Capitalism, State Economic Policy and Ecological Footprint: An International Comparative Analysis

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Introduction

This article examines the role of state and economic institutions in environmental performance. There is much debate surrounding the extent to which state involvement in the market advances ecological sustainability or contributes to ecological degradation. Several theorists argue that the dynamic expansionary nature of capitalist economies, together with the institutional incentive mechanisms that drive the pursuit of private profit, inevitably lead to greater resource withdrawals and pollution emissions that together represent ecological degradation.[1] In this context, state intervention is seen as a means to curb the ravages of a free market economy that operates in a way that is fundamentally inconsistent with ecological processes. Others claim that it is that very dynamic essence of market economies that will generate the solutions needed to achieve ecological sustainability.[2] Simon was an early proponent of the ability of markets to address ecological problems.[3] Ecological modernization theorists have since offered a more sophisticated assessment of how the free market, operating in conjunction with limited state intervention and with support from civil society organizations, can generate the technological development and social reforms needed to address environmental problems.[4] From this perspective, as the demand for environmentally sound products and the urgency of achieving ecological sustainability increases, the free market is well suited to respond. According to this logic, state policies that impede market functioning restrain the market's

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1. Foster 1999; O'Connor 1994; Schnaiberg 1980; and Schnaiberg and Gould 1994.
2. Esty and Porter 2005; Jaffe and Palmer 1997; Mol 1997; Mol and Spaargaren 2000; Porter 1991; and Simon 1981.
3. Simon 1981.
4. Mol 1997; and Mol and Spaargaren 2000.

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problem-solving potential and inhibit the development of technologies and processes that would improve environmental performance.

There has been much theoretical debate on this issue and there is now a growing body of empirical analyses looking at these questions. Case studies have examined the way in which state policies and market forces have helped or stifled environmental improvements within specific industries.[5] Some have found support for the notion that free market dynamics aid in the development of more sound environmental processes. For example, Mol found significant improvements in the environmental performance of the chemical industry, driven in part by market forces and the increased profitability associated with more efficient resource use and waste reduction.[6] Other cases suggest that market functioning, unrestrained by the state, has undermined potential environmental gains. Weinberg, Pellow, and Schnaiberg analyze how the consolidation of economic power common in market systems undermined the recycling industry in one US city.[7] Obach found contradictory evidence in his examination of organic farming: market forces expanded organic production but reduced the ecological benefits of this approach to agriculture.[8] These case studies shed some light on the processes by which market activity can help or harm progress toward environmental sustainability, yet more comprehensive quantitative analysis is needed to verify the patterns suggested by this research.

Some studies have utilized cross national data to develop a more encompassing picture of the effects of various political and economic conditions on environmental outcomes.[9] Yet, despite the centrality of capitalism to several theories of environmental performance, few studies have examined the effects of capitalism directly. Several studies consider the association between *economic development* and environmental performance, and economic development is, in most cases, closely associated with free market policies. But this is not the same as analyzing the effect of capitalism itself. Other research has considered various dimensions of free market economic activity, such as trade practices or private property protection, and their association with resource use and pollution. But again, these studies do not directly assess the effects of capitalism as a system. This study seeks to fill that gap by testing the way in which capitalism as a system relates to environmental performance.

In addition to understanding the relationship between broad economic institutions and environmental performance, it is also important to examine the role of particular state policies that collectively define economic institutions. It is possible to break the economy down into policy elements such as regula-

5. Desai 2002; Mol 1995; Sonnenfeld 2000; Obach 2007; and Weinberg, Pellow, and Schnaiberg 2000.
6. Mol 1995.
7. Weinberg, Pellow, and Schnaiberg 2000.
8. Obach 2007.
9. Burns, Davis, and Kick 1997; Esty and Porter 2005; Frank, Hironaka, and Schofer 2000; Grossman and Krueger 1995; Hammond 2006; Jorgenson 2003; Jorgenson 2005; Jorgenson and Burns 2007; Jorgenson and Rice 2005; Roberts, Parks, and Vásquez 2004; Scruggs 1999; and York, Rosa, and Dietz 2003.

tory policies, trade policies, fiscal policies, and the other policy dimensions that together define the economic system. This can further refine our understanding of the relationship between capitalism and ecological impacts. In this article we use panel data to assess the relationship between capitalism, and its specific policy components, and a state's ecological footprint, a standardized measure of environmental impact.

Literature Review

The growing global ecological crisis has been widely recognized. By any number of measures, including species loss, fresh water depletion, desertification, loss of forest land, oceanic pollution, and climate change, most scientists consider current practices to be unsustainable in the long term. Many studies have considered dimensions of this ecological degradation by focusing on particular ecological indicators such as carbon dioxide emissions,[10] heavy metal contamination,[11] deforestation,[12] or urban air quality.[13] But some researchers interested in the institutional causes of good or poor environmental performance have turned to composite measures of ecological sustainability.[14] While several such measures exist, increasingly scholars rely on "ecological footprint" as a measure of environmental impact.[15] The ecological footprint index incorporates the range of resources and services provided by the natural environment and converts them into a single measure based on the biologically productive land area needed to provide those resources and services at a given level of consumption and technology.[16] It considers land consumed for the built environment, land used to produce forest products, land needed to absorb carbon dioxide, and resources used for agriculture and fishing. These factors are then used to generate a number representing the hectares of biologically productive land needed in order to sustain given consumption levels within a state.

A team of scholars conducting footprint analysis at the global level concluded that human activity began to overshoot the planet's carrying capacity during the 1980s.[17] In 1961 humanity's use of the earth's total biocapacity stood at 70 percent, but by 1999 that figure had reached 120 percent resulting in the furtherance of such ecological problems as a rapid rate of extinction and the accumulation of carbon dioxide in the atmosphere. Since that time humanity's ecological footprint has continued to increase along with the size of the global population and the fraction of that population engaging in unsustainable levels of consumption.

10. Roberts and Grimes 1997.
11. Grossman and Krueger 1995.
12. Ehrhardt-Martinez, Crenshaw, and Jenkins 2002.
13. Esty and Porter 2005.
14. Levett 1998; Parris and Kates 2003; and Pearce 2006.
15. Ferguson 2002; Jorgenson and Burns 2007; York, Rosa, and Dietz 2003; and Wackernagel et al. 2002.
16. Wackernagel et al. 1999.
17. Wackernagel et al. 2002; and Loh and Wackernagel 2004.

But as would be expected, per capita ecological footprints, like other measures of sustainability, vary dramatically between countries and among individuals. People in some countries, especially those in economically developed ones, are living well beyond a sustainable capacity, while others, primarily those in less developed parts of the world, are consuming at a sustainable rate. Yet even within the developed and less developed worlds there is considerable variation between countries. This suggests that there is much to be learned by comparing state policies to ascertain what may allow for more sustainable development and what contributes to the overuse of resources.

Scholars have conducted several studies to identify how various social conditions and institutional factors influence ecological sustainability.[18] The factors most commonly associated with ecological impacts are population and per capita gross domestic product (GDP).[19] This was the conclusion reached by York, Rosa and Dietz who used footprint data to test a number of hypotheses regarding the causes of ecological degradation. They assessed the relationship between ecological impacts and such variables as population, GDP per capita, urbanization, political rights, civil liberties, and state membership in international environmental treaties. They found that both population size and level of affluence are key determinants of environmental outcomes.

The effect of population is consistent with traditional Malthusian predictions. More people means more consumers and resource use, and greater environmental impacts are expected as population grows. But when conducting comparative analysis of state and economic institutions, it is best to consider resource consumption on a per capita basis. The economic condition in a country, as measured by per capita GDP, is another factor that has commonly been associated with adverse environmental consequences. Using a per capita measure, York, Rosa and Dietz found that as GDP rises, so too does ecological footprint.[20]

The relationship found between ecological footprint and per capita GDP contradicts the Environmental Kuznets Curve (EKC) hypothesis. That hypothesis predicts a decline in ecological impacts once a state exceeds a certain level of economic development.[21] EKC theorists have offered a range of hypotheses for why we should expect this outcome. Some suggest that environmental degradation should slow with economic development because less polluting technologies become available. Development also brings with it a rising middle class that demands policy reforms to ensure a healthy living environment once basic economic needs have been met.[22] A shift in developing economies away from

18. Burns, Davis, and Kick 1997; Desai 2002; Ehrhardt-Martinez, Crenshaw, and Jenkins 2002; Esty and Porter 2005; Frank, Hironaka, and Schofer 2000; Grossman and Krueger 1995; Hammond 2006; Jorgenson 2003; Jorgenson and Burns 2007; Scruggs 1999; and York, Rosa, and Dietz 2003.
19. For example, Rosa, York, and Dietz 2004.
20. Rosa, York, and Dietz 2004
21. Ehrhardt-Martinez, Crenshaw, and Jenkins 2002; Grossman and Krueger 1995; and Roberts and Grimes 1997.
22. Barrett and Graddy 2000.

manufacturing and toward more service based industries is also thought to contribute to better environmental performance. This explanation raises doubts about the generalizability of the Kuznets curve phenomenon given that the manufacturing commonly associated with ecological degradation must be relocated to other countries who will then be inhibited from improving their own environmental performance (as discussed below).[23]

Evidence for an EKC has been found in several studies.[24] For example, Esty and Porter's cross national study of 71 states found that higher incomes reduce urban particulate and sulfur dioxide levels and improve energy efficiency.[25] This supports Grossman and Krueger's[26] earlier study that found ecological benefits associated with economic development.

Yet, overall, empirical support for the EKC hypothesis remains weak. Several authors have identified flaws in the statistical techniques used to demonstrate the phenomenon.[27] In addition, most of the research that finds support for the environmentally beneficial consequences of economic development relies on a limited number of domestic environmental quality indicators. While domestic pollution levels and energy efficiency may improve with economic development, the ecological footprint measure takes into consideration resources extracted abroad for domestic consumption by adjusting for imports and exports. Rothman argues in favor of consumption based measures of ecological impact for this very reason. His research suggests that more developed states address some of their own environmental problems by displacing environmental damage onto the less developed states where the goods are produced.[28]

This was the conclusion reached by Jorgenson and Burns who found that export dependence, characteristic of many less developed states, was associated with a smaller ecological footprint.[29] In other words, in accordance with uneven ecological exchange theory, poorer states produce more manufactured goods for export, enduring the pollution associated with that production, while wealthier countries, where the manufactured goods are consumed, shift to cleaner industries. This is also consistent with world systems and dependency perspectives in which resource flows are considered to benefit wealthy "core" states at the expense of those less developed states that occupy the "periphery." In this view environmental degradation follows a pattern similar to resource allocation, where benefits accrue to the rich and costs are borne by the poor. Jorgenson and Burns also reaffirmed conclusions reached by York and his colleagues regarding the positive association between per capita GDP and ecological footprint.[30]

23. Stern 1998; and Torras and Boyce 1998.
24. Ehrhardt-Martinez, Crenshaw, and Jenkins 2002; Esty and Porter 2005; Grossman and Krueger 1995; Roberts and Grimes 1997; and Shafik and Bandyopadhyay 1992.
25. Esty and Porter 2005.
26. Grossman and Krueger 1995.
27. For example, Arrow et al. 1995; and Stern, Common, and Barbier 1996.
28. Rothman 1998; Roberts and Grimes 1997; and Torras and Boyce 1998.
29. Jorgenson and Burns 2007.
30. York, Rosa, and Dietz 2003; and Jorgenson and Burns 2007.

A state's level of economic development and its associated position in the world system are clearly relevant to understanding environmental performance, but it is also necessary to consider how economic policy and related state functions influence this relationship. Similarly situated nations, both rich and poor, exhibit considerable variation in environmental performance. Some comparative studies have examined state policies and political institutional variables that bear on economic activity and the associated environmental outcomes.[31] Scruggs found evidence that institutional variables have ecological consequences in an analysis of environmental performance in seventeen western democracies.[32] He found that corporatist institutional arrangements yield better outcomes for the environment. While one might expect that the dominant economic actors in the corporatist model, labor and capital, would be inclined to unite in favor of economic interests at the expense of the environment, Scruggs argues that corporatist systems allow the state to bring these actors together in ways that are not possible in more pluralistic laissez-faire systems. The quasi-official roles adopted by economic interests organized through highly structured peak organizations create a context where cooperation in pursuit of public goods, like environmental protection, is more attainable. Scruggs' account affirms the importance of the particulars of state economic policy and institutional arrangements in determining environmental outcomes.

Esty and Porter also found political institutional factors to be relevant to understanding environmental performance.[33] While controlling for GDP, they found that states may pursue a "clean path" or a "dirty path" in regard to the environment. This is based, in part, on the type of regulatory regime in place, including such factors as the stringency of environmental requirements, enforcement, consistency, and participation in international agreements. But they also found that the broader institutional context is important. This includes political variables such as the protection of civil liberties and the independence of the judiciary, as well as some factors directly tied to the economic order, such as the level of corruption and the protection of property rights.

York, Rosa and Dietz also included political variables in their study using ecological footprints as the measure for environmental performance.[34] They found no association between state environmental action and factors such as civil liberties and political rights. They assessed these variables in a test of ecological modernization theory, which, in addition to free markets, suggests that political openness and state support for environmental protection facilitate movement toward ecological sustainability. However, their evidence failed to support this perspective. In contrast, they argued that their findings lend more support to the treadmill of production theory, the direct counterpoint to ecological modernization's optimism regarding free markets.

31. Esty and Porter 2005; and Hammond 2006.
32. Scruggs 1999; and Scruggs 2001.
33. Esty and Porter 2005.
34. York, Rosa, and Dietz 2003.

Treadmill theorists tie ecological degradation to free market activity and the unending pursuit of profit and economic growth.[35] Constant reinvestment, driven by market competition, inevitably yields greater resource withdrawals and pollution. Within this framework a largely powerless environmental movement is marginalized and coopted by the central state and the economic actors who determine economic policy and its associated ecological degradation.

Despite these competing claims, almost no quantitative comparative analysis has examined whether capitalism itself plays a role in advancing or preventing ecological degradation. In one study that does include a capitalism measure, York, Rosa and Dietz found that capitalism, in itself, cannot explain levels of ecological unsustainability. Their capitalism measure proved significant in only one of the six models they tested, and in that case it was found to reduce ecological footprint. In light of their other models that better predicted environmental outcomes they conclude that, "The results suggest that impacts are not *directly* the result of capitalism . . . per se, but rather are generated by more basic material conditions, which in turn may be mediated by capitalism."[36]

Although capitalism was not found to be directly associated with environmental performance, that study treated capitalism as a dichotomous variable based upon the Freedom House Index ("mixed capitalist" and "state capitalist" were also pooled with the capitalist category), thus the direct influence of capitalist institutions may have been obscured. Given that capitalism is a complex economic system composed of several key elements, many of which can be measured on a continuous scale, it is useful to analyze the impact of capitalism and its associated state economic policies on the basis of these individual features. Indeed, the York, Rosa and Dietz study revealed evidence that the specifics of state policy in regard to the economy may contain crucial determinants of ecological performance. They state that "increases in GDP per capita consistently lead to increases in impacts, but the increases are not proportional."[37] This suggests that there may be aspects of capitalism and state economic policy that mediate environmental impacts within the broader economic order.

Thus, understanding the role of capitalism in environmental performance requires examining each element of this overriding institution within the context of state policies that define this economic framework. Despite competing claims and ambiguous evidence, no quantitative comparative analysis has closely examined whether capitalism itself plays an independent role in advancing or preventing ecological degradation.

As described above, scholars have recently begun to move beyond case studies as a means of understanding environmental performance outcomes. Increasingly sophisticated measures of environmental impacts and the greater availability of this data have allowed researchers to test the correlates of envi-

35. Schnaiberg 1980; and Schnaiberg and Gould 1994.
36. York, Rosa, and Dietz 2003, 294.
37. York, Rosa, and Dietz 2003, 295.

ronmental performance cross-nationally. The ecological footprint is among the most comprehensive of these measures. While scholars have identified several political and economic factors which appear to contribute to a state's ecological footprint, questions regarding the role of capitalism, as an economic order and set of state policies, remain. The question presents itself, "What role does capitalism play in environmental performance and what specific state policies associated with market functioning affect that performance?" A comprehensive assessment of what elements of a free market system, if any, influence ecological impacts is needed. We now turn to the manner in which this study seeks to fulfill that need.

Variables

Dependent Variable

We use per capita ecological footprint as the dependent variable in this analysis. As noted above, ecological footprint is increasingly recognized as the best measure of environmental impacts.[38] It is based upon measures of six primary resource uses: 1) built space 2) crop land, 3) grazing land, 4) forests, 5) fishing, and 6) land needed to absorb carbon dioxide emissions. These combined measures capture the primary services provided by the natural environment for the human population: living space, resources, and a sink for wastes and converts them into a single measure based upon the biologically productive land needed to provide these services.

Environmental performance measures based upon consumption are superior for comparative analysis of overall environmental impacts, because they account for resource use regardless of the point of extraction or manufacture. Given this, ecological footprint is not a good measure for certain other types of analyses, such as evaluating environmental quality in a given geographical location. As described above, some consumers are capable of displacing the ecological consequences associated with their consumption through trade. The power of the footprint measure is that it can attribute resource depletion to the end user who benefits from the resource use, rather than producers along the production chain. While ecological footprint is considered by many to be the most comprehensive environmental impact measure, it does not consider all environmental impacts. For example hazardous waste is not accounted for, nor is consideration given to the land needed for species preservation other than those that directly serve human needs. Nonetheless, ecological footprint provides a powerful tool for comparative environmental impact analysis.[39]

Ecological footprint data was provided by the Global Footprint Network

38. Ferguson 2002; Hammond 2006; Parris and Kates 2003; and York, Rosa, and Dietz 2003.
39. For a more comprehensive critique of the ecological footprint see van den Bergh and Verbruggen 1999; Deutsch et al. 2000; Jorgenson 2003; and York, Rosa, and Dietz 2003.

which serves as the primary research center and clearinghouse for footprint analysis.[40] The Network's dataset includes per capita footprint data for 150 countries for the years 1961–2003. The years 1996–2003 were used for this analysis, since they are the years for which we have consistent data on the independent variable (described below). Of the 150 countries included in the Global Footprint Network dataset, 110 had the complete dependent and independent variable information needed for this analysis.

Independent Variables

The central question of this study concerns the effect of capitalist institutions on the natural environment. Yet capitalism is a complex system that involves many dimensions of state economic policy. Simple dichotomous designations fail to capture that complexity. Countries are neither purely capitalist nor noncapitalist. They vary along a continuum in terms of the extent to which they adopt policies that reflect capitalist characteristics.

A comprehensive accounting of all of the policies that define an economic system would be difficult to construct; however, the Heritage Foundation, a profree market think tank, has created an index designed to measure how closely states live up to the capitalist ideal. It is based upon nine measures[41] of state policy representing what they consider to be essential "economic freedoms."[42]

From this perspective, most forms of state involvement with the free market economy represent restrictions on the freedom otherwise enjoyed by individuals pursuing their own self interest through unfettered exchange. Although this is a simplification of such a complex economic order (let alone definitions of "freedom"), the basic concept is consistent with common understandings of laissez-faire capitalism or what we might consider to be capitalism in its purest form. In this conception, the state is recognized as necessary for carrying out basic functions, such as the enforcement of contracts and the protection of private property, yet capitalism in its ideal form minimizes state intervention. Within such an economic order individuals are left to engage in economic exchange with the state avoiding intervention except to provide basic functions necessary for commerce. While critics of unfettered capitalism will obviously take issue with the value that Heritage Foundation analysts place on such "economic freedoms" and may challenge the purported social and economic consequences of such policies, the Economic Freedom Index (EFI) represents one of the most thorough and systematic assessments of state adherence to orthodox free market principles.

40. Global Footprint Network 2007.
41. See *Index of Economic Freedom,* a yearly publication of the Heritage Foundation for further details on the methodology. In 2004 the Heritage Foundation added an additional figure for labor freedom, thus increasing the number of variables included in the index to ten. Since we use data from 1996–2003, the measures here are limited to the nine component variables that make up the index for that period.
42. Beach and Kane 2007, 37.

For each of the nine subcomponent measures that make up the EFI, quantitative data relevant to each policy is converted into a score of 0 to 100 with lower scores representing a lack of economic freedom (less capitalist) and higher scores representing greater economic freedom (more capitalist). The nine components are equally weighted in the construction of the index which, itself, is measured on a 0 to 100 scale. The variables that together constitute the EFI are drawn from a range sources such as the World Bank, the World Trade Organization, the International Monetary Fund, the Asian Development Bank, the African Development Bank, the US Department of Commerce, the Office of the US Trade Representative, the Economist Intelligence Unit, and Transparency International.[43] Below we describe the variables in the index as defined and calculated by the Heritage Foundation identifying them by the simplified names used in this study with original Heritage Foundation names in parentheses.

1) Regulation (Business Freedom) is defined as "the ability to create, operate, and close an enterprise quickly and easily."[44] This variable is based on ten equally weighted measures that include such factors as the number of days it takes to open a business and the cost of obtaining a business license.
2) Trade (Trade Freedom) is defined as "the absence of tariff and non-tariff barriers that affect imports and exports of goods and services."[45] This variable is based on minimum, maximum, and average tariff rates in addition to non-tariff barriers to trade.
3) Fiscal (Fiscal Freedom) "is a measure of the burden of government from the revenue side. This variable is based on tax burden in terms of the top tax rate on income (individual and corporate separately) and the overall amount of tax revenue as a portion of GDP."[46]
4) Spending (Freedom from Government) "is defined to include all government expenditures—including consumption and transfers—and state-owned enterprises."[47] This variable is based on a combination of government expenditures as a percentage of GDP (weighted as two thirds of the measure) and the share of government revenues generated from state owned enterprises.
5) Monetary (Monetary Freedom) "combines a measure of price stability with an assessment of price controls."[48] This variable is based on the weighted average of inflation rates over the previous three years combined with a penalty for price control policies.
6) Investment (Investment Freedom) "is an assessment of the free flow of capital, especially foreign capital."[49] This variable is based on policies to-

43. Beach and Kane 2007, 53.
44. Beach and Kane 2007, 38.
45. Beach and Kane 2007, 38.
46. Beach and Kane 2007, 39.
47. Beach and Kane 2007, 38.
48. Beach and Kane 2007, 38.
49. Beach and Kane 2007, 39.

ward foreign investment and capital flows using criteria such as whether foreigners can own real estate and whether there are legal protections against expropriations. Points are deducted for each type of investment restriction creating a scale ranging from 100, where foreign investment is encouraged and treated the same as domestic investment, to zero, where foreign investment is banned and international payments, transfers, and capital transactions are prohibited.

7) Financial (Financial Freedom) "is a measure of banking security as well as independence from government control."[50] This variable is based on an evaluation of whether policies meet the basic criteria, such as having no government ownership of financial institutions and limiting regulatory functions to enforcing contracts and preventing fraud. Points are deducted for such policy features as bans on the private ownership of financial institutions and for the lack of central bank independence.
8) Property (Property Rights) "is an assessment of the ability of individuals to accumulate private property, secured by clear laws that are fully enforced by the state."[51] This variable is based on an evaluation of characteristics including government protection of private property and for court systems that allow for the quick and efficient enforcement of contracts. Points are deducted for such factors as restrictions or bans on private ownership and judicial systems that are corrupt or inefficient.
9) Corruption (Freedom from Corruption) "is based on quantitative data that assess the perception of corruption in the business environment, including levels of governmental legal, judicial, and administrative corruption."[52] This variable is based on the Transparency International Index which utilizes 14 different surveys from 12 organizations that are designed to capture the frequency and level of bribery in the public and private spheres of each country. The subject pools for these surveys are drawn from foreign businesses, local businesses, foreign and local experts, and other business elites. Survey questions ask about experiences and perceptions of the country's level of corruption. The definition of corruption is limited to political and administrative officials engaging in activities such as bribe taking and the misuse of public funds.

Control Variables

A number of control variables are included in the analysis, each of which has been found, in at least some studies, to influence ecological footprint. These variables include the following:

50. Beach and Kane 2007, 39.
51. Beach and Kane 2007, 39.
52. Beach and Kane 2007, 39.

- urban population as a percentage of total population
- GDP per capita
- exports of goods and services as a percentage of total GDP
- climate

The first three measures come from the World Development Indicators report of the World Bank[53] and the fourth from the CIA Fact Book. Studies have found per capita footprint increasing with urban population and GDP per capita.[54] Exports as a percentage of GDP have also been found to influence ecological performance, with greater export dependence being associated with a smaller ecological footprint.[55] York, Rosa, and Dietz found climate to have a significant influence on environmental performance.[56] Adopting their measure, we use distance from the equator as an indicator of climate. Countries in the "tropical" zone (less than 30 degrees from the equator) were used as the reference category. Dummy variables were created for countries within the temperate zone (30–55 degrees from the equator) and those considered in the arctic region (more than 55 degrees north or south of the equator). Controlling for these variables allows us to discern the independent effects of capitalist policies on per capita ecological footprint.

Hypotheses

Although there has been little quantitative examination of the relationship between capitalism and its associated state policies and ecological footprint, several theories—from treadmill of production theory to world systems and dependency theory to unequal ecological exchange theory—suggest that capitalism has negative ecological consequences. Although others suggest a positive role for capitalism, the authors find the critical perspectives more compelling, both in terms of the empirical evidence they have generated and the logic of their analyses. For example, treadmill theory[57] emphasizes the way in which the constant reinvestment of capital in greater productive capacity, usually deploying more energy and chemical intensive technologies, will lead to increasing resource depletion and pollution generation. Analyses that draw on world systems, dependency and unequal ecological exchange theory find that trade—a central component of free market systems—tends to have negative consequences both ecologically and in terms of environmental justice. The "economic freedom" of capital to flow between countries facilitates regulatory avoidance and the ready exploitation of natural resources wherever they may be found. This relates to established economic theory regarding negative externali-

53. World Bank 2007.
54. Esty and Porter 2005; Hammond 2006; Jorgenson 2003; and York, Rosa, and Dietz 2003.
55. Rothman 1998.
56. York, Rosa, and Dietz 2003.
57. Schnaiberg 1980; and Schnaiberg and Gould 1994.

Table 1
Descriptive Statistics

	Minimum	*Maximum*	*Mean*	*Std. Deviation*
Economic Freedom Index (EFI)	25.4	82.4	58.88	10.60
EFI Regulation	10	90	43.11	15.89
EFI Trade	0	100	64.69	14.86
EFI Fiscal	32.6	100	77.74	10.95
EFI Spending	0	99	67.93	20.96
EFI Monetary	0	95.5	70.22	18.55
EFI Investment	10	90	56.79	17.11
EFI Financial	10	90	52.65	18.59
EFI Property	10	90	54.15	22.13
EFI Corruption	0	100	42.65	26.51
Ecological Footprint per Capita	0.39	12.24	2.480	2.01
Exports as a % of GDP	7.12	124.40	36.09	19.83
GDP per Capita	461	37,670	8,688	9,035
Urban population %	10.62	97.51	56.35	21.63
Observations (valid N listwise)	880			
Countries	110			
Years	8			

ties. Private profit seeking actors always have incentives to externalize costs and, barring state intervention, the natural environment bears at least some of that burden.

Although ecological modernization theorists and others argue that market forces can compel positive ecological transformation, without state action, the incentive structure seems to favor practices that degrade the natural environment. Although exceptions to this tendency have been identified, on the whole we find this counter evidence to be anecdotal and not indicative of a broader pattern.[58] Thus, in regard to the central question of this study we offer the following:

Hypothesis 1: The more a state's policies tend toward laissez-faire capitalism, that is, the higher its level of "economic freedom," the greater will be that state's per capita ecological footprint. The overall EFI measure serves as the primary independent variable in our main model. In other models, components of the index are tested independently. In addition to the central hypothesis regarding the relationship between capitalism and per capita ecological foot-

58. York 2004.

print, we offer hypotheses regarding some, but not all,[59] of the component elements that make up the Economic Freedom Index. Next, we briefly provide explanations for the predicted relationship between these component measures of economic freedom and ecological footprint.

Hypothesis 2: More regulation (less "business freedom") decreases a state's per capita ecological footprint. State restrictions on economic behavior are likely to prevent certain forms of production (and thus consumption) while channeling productive activity in less ecologically damaging ways. Regulations may delay or prevent the opening of a new business due to restrictions on development or environmental mitigation requirements in addition to the imposition of additional costs due to pollution control and monitoring requirements. Such regulations hamper ecologically destructive businesses in favor of those with lower environmental impact.

Hypothesis 3: Fewer trade restrictions (greater "trade freedom") increase a state's per capita ecological footprint. Unrestricted trade fosters the long distance transportation of goods and makes available a wider array of consumer products, both of which tend to increase resource use and pollution. Restrictions on free trade may also incorporate provisions that limit environmentally harmful products and production methods. In addition, free trade facilitates the outsourcing of ecologically destructive production and natural resource extraction to places with fewer environmental restrictions.

Hypothesis 4: Government spending ("freedom from government") may increase or decrease a state's per capita ecological footprint. The contradictory tendencies associated with state spending and the ownership of enterprises leaves us unable to offer a single hypothesis regarding this measure; thus, we provide the rationale for the two possible outcomes. Higher government spending may be associated with a smaller ecological footprint, because public spending is likely to be directed in less environmentally damaging ways than that carried out by private investors or consumers. Private economic actors have an incentive to externalize environmental costs, while state actors do not stand to profit personally from the manner in which state resources are used (except in instances of corruption—see below). Given their accountability to the public, state actors are less likely to impose environmental costs on the public. In addition, in the private market, collective action problems inhibit individuals from assuming the costs associated with their own environmentally harmful consumption, even in circumstances where they may wish to prevent environmental degradation. In contrast, ideally the state acts in the public interest, in es-

59. For the EFI measures Monetary, Investment and Financial we offer no hypotheses. Each of these policies are expected to contribute to per capita ecological footprint, however we expect that they do so by increasing economic growth.

sence coordinating resources and directing them in ways that benefit the whole of the population. That can include investment in environmentally beneficial practices such as waste cleanup or shared resources such as libraries.

However, an equally compelling argument suggests that higher state spending leads to a greater ecological footprint. Given the short-term pressures to produce economic results in many countries and limited public resources, state investments may not prioritize environmental concerns. States may have the capacity and incentive to pass laws that regulate private firms, thus protecting the public welfare at no direct cost to the state. But there is less incentive to hold public enterprises to strict standards, given that funds generated by state owned enterprises can be used to directly provide material benefits to the public. States that invest in state owned industries are also typically those most desperate for economic development. They may prioritize economic growth over the environment and may not self regulate strictly.

Hypothesis 5: Taxation ("ªscal freedom") may increase or decrease a state's per capita ecological footprint. Taxation, in addition to revenue-generating state enterprises, provides the main source of funds that the state can spend. As just described, the ecological implications of state spending may be greater or less than those of a corresponding level of private spending. Thus, we anticipate a relationship of unspecified direction between fiscal policies and per capita ecological footprint. We anticipate that this relationship will have the same direction as that of government spending.

Hypothesis 6: Greater protection of private property rights increases a state's per capita ecological footprint. The greater the protection of private property, the less the state or organized citizens are able to prevent environmentally damaging uses of private property. Various forms of expropriation can be used for the purposes of environmental protection, and policies which prioritize private property protection inhibit such actions.

Hypothesis 7: Lower levels of corruption decrease a state's per capita ecological footprint. Proponents and opponents of capitalist policies tend to oppose corruption and favor the systematic and even-handed enforcement of rules. Corruption within a state may include permissive violations of environmental regulations such as illegal dumping or poaching. Thus, freedom from corruption is likely to bring better environmental performance.

Methods

The analysis is based on panel data from 1996 to 2003 across 110 countries (see Table 1 for descriptive statistics of the variables and Appendix 1 for a list of countries included).

The relationship between capitalism and its policy components and eco-

logical footprint were tested in a number of ways. For the first hypothesis, the overall EFI measure served as the independent variable and per capita ecological footprint was the dependent variable. Controls were included for per capita GDP, urbanization, climate, and exports as a percentage of total GDP, all of which have been found to have an impact on ecological footprint in previous studies. In addition to testing the impact of capitalism overall, each of the components of economic policy described above was tested to determine their independent effect on environmental performance.

First, we corrected the skewness of GDP per capita, exports as percentage of GDP, and per capita ecological footprint by taking the log of these variables. Second, in each analysis, we examined the data for colinearity, outliers, and heteroskedasticity. We checked for colinearity using the tolerance figure and variance inflation measure (see Tables 2 and 3 for correlations). Due to colinearity found between EFI and GDP per capita, we used a residualized GDP per capita figure.[60] Next, we checked for outliers using the Cook's distance, studentized residuals, and the Hat Diagonal measure.[61] We did not find any extreme outliers influencing results. We used the Breusch-Pagan test to check for heteroskedasticity for the subset of data for each year. These tests indicated that no significant relationship exists between the independent variables and error terms.

In order to determine the appropriate regression technique, we checked for autocorrelation. The Durban Watson test of individual country cases indicated an average score of 2.6 for all the 110 cases. Some of the cases had high autocorrelation problems. Considering that our data consists of a wide but shallow pool (8 years and 110 countries), we use a random effects model.[62] The results reported in Tables 4 and 5 are GLS parameter estimates of the random effects regression model.

Results

Results were largely consistent with expectations. Random effects regression[63] indicated a positive and significant relationship between the Economic Freedom Index and per capita ecological footprint controlling for urbanization, ex-

60. The variance inflation figures and tolerance measures indicate that no other variables contributed to a colinearity problem.
61. The analysis was run with the outlying cases omitted one at a time including Mongolia, United Arab Emirates, United States, and Ethiopia. None of the excluded cases affected the results in any significant way therefore we left them in the model.
62. Our results are reported using the Fuller Battese method in SAS. The individual and time specific random effects are added to the error disturbances. The parameters are efficiently estimated using the GLS method.
63. The Haussman m value of 3.04 with a probability of 0.55 indicates that a random effects model is the appropriate regression technique.

Table 2
Correlations among Independent Variables (N=880)

		Exports	*GDP Per capita*	*Urban*	*Arctic*	*Temperate*	*Tropical*
EFI Total	Pearson Correlation	.19	.64	.51	.09	.12	−.16
	Sig. (2-tailed)	<.0001	<.0001	<.0001	.0097	.0005	<.0001
Exports	Pearson Correlation		.23	.20	.03	.08	−.09
	Sig. (2-tailed)		<.0001	<.0001	.3160	.0228	.0061
GDP per capita	Pearson Correlation			.63	.24	.34	−.46
	Sig. (2-tailed)			<.0001	<.0001	<.0001	<.0001
Urban	Pearson Correlation				.12	.38	−.43
	Sig. (2-tailed)				.0005	<.0001	<.0001
Arctic	Pearson Correlation					−.22	−.31
	Sig. (2-tailed)					<.0001	<.0001
Temperate	Pearson Correlation						−.86
	Sig. (2-tailed)						<.0001

Table 3
Correlations among EFI measures (N=880)

		Regulation	*Trade*	*Fiscal*	*Spending*	*Monetary*	*Investment*	*Financial*	*Property*	*Corruption*
EFI	Pearson Correlation	.75	.57	.13	−.10	.59	.70	.78	.82	.75
	Sig. (2-tailed)	<.0001	<.0001	.0002	.0023	<.0001	<.0001	<.0001	<.0001	<.0001
Regulation	Pearson Correlation		.38	−.06	−.31	.38	.44	.54	.73	.63
	Sig. (2-tailed)		<.0001	.0607	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Trade	Pearson Correlation			.06	−.23	.11	.43	.44	.45	.37
	Sig. (2-tailed)			.0840	<.0001	.0007	<.0001	<.0001	<.0001	<.0001
Fiscal	Pearson Correlation				.44	−.03	.06	.05	−.15	−.23
	Sig. (2-tailed)				<.0001	.4049	.1006	.1061	<.0001	<.0001
Spending	Pearson Correlation					−.03	−.14	−.19	−.41	−.44
	Sig. (2-tailed)					.4302	<.0001	<.0001	<.0001	<.0001
Monetary	Pearson Correlation						.30	.36	.39	.40
	Sig. (2-tailed)						<.0001	<.0001	<.0001	<.0001
Investment	Pearson Correlation							.64	.51	.39
	Sig. (2-tailed)							<.0001	<.0001	<.0001
Financial	Pearson Correlation								.60	.52
	Sig. (2-tailed)								<.0001	<.0001
Property	Pearson Correlation									.80
	Sig. (2-tailed)									<.0001

Table 4
Results of Random Effect Pooled Time Series Parameter Estimates
Dependent Variable: (Log) Ecological Footprint per capita

Independent Variable	
Intercept	−.592***
	(.0578)
Economic Freedom Index	.012***
	(.0010)
GDP per capita (Log/residualized)	.399***
	(.0362)
Urban population as a % of total	.003***
	(.0008)
Exports as % of GDP (Log)	−.055*
	(.0284)
Arctic	.165***
	(.0572)
Temperate	.089***
	(.0328)
R-square	.35
N	880

The values in parenthesis are the standard errors of the parameter estimates.
*$p < .10$
**$p < .05$
***$p < .01$

ports, per capita GDP, and climate (see Table 4).[64] A one point increase in the Economic Freedom Index measure is associated with a 1.2 percent[65] increase in per capita ecological footprint controlling for the other variables included in the model. This means that a shift from an EFI score of 25.4 (the lowest EFI score for all cases in the data set) to the mean EFI value (58.9) is expected to yield a 40 percent increase in per capita ecological footprint holding control variables constant. If a country were to increase its EFI scores from the minimum value to the maximum value (82.4), the ecological footprint per capita in that country is expected to yield a 68.4 percent increase, controlling for other factors.

Turning to the subcomponent measures (see Table 5), the regulation vari-

64. Several countries included in the Ecological Footprint data set have some inconsistencies across time. In order to ensure that these inconsistencies did not affect the outcomes, all models were retested using only a subset of countries that have consistent data. In each case the results were nearly identical to the original findings.
65. The regression coefficients are interpreted using Tufte transformations for logged dependent variables.

able had the greatest independent impact. Less stringent state regulation is associated with a larger per capita ecological footprint. A change in the regulation measure from the lowest to the highest score (corresponding to a decrease in regulation on the "economic freedom" scale) would result in an 80 percent increase in per capita ecological footprint controlling for other factors. It makes sense that more regulated systems would yield a lower footprint given that at least some regulation is specifically designed to lower environmental impacts.

Other factors associated with a state's level of capitalism, including trade, monetary policy, financial policy, and property rights all have positive, but slightly lower coefficients. The coefficients suggest that a one point increase in the trade measure is associated with a 0.7 percent increase in ecological footprint. This means that a move from the minimum level of trade freedom (0) to the mean level (64.69) is anticipated to yield a 45 percent increase in the per capita ecological footprint. Private property protection has a similar influence, as do other variables, though to a lesser extent. The monetary, investment, and financial variables all yielded a larger per capita ecological footprint as policies more closely reflected the capitalist ideal. An increase from the minimum to mean score yields an anticipated 28 percent increase in per capita footprint for the monetary and investment variables, and a 25 percent increase for the financial variable controlling, for other factors.

In regard to the corruption measure, we expected to find a negative relationship, that is, the freer a country is of corruption, the smaller the state's per capita ecological footprint. We expected lower rates of corruption to be tied to consistent and stringent enforcement of environmental regulations, thus lowering ecological impacts, yet we found the opposite. A one point increase in freedom from corruption is associated with a 0.6 percent increase in per capita ecological footprint. Lower levels of corruption are correlated with greater per capita ecological footprints.

Two subcomponents of the EFI—government spending and fiscal policies—had the opposite effect of that found among the other variables. As government spending increases so does per capita ecological footprint. This is also true for the fiscal corollary of the spending variable. As taxes increase, so does ecological footprint. Thus, when states are less capitalist in this regard, they do not perform as well it terms of environmental protection.

Discussion

Our analysis supports our central hypothesis that capitalist state economic policies have a negative influence on environmental performance. In almost every respect, the free market, left unchecked by state action, yields greater ecological degradation. The one measure that ran contrary to expectations, corruption, is not one that is directly linked to the central concern regarding capitalism. In addition, the fact that corruption was found to reduce per capita ecological footprint may be a product of the measure itself. The corruption variable is not

based on a direct measure of corruption, but rather upon surveys of business elites. It may be that the less corrupt countries' positive relationship with ecological footprint reflects satisfaction on the part of the business community and their sense that such states represent a better environment for businesses to invest and grow.

Despite this exception, our central findings indicate that capitalism and its associated state policies correlate with poor environmental performance. This is relevant to a number of theories that link economic institutions to environmental outcomes. This study provides further evidence for those perspectives that see negative ecological implications for unrestrained market practices and presents a direct challenge to those who make broad claims about the ability of the free market to address environmental threats. Ecological modernization theorists and others who place faith in capitalism to move us toward ecological sustainability should reconsider their opposition to command-based regulatory mechanisms and their embrace of market-oriented reforms.

Although capitalism generally appears detrimental to environmental protection, the policy subcomponents that make up the broader economic order require additional consideration. The findings in regard to trade provide a supplement to analyses put forth by world systems, dependency, and unequal ecological exchange theorists. These theories focus on the maldistribution of wealth and other social and economic outcomes that result from trade in a world characterized by inequalities of economic development and power. These injustices extend into the environmental realm when considering who bears the burdens of resource depletion and exposure to environmental hazards. This study demonstrates that the negative ecological outcomes found by these theories appear to be aggravated by free trade policies. While others have examined the costs and benefits experienced by countries integrated into the global trade system, this study indicates that state policies regarding trade have an independent effect on the environmental outcomes of that integration. These findings suggest that states can restrict trade in ways that limit environmental damage.

This study also lends significant support to treadmill of production theory and its sharp critique of capitalism. Our quantitative comparative examination reinforces the theoretical analysis and case study evidence put forth by treadmill theorists regarding the ecological impacts of free markets. But additional analysis is necessary given findings regarding the policy subcomponents of capitalist systems. Treadmill theory not only critiques the free market, but it also implicates the capitalist state. The state is considered guilty of actively advancing capital accumulation at the expense of ecological sustainability. While this may be true, our evidence suggests that state policies can restrict free market functioning in ways that truly reduce ecological impacts. This appears to be the case when states restrict trade, impose regulations, and implement policies that do not prioritize private property rights above other considerations. Our evidence also suggests monetary and investment policies can be devised to reduce ecological impacts. Thus, although the state in capitalist societies may commonly serve to

Table 5
Results of Random Effect Pooled Time Series Parameter Estimates

Independent variable	*Dependent Variable: Ecological Footprint per Capita (log)*								
Intercept	−.178***	−.181***	.514***	.448***	−.129**	−.168***	−.183***	−.265***	−.147***
	(.0461)	(.0481)	(.0894)	(.0860)	(.0534)	(.0548)	(.0544)	(.0531)	(.0542)
Exports	−.052*	−.059**	−.054**	−.055*	−.033**	−.057**	−.055*	−.053**	−.054*
	(.0283)	(.0285)	(.0283)	(.0283)	(.0285)	(.0284)	(.0284)	(.0282)	(.0281)
Urban	.003***	.003***	.003***	.003***	.003***	.003***	.003***	.003***	.003***
	(.0008)	(.0008)	(.0008)	(.0008)	(.0008)	(.0008)	(.0008)	(.0008)	(.0030)
GDP	.386***	.404***	.405***	.404***	.439***	.393***	.389***	.376***	.376***
	(.0337)	(.0341)	(.0339)	(.0338)	(.0349)	(.0342)	(.0343)	(.0340)	(.0340)
Arctic	.165***	.164***	.152***	.158***	.157***	.166***	.168***	.165***	.157***
	(.0561)	(.0567)	(.0570)	(.0560)	(.0566)	(.0571)	(.0572)	(.0559)	(.0554)
Temperate	.089***	.088***	.078**	.083**	.078**	.089***	.091***	.087***	.088***
	(.0321)	(.0325)	(.0328)	(.0322)	(.0325)	(.0327)	(.0327)	(.0320)	(.0317)
Regulation	.011***								
	(.0006)								
Trade		.007***							
		(.0005)							

Fiscal			−.005***						
			(.0005)						
Spending				−.004***					
				(.0004)					
Monetary					.004***				
					(.0003)				
Investment						.005***			
						(.0005)			
Financial							.005***		
							(.0005)		
Property								.007***	
								(.0005)	
Corruption									.006***
									(.0005)
R-square	.36	.35	.36	.36	.36	.35	.35	.36	.37
N	880	880	880	880	880	880	880	880	880

Note: The GDP was residualized for each model where colinearity was detected.
The values in parenthesis are the standard errors of the parameter estimates.
*$p < .10$
**$p < .05$
***$p < .01$

advance capital accumulation at the expense of the natural environment, states are not monolithic and they can and do implement policies that reduce ecological impacts even within a broadly capitalist context. When and under what circumstances states adopt such policies is not a question we answer here. It may even be the case that the ecologically beneficial outcomes associated with some policies are not intentional, but are an inadvertent by-product of policies intended to expand the economy. Nonetheless, treadmill theory can be strengthened by a closer examination of when, and under what circumstances, states can be effective environmental stewards, rather than enablers of ecological degradation at the hands of private enterprise.

This picture of the state's role is further complicated by our findings in regard to fiscal policy and government spending. Our analysis of taxation and spending suggests that state control of resources and enterprises does not bode well for the environment. Further analysis could clarify what specific government expenditures and state owned enterprises enlarge per capita ecological footprint, but it appears that, overall, direct government control of revenues does not lead to more environmentally beneficial outcomes, as some might expect.[66] This may provide more fodder for treadmill theorists who view the state as more concerned with capital accumulation than environmental protection. When the state does directly control resources, it does not perform well environmentally. But we must also bear in mind the state's ability to effectively regulate private actors. This implies that the optimal policy mix in regard to environmental performance may be one in which property is privately held, but where the state more actively restricts free market functioning through such measures as regulation and trade restrictions.

Conclusion

Several quantitative analyses have linked economic development with ecological degradation. Some case studies have linked market processes with poor environmental outcomes. This evidence, when interpreted through a critical theoretical lens, led many to conclude that capitalism is bad for the environment. Yet, very little quantitative evidence exists to directly link capitalism as an institution to poor environmental performance. Previous studies failed to fully identify the influence of free market policies on the environment due to the measures used. Simple dichotomous designations of capitalist versus non-capitalist states do not capture the complexities and policy variations that characterize economic institutions. Similarly, many measures of environmental performance are inadequate for this purpose, because they rely solely on domestic environmental

66. Governments run some particularly toxic enterprises in some states, such as the military and the energy industry, which may account for some of the footprint effects associated with these findings. Jorgenson (2005) found some evidence that certain forms of military expenditure, in particular military expenditures per soldier, was positively associated with ecological footprint.

conditions and fail to account for the ecological impact that people of one state have on another in the context of global trade and capital flows.

This study tests capitalism as a system and as a set of policies to empirically verify the environmental implications of a free market system. The measures used here overcome both of the problems associated with previous studies that have considered various dimensions of this question. The Economic Freedom Index provides a measure of capitalism on a continuous scale. No state is purely capitalist or non-capitalist; states exist on a continuum of policies that provide more or less private versus state control of economic functioning. In regard to the dependent variable, per capita ecological footprint captures environmental impacts neglected by other measures, because it accounts for factors that occur outside of the state that benefits from resource consumption.

Using these advanced measures in a large international comparative analysis allows us to more clearly identify the relationship between free market policies and environmental impacts. This research confirms what some case studies have indicated and that which is suggested by several theories: the more capitalist a state is, the greater its environmental impact is likely to be, even controlling for such factors as per capita GDP.

This is grounds for concern in an increasingly liberalized global economy in a world already facing ecological crises. The more states embrace the free market ideal, the more difficult it will be to achieve sustainability. However, our analysis also indicates that not all dimensions of capitalism are inherently ecologically harmful. While considering the larger question of the long term ecological viability of capitalism as a system, more research is needed to discern just how economic institutions can be modified in ways that foster improved environmental performance.

Appendix 1
Countries included in the Study

1	Albania	43	Hungary
2	Algeria	44	India
3	Argentina	45	Indonesia
4	Armenia	46	Iran
5	Australia	47	Ireland
6	Austria	48	Italy
7	Azerbaijan	49	Jamaica
8	Bangladesh	50	Japan
9	Belarus	51	Jordan
10	Belgium	52	Kenya
11	Benin	53	South Korea
12	Bolivia	54	Kuwait
13	Botswana	55	Laos
14	Brazil	56	Latvia
15	Bulgaria	57	Lebanon
16	Burkina Faso	58	Lesotho
17	Cameroon	59	Lithuania
18	Canada	60	Madagascar
19	Chile	61	Malawi
20	China	62	Malaysia
21	Colombia	63	Mali
22	Congo, Republic of	64	Mauritania
23	Costa Rica	65	Mexico
24	Croatia	66	Moldova
25	Czech Republic	67	Mongolia
26	Denmark	68	Morocco
27	Dominican Republic	69	Mozambique
28	Ecuador	70	Nepal
29	Egypt	71	Netherlands
30	El Salvador	72	Nicaragua
31	Estonia	73	Niger
32	Ethiopia	74	Nigeria
33	Finland	75	Norway
34	France	76	Pakistan
35	Georgia	77	Panama
36	Germany	78	Paraguay
37	Ghana	79	Peru
38	Greece	80	Philippines
39	Guatemala	81	Poland
40	Guinea	82	Portugal
41	Haiti	83	Romania
42	Honduras	84	Saudi Arabia

Appendix 1
(Continued)

85	Senegal	98	Tunisia
86	Slovak Republic	99	Turkey
87	Slovenia	100	Uganda
88	South Africa	101	Ukraine
89	Spain	102	United Arab Emirates
90	Sri Lanka	103	United Kingdom
91	Swaziland	104	United States
92	Sweden	105	Uruguay
93	Switzerland	106	Venezuela
94	Syria	107	Vietnam
95	Tanzania	108	Yemen
96	Thailand	109	Zambia
97	Trinidad and Tobago	110	Zimbabwe

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