The International Monetary Fund, World Bank, and Structural Adjustment: A Cross-National Analysis of Forest Loss

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Abstract

We test competing hypotheses drawn from dependency theory and neo-liberal economic theory regarding the effects of International Monetary Fund and World Bank structural adjustment on deforestation. In doing so, we analyze cross-national data for a sample of sixty-one nations from 1990 to 2005. We find substantial support for dependency theory that both International Monetary Fund and World Bank structural adjustment lending are associated with higher rates of forest loss. We also find that a number of other factors help to explain deforestation. These include non-governmental organizations, population growth, democracy, data quality, and tropical climate. We conclude with a discussion of the findings, theoretical implications, methodological implications, policy implications, and possible directions for future research.

Keywords: Deforestation, International Monetary Fund, World Bank, Cross-National

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Introduction

The "debt crisis" of the 1980s highlighted the inability of many poor nations to generate enough revenue to make payments on their mounting foreign debts (Magdoff 1986). The International Monetary Fund and World Bank responded to the debt crisis by rescheduling loan payments, renegotiating loan terms, and providing structural adjustment loans (McMichael 2004). The renegotiated loans and structural adjustment loans were designed to resolve balance of payment issues by requiring indebted nations to institute a variety of economic policy reforms in return for the money (Peet 2003). The policy reforms called for by the International Monetary Fund and World Bank include devaluing currency, reducing government spending, liberalizing trade, and privatizing government assets (Clapp and Dauvergne 2005; McMichael 2004; Barbosa 2001; Glover 1995; George and Sabelli 1994; Rich 1994; George 1992). The underlying logic behind structural adjustment is an attempt to generate hard currency for debt repayment by boosting exports and cutting government spending. While this "earn more" and "spend less" model of structural adjustment may facilitate debt repayment, it may well have additional impacts especially for the natural environment. In the context of this study, the effects of International Monetary Fund and World Bank structural adjustment lending on forests are contested.

On the one hand, Goldman (2005), McMichael (2004), Barbosa (2001), Tockman (2001), Peet (1999), Rich (1994), and George (1992) among others argue that International Monetary Fund and World Bank structural adjustment may contribute to deforestation by increasing exports of natural resources, liberalizing trade in extractive sectors, and reducing the regulatory

capacity of governments to deal with the causes of forest loss. Rudel (1993) also notes that structural adjustment lending may contribute to deforestation by exacerbating poverty, which often forces people to clear forests in order to grow subsistence crops. Accordingly, International Monetary Fund and World Bank structural adjustment should be associated with higher rates of deforestation.

On the other hand, the World Bank (1994) suggests that the impact of structural adjustment on the natural environment is hard to generalize but, in most cases, it has probably been favorable. Another World Bank (2001) report notes that "sixty-five percent of recent structural adjustment loans included an explicit section generally consisting of a statement that no or beneficial environmental effects could be expected" (65). Further, Glover (1995) argues that International Monetary Fund and World Bank structural adjustment tends to encourage private ownership of land, thereby creating incentives for environmental stewardship. Reed (1996) argues that structural adjustment may promote conservation of forests by raising prices of natural resources closer to true market values. Additionally, Fischer (1996) contends that structural adjustment stimulates economic growth and helps shift the focus of economic activity from agriculture to services, manufacturing, and industry, which presumably put less pressure on forests. These arguments suggest that International Monetary Fund and World Bank structural adjustment should have no impact on forests or should be associated with lower rates of deforestation.

Such opposing predictions beg for empirical assessment. Is structural adjustment lending associated with higher rates of deforestation? Is structural adjustment associated with lower rates of deforestation? Is there no relationship between these variables? The research that has been conducted to date has been based upon case study analyses or examined data for a single

nation (e.g., Barbosa 2001; Tockman 2001; Rich 1994). Further, there has been no cross-national work that examines the impact of both International Monetary Fund and World Bank structural adjustment on forest loss. Thus, we conduct the first cross-national study that directly assesses the impact of International Monetary Fund and World Bank structural adjustment on forests in order to provide answers to the preceding questions. To do so, we construct cross-national regression models using data for a sample of sixty-one poor nations and examine the effects of International Monetary Fund and World Bank structural adjustment separately and then together.

The predictions regarding the adverse effects of structural adjustment on forests are generally rooted in dependency theory while the arguments pertaining to the beneficial impacts of structural adjustment tend to come from neo-liberal economic theory. We not present several reasons why social scientists should be concerned with deforestation. We then turn to a discussion of each of these perspectives. We also describe the reasons for including other relevant independent variables in the cross-national models of deforestation. We conclude with a discussion of the findings, theoretical implications, methodological implications, policy suggestions, and possible directions for future research.

Why Should Social Scientists Study Deforestation?

There are several reasons why deforestation is particularly salient to social scientific research. First, it is associated with a number of other environmental problems. In particular, forest loss contributes to climate change because there are less trees removing carbon dioxide from the atmosphere (World Bank 2003). It is also associated with biodiversity loss since forests are home to over fifty percent of all living organisms on the planet (Hurst 1990). Further, deforestation contributes to local environmental problems such as soil erosion, flooding, and

desertification (Williams 2006). Second, forest loss may contribute to a number of social problems (Homer-Dixon 1999). These problems include rural-to-urban migration, declining agricultural productivity, disruptions of indigenous cultures, spreading of diseases, and violence (Homer-Dixon 1999). Third, forest loss is largely the result of human activities (Ehrhardt-Martinez 1998). The main anthropogenic factor, International Monetary Fund and World Bank structural adjustment, is the focus of this study. However, deforestation may also be influenced by debt service, non-governmental organizations, democracy, environmental ministry presence, gross domestic product, economic growth, agricultural-based economic activity, and population growth. All of these factors can be modeled using cross-national data. We now turn to a discussion of the hypothesized effects of structural adjustment on forests suggested by dependency theory and neo-liberal economic theory. We then briefly describe the potential impacts of these other factors.

Dependency Theory

According to dependency theory, rich nations become wealthy by exploiting the cheap labor and natural resources of poor nations through free trade (e.g., Evans 1979, Amin 1976; Frank 1967). The International Monetary Fund and World Bank facilitate this process via their structural adjustment loans, which may also contribute to deforestation (Peet 1999; Rich 1994). The links between structural adjustment and forest loss are complex. However, we review most common explanations why dependency theory suggests that structural adjustment should be associated with increased deforestation.

First, structural adjustment programs require that governments promote economic activity consonant with their "comparative advantage" (McMichael 2004). In other words, nations must increase export earnings in order to finance interest and principal payments. The most common

way to achieve this is currency devaluation, which creates a demand for a nation's exports on the world market (Peet 2003). Generally, poor nations meet increased demand by expanding production and extraction of primary products and agricultural goods for export (Rich 1994). The sectors that may increase deforestation include logging, cattle ranching, mining, and large-scale agriculture (McMichael 2004).

Second, structural adjustment loans also attempt to increase exports by recommending that governments liberalize trade (Barbosa 2001). This involves removing barriers to foreign investment by providing corporations with a variety of regulatory concessions and financial incentives (Jorgenson 2008; Clapp 1998). It also entails privatizing government assets (e.g., public land) (Walton and Ragin 1990). The regulatory concessions may include exemptions on logging harvest quotas, permission to export raw logs, to log protected species, and to log in protected areas (Hurst 1990). Other regulatory concessions may involve land reform including making public land and titles more easily available for purchase by foreign corporations, legalization of real estate markets, and limiting a government's ability to reclaim public lands even if obtained by illegal or semi-legal means (Kaimowitz and Thiele 1999). The most notable financial incentives are "tax holidays" that involve exemptions of export duties, import duties, and other corporate income taxes (Leonard 1988). The purpose of the regulatory concessions and financial incentives is to stimulate investment within a nation to generate currency to meet debt repayment obligations (Clapp 1998). However, regulatory concessions and economic incentives often result in deforestation because they tend to make cattle ranching, logging, mining, and export agriculture more profitable and easily undertaken (McMichael 2004). As a result, foreign investment tends to increase in these areas, and forest loss ensues (Jorgenson 2008; Rich 1994).

Third, structural adjustment loans usually require deep cuts in government spending to correct for budgetary imbalances (Tockman 2001; Bryant and Bailey 1997). The nature of the cuts has varied from nation to nation, but a common theme has been the slashing of budgets and staffs of conservation departments (Bryant and Bailey 19997). These cuts hamper enforcement of environmental regulations, impede efforts to prevent illegal logging, and hinder demarcation of protected areas (Rich 1994). In other words, structural adjustment reduces the regulatory capacity of governments to deal with causes of forest loss. We should also note that the tax breaks and selling off public enterprises yield additional reductions in spending by eroding a government's tax base because there is little new revenue being collected by the state (George 1992). Further, cuts in government expenditures may also lead to increased incursions into forests as people extract resources to supplement their incomes (George and Sabelli 1994). For example, Rudel (1993) describes how budgetary cuts required under World Bank and International Monetary Fund structural adjustment loans forced Ecuador to reduce or eliminate government subsidies and credits for fertilizers and pesticides. These cuts led to increased deforestation. Small-scale farmers unable to afford agricultural inputs were forced to expand production into marginal areas, especially forests, in order to maintain crop yields to survive (Rudel 1993).

Fourth, a focus on exporting natural resources and agricultural goods often exacerbates poverty, which may lead to increased forest loss (Mohan 2001). In this regard, a focus on raw material exports prevents increases in the sort of value-added industries that employ the poor (e.g., manufacturing, services, industry, etc.) (Mohan 2001). By slowing the job creation in sectors other than agriculture, fewer jobs are available to workers, who lacking alternatives, put more pressure on forests to make a living via agriculture and natural resource extraction

(Ehrhardt-Martinez 1998). For instance, Repetto and Cruz (1992) argue that International Monetary Fund and World Bank structural adjustment loans to the Philippines during the late 1980s and early 1990s led real wages to fall by more than twenty percent and increased unemployment to record levels especially in Manila. These factors deterred migrants from seeking jobs in urban areas and instead encouraged them to clear forests to grow subsistence crops (Cruz and Repetto 1992).

In sum, dependency theory predicts that International Monetary Fund and World Bank structural adjustment should be associated with higher rates of deforestation. This is because structural adjustment loans often result in poor nations boosting exports of natural resources, liberalizing trade in extractive sectors, and reducing spending for conservation. These loans also exacerbate poverty, leading people to clear forests to make way for subsistence crops. We now turn to a discussion of a competing perspective, neo-liberal economic theory.

Neo-Liberal Economic Theory

While dependency theory hypothesizes structural adjustment may adversely affect forests, neo-liberal economic theory predicts that structural adjustment should have a beneficial impact on the natural environment (Gandhi 1998; Reed 1996; Glover 1995; Reed 1992). This occurs by promoting free trade, limiting government intervention in the economy, and stimulating economic growth (World Bank 2001). Let us now turn to a discussion of how structural adjustment promotes these goals and may contribute to environmental improvements like limiting forest loss.

First, an overvalued exchange rate and high tariffs on imports often do not properly reward export-oriented farmers and deprive them of earnings (Gandhi 1998). Thus, governments are often required by the International Monetary Fund and World Bank under structural

adjustment to take steps that address these issues. This usually involves reducing the official exchange rate and lowering import duties (Kessler and Van Dorp 1998). After adopting these macro-economic policy reforms, forest loss may decline. This is because farmers may now have the capital to invest in technology that helps to improve soil fertility and crop production rather than clear additional forest areas to maintain yields (Gandhi 1998).

Second, the International Monetary Fund and World Bank often require governments undergoing structural adjustment to reduce government spending. This usually involves removing subsides for natural resources such as timber, minerals, and fuels (Reed 1996). The goal is to "get the prices right," which can promote conservation (Mohan 2001). By raising the prices of previously undervalued natural resources closer to true market values, structural adjustment should reduce demand for these products on the world market (World Bank 2001). Similarly, governments undergoing structural adjustment are often required to eliminate subsidies for agricultural inputs especially for fertilizers, pesticides, water, and energy (Kessler and Van Dorp 1998). By curtailing these agricultural subsidies, International Monetary Fund and World Bank structural adjustment reduces incentives for farmers to begin planting crops in the first place or to plant additional crops (Reed 1992). Declining incentives to engage in agriculture may also attract people to cities in search of alternative economic opportunities. This increased rural to urban migration may relieve pressure on forests although lead to other environmental problems especially in cities (e.g. air and water pollution) (Ehrhardt-Martinez, Crenshaw, and Jenkins 2002). Further, cutting spending helps prevent mounting government deficits and, therefore, inflation, which often leads the poor to excessive use and exploitation of natural resources (Gandhi 1998).

Third, structural adjustment encourages the privatization of government assets, which could be beneficial for the environment (World Bank 2001). In this context, this usually involves the selling off of large swaths of forests to logging and mining companies (Hurst 1990). The International Monetary Fund and World Bank may also recommend that governments change laws that ease restrictions on foreign corporations owning land and enact laws that limit a government's ability to reclaim public lands even if obtained by illegal or semi-legal means (Tockman 2001). The private ownership of land should create incentives for conservation and responsible resource management to ensure use well into the future, which may translate into less forest loss (Glover 1995).

Fourth, structural adjustment lending is hypothesized to stimulate economic growth via increased exports and foreign investment (McQuillan and Montgomery 1999). A lack of economic growth may preclude conservation by distorting inter-temporal choices, leading to an uncertain future where environmental protection is less attractive (Fischer 1996). Moreover, economic growth is often accompanies by higher levels of wealth (Rostow 1990). At higher levels of wealth, a shift in the predominant type of economic activity within a nation often occurs (Grossman and Krueger 1995). This usually involves movement away from agriculture to an economy based upon services and manufacturing, which are presumed to put less pressure on forests (Ehrhardt-Martinez, Crenshaw, and Jenkins 2002). There may also be greater demands for environmental protection at higher levels of wealth (Midlarsky 1998).

Clearly, neo-liberal economic theory suggests that International Monetary Fund and World Bank structural adjustment should be associated with lower rates of deforestation. This is most likely the case because structural adjustment promotes conservation via private ownership of land and reducing demand of cheap natural resources. International Monetary Fund and

World Bank structural adjustment may also increase economic growth within a nation, leading to a shift in types of economic activity undertaken and calls for greater environmental improvements. While the debate regarding the effects of structural adjustment on forests is the focus of the study, we also take into account alternative explanations of forest loss. We review these other theoretically relevant predictors of deforestation below in the description of the independent variables.

Methodology

Sample

We include all nations that are not classified as "high" income according to the World Bank (2003).[1] We also do not include nations formed following the collapse of the Soviet Union because there are no data for them in 1990. This yields a sample of sixty-one nations for which complete data are available. We follow the standard practice of checking for influential cases with Cooks D statistics and outliers with standardized residuals. There does not appear to be any potential problem with influential cases or outliers in the analysis.

Dependent Variable

The dependent variable for our analysis is the average annual percentage change in natural forest area from 1990 to 2005. Please note that deforestation is signified by a positive value for interpretation purposes. The data may be obtained from the Food and Agriculture Organization (2005). This measure includes land greater than half a hectare in size with trees higher than five meters and a canopy cover of more than ten percent. A natural forest consists only of native forest species with the possible exception of small areas of natural regeneration or assisted natural regeneration. This measure excludes forest plantations, which are areas established through planting or seeding (Food and Agricultural Organization 2005). Most cross-

national research (e.g., Shandra 2007a; Jorgenson 2006; Burns, Kick, and Davis 2003; Rudel 1989) examines the average annual percentage change in total forest area, which includes natural forest areas as well as forest plantations. A forest plantation often involves relative homogeneity in the types of species grown for commercial purposes (Food and Agriculture Organization 2005). We use natural forest area data because we are interested in the effects of structural adjustment on land that is not already being intensively managed for commercial production (e.g., forest plantations). We provide descriptive statistics and a bivariate correlation matrix in Table 1. Please note that all data come from the World Bank (2003) unless otherwise noted.

(Table 1 goes about here.)

Independent Variable

International Monetary Fund Structural Adjustment:

The first independent variable is whether a nation was undergoing International Monetary Fund structural adjustment for at least one year in 1990. We classify a nation as undergoing structural adjustment if it has received an International Monetary Fund's Standby Arrangement loan, Extended Fund Facility Arrangement loan, Structural Adjustment Facility Arrangement loan, or Enhanced Structural Adjustment Facility Arrangement loan. This is a dummy variable where we code nations that were undergoing adjustment with a value of one. All other nations serve as the reference category and are coded with a value of zero. The data may be obtained online from the International Monetary Fund's *Lending Arrangements Database*. According to dependency theory, we hypothesize that nations undergoing International Monetary Fund structural adjustment have higher rates of forest loss than nations not under an International Monetary Fund agreement.

World Bank Structural Adjustment:

The second independent variable is whether a nation was undergoing World Bank structural adjustment for at least one year in 1990. We classify a nation as undergoing structural adjustment if it has received a World Bank Programmatic Structural Adjustment Loan, Sector Adjustment Loan, Special Structural Adjustment Loan, or Structural Adjustment Loan. This is a dummy variable where we code nations that were undergoing adjustment with a value of one. All other nations serve as the reference category and are coded with a value of zero. The data may be obtained online from the World Bank's *Projects Database*. We hypothesize that nations undergoing World Bank structural adjustment should have higher rates of deforestation than nations not undergoing World Bank adjustment.

Debt Service Ratio:

In addition to the pressure to adjust their economies while under a structural adjustment loan, poor nations must continually service their foreign debts (Bradshaw and Wahl 1991). Therefore, it is also important to control for debt service as well as structural adjustment. Thus, we also include the sum of principal and interest payments in foreign currency, goods, or services on long-term public and publicly guaranteed private debt with maturity of one year or longer as a percentage of goods and services exports for 1990. According to dependency theory, higher levels of debt service should be associated with higher rates of deforestation. This is because poor nations tend to increase exports of logs, minerals, and agricultural goods, which often lead to forest loss (Marquart-Pyatt 2004).

Non-Governmental Organizations:

Based on insights from world polity theory (Schofer and Hironaka 2005; Frank, Hironaka, and Schofer 2000; Frank 1999), we include the number of international non-governmental organizations working on "environmental" and "animal rights" issues in a nation

per capita for 1990. The data were collected by Smith and Wiest (2005) from the *Yearbook of International Associations*. It is important to note that the data exclude labor unions, institutes, and foundations (Smith and Wiest 2005). Recently, Shandra (2007a) and (2007b) find that higher levels of non-governmental organizations per capita are associated with decreased rates of deforestation. This may be the case because non-governmental organizations finance local conservation projects, support social movement activity around environmental issues, shape the language of environmental agreements, and write codes of conduct (Shandra 2007a; Schofer and Hironaka 2005). As such, we hypothesize that higher levels of non-governmental organizations should be associated with lower rates of deforestation.

Environmental Ministry:

We also include a dummy variable that measures whether or not a nation had an environmental ministry. We code nations that had an environmental ministry in 1990 with a value of 1. All other nations serve as the reference category and are coded with a value of 0. The data may be obtained from Frank (1999). We hypothesize that nations with an environmental ministry should have lower rates of deforestation than nations without an environmental ministry. This is because environmental ministries tend to implement programs that may reduce deforestation including demarcating protected areas, combating illegal logging, and enforcing forestry regulations (Rich 1994).

Democracy:

We use the average of Polity IV's (2005) index of democracy. The variable ranges from -10 (autocracy) to 10 (democracy). According to Liu and Reuveny (2006), higher levels of democracy should be associated with lower rates of deforestation because democratic nations have more political activism than repressive nations. This is a result of democracies

guaranteeing certain rights to their citizens including freedoms of speech, press, and assembly (Marquart-Pyatt 2004). Further, leaders in a democracy must be responsive to such activism because of electoral accountability (Midlarsky 1998). In addition, greater freedom of the press and assembly leads to a wider diffusion of information, which, in turn, raises public awareness especially around environmental issues (Ehrhardt-Martinez, Crenshaw, and Jenkins 2002). Thus, we expect to find that higher levels of democracy are associated with lower rates of deforestation.

Gross Domestic Product:

As is standard in such analyses, it is incumbent on us to take into account a nation's level of development in order to make sure that any effects discovered are independent of a nation's level of wealth (London and Ross 1995). In this regard, we employ a measure of gross domestic product per capita for 1990. We log this variable to correct for its skewed distribution. Jorgenson (2006) finds that higher levels of economic development are associated with lower rates of deforestation. Burns, Kick, and Davis (2003), writing in the world system tradition, attribute this finding to wealthier nations "externalizing" their environmental costs by importing natural resources from poorer nations. We expect to find a similar relationship in this study.

Economic Growth:

We also include the average annual economic growth rate from 1980 to 1990. It is generally thought that economic growth should be associated with higher rates of deforestation. This is because there are large amounts of capital available for investment in activities that accelerate forest loss and other environmental problems (e.g., biodiversity loss) during periods of economic expansion (Clausen and York 2008; Rudel 1989).

Agricultural and Forestry Based Economic Activity:

It is also important to include a measure of domestic economy structure in cross-national research on forests (Ehrhardt-Martinez, Crenshaw, and Jenkins 2002). Therefore, we include value added from agriculture and forestry as a percentage of gross domestic product. These data are measured in 1990. We log this variable to correct for its skewed distribution. We expect this measure should be associated with higher rates of deforestation because these types of economic activities (e.g., growing crops, cattle ranching, logging, etc.) are presumed to put greater pressure on forests.

Total Population Growth:

The neo-Malthusian perspective suggests that demographic factors shape deforestation. Therefore, we include the average annual percentage change in total population growth from 1980 to 1990 in the analysis. Many cross-national studies find that higher rates of population growth are associated with higher rates of deforestation (e.g., Shandra 2007a; Jorgenson 2006; Ehrhardt-Martinez 1998; Rudel 1989; Allen and Barnes 1985). The general argument suggests that "geometric" growth in population outstrips "arithmetic" growth in the means of subsistence, leading to "carrying capacity" problems and ensuing environmental problems like forest loss (Clausen and York 2008).

Non-Dependent Population Growth:

York, Rosa, and Dietz (2003) argue that it is important to "decompose" demographic factors in cross-national studies. That is, researchers should examine not just overall growth rates per se but also the impact of population growth in different contexts. A key finding of their study is that higher non-dependent population levels (i.e., population aged 15-64) are associated with higher ecological footprint levels. They attribute the finding to this segment of the population consuming more resources than other segments (e.g., elderly and children). Thus, we

include the percentage change in non-dependent population from 1980 to 1990 in our regression models. We expect that higher rates of non-dependent population growth should be associated with higher rates of deforestation.

Rural and Urban Population Growth:

Jorgenson and Burns (2007) demonstrate the utility of decomposing population by geographical context—see also Rudel and Roper (1997). They find that higher rates of rural population growth are associated with increased deforestation while higher rates of urban population growth are associated with lower rates of deforestation. Jorgenson and Burns (2007) argue that expanding urban centers often create economic opportunities other than agricultural ones, which attract people to cities. This process relieves pressure on forest and, thus, reduces deforestation (Rudel and Roper 1997). Thus, we also decompose population in this manner to examine the differential effects of rural and urban population growth. To do so, we include the average annual percentage changes in rural and urban populations from 1980 to 1990 in the models.

Natural Forest Stocks:

It is necessary to include a measure that controls for the potentially biasing effects of relative abundance or scarcity of forest resources (Rudel 1989). Therefore, we include natural forest area in a nation for 1990. We log this variable to control for its skewed distribution. The data may be obtained from the Food and Agricultural Organizations (2005).

Data Quality:

We also take into account the data quality of the deforestation estimates. The data may be obtained from the Food and Agriculture Organization (2005). We classify forestry statistics as being highly reliable if they are based upon remote sensing survey or current national field

sampling estimates (Shandra 2007c). We classify forestry statistics as having low reliability if they are based upon expert estimates, which often involves extrapolation from an outdated national inventory. As such, we include a dummy variable to measure the reliability of deforestation, identifying those nations in which forest cover measures are based upon remote sensing surveys or current national field sampling estimates and should, therefore, be of higher quality (1 = high data quality). The reference category includes nations whose forestry estimates are based upon expert estimates or an outdated inventory (0 = low data quality).

Tropical Climate:

We also include a dummy variable to capture if a nation's predominant climate is tropical (York, Rosa, and Dietz 2003). The World Resources Institute (2005) defines a nation as having a tropical climate if more than half is land area has a mean monthly temperature that exceeds eighteen degrees Celsius. We code tropical nations with a value of one (1 = tropical). All other nations serve as the reference category and are coded with a value of zero (0 = not tropical). We hypothesize that nations with a tropical climate should have higher rates of deforestation because these nations tend to have more valuable tree species that are in demand on the world market (Rudel 1989).

Findings

In Table 2, we present ordinary least square estimates of deforestation.[2] In every equation, we include a measure of structural adjustment, debt service, non-governmental organizations, democracy, environmental ministry presence, gross domestic product per capita, economic growth, agriculture and forestry based economic activity, a measure of population growth, natural forest stocks, data quality, and a tropical climate dummy variable. We examine the effects of International Monetary Fund structural adjustment in equations (2.1) through (2.3).

We examine the effects of World Bank structural adjustment lending in equations (2.3) through (2.6). In equations (2.7) through (2.9), we examine the effects of both types of structural adjustment lending simultaneously. We consider the impact of total population growth in equations (2.1), (2.4), and (2.7). We decompose this measure and examine the impact of non-dependent population growth in equations (2.2), (2.5), and (2.8). We examine the effects of rural and urban population growth in equations (2.3), (2.6), and (2.9).

We organize our analysis in the way for a couple of reasons. First, we want to avoid potential problems with multicollinearity. If we examine the impact of all the population growth measures together, then variance inflation factor scores exceed a value of ten, indicating potential problems with multicollinearity.[3] Second, we use "cognate" but "distinct" indicators of similar theoretical constructs in order to shed some light on the complexity of dynamics under investigation and help to increase the reliability of the finding (London and Ross 1995). If the International Monetary Fund and World Bank structural adjustment variables maintain a similar effect across the alternative model specifications, for example, then our confidence in the reliability of the findings is enhanced. If they maintain different effects, then this helps us to discern what factors affect the natural environment and what factors do not. Third, the use of multiple indicators helps guard against potential problems with measurement error (Paxton 2002).

(Table 2 goes about here.)

Let us begin by discussing the structural adjustment variables. We find substantial support for dependency theory that International Monetary Fund and World Bank structural adjustment is associated with higher rates of deforestation. In equations (2.1) through (2.3), the coefficients for the International Monetary Fund structural adjustment dummy variable are

positive and significant. In equations (2.4) through (2.6), the coefficients for the World Bank structural adjustment dummy variable are positive and significant. The findings remain stable and consistent when examining these variables together in the same model. The coefficients for International Monetary Fund structural adjustment variables are positive and significant in equations (2.7) through (2.9). The coefficients for the World Bank dummy variable are positive and statistically significant in equations (2.7) and (2.9). This most likely happens because poor nations boost natural resource extraction and cut government spending for environmental protection. In this regard, the coefficients for agricultural and forestry based economic activity are positive and significant in seven of eight equations.[4] The coefficients for the environmental ministry dummy variable fail to reach a level of statistical significance in any equation of Table 2. Clearly, the results provide support for dependency theory that structural adjustment from both institutions is associated with higher rates of forest loss.

A number of other factors also help to explain forest loss. First, we find support for world polity theory regarding the beneficial impacts of non-governmental organizations on the natural environment. The coefficients for this variable are negative and significant in every equation of Table 2. Second, we find that higher levels of democracy are correlated with higher rates of deforestation. The coefficients for this variable are also positive and significant in every equation of Table 2.[5] This finding contradicts our hypothesis. However, Marquart-Pyatt (2004) finds a similar relationship in her cross-national study of forest loss. Midlarsky (1998) attributes this finding to the substantial influence of business interests in the politics of democratic nations and the need for democratic leaders to meet the demands of competing interest groups not just environmentalists. Fourth, we find that demographic factors are important to take into account in cross-national research. The coefficients for the total population growth rate are positive and

significant in equations (2.4) and (2.7). We also find that it is important to decompose total population growth. The coefficients for non-dependent population growth are positive and significant in equations (2.2), (2.5), and (2.8). The coefficients for rural population growth are positive and significant in equations (2.3), (2.6), and (2.9). Finally, we find that it is important to include biophysical control variables. The coefficients for the data quality variable are negative and significant in about half of the equations. The coefficients for the tropical climate dummy variable are positive and significant in every equation of Table 2. The coefficients for natural forest stocks are negative and significant in equations (2.4) and (2.6).[6]

There are a number of non-significant findings that also deserve to be mentioned. First, we do not find that debt service is related to increased forest loss. The coefficients for this variable are not significant. Second, we do not find support for the idea that economic growth is related to deforestation. This variable fails to explain any significant variation in the dependent variable. Third, we do not find that economic development is significantly related to deforestation. The coefficients for gross domestic product per capita do not reach a level of statistical significance.[7] Fourth, we do not find that urban population growth is significantly related to deforestation. The coefficients are not statistically significant.[8]

Discussion and Conclusion

This study expands our understanding of forest loss in a novel way. We begin this study by noting the contradictory evidence and competing theoretical perspectives regarding the impact of structural adjustment on deforestation. We seek to address the debate between neo-liberal economic theory and dependency theory by constructing the first cross-national models that examine the impact of International Monetary Fund and World Bank structural adjustment lending using cross-national data for a sample of sixty-one countries. In doing so, we find

substantial support for dependency theory that structural adjustment loans from both the International Monetary Fund and World Bank are associated with higher rates of forest loss. This is most likely the case because structural adjustment leads nations to increase exports of natural resources, liberalize trade in extractive sectors, and reduce the regulatory capacity of governments to deal with the causes of forest loss (Clapp and Dauvergne 2005; Tockman 2001; Barbosa 2001; Rich 1994; George 1992). It may also exacerbate poverty, thereby forcing people to clear land to grow crops in order to survive (Rudel 1993). We attempt to increase the reliability of the findings by demonstrating their statistically significance across several alternative model specifications.

In fact, we also find support that independent variables suggested by other theoretical perspectives help to explain deforestation. First, we find that higher levels of international non-governmental organizations are associated with lower rates of deforestation. This supports world polity hypotheses regarding the beneficial impact of these organization on the natural environment (Shandra 2007a; Schofer and Hironaka 2005; Frank, Hironaka, and Schofer 2000). Second, we find that higher levels of democracy are associated with increased rates of deforestation (Marquart-Pyatt 2004). Third, we find that it is important to incorporate demographic factors in cross-national research on forest loss. The coefficients for the total, non-dependent, and rural population growth rates are positive and statistically significant (Jorgenson and Burns 2007; Rudel and Roper 1997; Allen and Barnes 1985). These findings support hypotheses from neo-Malthusian theory. Fourth, we find that it is necessary to include certain biophysical control variables in the models (Shandra 2007b; Rudel 1989). The coefficients for the data quality, tropical climate, and natural forest stocks are statistically significant several equations. While it is important to take into account International Monetary Fund and World

Bank structural adjustment, a failure to consider factors from other theoretical perspectives would lead to an incomplete understanding of deforestation.

There are some theoretical and methodological implications that follow from these findings. The results are reminiscent of an approach used by Shandra, Shandra, and London (2008). These authors find higher levels of environmental and women's non-governmental organizations are associated with lower rates of deforestation. Shandra, Shandra, and London (2008) conclude that it is necessary to consider both types of international non-governmental organizations in cross-national research on the environment. We extend this line of reasoning here but in a slightly different way. We argue that it is necessary to consider how structural adjustment loans from the International Monetary Fund and World Bank affect forest loss in order to arrive at a more complete understanding of the factors that shape deforestation. The same line of reasoning applies to examining if population growth in different sectors contributes to deforestation. It is refinement of this sort that makes cross-national research more nuanced and refined. At the same time, it deepens our understanding of how political-economic factors shape the natural environment.

There are some policy implications that follow from our main findings regarding structural adjustment and non-governmental organizations. It may serve international non-governmental organizations well to lobby the World Bank and International Monetary Fund leaders to eliminate or change their structural adjustment lending policies. However, non-governmental organizations may be better served by focusing their attention on the lawmakers in the rich nations of the world that fund these multilateral institutions. This was the approach taken by the National Wildlife Federation and Environmental Policy Institute against the World Bank to stop financing of a massive resettlement and rural development project in the Brazilian

Amazon during the 1980s (Bryant and Bailey 1997). While protests directed by the non-governmental organizations at the World Bank achieved little, a well publicized media campaign in the United States Congress forced the World Bank to stop remaining loan disbursements "pending the preparation and carrying out of emergency environmental and Indian lands protection measures by the Brazilian government" (Rich 1994: 126). This media campaign involved working with Brazilian non-governmental organizations to document how forest loss was affecting local people and then publicizing the findings in the media. The non-governmental organizations also brought those affected by the deforestation to tell their stories before Congress (Barbosa 2001). Such an approach may be effective in helping non-governmental organizations bring about change to International Monetary Fund and World Bank structural adjustment loan terms.

We conclude with some possible directions for future research. First, we demonstrate that poor nations that have receive an International Monetary Fund and World Bank loan tend to have higher rates of forest loss. However, forest loss has been associated with a number of other environmental problems. It may well be that these factors help to shape biodiversity loss, carbon dioxide emissions, and water pollution in poor nations. Second, we consider how the World Bank contributes to forest loss by via structural adjustment. The World Bank also provides loans for large-scale infrastructure, migration, and agricultural projects (Rich 1994). Nevertheless, there has been no cross-national research that examines how lending for these types of projects affect the natural environment. Third, we use cross-national data over a span of fifteen years (i.e., 1990-2005) to examine the how various political-economic factors impact forests. Unfortunately, comparable data on deforestation are limited to this time period due to changes in data collection methodologies (Food and Agriculture Organization 2005). However, it may well

be that macro-structural changes occur over longer periods of time. Our efforts to gauge processes from the most recent period are bound to miss such historical trends. Therefore, when comparable longitudinal data become available scholar should use other modeling strategies including pooled time series, fixed effects, and random effects models. It is also imperative that cross-national research using statistical data be supplemented with historical-comparative analyses in order to arrive at a more nuanced understanding of the forces that shape deforestation across time and space (Rudel 2005; Goldman 2005).

Endnotes

1. The following sixty-one nations are included in the analysis after listwise deletion of missing data. They include Albania, Angola, Argentina, Bangladesh, Benin, Bolivia, Brazil, Bulgaria, Burkina Faso, Central African Republic, Chad, Chile, China, Colombia, Congo, Costa Rica, Ecuador, El Salvador, Ethiopia, Gabon, Gambia, Ghana, Guatemala, Guinea-Bissau, Honduras, Hungary, India, Indonesia, Jamaica, Lesotho, Madagascar, Malawi, Malaysia, Mexico, Mozambique, Nepal, Nicaragua, Nigeria, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Romania, Rwanda, Senegal, Sierra Leone, South Africa, Sri Lanka, Swaziland, Syria, Tanzania, Thailand, Togo, Trinidad, Turkey, Uganda, Uruguay, Zambia, and Zimbabwe.
2. According to Abouharb and Cingranelli (2009) and Przeworski and Vreeland (2000), non-random selection bias may be a problem when examining the impact of International Monetary Fund and World Bank structural adjustment in cross-national research. To determine if it is a problem in this analysis, we estimate two stage treatment effects models (Maddala 1986). In the first stage of the analysis, a selection equation is estimated using a probit model. The dependent variable in the selection equation is a dichotomous variable that indicates whether a nation is undergoing International Monetary Fund or World Bank structural adjustment. The independent variables are the factors hypothesized to influence whether or not a nation is undergoing International Monetary Fund structural adjustment. The residuals of the probit analysis are saved and then used to construct a selection bias control factor commonly referred to as lambda (Maddala 1986). The lambda variable captures the effects of characteristics related to whether or not a nation receives a structural adjustment loan for independent variables not included in the model. In the second stage, a

substantive equation is estimated using an ordinary least squares regression. The dependent variable in the substantive equation of this analysis is deforestation. In the second stage of the model predicting deforestation, lambda is included as an independent variable along with the dummy variable representing if a nation is undergoing International Monetary Fund or World Bank structural adjustment. Because the coefficient for lambda reflects the effect of the variance unexplained by the predictors in the first stage of the model, we are controlling for the effects of the variables that predict whether a nation is undergoing structural adjustment (Maddala 1986). When selection bias is negligible, lambda is not statistically significant, and the least squares estimates of the substantive parameters have optimal properties. A statistically significant coefficient for lambda indicates that non-negligible sample selection bias exists in the model. We draw upon Abouharb and Cingranelli (2009) to specify the selection equation, which predicts whether or not a nation received a structural adjustment loan. The model specifications for the second stage of the model with deforestation as the dependent variable are same as Table 2 except they also include the selection bias control, lambda. The coefficients for lambda are not statistically significant in the second stage of the model, indicating that non-random selection bias does not appear to be a problem. Thus, the ordinary least squares estimates that we present in Table 2 should have optimal properties (Maddala 1986).

3. The highest and mean variance inflation factor scores do not exceed a value of ten for any model. Therefore, multicollinearity should not be a problem in the analysis (York, Rosa, and Dietz 2003). In Table 2, we also present Breusch-Pagan statistics to determine if heteroskedasticity is a potential problem. The statistics are significant for every equation,

indicating heteroskedasticity is present. We calculate robust standard errors to deal with this problem (Shandra, Shandra, and London 2008).

4. We consider how other aspects of the domestic economy structure impact forest loss. It is thought that poor nations with larger service and manufacturing economies may have lower rates of deforestation because these types of activities are thought to put less pressure on forests (Shandra 2007c). Therefore, we examine the impact of service-based economic activity and manufacturing-based economic activity in our models. The coefficients for both of these variables fail to reach a level of statistical significance.
5. Bollen and Paxton (2000) argue that non-random measurement error arising from the subjective perceptions of judges affects all cross-national measures of democracy to some degree. This bias may distort comparisons across nations, undermining empirical results that ignore it. Therefore, we also estimate our models using the average of Freedom House's (1997) political rights and civil liberties scales. The results are similar to the findings presented in Table 2.
6. We include dummy variables for the region of the world in which a nation is located to deal with findings that may arise out of geographical circumstances, which cannot be accounted for by the independent variables in the model (Shandra 2007c). These dummy variables identify a nation as being located in Latin America, Asia, Europe, and Africa. The reference category includes nations in Middle East. The coefficients for the geographical control variables fail to predict any significant variation in deforestation. The other findings remain similar to the results reported in Table 2.
7. Ehrhardt-Martinez, Crenshaw, and Jenkins (2002) find an inverted u-shaped relationship exists between gross domestic product per capita and deforestation. We test this hypothesis

using a quadratic polynomial equation in which the gross domestic product per capita and its square are entered into the same model. If this relationship exists, the sign of the coefficient for the linear term should be positive and the sign for the coefficient for the squared term should be negative and statistically significant. To reduce problems of multicollinearity, we begin by centering the linear term around its mean. We then square the centered term. Finally, we include the centered linear term and squared term in our models (York, Rosa, and Dietz, 2003). The coefficients for the squared term are negative but fail to achieve statistical significance.

8. Ehrhardt-Martinez (1998) finds an inverted u–shaped relationship exists between urbanization and deforestation. We use the procedure discussed in endnote seven to test this hypothesis. The squared urbanization term is negative but fails to predict any significant variation in deforestation, indicating no support for an environmental Kuznets curve between urbanization and deforestation.

References

Abouharb, M. R. and D. Cingranelli. 2009. International monetary programs and human rights, 1981-2003. The Review of International Organizations 4, 47-72.

Allen, J. and D. Barnes. 1985. The causes of deforestation in developing countries. Annals of the Association of American Geographers 75, 163-184.

Amin, S. 1976. Unequal development: An essay on the social formation of peripheral capitalism. New York, Monthly Review Press.

Barbosa, L. C. 2001. The Brazilian Amazon rainforest: Global ecopolitics, development, and democracy. New York, University of American Press.

Bollen, K. and P. Paxton. 2000. Subjective measures of liberal democracy. Comparative Political Studies 33, 58-87.

Bradshaw, Y. and A. Wahl. 1991. Foreign debt expansion, the International Monetary Fund, and regional variation in Third World poverty. International Studies Quarterly 35, 251-272.

Bryant, R. L. and S. Bailey. 1997. Third world political ecology. London, Routledge.

Burns, T. J., E. L. Kick, and B. L. Davis. 2003. Theorizing and rethinking linkages between the natural environment and the modern world system: Deforestation in the late 20th century. Journal of World-Systems Research 9, 357-390.

Clapp, J. and P. Dauvergne. 2005. Paths to a green world: The political economy of the global environment. Cambridge, MIT Press.

Clapp, J. 1998. Foreign direct investment in hazardous industries in developing countries: Rethinking the debate. Environmental Politics 7, 92-113.

Clausen, R. and R. York. 2008. Global biodiversity decline of marine and freshwater fish: A cross-national analysis of economic, demographic, and ecological influences. Social Science Research 37, 1310-1320.

Cruz, W. and R. Repetto. 1992. The environmental effects of stabilization and structural adjustment programs: the Philippines case. Washington D.C., World Resources Institute.

Ehrhardt-Martinez, K., E. M. Crenshaw, and J. C. Jenkins. 2002. Deforestation and the environmental Kuznets curve: A cross-national investigation of intervening mechanisms. Social Science Quarterly 83, 226-43.

Ehrhardt-Martinez, K. 1998. Social determinants of deforestation in developing countries. Social Forces 77, 567-86.

Evans, P. B. 1979. Dependent development: The alliance of multinational, state, and local capital in Brazil. Princeton, Princeton University Press.

Fischer, S. 1996. What is reasonable to expect of the International Monetary Fund on the Environment? In Gandhi, V. P., (ed.) Macroeconomics and the environment. Washington D.C., International Monetary Fund.

Food and Agriculture Organization of the United Nations. 2005. Global forest resources assessment 2005: Progress towards sustainable forest management. Food and Agriculture Organization Forestry Paper 147. Rome, United Nations.

Frank, A. G. 1967. Capitalism and underdevelopment in Latin America. New York, Monthly Review Press.

Frank, D. J., A. Hironaka, and E. Schofer. 2000. The nation-state and the natural environment over the twentieth century. American Sociological Review 65, 96-116.

Frank, D. J. 1999. The social bases of environmental treaty ratification. Sociological Inquiry 69, 523-550.

Freedom House. 1997. Freedom in the world: 1996-1997. New York, Freedom House.

Gandhi, V. P. 1998. The International Monetary Fund and the environment. Washington D.C.. International Monetary Fund.

George, S., and F. Sabelli. 1994. Faith and credit: The World Bank's secular empire. Boulder, Westview Press.

George, S. 1992. The debt boomerang. Boulder, Westview Press.

Glover, D. 1995. Structural adjustment and the environment. Journal of International Development 7, 285-289.

Goldman, M. 2005. Imperial nature: The World Bank and struggles for social justice in the era of globalization. New Haven, Yale University Press.

Grossman, G. and A. Krueger. 1995. Economic growth and the environment. Quarterly Journal of Economics 110, 353-377.

Hurst, P. 1990. Rainforest politics. London, Zed Books.

Jorgenson, A.K., and T. J. Burns. 2007. Effects of rural and urban populations and national development on deforestation in less developed countries, 1990-2000. Sociological Inquiry 77, 460-482.

Jorgenson, A. K. 2008. Structural integration and the trees: An analysis of deforestation in less-developed countries, 1990-2005. Sociological Quarterly 49, 503-527.

Jorgenson, A. K. 2006. Unequal exchange and environmental degradation: A theoretical proposition and cross-national study of deforestation. Rural Sociology 71, 108-125.

Kessler, J. J. and M. Van Dorp. 1998. Structural adjustment and the environment: The need for an analytical methodology. Ecological Economics 27, 267-281.

Leonard, H. J. 1988. Pollution and the struggle for world product: Multinational corporations, the environment, and international comparative advantage. Cambridge, Harvard University Press.

Li, Q. and R. Reuveny. 2006. Democracy and environmental degradation. International Studies Quarterly 50, 935-956.

London, B. and R. J. S. Ross. 1995. The political sociology of foreign direct investment: global capitalism and capital mobility, 1965-1980. International Journal of Comparative Sociology 36, 198-219.

McMichael, P. 2004. Development and social change: A global perspective. Thousand Oaks, Pine Forge Press.

McQuillan, L. J. and P. C. Montgomery. 1999. The International Monetary Fund: Financial medic to the world? Stanford, Stanford University Press.

Maddala, G. S. 1986. Limited-dependent and qualitative variables in econometrics. New York, Cambridge University Press.

Magdoff, H. 1986. Third World debt: Past and present. Monthly Review 38, 1-10.

Marquart-Pyatt, S. 2004. A cross-national Analysis of deforestation, debt, state fiscal capacity, and the environmental Kuznets curve. International Journal of Sociology 34, 33-51.

Midlarsky, M. I. 1998. Democracy and the environment: An empirical assessment. Journal of Peace Research 35, 341-361.

Mohan, G. 2001. The environmental impacts of adjustment. Pp.95-117 in Structural Adjustment: Theory, Practice, and Impacts edited by G. Mohan, E. Brown, B. Milward, and A. B. Zack-Williams. New York, Routledge.

Paxton, P. 2002. Social capital and democracy: An interdependent relationship. American Sociological Review 67, 254-77.

Peet, R. 2003. The unholy trinity: The International Monetary Fund, World Bank, and World Trade Organization. London, Zed Books.

Polity IV Project. 2005. Polity IV project: Political regime characteristics and transitions. College Park, University of Maryland.

Przeworski, A. and J. R. Vreeland. 2000. The effects of IMF programs on economic growth. Journal of Development Economics 62, 385-421.

Reed, D. 1996. Structural adjustment, the environment and sustainable development. London, Earthscan.

Reed, D. 1992. Structural adjustment and the environment. Boulder, Westview Press.

Rich, B. A. 1994. Mortgaging the Earth: The World Bank, environmental impoverishment, and the crisis of development. Boston, Beacon Press.

Rudel, T. and J. Roper. 1997. The paths to rain forest destruction: Cross-national patterns of tropical deforestation, 1975-1990. World Development 25, 53-65.

Rudel, T. 2005. Tropical forests: Regional paths of destruction and regeneration in the late twentieth century. New York, Columbia University Press.

Rudel, T. 1993. Tropical deforestation: Small farmers and land clearing in the Ecuadorian Amazon. New York, Columbia University Press.

Rudel, T. 1989. Population, development, and tropical deforestation: A cross-national study. Rural Sociology 54, 327-38.

Schofer, E. and A. Hironaka. 2005. The effects of world society on environmental outcomes. Social Forces 84, 25-47.

Shandra, J. M., C. L. Shandra, and B. London. 2008. Women, non-governmental organizations, and deforestation: A cross-national study. Population and Environment 38, 48-72.

Shandra, J. M. 2007a. The world polity and deforestation: A cross-national analysis. International Journal of Comparative Sociology 48, 5-28.

Shandra, J. M. 2007b. Non-governmental organizations and deforestation: Good, bad, or irrelevant? Social Science Quarterly 88, 665-689.

Shandra, John M. 2007c. Economic dependency, repression, and deforestation: A cross-national analysis. Sociological Inquiry 77, 543-571.

Smith, J. and D. Wiest. 2005. The uneven geography of global civil society: National and global influences on transnational association. Social Forces 84, 632-652.

Tockman, J. 2001. The International Monetary Fund—Funding deforestation. Washington D.C., American Lands Alliance.

Walton, J. and C. Ragin. 1990. Global and national sources of political protest: Third world responses to the debt crisis. American Sociological Review 55, 875-90.

World Bank. 2003. World development indicators. Washington D.C., World Bank.

World Bank. 2001. Adjustment lending retrospective: Final report, operations policy, and country services. Washington D.C., World Bank.

World Bank. 1994. Adjustment in Africa: Reforms, results, and the road ahead. Washington D.C., World Bank.

World Resources Institute. 2005. World resources 2005: The wealth of the poor. Washington D.C., World Resources Institute.

York, R., E. A. Rosa, and T. Dietz. 2003. Footprints on the Earth: The environmental consequences of modernity. American Sociological Review 68, 279-300.