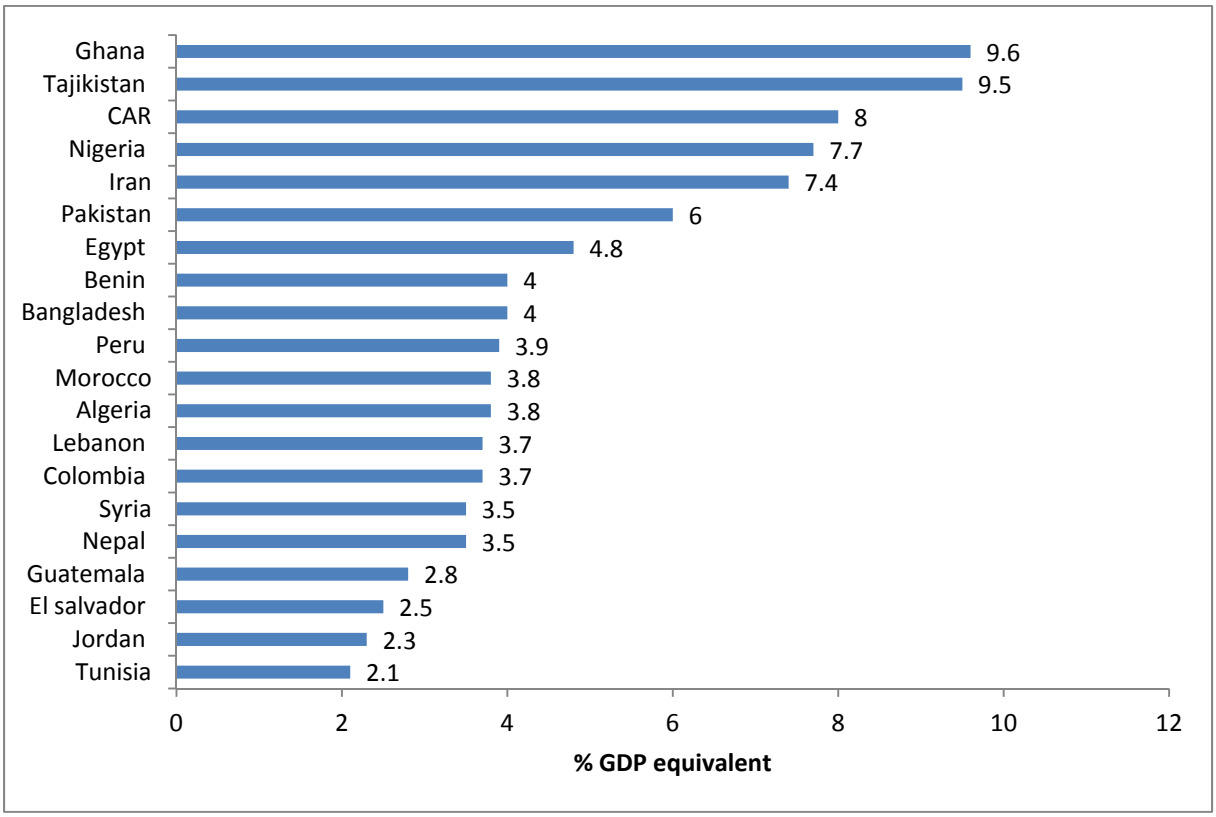
Further, even after the rapid growth of the last decade, the 84 percent of the world's population who live in developing countries still only account for around a quarter of global income and consumption.

Continued growth at about the same speed as that of the last 20 years would mean developing countries would account for about half the world's income and consumption (but close to 90 percent of world population) by 2050.

In sum, growth is a necessary, legitimate and appropriate pursuit for the developing world—but so is a clean and safe environment.

Further, environmental degradation itself is costly: equivalent to some 2 percent of GDP in Tunisia and and more than 7 percent in Iran (Figure O.3). Further, much of environmental destruction is driven by market failures and inefficient policies. Correcting them can therefore result in more efficient and productive economies, with increased output and prosperity. It may be possible to have green growth without too much of a cost, and possibly with some significant co-benefits.

Figure O.3. Environmental degradation can be very costly (cost of environmental degradation expressed as percentage of GDP equivalent)



Sources: World Bank 2004, 2005a, 2006a-b-c-d-e-f, 2007a-b-c, 2008, 2009, 2010a-b-c, 2011

Without aggressive policies growth will continue to degrade the environment and deplete resources critical to the welfare of future generations. But many argue that the needed efforts would be too costly; that they would slow growth and destroy jobs; that poor countries cannot afford them. Evidence reviewed in this report does not support these arguments.

Message 2. Current patterns of growth are not only unsustainable they are wasteful

There is mounting evidence that our patterns of growth and consumption are unsustainable at the scale required by our current and projected population. Much of this, however, is due to inefficient production and consumption and poor management of natural resources.

Unsustainable[1]

Rising incomes and population growth have driven the expansion and intensification of agricultural production around the world, in many cases exacerbating agrochemical pollution, soil exhaustion, and deforestation. Associated land-use changes, for example, cost forests 5.2 million hectares annually from 2000-2010. While there were some forest area gains in temperate and boreal zones, losses continued to mount in tropical – and hence more densely bio-diverse – regions (FAO 2010a). In fact, by 2008 one quarter of the world's land surface was degraded from soil erosion, salinization, nutrient depletion, and desertification (Bai and others 2008).

Income and population growth have also stretched water supplies. Water withdrawals have tripled in the last 50 years, leading to water scarcity and ground water depletion (World Bank 2007c). Withdrawals are projected to increase in developing countries by another 50 percent by 2025, by which time roughly 5.5 billion people – two-thirds of the projected global population – will live in areas facing moderate to severe water stress (UNESCO-WWAP 2006).

Growth has similarly strained ecosystems, with roughly 60 percent of ecosystem services now of lower quality than 50 years ago (MEA 2005), largely due to under-valuation in national systems of wealth accounting. Additionally, the current rate of species extinction, stemming mainly from habitat loss and degradation, is 100 to 1,000 times higher than before humans walked the planet (Pimm and others 1995). 875 species went extinct in 2008, and more than 17,000 others are at high risk (IUCN 2009).

Lastly, carbon dioxide emissions are wreaking havoc on the world's oceans. Due to global warming we have already committed to high probabilities of coral bleaching and mortality by the late 21st century, which would significantly impact reef ecosystems (World Bank 2009). The concurrent acidification of oceans, which absorb about one quarter of the excess carbon dioxide in the atmosphere, is threatening marine food webs and could undermine the global fishing industry and food security more generally (Ocean Acidification Reference User Group 2009).

Wasteful

As mentioned earlier, the environment can be thought of as natural capital that is often inefficiently managed, with many precious resources wasted. This is partly due to the fact that many natural resources are common property, so consumption by one person precludes consumption by another, and it is hard to exclude potential users. Open resource regimes for common property create incentives to use up such resources as quickly as possible. Open access fisheries are a classic example in which catch

1 This section draws from World Bank 2012.

per fisher and per vessel have been declining steadily due to overfishing, and continued depletion threatens the livelihoods of more than 100 million people and the food security of many more. More than half the world's fish stocks are exploited at or close to maximum sustainable production levels, yet fishing capacity is estimated to be 2.5 times sustainable harvest levels (FAO 2010b).

When clear property rights are established, natural resources tend to be better managed. Fisheries that instituted individual transferable fishing quotas (ITQs) found a dramatic increase in catch within a few years of ITQ implementation, and a great decrease in the chance of fishery collapse. A study of some 120 fisheries that implemented an ITQ found that the catch was multiplied by a factor of five within seventeen years of establishing the ITQ (Heal and Schlenker 2008). So the fisheries prospered and generated a better living for those who worked in them, produced a large amount of food, and maintained the health of fish stocks.

Similarly, land tenure results in better soil management: in Rwanda, for example, a land tenure regularization program resulted in an immediate doubling of investments in soil conservation (Ali, Deininger, and Goldstein 2011). Many more such programs are needed for fisheries, water resources, soil and land management.

Subsidies exacerbate common property problems. Global subsidies to fisheries are estimated at 10-40 billion USD (Box O.2) and are partly to blame for the six-fold increase in the fleet capacity index[2] between 1970 and 2005 (Arnason, Killeher, and Willman 2009). In Mexico, subsidies for energy used in irrigation amounting to around 1 percent of GDP are exacerbating excessive groundwater withdrawals and the depletion of key aquifers. India suffers from the same problem, in addition to spending some 2 percent of GDP on a fertilizer subsidy excessively weighted in favor of nitrogen; the resulting fertilizer is causing serious pollution problems.

The value of services provided by natural capital is hard to estimate and, as such, are often undervalued, let alone priced.[3] Thus, mangroves are pulled out to create waterfront real estate or shrimp farms, thereby increasing exposure to storm surge, reducing fish breeding ground, and depleting wood resources for local communities. Deforestation in Ethiopia, where less than 3 percent of the country's native forests remain, threatens groundwater resources and has resulted in severe erosion. The value of the services provided by forests and well-managed eco-systems is illustrated by the impact of reforestation programs. In China's Loess Plateau, government-led reforestation programs were associated with a near doubling in household incomes, as well as reduced frequency of landslides and flooding (World Bank 2005b).

2 The fleet capacity index is the relationship between the capacity of a fishing fleet to catch a particular quantity of fish and the quantity of fish that it actually catches.

3For this reason the World Bank, UNDP, UNEP and other agencies and NGOs have launched a partnership on Wealth Accounting and Valuation of Ecosystem Services (WAVES) whose aim is to promote wealth accounting and develop the tools needed for its improved implementation, notably better information on how to value ecosystems.

In addition to our management of natural resources, our production and consumption processes are often wasteful. In no sector is this more obvious than in energy Existing energy-efficiency technologies can cost-effectively reduce by at least 30 percent energy use in new buildings. In fact, making new buildings in China more energy efficient would reduce energy costs by more than 50 percent, while increasing construction costs by only 10 percent. Additionally, existing technologies and best practices could reduce energy consumption in the industrial sector by 20 to 25 percent without slowing growth. Globally, a dollar spent on energy efficiency saves two dollars in investments in new supply, with the savings even greater in developing countries (World Bank 2009). Waste also plagues food production. Some 15 to 30 percent of food produced in developing countries is lost before it reaches markets due to poor storage and transport facilities. In high-income countries, meanwhile, one-third of food is wasted through losses in supermarkets and homes and "plate-waste" (Foresight 2011).

The possibility of solving market and governance failures opens the way to policies that have both economic and environmental benefits, and is at the heart of green growth strategies. These market and governance failures have long been understood, and their persistence suggests that the costs and difficulty of correcting them should not be underestimated. The ability to address inefficiencies will be highly dependent on the context, on the particular market failure that drives environmental and non-environmental sub-optimalities, and on local capacity and willingness to act. Overcoming these challenges is central to green growth. Fortunately, much of what is required is simply good growth policy.

Message 3. Much of green growth policy is good growth policy, though it is no substitute

Greening growth is mostly about addressing market failures and "getting the price right" by introducing environmental taxation, pricing environmental externalities (for example through a carbon price), reducing inappropriate subsidies (such as the environmentally harmful subsidies to fossil fuels, agriculture, water and fisheries, which are estimated to amount to some 1 to 1.2 trillion USD, Box O.1) or creating tradable property rights. [4]

Box O.2 The cost of environmentally harmful subsidies: USD 1-1.2 trillion annually

Very rough estimates of environmentally harmful subsidies place them at USD 1-1.2 trillion. This includes:

Fossil fuel subsidies: USD 455-485 billion. This includes subsidies to fossil-fuel production or use in OECD (USD 45-75 billion a year between 2005 and 2010) and to consumption in developing and emerging economies (USD 409 billion in 2010).

Subsidies to agriculture: USD 390 billion. This represents total support to the agriculture sector in OECD countries.

Subsidies to water: USD 200-300 billion. Limited data is available on this topic but Myers and Kent (2001) estimated water sector subsidies at USD 230 billion in 2000 and McKinsey (2011) cites estimates of $200-300.

Subsidies to fisheries: USD10-40 billion per year. Different estimates range from USD10 billion per year (Arnason, Killeher, and Willman 2009*)* to USD 27 billion (UNEP 2011).

These numbers are consistent with a recent estimate by McKinsey of USD 1.1 trillion (McKinsey 2012). While these estimates are surely not exhaustive (they do not for example include agriculture subsidies in developing countries) they at least make the point that substantial resources are dedicated to what are largely environmentally harmful subsidies.

Sources: OECD 2011a-b, IEA 2011.

Good growth policy (which is no textbook policy)

As with all good economic policymaking, textbook policy recommendations–however appropriate—must be applied with a good understanding of behaviors and political economy, and the associated limitations of prices and taxation.

First, getting prices right may be difficult because of political or social acceptability issues. Even when a price change has positive distributional impacts, it can still hurt the poor. In such a case, it is necessary to introduce complementary measures to mitigate a price policy's negative impacts and increase its acceptability. For example, in 2010 Iran removed fossil fuel subsidies amounting to some 50-60 billion USD replacing them with 30 billion USD in cash transfers that benefited 80 percent of its population. The combination of cash transfers with a well-orchestrated public relations campaign was critical to the success of the reform. This stands in stark contrast with Bolivia and Pakistan's attempt to raise energy prices within days of the start of the Iranian reforms but had to back off in the face of stark public opposition (Guillaume and others 2011).

Second, getting prices right may not be sufficient since other market imperfections can prevent prices from being the silver-bullet of environmental policies. These include:

- *Low price elasticity.* The ability of prices to trigger changes in behaviors and technological changes is sometimes limited by substitution possibilities: the responsiveness of drivers to higher fuel prices is low in the absence of alternative means of transportation. The responsiveness of investment in renewable energy to feed-in tariffs will depend on whether transmission lines are built between centers of consumption and production. In these cases, price-based policies may have to be complemented with direct investments in infrastructure (e.g., public transportation, transmission lines) and with additional policy actions, like

changes in urban planning or in norms and regulations. Moreover, if substitution capacity is limited by alternatives, then the provision of these alternatives may increase the efficiency of the economy and increase income or promote economic growth. They may also make the increase in price more politically acceptable.

- *Missing markets or institutions.* Specific institutional measures can be required to transform the "right price" into the right incentive. Where tenants are paying energy bills, for instance, owners have little incentive to invest in more energy efficient appliances unless energy costs are influencing rents. This can be done through information (e.g., energy efficiency labels for homes), specific schemes to finance energy-efficiency investments, or norms (e.g., compulsory retrofit when homes are sold).

- *Lack of credibility and predictability of price signals.* This makes them poor instruments to trigger long-term investments, notably in R&D and long-lived infrastructure.

Third, inertia and biases in behavior are such that many efficiency measures that might pay for themselves are not implemented. Households do not always react to an increase in energy price by improving building energy efficiency (see for instance, Gillingham, Newell, and Palmer 2009; Allcott and Mullainathan 2010). Measures based on labels, information, and fiscal incentives may help influence behaviors. For instance, households with access to an internet-based tool that combines feedback on past consumption, energy saving tips, and goal setting reduced their energy consumption by nearly 6 percent relative to households without such a tool (Abrahamse and others 2007).

It is useful then to distinguish two cases. When prices can be adjusted to reflect social costs, additional complementary policies may still be needed to support substitution, influence behaviors, translate the price into the right incentive, and offset distributional impacts of the price change. When prices cannot be adjusted for technical or political reasons, alternative policies can be implemented, but care should be taken to manage the risk of rebound effect: with low prices, for example, norms to increase energy efficiency can reduce energy bills and result in increased consumption. These effects have been observed in the transport (with the rebound effect taking back up to 30 percent of saved energy), water (with subsidies to water-saving equipment resulting in more water-consuming crops and higher overall water consumption), and energy sectors. Where prices and social costs cannot be aligned, "behavior-based" policies might usefully complement norms and help reduce rebound effects.

Green growth strategies, like all growth strategies, require some type of industrial policies. But implementation of industrial policies is subject to a critical set of caveats: governments should subject firms to competition, have clear sunset clauses, and carefully navigate the twin risks of governance and market failures. In general, it is most efficient to have an environmental policy (e.g. carbon tax) address the environmental externality, while the standard tools of innovation and other industrial policies are deployed to address knowledge externalities and other market failures such as economies of scale, coordination failures. Again, green growth relies largely on standard good policy advice.

No substitute for good growth policy

Green growth strategies are growth strategies with an additional goal of improved environment. As such, they cannot substitute for good growth policies: environmental measures are unlikely to offset distorted labor markets, illiquid financial systems. or poor business environments.

A case in point is that of "green jobs," a topic that has attracted substantial attention in the context of the crisis with the notion that in a situation of high unemployment, a green fiscal stimulus could be very effective to address recession-induced unemployment and set the basis for cleaner post-recession growth patterns. The argument is attractive—though green spending may not be the most labor intensive or "shovel-ready," it has the additional advantage of carrying environmental benefits.

But green policies are not better instruments to address structural unemployment, at least if deployed alone. They will not be effective at creating green jobs where labor markets are distorted and regulations stand in the way of small business development. They will not offset an unattractive business environment. Where the labor force's skills are inappropriate for the development of a competitive manufacturing sector, environmental policies can hardly replace education. In such conditions, much like the case of South Africa mentioned earlier, a policy to promote green industries runs the risk of stimulating imports rather than creating domestic jobs.

Skill shortages already appear to be impeding the greening of growth, even in high-income countries. The OECD has called attention to widespread skill shortages for energy-efficient construction and retrofitting, renewable energy development, and resource efficiency and environmental services (OECD 2011c). In India, the Remote Village Electrification Program is complicated by the lack of skilled workers (IEA 2010). Rural electrification in China suffers from a lack of electricians for grid maintenance and operation. Reasons for these shortages include the general shortage of scientists and engineers, the low reputation and attractiveness of some sectors important for the green transition such as waste management, and the limited number of teachers and trainers in environmental services (ILO/CEDEFOP 2011).

In countries where the economic context is detrimental to investment and growth, better economic policies must be the first step. Lessons from trade liberalization are telling: where labor mobility across sectors is limited by skills and regulations, and where investment in the sectors that benefit from trade liberalization are impaired by inappropriate policies, the benefits from more trade take longer to materialize, and adjustment costs are much higher. Similarly, economic benefits from green policies are more likely to be large and immediate if economic policies are conducive to change and favor the development of more environment-friendly and more productive activities.

Message 4. Green growth is challenging, but not for the oft-cited reasons

Two classic obstacles to any change are the fear of the unknown and inertia. In the context of green growth, the fear of the unknown is usually couched in terms of risks in terms of losses in jobs and competitiveness, as well as high costs. But while green growth may not be the answer to chronic

unemployment and low competitiveness, evidence to date suggests these fears are misplaced. Instead, inertia is the real challenge and stems from a combination of governance failures, behavioural biases, and the difficulty in changing our financing models to ensure capital flows to greener activities.

Green growth is affordable and need not destroy jobs or harm the poor

Environmental policies clearly have costs, either for taxpayers, as in the case of subsidies for renewable energy or public spending on green R&D, or for producers and consumers if such policies mandate them to use more expensive or less productive technologies (e.g. renewable energy resources that are more costly than coal). Also, environmental policies can lead to the crowding out of other R&D expenditures. Environmental policies may require the early retirement of physical capital that relies on polluting technologies. They alter relative prices and therefore change the structure of demand, requiring adjustments in the structure of production. Demand may decrease in sectors that have high capacity (coal production) and increase where there is more limited capacity (public transport). This will imply a decrease in efficiency, at least during an adjustment phase. It may also result in job losses, or harm the poor if compensatory measures are not adopted.

Even when costs are modest or will be offset by future benefits, immediate costs (or perceptions of such costs) create strong social and political obstacles to policy implementation. As such, successful green growth strategies are likely to be those that favor environmental policies with immediate and visible growth or welfare co-benefits.

And such co-benefits exist. For example, getting the price right can offer co-benefits in terms of economic growth and social welfare. Environmental taxation (taxing "bads") and removing distortionary subsidies creates additional fiscal space to permit reduced taxation or subsidization of green public “goods” like public transport, renewable energy, or green R&D. In addition to generating some reduction in traffic, for instance, London’s congestion tax has generated revenues to finance new investments in the city’s aging public transport system, thereby increasing the effectiveness of the price signal by reducing the costs or “dis-utility” associated with switching from single-car use to public transport (Transport for London 2008).

Beyond this so-called “double dividend”, there are three channels through which environmental policies can conceivably contribute to growth. First, it can help increase the amount of natural, physical, and human capital available. Better managed soil is more productive. Well-managed natural risk results in lower capital losses from natural disasters (Hallegatte 2011). Healthier environments result in more productive workers: a recent study from California shows a strong impact of air quality on the productivity of farm workers (Graf Zivin and Neidell 2011).

Second, many environmental policies aiming to reduce pollution also correct market failures and promote efficiency: measures to reduce air pollution or carbon emissions may promote energy efficiency; increased public transport results in reduced congestion. Producing equal amounts of outputs with fewer inputs (or moving firms closer to their production possibility frontier) is good for

growth. Many firms are finding that embracing sustainability has been good for the bottom line (Box O.3)

Box O.3: Examples of enhancing the bottom line through sustainable corporate practices, including…

Seizing early-mover opportunities
In the 1990s Hewlett-Packard (HP) worked to eliminate lead solders from its products because it anticipated governments would eventually outlaw them due to toxicity. By the time the European Union enacted such regulations in 2006, HP enjoyed a significant head start on compliance. HP, Cisco, and others have achieved significant economies of scale and optimized supply chain management by imposing a single, gold-standard set of sustainability targets based on the most stringent regulations in force.

Greening value chains and operations
FedEx has turned over its air fleet and developed sophisticated software to optimize schedules and routes to reduce fuel consumption, and has replaced more than 25 percent of its trucks with smaller, more fuel-efficient vehicles. The company has launched an energy-saving consultancy to leverage its expertise into a new business opportunity.

Large companies like Cisco have reduced and waste from product returns by identifying secondary markets, including internal customers, which helped reduce recycling costs by 40 percent and generate $100 million in new revenue.

Offering sustainable products and services, often with a price premium
Proctor & Gamble wanted to help customers save on energy so invested in cold water detergents. From 2005 to 2008 cold-water laundry habits went from 2 to 21 percent in Britain and 5 to 52 percent in the Netherlands. Similarly, Clorox capitalized on market demand for sustainable cleaning products and helped spur a doubling in market size, capturing 40 percent share due to its concerted marketing efforts and strategic partnership with the Sierra Club.

Rethinking entrenched business models
FedEx rolled out a new approach to document shipping by harnessing the Kinko's network of print shops to enable most of the transportation to take place electronically and then printing and delivering from the destination's closest shop. FedEx provides an enhanced service while reducing fuel costs.

Source: Nidumolu and others 2009

Third, green policies stimulate innovation. Empirical evidence reviewed in chapter 3 shows that well-designed environmental regulations, incentives, and standards stimulate innovation by firms. Firm surveys in Europe show that existing or future environmental regulation is the top driver for firms to introduce environmental innovation. Similarly, international sustainability standards can help local firms upgrade their environmental practices, a form of catch-up innovation. However, as for general innovation, public support to R&D policies may need to supplement regulation to generate new radical innovation. In the case of wind power, for example, the marginal million-dollar public investment in R&D generated 0.82 new inventions, whereas the same amount spent on demand-pull policies, such as feed-in-tariffs, induced at best 0.06 new inventions (Dechezleprêtre and others 2011).

Environmental policies may have additional co-benefits that increase welfare, including the possibility of promoting more labor-intensive technologies or stimulating new industries that create jobs. If well-

designed they may also help protect the poor and their livelihoods.[5] Finally, they may help reduce output volatility if they increase resilience to environmental shocks (such as natural disasters) or economic shocks (such as oil shocks or spikes in other commodity prices).

Thanks to such co-benefits, estimates are that the net costs of greening growth are manageable. Macro level estimates are that more than half the measures needed to de-carbonize developing countries' energy systems would eventually pay for themselves, bringing the net annual costs down to 140 to 175 billion USD per year in 2030. An additional 75 to 100 billion USD might be needed to adapt to climate change (World Bank 2009). Resources would be needed to address other types of pollution, but again many abatement policies can pay for themselves. Recent estimates by McKinsey suggest that sustainability would require additional annual investments of 0.9 to 1.7 trillion USD in water, energy, land, but that these would yield benefits around 3 trillion USD per year (rising to 3.7 trillion USD for carbon at 30 USD per ton and with energy, agricultural, and water subsidies removed, McKinsey & Company 2011)

Meanwhile, micro evidence from firm level data shows that the cost of environmental regulation is typically modest, with costs lower than expected due to the ability of firms to innovate (chapter 3). As a result, there is no evidence of a systematically negative impact of environmental regulation on profitability. While the earlier literature from the 1980s and 90s found some, more recent papers find more positive results, partly because they tend to allow a few years for firms to adapt and partly perhaps because we have become better at designing environmental regulations that promote efficiency gains (Ambec and others 2010, Box O.4). Further, where environmental taxes are used to reduce taxes on labor and income, the impact on GDP is likely to be neutral or positive, as was found in an analysis of seven EU countries (Andersen and others 2007, cited in Ambec and others 2010).

Box O.4 Environmental regulation need not negatively affect firm productivity and profitability, and may help improve it

Recent analysis of the impact of the climate levy on UK firms finds a significant impact on energy efficiency but non on economic performance and firm exit (Martin et al 2011). The same conclusion was reached about the impact of the European Trading System on German firms (Anger and Oberndorfer 2008). Similarly, the impact of the European Emission Trading Scheme on the competitiveness of the European iron and steel industry was found to be smaller than that of variations in exchange rates (Demailly and Quirion, 2006).

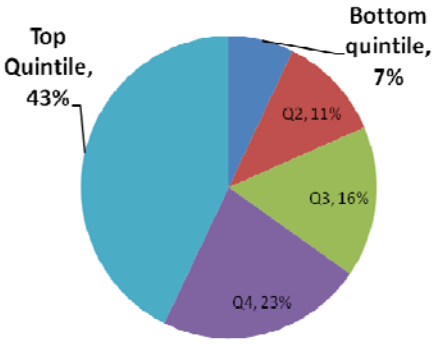
Refineries located in Los Angeles enjoy significantly higher productivity than refineries in the rest of the US despite facing tighter air pollution regulation (Berman and Bui 2001, cited in Ambec and others 2010). Similarly, the productivity of the Mexican food processing industry increased with stronger environmental regulations (Alpay, Buccola and Kerkvliet 2002 cited in Ambec and others 2010).

5 Note that while there is a general presumption that the poor will suffer most from environmental degradation and its impact, this need not imply that they would automatically benefit from green growth policies. Some policies, such as the removal of fossil fuel subsidies would clearly reduce their purchasing power. Green policies need to be carefully examined for their impact on the poor and where needed must be complemented with safety nets or compensatory measures for the poor.

More generally, there is no evidence that environmental policies have led to job losses due to an exodus of firms to "pollution havens" (locations with lax environmental policies). Tighter environmental regulation may cause firms to relocate, but they will chose locations that are more attractive overall, as pollution abatement costs represent a small share of production costs for most industries (Copeland 2011). Factors such as availability of capital, labor abundance, location, institutions, and agglomeration effects are more important than environmental policy in determining firm location choice and competitiveness.

A more complex issue is whether green growth is likely to harm the poor. The argument is usually made that the poor are most dependent on natural resources and less able to protect themselves against the harmful effects of pollution or natural disasters. As such, they are likely to be the primary beneficiaries of green policies. At the same time, however, many green policies involve increasing prices or restricting the use of public goods, including fish stocks and forests. Clearly, if such policies are not carefully managed and compensatory measures are not taken, poor individuals and communities will be harmed. But subsidies tend to be very regressive and can be replaced by better targeted transfers at a fraction of the cost (Figure O.4). By one estimate, the cost to the budget of transferring 1 dollar to the poorest 20 percent of the population via gasoline subsidies is 33 dollars (Arze del Granado, Coady and Gillingham 2010).

Figure O.4. Fossil fuel subsidies primarily benefit the rich (fossil fuel subsidy allocation by quintile, average across 33 countries, various years)



Source: Arze del Granado, Coady, and Gillingham 2010.

In sum, fears that environmental regulations will lead to massive job losses or loss of competitiveness are probably as unfounded as the hope that green jobs will single-handedly solve countries' employment problems. Meanwhile, Better regulations, particularly those supported by training, support for R&D, and the recycling of environmental taxes into other tax cuts, will help minimize the risks of green growth policies. Concurrently, care needs to be taken to protect the poor from the potential downsides of green policies and to ensure they benefit fully from the likely upside. Finally, some sectors are inherently more innovative than others, and will tend to adapt better. Adjustment costs may therefore vary across industries.

The real challenges of green growth are to tackle governance failures, entrenched behaviors, and financing constraints

Greening growth requires governments to do a better job at managing market failures. As such it requires more and better government. And it is highly vulnerable to governance failures. This is obvious in any discussion of green innovation or other industrial policies, but also in any of the regulatory and market reforms that are needed, some of which are complex. For instance, even sophisticated administrations may struggle with market-based instruments as experience with the European Trading System has demonstrated (Betz and Sato, 2006). As such optimal solutions will differ across countries with varying degrees of institutional capacity, transparency, accountability, and capacity of civil society, and the implication is that green growth strategies will need to be tailored to a country's circumstances, and that "best practices" should be imported with caution.

Greening growth requires deep changes in pricing, regulation, and public investment patterns. Resistance to welfare-improving environmental policies will occur as it goes against the interest of well-connected businesses or interest groups. The political economy of reform is a critical component of making green growth happen. A look at recent successes and failures at subsidy reform only reinforces this lesson (Nikoloski 2011).

Greening growth will also require changes in behaviors and social norms. It is unlikely that technology will enable us to fully stick to current patterns of consumption of middle- and high-income consumers and that efficiency gains can be fully achieved through price signals and norms.

The fact that what is needed has not yet been done even though much of it pays for itself is in large part due to behavior biases. For example, obstacles to improvements in energy efficiency have to do with the fact that people suffer from "cognitive myopia," which prevents them from accurately future benefits against immediate costs. Also, individuals have "loss aversion": they measure gains and losses with respect to a reference point and weigh losses more than gains (Tversky & Kahneman, 1992). Indeed, if individuals use the current situation as their reference point, they will consider the cost of environmental policy as a loss and disregard avoided environmental damages. People are biased towards the status quo, tend to chose the default option, and have an aversion for ambiguity, resulting in a tendency to delay decision-making (Tversky and Shafir, 1992). At the same time, people like to "do the right thing" and are heavily influenced by social norms.

As a result, how messages are framed, what values are appealed to, and how the needed efforts are presented are critical. Thus, when given the choice of voluntarily paying for a carbon offset for an airline ticket, some 60 percent of Americans –Republican, Democrats or Independents—will do so. When the offset is referred to as a carbon tax, support falls to 25 percent among Republicans (Hardisty, Johnson, and Weber 2010) Chapter 2 discusses what social psychologists and others have learned about ways to influence social norms and appeal to individuals' higher values. But what is clear is that much more efforts will be needed on this front.

Finally, access to capital to finance the needed upfront investments is a significant challenge. Many green investments then generate subsequent savings so the net costs are likely to be modest or even negative. Nevertheless significant financing is needed upfront. For example, renewable energy is characterized by much higher capital costs than fossil based energy but extremely low operating costs. Similarly, energy efficiency requires upfront investments in new equipment or add-ons that are then recouped over time. Even in the case of agriculture or fisheries, a shift to more sustainable practices typically will result in lower returns and investments in early years that are then offset by higher returns in the future.

So the financing constraint has to be understood as primarily an issue of *access* to capital, rather than a need for grant finance or net new resources. This may appear to be less of a challenge, though experience has shown that access to capital is often a binding constraint in developing countries. This is particularly well documented in the infrastructure sector, where developing countries are well-known to under-invest relative to desirable levels (Fay, Iimi and Perrissin-Fabert 2010) due to difficulties in accessing the needed capital and fiscal constraints. This even affects private participation in infrastructure, as resources are lacking to prepare bankable projects likely to attract private financiers. (Such a finding has resulted in a call for less emphasis on creating infrastructure funds and more on creating project preparation facilities, MDB Working Group on Infrastructure 2011).

The implication then is the need to develop innovative financing products and measures that address capital constraints rather than focus on the need for net new resources. The challenge is no less complicated, but it is different and requires leveraging resources to address the upfront capital needs. The experience of the multilateral development banks is that a leverage ratio of 3 to 6 can be achieved for non-concessional lending, though a much higher ratio can be achieved in projects with well-established private sector players and fewer technological surprises, such as power sector energy efficiency (MDB Working Group on Climate Finance 2011).

And do so urgently to avoid getting locked into unsustainable and costly paths

Many have argued that poor countries can and should "grow dirty and clean up later." The argument is that poor countries should focus on satisfying human needs before attending to nature; that they tend to have a relatively low environmental footprint. There are, however, many reasons why this argument is often misleading.

First, not all environmental goods are superior goods, whose share in total consumption increases with income. Individuals who struggle to feed and house themselves may not see biodiversity protection and climate change mitigation as priorities, but local environmental goods affect their daily lives, with significant impact on income and welfare. The lack of solid waste disposal, for example, is not merely an environmental issue. By clogging drains, it leads to health hazards and to more floods, with very material economic and human consequences. By destroying people's homes and assets, floods affect their savings and their ability to save, to create small business, and ultimately to escape of poverty. The mismanagement of water resources has consequences on people's ability to grow crops and feed their families. In cases where natural assets like soil quality, water, and safety from disasters serve as critical

inputs into economic production, good environmental policies enhance income generation and poverty alleviation. In these cases, "grow dirty and clean up later" is misleading because clean growth would also be more efficient, robust, and sustainable growth.

In other cases, it is either impossible or prohibitively expensive to clean up later. The loss of many environmental assets is irreversible, most obviously biodiversity. It is also the case with the climate. Because greenhouse gases have a long residence time in the atmosphere, each emitted molecule will influence the climate over decades (for methane), centuries (for CO_2), or longer. And sea level rise is a very slow process that has been triggered by increased temperatures and could continue for millennia (IPCC, 2007). As the world delays action, the degree to which climate change can be mitigated decreases rapidly. Irreversibility also occurs with local environmental goods. When a mangrove or a forest is destroyed, it is very difficult to recreate it. Even when we try, the new asset's characteristics and biodiversity richness are very different from before. If the value of these assets is to rise in the future with income, then their definitive loss as a result of current choices and policies will yield substantial regrets.

It will also be difficult and expensive to clean up later because of economic and technological irreversibility. A lot of infrastructure is long lived, and today's choices will be hard to reverse in the future if different preferences and priorities make it desirable. Urban forms are largely determined when city populations increase rapidly and most buildings and transport systems are built. If a city is developed based on an individual vehicle transportation model and with low density, it is unrealistic to imagine that it will be modified in a few decades, when environmental objectives gain more traction. The same is true for energy and transport systems, which also involve long-lived infrastructure. And this irreversibility is reinforced by technological lock-ins: an early development based on one technology, say individual vehicles, will lead R&D to focus on improving this technology, increasing the productivity gap with alternative choices.

So, when decisions create a risk of lock-in in a situation that may be considered undesirable in a few decades, early action may prove useful to limit the potential for regret.

This need for foresight leads however to unprecedented decision-making challenges, since there are significant uncertainties associated with many of the key variables:

- *Uncertainty in demand and preferences:* there is a large uncertainty about how societies will value the costs and benefits of environmental and economic conditions in decades.
- *Policy uncertainty:* depending on future environmental and economic policies, and future prices (for energy, oil, or carbon), an energy-intensive development may appear as particularly inappropriate in 50 years (World Bank, 2009; Rozenberg and others, 2010).
- *Technology uncertainty:* Infrastructure choices are dependent on how technologies will evolve in the future. For instance, the future availability of decarbonized electricity production and electric vehicles is a critical question for urban planning.

- *Climate uncertainty:* infrastructure's dependence on weather and climate conditions, combined with large uncertainty about the future climates, is making infrastructure design more difficult (Hallegatte 2009).

The need to account for the very long term in some sectors, combined with significant uncertainty, makes it necessary to consider alternative decision-making approaches that aim at minimizing the risk of costly mistakes.

Message 5. The way forward: policies that maximize co-benefits, focus on the most urgent issues, and develop innovative finance

Even when environmental policies increase welfare (or even wealth) over the short term, they may lead to a decrease in GDP, for instance due to a change in investment structure or a higher reliance on (non-measured) ecosystem services. Wealth and green accounting are thus essential tools to the design of green growth policies, but in many cases they are not available, at least not yet.

In the absence of comprehensive, consensual, and operational wealth accounting, one approach is to screen green policies through the following check-list, to determine whether it is possible to design policies differently to obtain, in addition to environmental benefits, short-term, local co-benefits, such as:

- Increases in production factors that directly contribute to economic production, especially natural capital, and human and social capital, through improvements in health, education, cohesion, and stability.

- Improved economic efficiency by correcting market failures to get closer to the production frontier with existing technologies, and thus reducing production costs and increasing competitiveness (including stimulus during periods of non-structural under-utilization of resources).

- Shifts in the production frontier (i.e. being able to produce more with less) by correcting market failures in innovation, development, and dissemination and improving knowledge spillovers in the entire economy.

- Increased *resilience* to environmental shocks, such as natural disasters, and economic shocks, such as oil shocks, or spikes in commodity prices.

- Increased inclusiveness of growth, including jobs creation and poverty alleviation.

The first three potential benefits are pure growth benefits in that they increase the growth rate. The last two address welfare by reducing the variance and volatility of growth and by potentially improving its distributional impacts.

Not all five will be relevant or feasible for all green growth policies. The point, however, is that policy designs can be scrutinized for opportunities to achieve more in these five areas of potential win-wins, if necessary by combining several policy interventions.

While there is no reason to think that green growth would be any slower in the longer run than "brown" growth, there will clearly be costs associated with the transition to a green economy.[6] Green growth strategies should therefore aim to minimize transition costs by offsetting them to the extent possible with direct environmental benefits and potential co-benefits. The ability of countries to follow more sustainable growth strategies will depend on their ability to use these co-benefits to manage the political economy of reforms.

The other dimension that policies need to factor in is urgency. A focus on the sectors and interventions that can help prevent irreversibility or reduce inertia is called for. Table O.1 provides an illustration of the implications for priority setting of an emphasis on co-benefits and urgency. As such, while renewable energy is very much desirable, it is easier to build renewable plants later (even if this requires retiring thermal power plants) than to try and revert poor land use planning that has resulted in sprawling cities.

Table O.1 Some guiding principles for establishing green growth strategies

Co-benefits **Inertia/Irreversibility risk**	Trade-offs (to be considered at higher level of income or paid for by external funds)	Synergies (attractive regardless of income, provided that financial mechanism can be found)
Low inertia and irreversibility risk (i.e. action is not urgent)	Renewable energy production in connected locations Carbon pricing	Renewable energy in off-grid locations Drinking water and sanitation
High inertia and irreversibility risk (i.e. action in urgent)	Higher gasoline price Reduce deforestation Coastal zone protection	Public urban transport Land use planning in cities Fisheries catch management

Note: this assumes that renewable energy is more costly than thermal, which is not always the case.
Source: authors.

6 GDP may be higher, like in the case of fisheries because better managed natural assets increase production capacity; it may also be lower, for instance because of a higher reliance of non-measured ecosystem services. But in any case, welfare – which is what we care about – is higher.

Finally, innovative financing is urgently needed to cope with the increased need for upfront financing. Resources are available but remain small relative to need, so they will need to be leveraged. For example, with respect to climate change mitigation, recent estimates suggest that a package of public sources (including a repurposing of subsidies currently destined to fossil fuels), MDB flows, and carbon offset flows could leverage some 200 to 400 billion USD in 2020 in additional private flows (MDB Working Group on Climate Finance 2011). As for the biodiversity market, offset and compensation programs officially amount to roughly 2.4 to 4 billion USD per year, but may be much bigger since 80 percent of existing markets are not transparent or analyzed enough to estimate their size (Madsen et al 2011)

Going forward, the public sector, particularly the International Financial Institutions (IFIs) and bilateral donors, can help to overcome the barriers holding back private equity and venture capital by anchoring new funds, supporting pioneer investments, investing in a new fund on a concessional basis through a so-called "waterfall" structure, and more. Care must be also given to address local public finance, as evinced by the aforementioned case of China's cities.

Finally, payment for environmental services – whereby farmers and landowners are compensated for maintaining their land's ability to provide ecosystem services, such as the regulation of water flows, water purification, control of soil erosion, and habitats for wildlife – remain underutilized, though efforts to develop "REDD+" are helping.[7]

In sum, this report approaches green growth very much from a pragmatic point of view. Let's fix market failures, internalize externalities, assign property rights, fiddle with production functions, improve governance and influence behaviors. The current model is not just unsustainable, it is also inefficient. Improving it is good economics, though making green growth happen will also require an acute understanding of political economy and social psychology.

As such this report speaks primarily to those who fear greening growth may be too expensive, that it may be too ambitious at an early stage of development, or that it should concern only high-income countries. To them, the report makes a clear case that greening growth is neither unaffordable nor technically out of reach; that there are plenty of immediate benefits even a poor country can reap from better environmental management; and that although high-income countries, which still account for three quarters of global consumption and a disproportionate share of environmental degradation,

[7] Reducing Emissions from Deforestation and Forest Degradation (REDD) is an effort to create a financial value for the carbon stored in forests, offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development. "REDD+" goes beyond deforestation and forest degradation, and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks (http://www.un-redd.org/).

absolutely have to implement ambitious environmental measures, all countries will gain from starting early.

The costs of greening growth will vary depending on the degree of ambition. Very rapidly and dramatically decreasing our impact on the planet would be very costly. So too would delaying action indefinitely. Greening growth need not entail slower growth and is affordable; achieving a green economy over night, however, probably is not. Dramatic shifts would entail much slower growth at least in the medium run.

For this reason our message to those who think that the report is too timid in its recommendations is clear: developing countries remain too poor to offer a decent quality of life to all their citizens. In short, developing countries need growth, and the question is how to both rapidly and sustainably achieve it.

Clearly green growth has costs, which will depend on the degree of ambition and the optimality of the policy of the design. Thus, adopting key measures in a timely fashion will do much to reduce costs. Many of the initial costs will be offset by subsequent benefits like energy savings, improved public health, and reduced vulnerability to environmental and economic shocks, to name a few.

This report adds to the chorus started by the OECD and UNEP in recent reports to support the idea that greening growth is good economics and good development policy (OECD 2011c, UNEP 2011). While we are still far from being able to properly price eco-system services, it is clear that they are valuable. As such, neglecting natural capital, like neglecting human and physical capital, is simply poor management. And countless examples exist of the inefficiencies that drive environmental degradation.

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