Is Green Growth Good for the Poor?

Stefan Dercon

The developing world is experiencing substantial environmental change, and climate change is likely to accelerate these processes in the coming decades. Due to their initial poverty and their relatively high dependence on environmental capital for their livelihoods, the poor are likely to suffer most due to their low resources for mitigation and investment in adaptation. Economic growth is essential for any large-scale poverty reduction. Green growth, a growth process that is sensitive to environmental and climate change concerns, can be particularly helpful in this respect. We focus on the possible trade-offs between the greening of growth and poverty reduction, and we highlight the sectoral and spatial processes behind effective poverty reduction. High labor intensity, declining shares of agriculture in GDP and employment, migration, and urbanization are essential features of poverty-reducing growth. We contrast some common and stylized green-sensitive growth ideas related to agriculture, trade, technology, infrastructure, and urban development with the requirements of poverty-sensitive growth. We find that these ideas may cause a slowdown in the effectiveness of growth to reduce poverty. The main lesson is that trade-offs are bound to exist; they increase the social costs of green growth and should be explicitly addressed. If they are not addressed, green growth may not be good for the poor, and the poor should not be asked to pay the price for sustaining growth while greening the planet.
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Environmental degradation is occurring in many parts of the developing world. Nationally and locally, it is the result of deforestation, soil degradation, the depletion of water resources, and environmental pressures linked to urbanization and economic change. Globally, the overall process of climate change is expected to gradually but sharply increase in the coming decades with mean temperature rises, sea-level rises, and spatial changes in rainfall and other climatic conditions as well as the increased frequency or severity of extreme weather events.

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Environmental change is rarely equity neutral. The poor are generally considered the main losers from both climate change and the burdens of local environmental damage and natural resource degradation. They are typically more dependent on environmental capital and climate for their economic activities because most of the poor still live in rural areas that are dependent on agriculture. Those in urban areas face the consequences of environmental hazards linked to overcrowding, pollution, and inadequate water and sanitation provision. The poor are also more vulnerable to extreme events affecting economic productivity, health, and security of livelihood with limited insurance or social protection. Furthermore, informal insurance mechanisms are not suited to address covariate risks such as climate risks or other risks affecting entire communities. The poor may also find it more difficult to adapt their livelihoods to changing environmental conditions because they lack the resources to invest in appropriate and profitable economic activities.[1]

Development and poverty reduction investments are powerful instruments to mitigate these environmental impacts on the well-being of the poor and to offer them the resources to develop their resilience to further environmental pressures. Economic growth and development in the poorest economies is essential to build this resilience to adapt to and cope with the new reality (World Bank 2010a). It has been the key element in large-scale poverty reduction, most notably in Asia, although there are considerable geographical, sectoral, and structural differences in the speed with which poverty reduction is delivered in the context of growth (Ravallion 2000). Growth has been found to be important specifically for increased climate change adaptive capacity. For example, examining time series data across countries over the last 50 years, Dell et al. (2008, 2009) found that higher temperatures significantly reduced economic growth rates in poor countries but not in rich countries. Raddatz (2009) showed large declines in GDP per capita from climate-related disasters in low-income countries; in percentage terms, these declines were four times the size of the declines in rich economies. Noy (2009) showed that higher GDP per capita and better institutional and human development indicators reduced losses from climate-related disasters. Raddatz (2009) also found that the larger impacts in low-income countries are much more than could be explained by the relatively high share of agriculture in these countries, so this issue is not simply solved by diversification away from agriculture. Although they are difficult to identify statistically, Fomby et al. (2012) also found losses in both agricultural and non-agricultural growth, although the type of shocks appears to affect generalizations on this issue.

Unfortunately, engineering these growth and poverty reduction processes in a world of environmental change is problematic. It is generally acknowledged that the pressures of climate and other environmental changes will have serious implications for the growth prospects of some of the poorest countries in the developing world over the coming decades (IPCC 2007; World Bank 2010a). Changes in

climatic conditions will change the mean return to agriculture and increase its variance. Furthermore, the increased impacts of extreme weather events will affect the accumulation of productive assets, not least in low-lying areas such as coastal cities, where the potential returns to economic activity are especially high. These effects are also likely to accelerate the depletion of many forms of environmental capital and increase threats to human health from disease and water scarcity. The impacts of climate change on agriculture and other sectors of the economy are bound to affect the scope for their transformation from economies that are largely dependent on agriculture to a more diversified, higher-return economy.

Climate change is only one source of environmental pressure that has serious impacts in many developing countries. There are also difficult choices to be made with respect to curbing *current* environmentally damaging activities. The depletion of soil, forests, coastal fisheries, and more accessible fresh water supplies reflects an ongoing loss of potential productivity in the economy. Air and water pollution represent significant burdens on human health in a number of locations, lowering productivity and diverting scarce resources into the treatment of pollution-related illnesses. These externalities are rarely adequately internalized into the decisions made by the users of these resources, so addressing them can have potentially significant impacts on growth and the distribution of gains from growth. However, curbing environmental damage *now* to reduce natural resource degradation and improve the population's health and quality of life means diverting resources from other conventional growth-oriented opportunities.

To address these issues, various strategies have been discussed to provide a blueprint for 'green' growth, in which the need to protect the environment is internalized while leaving sufficient opportunities for economic growth (OECD 2011). This option appears particularly attractive when viewed from a poverty angle. Importantly, it retains and may even provide further impetus to a growth focus, which is essential for poverty reduction in low-income economies, while contributing to their resilience in the face of environmental problems. Furthermore, because environmental damage is currently not equity neutral, it could help ameliorate the consequences of environmental costs for the poor under current growth trajectories.

Much of the discussion on 'green growth' remains relatively vague in terms of specifics, including for poor countries or the poor in general. However, more recent reports (e.g., World Bank 2012) begin to amend this discussion in a careful, nuanced way. Just as not all growth leads to the same degree of poverty reduction or to the same environmental impacts, it is likely that not all efforts to maximize growth given environmental constraints will maximize poverty reduction. The question rarely asked is how various green growth strategies and resilience-enhancing investments interact with poverty. To what extent is green growth good for the poor?

Under what conditions can certain green growth strategies lead to unwelcome adverse impacts on the poor or even to 'green poverty'?

In this paper, we first provide a stylized discussion of the nature of poverty, particularly its dynamics and interaction with growth. We focus not only on the various assets and capital sources of the poor but also on the sectoral and spatial dimensions of the dynamics of poverty reduction. We then discuss how global and local environmental change affect these dynamics and whether current patterns of change may persist. We introduce a number of stylized examples of 'green' growth initiatives and assess their impact on poverty based on their interaction with the patterns identified earlier in the paper. Finally, we present our conclusions.

The perspective that we take is to examine the *consequences* of possible greener versions of growth processes on poverty reduction. Although growth is important for poverty reduction, our focus is not on the *possibility* of sufficiently high growth from green growth strategies in developing countries. There is more evidence on this subject, and it is well reviewed (World Bank 2012). We focus on *current* poverty, not on the important issues of intergenerational equity. This is an important caveat. However, this is a deliberate choice; we have in mind the extreme poverty that is experienced in many low and lower middle income countries. Current growth patterns that do not internalize the depletion of natural capital may, of course, reduce opportunities in the future and risk some future poverty. However, those who are currently poor could be considered to have high discount rates shortening their horizon. Their current dire circumstances leave little room for the use of long planning horizons. Furthermore, most work on resilience, including resilience to future climate change, stresses the need for development, including higher incomes and wealth, as key factors in the ability of the poor to withstand this future (World Bank 2010b). Therefore, a strong focus on the current poor has considerable legitimacy in these debates. Towards the end of this paper, we revisit these two issues.

Framing Poverty and the Environment

In this section, we offer a stylized discussion of poverty and how the current environmental pressures may affect the poor. First, we provide the standard microeconomic analysis, as implicitly embedded in much of the basic writing on the welfare costs of environmental damage, and the correction of market failures. This analysis also underlies some of the writings that use a simple livelihoods framework to discuss environmental pressures (Ellis 2000). Then, we expand the framework to consider the sectoral, spatial, and dynamic (intertemporal) dimensions that are relevant in a growth context, and we show that these dimensions affect ways of thinking about poverty and environmental linkages. This discussion forms the basis for a

more in-depth discussion of how a 'green growth' strategy may affect poverty in troublesome ways.

Profile of the Poor and the Environment

Much of the analysis of poverty and its links with environmental change is rooted in a micro-level analysis of household and community livelihoods. In a stylized way, households are viewed as having access to various assets, such as financial, physical, and human capital, and importantly, environmental (or natural) capital, such as land, air quality, or water resources. Markets define the opportunities for earning a living by combining these assets and the benefits that households can obtain from them. Ownership and control of the use of these assets is not always well defined. Whereas financial or human capital is typically private with well-defined property rights, rights to environmental capital are not always clear, with a mixture of private, communal, and often contested or undefined rights. Obvious examples are the use of water resources, fisheries, and forests, whose use and management are rife with collective action problems. Furthermore, the use of environmental capital often involves externalities on others, from the local-level effects of local air or water pollution, soil degradation, and increasing global impacts, including effects on production opportunities and welfare.

These problems lead to some of the standard economic and welfare impacts of environmental pressures, with emphasis placed on market failures (stemming from externalities and coordination failures). Overcoming these market failures will improve efficiency in the economy (in the Pareto sense). This does not mean that the poor will be better off; starting from a particular distribution of income and environmental impacts with market failures, there will be winners and losers. The possibility of efficiency gains only means that the winners, in principle, would be able to compensate the losers sufficiently given the size of the gains. However, such a redistribution of gains certainly does not occur automatically. We return to this issue later in the discussion of green growth.

Labor Demand, Sectoral, and Spatial Dimensions

Beyond a standard treatment of environmental externalities and policy responses, it is helpful to add specifically sectoral, spatial, and dynamic elements that are relevant for understanding poverty. These elements are crucial in setting the stage for how environmental pressures and green growth strategies affect the poor. First, there are sectoral elements to poverty and the way in which it interacts with growth. Most of the poor are living in rural areas and are engaged in agriculture, either as smallholders or farm workers. Their labor productivity and, therefore, their incomes are low. At the same time, a substantial and likely increasing number

of the poor are living in urban areas, as in large parts of Latin America (Ravallion et al. 2007), and are working in low-paying jobs or are self-employed in the informal sector. A high dependence of the poor on agriculture or self-employment implies risky livelihoods, with limited wealth or sources of informal or formal insurance to protect themselves against these risks. Rural livelihoods are directly linked to environmental and agro-climatic risks, with particularly important implications given the pressures of climate change.

Nevertheless, this is only a static picture. Poverty reduction will require structural and sectoral change, with a decline in the dependence on agriculture for the poor, a vast reduction in the number of peasants, a reduction in informal sector employment, and increasing wage employment in other sectors. Furthermore, in addition to a change in livelihoods, this structural change will have significant spatial dimensions, implying a substantial migration from rural areas into urban areas (Dercon 2009). Large-scale migration is a standard feature of the process of large-scale poverty reduction. For example, over the last two decades, poverty reduction was accompanied by substantial migration in China, with more than 170 million people moving into cities from rural areas since 1990 (Chan 2012). Internal migration is also closely linked to welfare increases (Beegle et al. 2011).

Successful poverty reduction has other spatial dimensions, with a massive increase in the coastal population (which is where economic activity will increasingly be located due to comparative advantage) and a vast reduction of the size of the population living in areas relatively far from urban areas and the coast (because incomes in agriculture can only keep up with other incomes where demand is located or where transport is cheap).

Of course, this is not just a deterministic process of the poor uprooting, changing livelihoods, and migrating as a successful strategy to move out of poverty. With their limited capital sources and often only their labor as an asset, the poor themselves will not be the engine of growth and transformation. At best, they can be responsive to changing opportunities. Even then, these processes are fraught with problems and risks, even in a context of rapid growth. The speed of these sectoral and spatial dimensions of poverty change during growth is largely dependent on the evolution of the demand for labor during the growth process: are the growth sectors in the economy labor intensive? The higher the growth of labor demand, especially for the lower-skilled labor with which the poor are largely endowed, and the more the poor are able to respond to it via sectoral and spatial mobility, the faster poverty is reduced in the face of growth (Loayza and Raddatz 2010).

Poverty Dynamics

There is no need for this transformation to happen always and everywhere. Others have argued for the existence of combinations of economy-wide processes that

could result in low growth and high poverty 'traps', such as those linked to the natural resource curse, conflicts, governance, geography, or even aid (Sachs 2005; Collier 2007). All of these processes could stifle growth and the economic transformation needed to lift large populations out of poverty. Here, our focus is on the constraints that prevent particular poor populations from *benefitting* from growth. A framework allowing for various market failures can help illustrate the risks and constraints for poor populations that limit their ability to move out of poverty and potentially even trap them in persistent poverty.

The first constraint is the failure of credit markets to offer capital to the poor. Credit market failures tend to lead to collateral requirements for access to credit, resulting in those without collateral being frozen out of the market. If livelihood transformation requires at least some threshold level of capital, then a trap may occur whereby some can take advantage of opportunities, whereas others remain trapped in livelihoods with low returns. This phenomenon provides much of the justification for microcredit interventions, even if their transformative success is not clearly proven (Armendariz and Morduch 2010). The second constraint relates to risk and the lack of insurance for the poor. In this case, the poor may be induced to choose safety over higher returns, resulting in limited investment in high-return activities and technologies but choosing to hold safe assets and activity portfolios, implying a choice of poverty to reduce their exposure to even more dramatic risks (Dercon 2002; Carter and Barrett 2006). A variation of both credit and insurance market failures relates to the impact of large shocks, which, if uninsured, could push the poor back to lower levels of assets from which recovery is slow or even impossible due to limited credit, again leading to poverty traps.[2]

A third source of market failure relates to spatial externalities. In a positive form, these are the basis of increasing returns to scale linked to location and agglomeration and are central to much of the thinking about growth and geography (Fujita et al. 2001). In a negative form, they imply that the areas that stayed behind, such as those linked to particular poor geographical features or very limited human, physical, or social capital, may find it increasingly difficult to keep up with progress elsewhere. In turn, this may make poverty persistent (Ravallion and Jalan 1997). Migration may be a way of overcoming these spatial traps; however, interactions of various types of market failures conspire to make this difficult. Migration tends to be costly, and often only the relatively better off will manage to leave when opportunities are better elsewhere. Successful migration also tends to require networks in destination areas (Massey 2002), and those from poorer geographical areas may find it even more difficult to set up these 'chains' of migration. The result is that some may end up trapped in locations with limited income opportunities.

Taken together, poverty and its reduction are not only about the assets that the poor currently own or have access to, the activities in which they are engaged, and where they are currently living. Growth and poverty reduction takes places as part

of dynamic processes with important spatial and sectoral dimensions. As a result, the poverty impacts of considering environmental capital, such as by appropriately pricing environmental costs, should not be assessed only via its consequences on the value of the assets of the poor, their current activities, and their location. It will also be important to assess the sectoral, spatial, and other dynamic consequences of any changes to the growth process. In what follows, the key question is therefore: how will environmental change and greener policies not just affect the poor directly but also the particular spatial or sectoral growth incentives and the extent to which growth is intensive in the production factors owned by the poor? Before turning to green growth policies, we discuss how environmental change, not least climate change, affects poverty including via these dynamic processes.

Environmental Change and Poverty

How does environmental change affect the poor? There are various dimensions of change, such as the processes of deforestation, soil degradation, depletion of water resources, and environmental pressures linked to urbanization and economic change. There are also risks linked to climate change, which magnify other environmental pressures and appear likely to have an increasingly negative impact in coming decades, with mean temperature rises, sea-level rises, and spatial change in climatic conditions as well as an increased frequency of extreme weather events. Although the poor will no doubt be strongly affected because they have limited resources to protect themselves, it will be helpful to provide a structure for the patterns of consequences by revisiting some of the features of the poor and poverty reduction processes.

A first feature of much environmental change is the gradual erosion of the environmental capital base in many rural settings that affects the livelihoods of the poor, such as loss of forests, soil erosion, depletion of fish stocks, and water scarcity. Lower environmental capital makes income generation more difficult and affects wealth accumulation. Given credit market imperfections, this situation will affect entry into more profitable activities, including the potential exit from agriculture or diversification into other higher-return activities. Climate change is likely to accelerate these pressures, with some winners and many losers in terms of the potential for agricultural production and other climate-dependent activities. A higher frequency of extreme weather events and disasters, including droughts and floods, will put further pressure on rural livelihoods and will contribute to the poverty persistence cycles described above as investments focus on minimal livelihood security rather than higher returns and assets are lost without scope for recovery. In urban settings, livelihoods are also affected by environmental change, not least in many industrial or informal sector activities that are dependent on water and local fuel

sources, such as wood. The lives of the urban poor are further blighted by increased scarcity of clean water and air, pressures on sanitation, and the risk of disease. In both rural and urban areas, climate change and extreme events also erode infrastructure and other types of public capital.

Although higher incomes and growth could provide a route to economic diversification, investment in more productive or less environmentally damaging capital, and greater resilience in the face of environmental change, those who miss the boat may end up trapped in lower return activities that perpetuate their poverty. Importantly, the *economic and sectoral transformation* required for rising living standards is likely to be negatively affected. For example, the negative impacts of climate change on agriculture are likely to affect growth and demand for labor, thereby slowing poverty reduction. Furthermore, unlike wealthier farmers, the poor may not have the means and capital to make the necessary investments in agriculture to adequately adapt to new circumstances (including adjusting output patterns to take advantage of likely higher food prices), trapping them in low productivity agriculture. Of course, environmental degradation (specifically, climate change) may lead to winners among some of the poor in areas where agricultural opportunities increase or where adaptation investments by richer parts of society provide jobs and higher labor demand.

The *spatial* consequences of economic activity and the location of the poor are also considerably affected, not least when climate change takes hold. Some have argued that climate change would create large numbers of displaced international 'climate migrants', with figures of 200–300 million suggested (Myers 2002). However, the empirical basis for this scale of displacement is all but nonexistent (Gemenne 2011). On the contrary, lower wealth accumulation in rural settings is likely to hinder large-scale migration from marginal areas, contributing to 'spatial poverty trap'-like processes in which populations may remain trapped in marginal and vulnerable areas (Black et al. 2013; UK Government Office for Science 2011).

In a limited number of island and other locations, migration may be the only option, but its scale will be more modest. Nevertheless, there will be migration pressures, although recent reviews suggest that drivers of migration other than environmental drivers (such as those linked to economic opportunities and socio-political pressures) may still dominate (Connell 2011). Economic growth and transformation, especially as experienced in Asia in recent decades, has meant a rapid urbanization in low-lying coastal areas, and these areas will be especially vulnerable to extreme events and sea-level rises. In other words, migration *into* vulnerable areas has been the pattern and is likely to continue (Blake et al. 2011). These relatively recent and poor settlers may end up becoming more marginalized, thus undoing some of the progress that they experienced previously and making them unable to move into better areas of cities. This situation may expose them to poverty and to poor water quality and sanitation and lead to deprivation and higher disease

burdens (Black et al. 2013). Environmental change may even cause the emergence of further spatial poverty traps that are linked to higher threshold costs to move to better areas because these settlers lack the wealth to invest in necessary adaptation.

All of these processes will be exacerbated as the pressures to reduce greenhouse emissions lower global growth, with impacts on the export demand of these transforming economies and therefore on jobs and income growth. These poor and emerging economies will also face pressures to reduce their own emissions, thus also reducing growth opportunities. Indirect effects could also arise as pressures for the global reduction of greenhouse gas emissions impose costs on the world economy, thereby limiting global GDP growth and affecting both the demand for poorer countries' exports and their income growth. Furthermore, although poor countries generally have much lower greenhouse gas emissions than do higher income countries, there is likely to be increasing pressure to force low-income countries to curb their emissions as well. This would further increase the costs of transformation to a higher-return economy. Finally, climate change is only one source of environmental pressure that has serious impacts in many developing countries and elsewhere. Curbing environmentally damaging activities to safeguard natural resources for the future as well as the population's health and the quality of life will divert resources from growth-oriented opportunities and impose further costs on their economies and current economic growth opportunities.

Green Growth and Poverty

Can alternative growth paths be designed to avoid these negative consequences linked to climate change and other long-term environmental pressures? 'Green growth' alludes to patterns of growth that are consistent with internalizing some or all environmental costs but leaving sufficient opportunities for economic growth. Internalizing the social costs linked to negative environmental consequences makes the allocation of resources more efficient in a static efficiency framework. Hallegate et al. (2011) offer a careful discussion of when and why green growth could improve overall growth. Using an output (frontier-expanding) growth equivalent of the static efficiency arguments, properly assigning values to environmental capital would raise potential output by unlocking production factors. The less substitutable environmental capital is by other sources of capital, the higher the output gains. Furthermore, there could be efficiency gains on other production factors and more scope for technological progress. The key to these results is that we use an output measure that accounts for the environmental capital and uses appropriate (shadow) prices. In that case, appropriately valued overall output should be able to compensate any losses in efficiency gains on other factors.[3]

As Hallegate et al. (2011) helpfully note, growth in conventionally measured output or GDP may not necessarily increase. Environmental regulation could *reduce* conventionally measured output growth if other growth-benefiting efficiency gains or technology changes are discouraged or are not possible and the net return from those investments exceeds the net return from the environmental measure.[4] If particular green policies reduce overall growth, then given the close link between GDP growth and poverty, poverty reduction may be slowed. Much of the overall assessment of the beneficial impact of 'green' growth will depend on the overall welfare objectives, the way it is measured, and whether returns to environmental capital and ecosystem services are valued directly and appropriately.

Even if welfare gains are valued properly by considering returns from environmental capital, the conclusion that there will necessarily be welfare gains from this internalization is only correct 'on average' for the welfare of country as a whole because any (appropriately valued) output gains create the possibility of compensation. However, among a heterogeneous population with different people owning different endowments and supplying or using factors of production, when we begin from a particular allocation that did not account for these environmental valuations, there will be distributional effects that do not necessarily imply Pareto improvements for everyone *unless* there are also (lump sum) transfers to compensate the losers. Given that this compensation rarely happens, it will be important to identify those policies that will favor or hurt the poor, even if they increase the overall output or welfare measured in particular aggregate or global ways.

Identifying Distributional Linkages

Our key concern in the remainder of the paper is the following: under what conditions do different green growth policies favor the poor? We are *not* considering further whether any overall growth trade-off exists between the greening of growth and growth itself, although this issue will remain crucial for poverty reduction. Other research, such as the study of Hallegate et al. (2011), has focused on this issue, and its implications (and opportunities) for policy are well summarized (World Bank 2012). As discussed above, under certain assumptions, green growth that appropriately values environmental capital will increase the overall (appropriately valued) output, potentially allowing any losers from this new growth path to be compensated. However, this does not mean that this compensation will occur; as a result, it does not follow that the poor gain from this move to green growth. In other words, we *only* focus on the distributional costs and benefits of green growth, with an emphasis on current poverty. Because green growth is framed in a growth context, the appropriate counterfactual to consider is how a green growth path would *change* the relationship between growth and poverty reduction. As argued

previously, this must include a consideration of the spatial, sectoral, and dynamic consequences of greening growth.

To do so, we must make 'green growth' more specific by articulating a number of possible families of policies that could have spatial, sectoral, and dynamic consequences. We consider green growth to consist of three types of (linked) policies. First, it relates to policies that aim to change the *prices or shadow prices* of environmental capital to internalize the externalities and other market failures that are inherent in the use and management of environmental capital. Key examples would be fuel prices, products with high intensity of fossil fuels (such as inorganic fertilizer), or water charges. Because correct pricing, including via taxation and subsidies, may not always be feasible, it could also involve other non-price interventions to affect production processes, typically via *regulation*, such as the nature of technology allowed in production processes. Examples include environmental controls on vehicles or manufacturing technologies linked to the use of water or air.

A second set of policies considered are interventions that focus directly on *investments* in low carbon or otherwise less environmentally damaging production processes. The main instruments considered are public investments and financing deals to encourage private investment or other forms of joint ventures between the public and private sector. Examples include the location and nature of transport or water infrastructure.

A third set of green growth policies might be considered, in principle, a subset of the other two, but this set of policies often is considered separately, particularly in the context of *climate change adaptation efforts* and *climate-resilient investments*. Examples include efforts to make growth more resilient to factors such as sea-level changes or increased risks in production linked to extreme weather events. This class includes infrastructure investment to reduce the impact of sea-level rises, urban planning in flood plains, or the development of lower-risk crops for (increasingly) drought prone areas. We do not consider policies that are generally good for growth but make growth more resilient in the face of climate or other environmental change and extreme events. Examples are human capital investments, flexible market access including by the poor, appropriate macroeconomic policies, and the development of better savings and insurance mechanisms (DFID 2010; World Bank 2010b).

Although we do not yet have high-quality empirical evaluations of well-defined examples of 'green growth' in action, we can think conceptually through its consequences and offer suggestive evidence. In principle, there are several channels through which green growth could favor the poor. For example, it could ensure that the negative costs on the poor's livelihoods are properly internalized by producers, such as halting unmanaged commercial deforestation or the pollution of water and air, which has serious health and sanitation consequences. This is likely to have positive consequences for the poor's living conditions, although there may be a

reduction in incomes or GDP growth. It could make growth more labor-intensive so that labor demand would rise more quickly, with real income benefits. It could facilitate the structural transformation from agriculture into other activities by, for example, increasing the prices and returns to the agricultural activities in which the poor are more involved. It could increase the connectivity between poorer and richer areas and facilitate the migration into less vulnerable areas, such as if green growth investments are used to make the roads connecting marginal and richer areas more resilient to extreme events.

These examples reflect four central dimensions to assess various 'green growth' measures and their consequences on the poor, as developed previously: first, (static) efficiency gains, whereby internalizing externalities may offer potential welfare gains to the poor; second, the way in which green growth could contribute to poverty reduction via growth in employment (i.e., the labor intensity of green growth); third, the livelihood and sectoral transformational dimension of green growth and the extent to which it allows the poor to move into higher return activities; and finally, the spatial connectivity and mobility dimension of green growth in terms of migration opportunities and the linkages between poorer and richer areas.

It is possible to test a number of core examples from each of the three categories of green growth policies, environmental pricing and regulation, low carbon investment (as an example of clean investment more generally), and adaptation investment (as an example of risk-mitigation investment) with regard to their potential impact on the four dimensions above. The result is that certain elements of the 'green growth' policy set may have far less positive (or even negative) impacts on current poverty reduction than others. The list is not exhaustive, but the overall patterns will become clear. These examples do not make assumptions about their effectiveness to increase growth; this is left to other work to assess. We only assume that they may offer reasonable growth prospects that are 'green'. At most, a simple narrative is offered for how this may happen.

Environmental Pricing and Regulation

Let us first consider charging prices for natural resources such as fuel or water that more closely reflect the full social opportunity costs of their production and use. Considering first the poor as consumers, such charges would be paid in absolute terms more by the rich than the poor simply because they use more fuel and water. However, the welfare effects on the poor are more appropriately assessed by the share of spending on these commodities, which is likely to be relatively high for the poor. In any case, the poor will be affected as consumers irrespective of whether they are relatively less or more affected by the charges than are the rich. These impacts can be considerable (Coady et al. 2006). In theory, the efficiency gains should allow for enough resources for lump-sum transfers to compensate the poor, but in

practice, ex-post redistributive measures have been difficult to institute. This reflects an important general principle in *any* pricing-based green growth strategy: without complementary actions, the poor will be harmed as consumers. *Compensatory social protection must be part and parcel of any attempt to internalize shadow prices of natural capital for the poor not to suffer reduced real income.*[5]

Forms of regulation could have similar impacts as pricing, even in cases in which the poor may not be forced to pay more directly. In terms of distributional consequences, it is easy to imagine gains from regulatory changes for poor slum dwellers who are exposed, for example, to air and water pollution. For their part, richer groups already have more resources to adapt to environmental pressures (such as via private clean-up of local environmental damage or better garbage collection). Provided that the improvement in environmental consequences for consumers does not substantially or even totally exclude the poor and the benefits that they obtain are not outweighed by increased payments for public or private services (such as garbage collection), this may even be seen as pro-poor regulation. In general, the design and enforcement of pricing policies or other regulation as part of green growth policies will determine the extent to which the poor benefit.

Bias in favor of richer groups in society is also a distinct possibility. Regulation in the form of planning restrictions is a good example. As part of the introduction of green growth in some middle and low-income countries, stricter planning restrictions may exist for industries to be forced not to locate near residential areas to protect air quality. However, if the poor live in unplanned city settlements, then they may suffer more because these settlements may not be covered by the regulatory protection, and industries may relocate toward these areas (Blake et al. 2011).

Thus far, we have only considered the poor as consumers of ecosystem services from environmental capital. Poor households are also dependent for their incomes on environmental capital. Whether poor households are losing or gaining will therefore also depend on how regulation or pricing affects their production and job opportunities. Many of the poor use environmental capital directly, as occurs in agriculture or fisheries. Internalizing environmental capital costs is predicted to have a positive impact on sustaining this source of capital. However, a longer-run improvement can be accompanied by lower returns to activities in the nearer term. If the poor have relatively high discount rates (as seems reasonable; see Deaton 1990), then they will put a relatively higher weight on nearer-term costs compared to the rich. It is possible that the policy could redistribute wealth away from the current poor.

The poor may also be employed in industries with strong impacts on the environment. If the cost of using environmental capital rises, then there would be incentives to move to production processes that are less intensive in environmental capital and more intensive in alternative production factors, such as physical or human capital (e.g., linked to more costly and sophisticated technologies that

require more capital and technical support). Although the size of these effects would depend on the substitutability of environmental capital with these other capital sources, the poor tend to have less access to human and physical capital, so it may be more difficult for the poor to enter these now more profitable activities and compete with wealthier incumbents or more skilled workers.

A similar concern is related to labor demand of the type the poor can supply and the consequences for labor demand from rising relative costs of using environmental capital, such as the impact of a relative increase in fuel or water prices or environmental regulation. The key for the poor would be the low-skilled-labor intensity of this 'new' growth trajectory. Arguments are often made for 'green jobs', but a priori, the expectation that industries need to find more energy efficient ways of production may lead to higher intensity in human and physical capital with sophisticated technologies, which are not *necessarily* labor intensive. In any case, it will be crucial to explicitly assess the labor intensity of these alternative technologies for cleaner production. Their efficiency and ability to sustain longer-term growth is not sufficient to make a judgment about whether these green growth changes are good for jobs in the nearer term, or even in the longer term, if the poor continue to face barriers to acquiring additional human capital.

There is as yet no evidence for developing countries, so the views expressed on this are mainly conjecture. Although it is often taken for granted, the evidence on green jobs in rich economies in response to reducing incentives for the use of environmental capital is not clear-cut at best, and positive effects – if any – are dependent on local circumstances (Huberty et al. 2011). Some of the highest quality evidence on reducing incentives for the use of environmental capital gives one pause. Using very detailed plant-level growth data, Greenstone (2002) shows that 590,000 jobs were displaced between 1972 and 1987 in the United States due to a particular key environmental regulation: the US Clear Air Act. Recent work on more cost-effective incentive-based policy instruments finds milder negative effects (Harrington et al. 2012). In any event, the way in which this would play out in the developing world is difficult to judge, but maintaining labor-intensive growth that internalizes environmental capital costs is not automatic. The above discussion indicates that the implications of the latter for the former depend on numerous adjustments of factor proportions and technology within sectors as well as adjustments of output shares across sectors.

If the labor intensity of growth cannot be maintained, this situation leads to further consequences in terms of structural transformation. Growth that is less labor intensive will slow the labor absorption from agriculture. Moreover, inputs into agricultural growth, such as fertilizer, water, or transport, will become more expensive. Although lower intensification of agriculture may preserve the environmental capital required for agriculture in the long run, it will slow the agricultural and labor productivity growth that feeds structural transformation in the nearer

term. If policies reduce incentives for mobility (due to fuel costs or transport regulation), the spatial development effects could also be considerable because longer-distance trade may become less profitable and because populations in more remote areas are at risk of losing their connectivity with urban centers.

Low Carbon and Other Environmentally Friendly Public Investments

The second set of green growth policies we consider here is the direct implementation or encouragement by the public sector of environmentally friendly investments. In the transport sector, for example, some capital may be allocated away from long-distance travel (such as highways connecting towns over large distances), making the movement of goods and people more expensive and affecting the integration of economies. Investments may instead focus on local-level development (such as supporting growth focused on local linkages, including agriculture near cities and other local product focuses). More marginal areas would find it more difficult to catch up because the integration of economies would be affected. In both examples, the dynamic transformation of economies across sectors and space would be affected. Whether the local growth effects would compensate for these negative effects is not clear a priori. However, it is highly unlikely that such plans would survive any serious economic scrutiny.

Among the more serious options, some have argued that investment in low carbon energy production could raise employment considerably because it would require considerable labor. This view would lead to green growth as an engine of pro-poor job creation. For example, Engel and Kammen (2009) provide data on the labor intensity in years per GWh for various means of producing energy, including gas, coal, nuclear, solar, geothermal, and biomass. The data suggest that much more labor is required per GWh for low carbon alternatives than for gas or coal. The implication of this higher labor intensity is that moving resources to invest more in low carbon alternatives would create more jobs for the same energy supply; therefore, moving to low carbon would be pro-poor. However, this reasoning is incorrect because this shift does not necessarily keep the cost of fuel constant. At present, low carbon energy sources may well be more expensive, leading to some of the effects discussed above. The impact on jobs and the poor requires a proper accounting of the impact on labor demand both directly, in energy production, and indirectly in the rest of the economy as a result of changes of costs and price incentives.

Of course, investments in these sectors may be subsidized to ensure that the delivered energy costs themselves are not affected (while energy production is made relatively greener); these jobs may then seem 'secure'. Huberty et al. (2011) reviewed evidence from richer economies and correctly remarked that these jobs are effectively 'Keynesian' demand boost jobs whose sustainability can be questioned. Even if 'Keynesian' consequences are expected (in that these jobs are securely created due

to the growth impacts of these investments), there is still an opportunity cost to creating jobs using this investment capital. If these investments occur with subsidies or public capital, then the net impact on pro-poor jobs should be compared with alternative ways of stimulating positive impacts on the poor. It remains to be seen whether spending resources on greening energy production is necessarily the best option. In many circumstances, a trade-off between poverty reduction and greening energy production would seem most plausible. Strand and Toman (2010) offered a further discussion of trade-offs between 'green' investments beyond energy production with employment and poverty reduction.

Adaptation and Other Resilience-Enhancing Investments

A particular set of investments includes those intended to adapt economies to the new realities of climate change, including providing more resilience against extreme events. These are examples of a broader class of investments that can increase resilience (e.g., a greater capacity to mitigate the impacts of extreme weather with the current climate). It is sometimes difficult to distinguish these from the previous two categories of intervention, although they differ conceptually: the policies considered previously largely attempt to reduce the pressures on the environment (via pricing, regulation, and environmentally sensitive investments), whereas here we focus on green growth investments that are intended to reduce the socioeconomic hazards that are consequences of climate and other large-scale environmental change.

Again, the range of investments involved can be considerable. Their relative poverty impact will depend on similar considerations to those discussed above. How will they affect prices for natural resources, such as fuel or water? How will they affect the quality of resources available and the efficiency with which they are used? What are the labor demand consequences of these changes? Are these investments themselves labor intensive? It is worthwhile to reflect briefly on two further aspects: the consequences for structural and spatial transformation and thus for poverty.

There is considerable discussion on how to make agriculture, the main sector in which the poor are involved, and especially smallholder agriculture more resilient to extreme events and adapted to shifts in potential climate conditions (e.g., Howden et al. 2007). In a context of poverty in potentially affected areas, it is not surprising that the response is largely focused on increasing the local food security and self-sufficiency. Furthermore, to reduce the consequences of extreme events, the use of drought-resistant or salt-tolerant crops is promoted. These may be sensible policies, although they can also reduce mean returns. For example, many drought-resistant crops have low returns, leading to more security but also less poverty reduction (Morduch 1995; Dercon 1998). Some alternative investments may reduce risks without affecting expected returns, such as flood protection infrastructure, although they may require substantial upfront investment.

More crucially, these policies appear to start from the premise that for poverty reduction, the best investment is to ensure that adaptation occurs where the poor are currently located. However, because this adaptation investment has opportunity costs, for a dynamic process of poverty reduction, investing in agricultural resilience for marginal, increasingly drought-prone areas may not be effective or efficient. Instead, investment could be used to speed diversification out of agriculture for affected populations, including via migration, in line with well-established routes out of poverty (Blake et al. 2011). Without such careful weighing of different alternatives for adaptation for the poor, the risk may be exacerbated that the poor will remain trapped in unsuitable areas and with low-value livelihoods and that they will find it increasingly difficult to move out of agriculture as part of the economic transformation. In short, processes consistent with spatial poverty traps, as discussed previously, are also a risk with forms of adaptation investments that focus disproportionately on marginal rural areas.

Related concerns should be highlighted when considering adaptation or other resilience-enhancing investments in urban settings. An example is infrastructure investment to avert the consequences of sea-level rises or to protect assets against extreme weather events in one of the many large coastal cities at risk. The greatest direct economic returns for these investments would be from protecting the business districts or the residential areas of the rich because these assets are of the highest value. Similarly, if relocation investments are necessary, they would most easily be accomplished by protecting businesses and the highest value assets in cities. Many of the poor are located in flood plains and unplanned settlements, and they would find it far costlier to move permanently, partly because their main assets are the houses in which they live without legal title. Large-scale infrastructure investments to protect them are hardly sensible because these marginal areas should not be places of urban settlement. Sensible urban resettlement policies would need to be designed with sensitive relocation strategies to ensure that poor populations are not spatially trapped (see, for example, Patel et al. 2002, for a description of sensitive resettlement in the case of Mumbai; other examples are in World Bank 2011).

Conclusion: Is Green Poverty a Possible Consequence of Green Growth?

There is no doubt that environmental change is affecting the poor disproportionately, whereas growth is essential for poverty reduction. Green growth is offered as a recognition of the need to sustain the growth required for poverty reduction while ensuring that environmental costs are internalized. Until recently, however, discussions of green growth have said little about *how* it is realized other than conventional measures for externality internalization and innovation. Even less has been said

about the potential consequences on poverty reduction from policies that steer an economy onto an environmentally sustainable trajectory.

In this paper, we do not take issue with whether growth can be sustained, although environmental costs must be internalized. We argue that internalizing environmental constraints may change the patterns of growth with distributional effects that are not necessarily pro-poor growth. We choose to focus on those currently in extreme poverty as experienced in some of the poorest countries. A focus on the currently extreme poor is not only relevant but can also be justified because their plight leaves little scope for long-term horizons (another way of saying that their discount rate is likely to be relatively high), whereas building resilience for future climate and environmental pressures requires higher wealth and incomes for the poor. A stronger sensitivity to intergenerational concerns could change much of what has been said in this paper, not least if the focus were on relative poverty or inequality rather than on extreme absolute poverty.

In developing this focus on the implications for the currently poor, the paper focuses on three elements of green growth policies: pricing and regulation to internalize environmental capital costs (such as via fuel or water pricing or regulation on water and air pollution); low-carbon and other environmentally sensitive public (or publicly stimulated) investments; and 'green' adaptation and other resilience-enhancing investments, particularly to effectively address the consequences of climate change. Four elements for assessing a green growth strategy with regard to its effectiveness to reduce poverty are offered: first, the efficiency gains from internalizing environmental externalities; second, its labor intensity because labor is the main asset of the poor; third, whether it contributes to a transformation of the livelihoods and sector of employment of the poor because most of the poor are either engaged in agriculture or in low-return informal sector self-employment; and finally, how it contributes to the spatial transformation of economies during growth and how it affects the opportunities for poverty reduction from internal migration and urbanization.

We argue that green growth could have important negative consequences for the currently poor that may outweigh the benefits for the poor from growth. In particular, *environmental pricing and regulation* may have considerable negative consequences for the poor as consumers and would require specific social protection measures to compensate for price rises. In terms of regulation, there is a risk of a bias in favor of the rich, which could exclude the poor from the benefits of regulation or even make them worse off, such as by displacing pollution.

Environmental pricing and regulation also affect the poor as producers because they may not have sufficient access to the wealth or human capital required to substitute for more expensive energy or other natural resources in their production processes. Furthermore, because the poor often only have their labor to sell, they depend on the labor intensity of growth for rapid poverty reduction linked to

growth. With higher costs of natural resources and other services of environmental capital, incentives are likely to be present to substitute human and physical capital for fuel and environmental capital. The labor intensity of such 'green' growth is crucial, however. More technology and capital intensive growth are unlikely to favor the poor.

Low carbon and environmentally sensitive investments can also have impacts that are not pro-poor. For example, although low carbon energy production may be more labor intensive, the size of the subsidy and/or public investment required may crowd out more pro-poor ways of spending resources. Other environmentally sensitive investments, such as promoting local food self-sufficiency or discouraging the movement of goods and people, do not necessarily benefit the poor because poorer areas may face increased risk of becoming trapped in low incomes and disconnected from higher growth areas.

The trade-off is even more stark when considering adaptation and other resilience-enhancing investments. In rural areas, these investments may induce the poor to adhere to lower returns and lower-risk livelihoods with little chance of escaping, even in increasingly marginal areas. This would follow if local adaptation is seen as the main option rather than also considering the critical need for economic transformation, including options related to migration and investing in urbanization. In urban settings, creating climate resilience may be targeted toward the most important economic assets, whereas the poor may end up trapped in environmentally marginal and unsuitable areas with little hope of being included in infrastructure plans for climate resilience.

Green growth is not necessarily bad for the poor. However, the key message of this paper is that promises that green growth will offer a rapid route out of poverty are not plausible, although there may be a less rapid exit than with more conventional growth strategies. To sustain growth, green growth also needs to be weighed in terms of its ability to reduce poverty. To sustain poverty reduction, green growth may involve giving up some environmental benefits to keep the growth-poverty elasticity high. Because poverty reduction remains at the top of the agenda, different shades of green may be needed. In particular, poverty reduction is a powerful force for giving those who are currently poor more resilience to the increasing risks of climate change. They should not be asked to pay the price for greening the planet.

Notes

Professor of Development Economics, University of Oxford and Chief Economist, Department for International Development, the UK government department involved in aid and development. Paper prepared for the World Bank project on Inclusive Green Growth. I am grateful for helpful comments by Mike Toman and the editor and referees of this journal. All views and errors are mine and should not be attributed to the UK's Department for International Development.

1. Although always a difficult exercise, some serious attempts have been made to quantify the costs of climate change for the poor, combining microeconometric evidence with modeling. World Bank (2010b) puts the price tag for adaptation at $70-$100 billion per year for the developing world, well outweighing the likely future welfare costs of climate change.

2. We must be careful with the evidence for poverty traps narrowly defined. In fact, it is difficult to find strong evidence. However, there is considerable evidence of poverty persistence in the sense of very slow escape and recovery and actions that lead to a perpetuation of poverty to avoid risk (Dercon 2009).

3. Note, however, that in an endogenous growth framework with growth externalities from the accumulation of certain factors of production, this may not *necessarily* be the case. For example, in some models, temporary reductions in growth due to increases in costs of production may actually have permanent consequences. For example, increasing environmental costs may reduce short-run resources for human capital investment, and overall growth may slow. Of course, there is no necessity to this either; it depends on the specific endogenous growth model applied (Aghion and Howitt 1998).

4. This same reason could also be the case for *appropriately* valued output growth if only *some* environmental regulations are put in without a full accounting of environmental capital such that not all factors are appropriately accounted for. A well-known welfare economics result from the theory of second best is that if only *some* and not all distortions are removed, then the allocation may actually become *less* efficient, both statically and dynamically. Applying this result, environmental regulations on some but not all forms of fuel-intensive transport may make the allocation less efficient and slow *appropriately* valued output growth.

5. The exception would be if the benefits for the poor that result from the new pricing of scarce resources, such as cleaner water or air, have a value to them that is larger than the costs of increased payments for public services (or for private goods whose costs are higher to reflect internalization of externalities outweigh the cost). This is possible, but they are likely to be potential benefits in the long run for higher short-run costs in the form of reduced real income.

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