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Changing the Climate for Development

A climate-smart world is attainable despite substantial challenges of mitigation and adaption

Climate change is inextricably linked with development and human progress, says the World Bank's recently released *World Development Report* 2010. With climate change already drawing resources away, continued change at current rates will pose increasingly severe challenges to development. Even a warming of 2°C above preindustrial temperatures—the minimum the world is likely to experience—could result in increased weather variability, more frequent and more intense extreme events, and greater exposure to coastal storm surges leading to a higher risk of catastrophic and irreversible impacts. Up to 400 million more people could be at risk of hunger, and 1–2 billion more may no longer have enough water to meet their consumption, hygiene, and food needs.

The report reviews existing evidence to argue that developing countries are more exposed and less resilient to climate hazards. A temperature rise of 2°C above preindustrial temperatures could result in permanent reductions of 4–5 percent in annual per capita consumption for Africa and South Asia, but minimal losses for high-income countries and an average reduction in world consumption equivalent to about 1 percent of global GDP. Overall, the developing world could bear up to 80 percent of the cost of the damages associated with climate change.

Several factors explain this. Developing countries are particularly reliant on ecosystem services and natural capital for production in climate-sensitive sectors. Much of their population lives in physically exposed locations under economically precarious conditions, and their financial and institutional capacity to adapt to climate change is limited.

Yet reducing climate risk is affordable, the report argues. Major models of climate change predict that the benefits of stabilization exceed costs at 2.5°C warming, and all conclude that proceeding without mitigation efforts would be disastrous. Moreover, immediate action is needed to deploy energy-efficient, low-carbon technologies, because the dynamics of the climate system limit the extent to which future mitigation can substitute for efforts today. For example, stabilizing the climate near 2°C warming would require global emissions to begin declining immediately by about 1.5 percent a year. A five-year delay would have to be offset by faster declines in emissions, and longer delays could not be offset.

The report argues for coordinated action with global participation in mitigation efforts and finds that if any country or group of countries does not participate, others must use higher-cost mitigation options to achieve a given global target. According to one estimate, if the United States, which is responsible for 20 percent of world emissions, does not participate in the

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FOCUS
FDI Protectionism on the Rise

A balance needs to be found between the rights and responsibilities of governments and those of investors

Foreign direct investment (FDI) is an important source of capital, technology, know-how, and market access, each of which is central to economic growth and development. Global FDI inflows rose from an average of $50 billion a year in 1981–85 to $1.9 trillion in 2007. By the end of 2007 a global FDI stock of $15 trillion had accumulated, controlled by more than 80,000 multinational enterprises with more than 800,000 foreign affiliates.

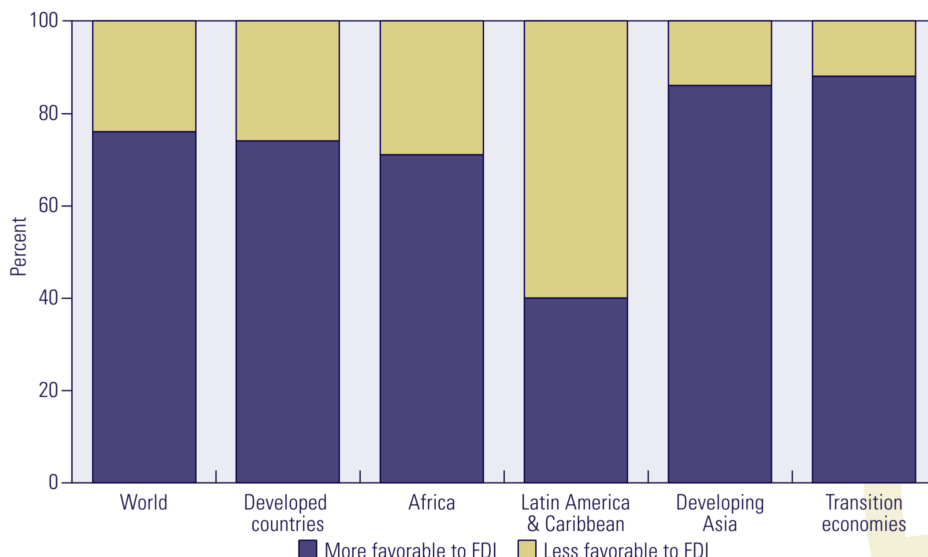
This growth in FDI was made possible in large part by an enabling regulatory environment. Since the mid-1980s countries have liberalized entry conditions for multinational enterprises and instituted aggressive measures to attract them. Complementing these national regulatory developments has been a rapid increase in international and, especially, bilateral investment agreements that enshrine nondiscriminatory protection of investment.

Yet FDI protectionism is on the rise, a new paper by Sauvant finds. In 1992–2002, 6 percent of recorded regulatory changes related to FDI tended to make the investment climate less welcoming. The share of unfavorable changes doubled in 2003–04 and doubled again in 2005–07, to 21 percent. In Latin America about 60 percent of FDI-related regulatory changes in 2007 were unfavorable to foreign investors (figure 1).

Moreover, foreign investments have been subject to heightened scrutiny as a result of actions taken to protect national security interests, often in relation to strategic sectors. In the United States, for example, these concerns have centered on protection of the defense industry. Since 9/11 the number of notifications by the Committee on Foreign Investment in the United States (CFIUS), which reviews and investigates cross-border mergers and acquisitions, has steadily increased, from 55 in 2001 to 165 in 2008. Meanwhile, CFIUS investigations grew from 1 to 22.

Many other countries have also tightened regulatory frameworks. Among these, Australia, Canada, China, France, India, Japan, and the Russian Federation have recently introduced legal mechanisms that bring foreign investment activity in strategic sectors under greater government scrutiny if such activity threatens national security and public order.

Figure 1. Direction of National FDI-Related Regulatory Changes, 2007



Source: James X. Zhan, "Recent Global Trends: FDI Flows, TNCs and Policies" (Geneva: UNCTAD, 2008).

These findings raise several concerns. First, that governments are finding it necessary to institute stricter screening mechanisms suggests that the welcoming attitude toward FDI is giving way to a more cautious approach. Second, while governments need the flexibility to pursue legitimate public policy objectives, regulatory mechanisms based on such concepts as *national security* and *public order*—which remain poorly defined—give governments the discretion to limit the applicability of existing regulations. This opens the door for discriminatory treatment of foreign investors and creates a risk of abuse for protectionist purposes. Moreover, regulatory decisions are made by screening bodies that often do not represent an adequate plurality of interests and typically result from "black box" deliberations that cannot be appealed. This makes the investment climate unpredictable and less transparent.

The paper argues that regulatory changes at the national level are leading to changes at the international level, most notably in the bilateral investment treaties that make up much of the international investment regime. The U.S. model bilateral investment treaty of 2004 is one example. Compared with the 1984 model, it weakens protections that international investors had acquired through free trade and investment agreements and gives more rights to governments.

The international investment law regime faces the challenge of finding a balance between the rights and responsibilities of governments and those of investors. This process will entail clarifying poorly defined concepts such as *national interest* and *essential security interests* and developing an international consensus on their meaning.

Such a process could be undertaken in an international organization or through a more ambitious process resembling U.S. policy restatements. A restatement of international investment law could indicate common ground in investment agreements'

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Do Poorer Countries Have Less Capacity for Redistribution?

The capacity for redistribution is less in poorer countries. But it varies among those at any given income level

The government of a rich country will (understandably) be disinclined to give its aid to a poor country that has ample internal capacity to address its poverty problem through redistribution from people whose standard of living is similar to that of taxpayers in that rich country. Yet we do not have adequate tools for measuring this capacity for redistribution. Indeed, past measures imply heavy tax burdens on people who would be considered poor in rich countries.

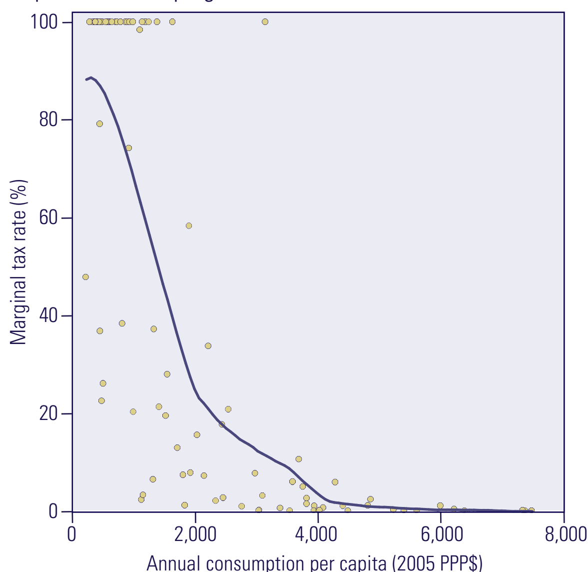
The issue of country capacity for redistribution also arises in discussions of development policy *within* developing countries. It is often argued that sustained poverty reduction is impossible without sustained growth. To accept this claim, one must essentially reject its corollary: sustained poverty reduction is impossible through income redistribution. Is that right?

New and better measures of the capacity for redistribution can be devised and implemented with currently available data. These measures make a more appealing assumption about how the required tax burden is to be allocated among those living above the poverty line: the burden is set to zero until one reaches a standard of living that would not constitute poverty in a representative rich country, then rises as a share of income in excess of the rich-country line.

Using these measures with data for 90 developing countries, a new paper by Ravallion finds that developing countries fall into two distinct groups. The first appears to have little or no scope for making a serious impact on the problem of extreme absolute poverty through internal redistribution from those who are not poor by U.S. standards. The second appears to have far more scope for such redistribution.

Most of the poorest countries fall into the first group. The marginal tax rates needed to cover the poverty gap for the international poverty line of $1.25 a day are clearly prohibitive (more than 50 percent and in many cases 100 percent or higher) for most countries with consumption per capita under $2,000 a year at 2005 purchasing power parity (figure 1). Even covering half the poverty gap would require prohibitive marginal tax rates in most poor countries. Yet among better-off developing countries (consumption per capita of more than $4,000 a year, say) the marginal tax rates needed for significant pro-poor redistribution are very small—less than 1 percent on average and less than 6 percent in all cases.

Figure 1. Marginal Tax Rates on Those Living above the U.S. Poverty Line Needed to Cover the Poverty Gap in 90 Developing Countries



Note: Based on a poverty line of $1.25 a day.

Basic-income schemes (guaranteeing the poverty-line income to everyone, whether poor or not) financed by progressive income taxes would also require prohibitive marginal tax rates in the poorest half of developing countries. If the tax burden is confined to those who are not poor by developed-country standards, providing a basic income of $1.25 a day would call for marginal tax rates of 100 percent or more for three-quarters of countries. Even for middle-income developing countries, this type of redistribution starts to look feasible in terms of the implied marginal tax rates only if one allows for a basic income appreciably less than $1.25 a day, significant tax burdens on the middle class, or both.

The emphasis often given to the role of economic growth in poverty reduction can claim support from this new evidence on the capacity for redistribution in poor countries. While the poorest countries appear to have weak capacity for attacking poverty through income redistribution—given the sheer weight of poverty and thinness of the rich strata in their starting distribution—with sufficient economic growth the tax rates on the rich required for covering the poverty gap start to fall rapidly. It makes sense that the relative emphasis on growth as against redistribution, and the reliance on external aid, change with the level of economic development.

These new measures and data suggest an affirmative answer to the question posed in the title. But that support comes with qualifications. The capacity for redistribution varies among countries at any given level of mean income. And the variance is highest among the poorest countries; there are even a few poor countries where seemingly light taxation of the rich could make a substantial dent in poverty. These differences bear little relationship to a standard measure of inequality, but reflect the deeper parameters of the distribution of income in countries that have generated lower poverty to start with.

Martin Ravallion. 2009. "*Do Poorer Countries Have Less Capacity for Redistribution?*" *Policy Research Working Paper* 5046, *World Bank*, *Washington*, DC.

Does Trade Credit Substitute for Bank Credit during a Financial Crisis?

When bank credit dries up during a crisis, can a firm count on its suppliers to step in with trade credit? Probably not

Around the world, many firms cite insufficient access to bank credit as one of the biggest constraints to the operation and growth of their business. These financing constraints are especially binding for small and medium-size enterprises. During times of financial crisis, as banks become more reluctant to lend, the financing constraints are likely to worsen. As a result, firms may forgo attractive investment projects and cut back on investments in capital and research and development.

An alternative source of finance is trade credit, provided by suppliers of raw materials and other inputs. Trade credit has the potential to serve as an important source of finance for financially constrained firms, because suppliers may be better able to overcome information and enforcement problems than financial institutions can. These factors may allow suppliers to lend more liberally than banks, especially during downturns.

A new paper by Love and Zaidi tests whether suppliers can mitigate the impact of a systemic financial crisis by increasing the provision of trade credit to their financially constrained customers—or whether the liquidity shocks are propagated along the supply chains, amplifying the impact of the crisis. The analysis uses a unique data set based on a survey carried out by the World Bank after the 1998 financial crisis in four East Asian countries: Indonesia, the Republic of Korea, the Philippines, and Thailand. The Bank surveyed about 3,000 firms on the impact of the crisis, their access to various sources of finance before and during the crisis, and their prospects for recovery.

The study finds that on average the use of trade credit declined during the crisis. This is evidenced by a decline in the share of inputs the firms bought on credit from their suppliers (accounts payable) and in the share of sales they made on credit to their customers (accounts receivable). The study also finds evidence that the length of payables declined in three of the four countries, but finds mixed evidence on the length of receivables. Interestingly, the cost of credit increased because firms offered higher discounts on cash purchases during the crisis. Thus trade credit became more expensive and more restrictive during the crisis. The aggregate results do not support the hypothesis that trade credit is a viable substitute for contracted bank credit in times of financial crisis.

In addition, the study analyzes heterogeneous responses of the trade credit positions of financially constrained firms using two key indicators for financing constraints. The first is an objective measure (whether a firm has been denied a loan), and the second a subjective measure (a manager's perception of whether domestic bank finance has become more restrictive during the crisis).

The analysis finds that financially constrained firms extended less trade credit to their customers during the crisis. This is observed both in the share of output sold on credit and in the length of time the firms allowed their customers for repaying the credit. The firms also charged higher prices for the trade credit they offered. This suggests that firms that face financial constraints pass on their liquidity shock upstream to their customers, which in turn may cut trade credit to their own customers.

Moreover, financially constrained firms received less trade credit from their suppliers. Thus they bought a smaller share of inputs on credit, had less time to repay the credit to their suppliers, and had to pay a higher price for trade credit. The reason could be that the suppliers to the financially constrained firms were themselves more financially constrained than the firms in the sample on average. In other words, there might be a high correlation between suppliers' and customers' financing constraints, suggesting that suppliers simply pass on their liquidity shock up the supply chain to their customers. Whether or not the suppliers to firms identified as more financially constrained are themselves more constrained, the results imply that they do not lend their financially constrained customers a "helping hand" and instead withdraw credit from less creditworthy firms.

The results show that negative shocks to the supply of bank credit were not mitigated by an increase in trade credit during the Asian crisis. In addition, firms constrained in their access to bank finance were also constrained in their access to trade finance, which results in propagation of the liquidity shocks along the supply chain. This finding underscores the importance of bank credit and policies aimed at ensuring stability of the banking system during a financial crisis.

Inessa Love and Rida Zaidi. Forthcoming. "Trade Credit, Bank Credit and Financial Crisis." International Review of Finance.

FDI Protectionism on the Rise

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provisions on rights and responsibilities of investors and states. Where differences cannot be resolved, characterizing the differences and explaining the rationale behind them could help harmonize investment law. At the very least, such a restatement could aid investors and governments in understanding the complexities of investment law and serve as a useful guide for arbitrators and negotiators of investment agreements.

Karl Sauvant. 2009. "FDI Protectionism Is on the Rise." Policy Research Working Paper 5052, World Bank, Washington, DC.

Demographic and Socioeconomic Patterns of HIV/AIDS Prevalence in Africa

Despite an accumulation of evidence about patterns of HIV prevalence in Africa, many misconceptions persist

The demographic and socioeconomic patterns of the prevalence and incidence of HIV/AIDS in Sub-Saharan Africa should shape programs and policies to combat the epidemic. With new and expanded data sets, researchers are increasingly able to both measure HIV status and collect detailed socioeconomic data in population-based samples. This enables more-detailed analyses than were previously feasible. A new paper by Beegle and de Walque explores the methods and unusual evidence on the link between demographic factors, socioeconomic status, and HIV/AIDS.

Having direct measures of HIV status is important because single risk measures may not be consistent with actual HIV status. For example, clinical trials on the efficacy of circumcision in preventing HIV show that circumcised men are less likely to contract HIV. Yet in some countries the opposite association is observed: in Cameroon, Ethiopia, and Malawi HIV rates are higher or at least not lower among circumcised men. In Kenya HIV prevalence is higher among men who used a condom the last time they had paid sex than among men who did not. These results do not contradict the scientific evidence of lower HIV risk with use of condoms and circumcision, but reflect the fact that other behaviors can counteract the protection they afford.

Understanding HIV patterns is complicated by the connections between covariates. In national samples of Ethiopian women and Kenyan men there is a positive correlation between education and HIV status. But this correlation disappears in urban and rural subgroups because HIV infection in Africa is higher in urban areas, where the education levels of adults are also higher. Consequently, how one interprets the link between education and HIV status depends critically on how the correlation is modeled.

To what extent is poverty to blame for the AIDS epidemic? Globally, the countries hardest hit by the AIDS epidemic are poor. In Sub-Saharan Africa, however, some of the hardest hit countries are relatively richer. Despite the lack of evidence, poverty continues to be associated with the spread of the epidemic. HIV/AIDS, however, is contracted very differently from other prevalent contagious diseases. In fact, it is associated with behaviors and characteristics often associated with higher income (lower poverty) and education: more concurrent partners, geographic mobility, and urbanization.

Early marriage has often been cited as an HIV risk factor for young women. Yet, overall, data drawn from several national surveys do not support the hypothesis that early marriage increases the HIV risk for women. At the same time, with rare exception in the countries studied, women married at younger ages are not less likely to contract HIV.

A pervasive, if unstated, belief is that males are largely responsible for spreading the infection among married and cohabiting couples. Evidence on discordant couples (couples in which only one partner is HIV-positive) yields two findings that challenge conventional notions about HIV transmission. First, in at least two-thirds of HIV-positive couples (couples with at least one HIV-positive partner), only one partner is HIV-positive. Second, in many such couples only the woman is HIV-positive. HIV prevention policies should take into account the fact that partners who are not yet HIV-positive are an important target group and that women are almost as likely to transmit the infection to their uninfected partners as men are.

Several important messages emerge. First, it is important to bring a critical eye to empirical evidence on the link between socioeconomic status and HIV, especially in relation to definitions, sample design, and empirical methods. Sexual behaviors that may be viewed as proximate determinants of HIV status are not necessarily correlated with actual HIV status. For example, risky sexual behaviors with low-risk partners may not increase the likelihood of contracting HIV. The details of sample and methods matter in interpreting results. A positive education-HIV correlation may mask the urban-rural pattern of the disease, rather than indicate an actual association between schooling and prevalence.

Second, there are gaps in knowledge and thus a need to continue to improve the evidence base. The introduction and scaling up of antiretroviral therapy (ART) in most African countries profoundly affect the dynamics of the epidemic and have the potential to modify the links between demographic and socioeconomic variables and HIV. If ART is more easily available for specific groups (such as wealthier or urban populations), HIV prevalence may shift, controlling for changes in incidence. By reducing AIDS-related mortality, ART modifies the link between HIV prevalence and incidence, reinforcing the need for accurate measures of incidence, potentially the more appropriate indicator of the current state of the epidemic.

Finally, even with better data sources it will still be difficult to generalize results across countries. Moreover, even within countries patterns across regions and groups can be starkly different. As shown by the results presented here, few consistent and significant patterns of prevalence by socioeconomic and demographic status are evident.

Kathleen Beegle and Damien de Walque. 2009. "Demographic and Socioeconomic Patterns of HIV/AIDS Prevalence in Africa." Policy Research Working Paper 5076, World Bank, Washington, DC.

Making (More) Sense of Subjective Rankings

Do firms' subjective rankings of constraints to their business reflect reality? Evidence suggests that they do

Qualitative rankings of constraints to business are popular among policy makers and in the private sector. Beyond the relative ease of collecting this type of data, firm rankings of constraints are appealing because they implicitly combine an assessment of the severity of the conditions with their importance to the firm's operations. Short delays in a critical area should be ranked higher than long delays in less critical areas. And perceptions can have real effects, influencing firms' decisions to undertake investments, hire workers, or expand production.

Yet there is skepticism among economists about the reliability of such rankings and therefore the weight they should be given in determining reform priorities. Comparisons can be difficult if there are differences in respondents' willingness to complain; one person's "moderate" constraint may be another's "major" constraint. There are also concerns about whether answers reflect the issue or the firm's performance—that is, whether poorly performing firms are more likely to blame poor external conditions for their plight.

A new paper by Hallward-Driemeier and Aterido tests how well subjective rankings reflect the realities they are intended to measure—using comparable data from World Bank Enterprise Surveys covering 72,000 firms in 105 countries along with both more objective data from the survey and outside data sources. It also examines whether what you say you care about depends on who you are (for example, firm size) and how you are doing (performance).

As a first step the absolute rankings are converted to relative rankings. With 17 issues being ranked, a respondent's average level of complaint can be subtracted away. This controls for differences in willingness to complain that are likely to shift all of an individual's responses up or down. It also addresses any performance bias acting as a firm-level effect.

The analysis finds strong empirical evidence that perceptions reflect the real investment climate. The relative rankings are strongly correlated with matching quantitative measures from both the survey and external sources. Thus those complaining relatively more about electricity do face more outages. This provides credibility to the subjective rankings.

Firm size and performance could still matter. Certainly there is much variation in responses across firms within a country. But size and performance do not simply shift rankings up or down monotonically. Indeed, average levels of complaints are lowest for small firms and higher for both micro and larger firms, and both expanding and contracting firms report significantly higher levels of overall constraints than stable firms do. These nonlinearities in the effect of characteristics on the severity of a constraint caution against simply including firm characteristics as controls; the overall effect can be insignificant when there are important relationships in different segments of the data.

The analysis investigates three potential channels through which firm size and performance could affect subjective rankings:

- *The actual conditions experienced vary with firm size or performance*. Indeed, the analysis finds that smaller firms are less able to access external finance and the bribes they pay are proportionately larger. Contracting firms are more likely to have experienced losses from crime and spend more time with officials and in inspections. These patterns in the quantitative data correlate well with the importance given to these issues in the relative rankings.
- *Relative priorities across investment climate areas vary with firm characteristics*. While firm characteristics do not have simple level effects on rankings, they do affect the relative importance of constraints. Crime and access to finance are more likely to be among the top constraints of smaller firms. Expanding firms rate labor skills relatively high; contracting firms see labor regulations as more constraining.
- *Firm characteristics have a nonlinear impact on how constraining the same objective condition is reported to be* (for example, large firms may report the same number of power outages as being more constraining than small firms do). There is little evidence of nonlinearities by either size or performance in how constraining objective conditions are reported as being.

The analysis confirms that variations in relative rankings by firm size and performance reflect differences in the objective conditions these firms face as well as differences in their relative priorities. Thus endogeneity does remain a concern when trying to use subjective rankings to explain performance. But it is reassuring that who you are has little independent effect on how constraining the same objective conditions are reported to be.

Overall, the qualitative rankings do not simply reflect the respondent's characteristics, nor does performance or size affect how the same objective conditions are translated into rankings. Instead, the subjective rankings appear to be a good reflection of objective conditions and the importance of these conditions to the firm—which is the original appeal of this type of data.

Mary Hallward-Driemeier and Reyes Aterido. 2009. "Comparing Apples with…Apples: How to Make (More) Sense of Subjective Rankings of Constraints to Business." Policy Research Working Paper 5054, World Bank, Washington, DC.

Legacy of the Caste System in the Enforcement of Norms

Denial of basic social and economic rights may diminish the repressed group's ability to organize collective action

Well-functioning groups enforce social norms that restrain opportunism. Social norms are enforced by informal sanctions that are often imposed by those who obey the norm even though sanctioning is costly and yields no material benefits to the punisher.

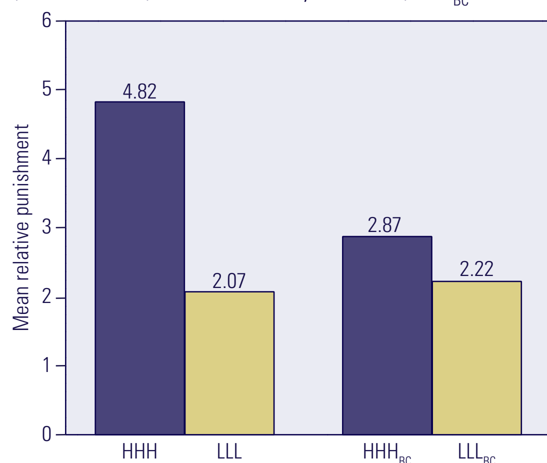
A recent study by Hoff, Kshetramade, and Fehr examines factors that can influence social capabilities to enforce restraints on opportunism. The study shows how individuals' lifelong position at the top or bottom of an extreme social hierarchy—the Indian caste system—affects their willingness to punish norm violations. The Indian caste system is an excellent setting for studying the effects of social structure on the willingness to altruistically punish norm violations. Individual mobility across caste status groups is virtually absent, while the greater freedoms enjoyed by low-caste individuals in the past 50 years have created much overlap between high- and low-caste groups in wealth, education, and political participation in village government. This means that the study can identify the impact of caste status on individuals' willingness to sanction norm violations.

The study conducts an experiment with participants drawn from more than 200 villages in rural north India. In the experiment individuals play a game in their home village with two anonymous players from other villages. The subjects are unobtrusively informed of the caste status of the matched players. Two players (A and B) each have an endowment (50 rupees) roughly equal to the daily wage of an unskilled agricultural worker. Player A has to choose one of two actions: he can "send" his total endowment to B, in which case the experimenter triples its value so that B has 200 rupees altogether; or he can opt out, in which case A keeps his endowment and the game ends. If A sends his endowment to B, then B must make a binary choice: to keep everything for himself or to send 100 rupees back to A.

Player C is an uninvolved outside party who can punish B at a cost to himself. His endowment is 100 rupees. For each 2-rupee coin that player C spends on punishment, player B is docked a 10-rupee note. C has to make a choice for the case in which B keeps all the money and for the case in which B sends money back to A. Player C makes this choice before learning of B's decision. He indicates his choice by moving coins on a game board in private.

The study finds that those at the bottom of the caste hierarchy adopted an attitude toward norm enforcement that was closer to pure self-interest than did those at the top. As figure 1 shows, compared with high-caste subjects, low-caste subjects are considerably less willing to altruistically punish violations of a cooperation norm when the victim is a member of their own specific caste (treatments HHH and LLL). The vertical axis shows the amount spent on punishment when the player defects compared with the amount spent on punishment when the player cooperates ("mean relative punishment"), measured in units of 2-rupee coins.

Figure 1. Relative Punishment When the Victim and Third-Party Punisher Are Members of the Same Specific Caste (HHH and LLL) and When They Are Not (HHH_{BC} and LLL_{BC})



In the game results shown in the first two columns, the injured party always belonged to the punisher's specific caste while the norm violator did not. In the results reported in the last two columns, the norm violator always belonged to the punisher's specific caste, while the injured party did not (HHH_{BC} and LLL_{BC}). If the punisher is motivated by in-group favoritism—taking revenge if the injured party is a member of his own specific caste, or giving a norm violator from his own specific caste a break—less punishment should be observed in the second experiment. There is a substantial reduction in the severity of punishment imposed by high-caste individuals but no significant change in that imposed by low-caste individuals. As a result, the caste gap in punishment vanishes. This suggests that in-group favoritism—being more socially minded, but only toward those considered part of one's community—is an important driving force behind the higher castes' stronger willingness to punish norm violations altruistically.

The results suggest that a regime that deprives a group of basic rights may shape the repressed group's culture in ways that moderate members' willingness to altruistically punish violations of cooperation norms, with effects on the group's ability to enforce informal agreements and sustain collective action.

Karla Hoff, Mayuresh Kshetramade, and Ernst Fehr. 2009. "Caste and Punishment: The Legacy of Caste Culture in Norm Enforcement." Policy Research Working Paper 5040, World Bank, Washington, DC.

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Kyoto Protocol, the cost of achieving the original target would increase by about 60 percent.

If financing is available, can emissions be cut deeply or quickly enough without sacrificing growth? The report finds that most models suggest that this is possible, though not easy. Dramatically higher energy efficiency, stronger management of energy demand, and large-scale deployment of existing low-carbon electricity sources could result in about half the emission reductions needed to put the world on the path toward 2°C warming. Many of these measures have substantial co-benefits, but are hampered by institutional and financial constraints that have proved hard to overcome.

Moreover, investments to enhance agricultural productivity and efficiency in water use will be needed to feed an additional 3 billion people by 2050 without further threatening already stressed ecosystems. The report estimates that to avoid pulling more land into cultivation and spreading into "unmanaged" lands and forests, agricultural productivity will have to increase by as much as 1.8 percent a year, compared with 1 percent a year without climate change. A substantial part of this increase will have to occur in developing countries because agriculture in high-income countries is already close to the highest feasible yields.

The report shows that improved management of land and water resources is not always as complicated as it may appear. In the Indian state of Andhra Pradesh, for example, farmers participated in a simple scheme to monitor rain and groundwater levels and learned new farming and irrigation techniques. As a result of the scheme, about a million farmers voluntarily reduced groundwater consumption to sustainable levels.

The report also finds that the existing instruments and sources of climate finance remain inadequate and are in need of reform. For example, the novel 2 percent tax on certified emission reductions used by the Adaptation Fund under the Kyoto Protocol would result in lost gains from trade for developing-country suppliers of carbon credits. Adaptation finance thus requires an allocation mechanism that embraces the principles of transparency, efficiency, and equity.

World Bank. 2009. World Development Report 2010: Development and Climate Change. Washington, DC: World Bank.

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