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Grow rich and clean up later? International assistance and the provision of environmental quality in low- and middle-income countries

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Abstract: This paper deals with the question whether low- and middle-income countries that are politically better integrated into the international system are able to provide higher levels of environmental quality than could be expected only according to their national income levels. Using time-series cross-section regression analysis of 110 countries for the period 1950-1999 it can be shown that those countries that have signed and ratified more environmental treaties, have significantly lower SO₂ emissions than countries that are less integrated into the international system. However, in contrast to theoretical predictions democratic low- and middle-income countries despite their stronger integration into the international system exhibit higher SO₂ emissions indicating lower environmental quality than autocratic countries.

1. Introduction

When a country's economy is growing, environmental pollution usually tends to increase as well. The theoretical and empirical literature on the relationship between income and pollution shows that most pollutants like SO₂, heavy particles, smoke, etc. rise monotonically with growing income until a country reaches a certain threshold whereupon pollution often starts to decline. This inverted U-shaped relationship is called the Environmental Kuznets Curve (Grossman and Krueger 1995). Although most industrialized countries have already passed this threshold and have declining pollution this is not the case for most low- and middle-income countries. Consequently, the question arises as to whether those countries have to grow rich before giving attention to the provision of environmental quality or whether there exist other channels through which the provision of environmental quality could be attained also by low- and middle-income countries. This paper examines the possibility that due to increasing international political integration, low- and middle-income countries are able to provide better environmental quality than should be expected according to their national income level. Furthermore, it is assessed whether democratic low- and middle-income countries are better integrated into the international system and thus achieve through this better integration a higher provision of environmental quality.

This paper intends to analyze how the political system and the degree of international integration alter the provision of environmental quality with regard to low- and middle-income countries. It further tends to capture the interaction between these two factors leading to a more comprehensive analysis of the question how low- and middle-income countries can be enabled to provide better environmental quality. Figure 1 displays the key factors of this study. Using a time-series cross-section regression analysis it can be shown that higher levels of international political integration, measured by the number of environmental treaties a country has ratified, significantly increase the level of environmental quality in a particular country. In contrast, the influence of the political system is contrary to expectations. Although democratic low- and middle- income countries sign and ratify more international environmental treaties the net effect of democracy on the provision of environmental quality is negative.

(Figure 1 about here)

The remainder of the paper is structured as follows: The next section reviews the state of research and develops a theoretical framework from which testable hypothesis are derived. Thereafter, the research design is outlined and the operationalization and measurement of the dependent and independent variables of the analysis are specified. The paper concludes with the discussion of the results and a summary.

2. Literature review and theoretical framework

2.1 National income and environmental quality

The starting point of the theoretical framework underlying this paper is the literature on the relationship between national income and environmental quality. Different studies like Shafik and Bandyopadhyay (1992), Selden and Song (1994) and Grossman and Krueger (1995) empirically found an inverted U-shaped relationship between growing GDP per capita and several indicators of environmental pollution such as SO₂, heavy particles, smoke and water pollutants and labeled this relationship Environmental Kuznets Curve (EKC).

According to Grossman and Krueger (1995) the effect of increasing GDP per capita on environmental quality can be decomposed into a scale, composition and technology effect. Rising industrial production would lead to monotonically rising pollution all else being equal. This is called the scale effect as pollution increases with the scale of the economy. However, as the economy grows the composition of the industry usually changes from manufacturing and agricultural oriented industries towards a more service-oriented industry¹. This composition effect usually leads to a decrease in pollution. Finally, the development of the economy additionally leads to technological improvements, which are supposed to also reduce pollution. This can work either the way that the same amount of output can be produced by a smaller amount of input or due to filter systems or other abatement technology the same amount of input produces a smaller amount of pollution. On the basis of this division into scale, composition and technology effects Grossman and Krueger (1995) explain the inverted U-shape of the EKC as follows: first with rising income due to the scale effect pollution is increasing. After a certain level composition and technology effect are growing in importance and when they surpass the scale effect pollution is decreasing².

¹ This is only true for an economy, which changes from a predominantly manufacturing industry towards a more service-oriented industry. If an economy with a strong agricultural sector, as it is the case for most low-income countries, increases its manufacturing sector pollution is more likely to rise.

² It is important to note that the EKC only constitutes a theoretically stylized explanation for the relationship between national income and environmental quality. Consequently, countries might empirically deviate from this

Additionally, Selden and Song (1994) and Grossman and Krueger (1995) point to a political component to the relationship between environmental pollution and growing income levels. At the stage of early economic development environmental quality is considered a luxury good by most people in a particular country. As states have only limited resources available environmental quality ranks far behind the demand for increasing economic conditions and living standards. Only after they attend a certain level of living standard environmental quality turns into a normal public good and people demand that a government takes actions to reduce or avoid pollution, for example by enacting appropriate environmental regulations. Grossman and Krueger (1995) subsume this mechanism under the concept of the technological effect, introduced in the above paragraph, and call it “induced technological change”. They assume that “the strongest link between income and pollution in fact is via an induced policy response” (Grossman and Krueger 1995: 372). In the same line, Selden and Song (1994: 147) consider “increasing levels of education and environmental awareness” as well as a “more open political systems” as decisive factors explaining the relationship between income growth and environmental quality besides the “positive income elasticity for environmental quality” and “changes in the composition of production and consumption”. Consequently, “the development trajectory for pollution is likely to reflect both market forces and changes in government regulation” (Selden and Song 1994: 147).

From all this follows that according to the logic underlying the EKC, most low- and middle-income countries are still on the upward part of the curve and are likely to face increasing pollution levels as the manufacturing part of their industry is still increasing and their technological level has not yet reached high standards. Furthermore, according to the political explanation of the EKC most low- and middle-income countries in many cases are also expected to lack the *means* and most likely also the *interest* to provide better environmental quality.

First of all, they lack the *means* to provide better environmental quality as usually low- and middle-income countries have only very limited resources available to spend on public goods. It can be expected that these limited resources are firstly allocated to the most pressing needs of those countries, i.e. to actions that raise the economic conditions and therefore the living standards within a particular country. In addition, due to the low technological levels of most

U-shaped relationship. Furthermore, the inverted U-shape relationship is not un-debated in the literature see Stern (2004), who argues that the EKC needs very careful interpretation.

low- and middle-income countries, their governments often lack the capacities to provide environmental quality. This is because information and knowledge on environmental problems are missing, the technology to abate pollution is not available and often the institutional capacities are low so that clear and binding regulations are absent or cannot be enforced (Hettige et al. 1996).

Secondly, for most low- and middle-income countries environmental quality is not of first *interest* and so it does not constitute a very important objective to spend resources on. As outlined above, it is assumed that people usually do not demand better environmental quality until their living standards reach a certain threshold. Hence, environmental quality is considered a luxury good until a certain level of economic development is reached. “This need not imply that poor countries care less about the environment per se. Rather, because of their poverty, they might prioritize issues other than the environment” (Neumayer 2002: 150). Consequently, the top priority of most governments in low- and middle-income countries does not consist in the provision of environmental quality but rather in economic growth for example. In addition, these countries do not only spend little or no extra means on environmental quality they are also unlikely to enforce environmental regulations. On the one hand, environmental regulations often imply an increase in the prize of production, which would thus hurt economic growth. As Boyce (2002: 25) argues “people cannot be expected to cease activities that degrade the environment yet are essential to the sustenance of their families”. On the other hand, in order to enforce and monitor environmental regulations public authority and administration is needed. However, the functioning and maintenance of public authorities with the aim of enforcing environmental regulations also presupposes resources in the form of institutional capacities, e.g. trained personnel, and money to maintain these institutions. As resources are however limited in most low and middle-income countries, the enforcement of environmental regulations is rendered unlikely.

In summary, it can be concluded that most low- and middle-income countries should not or only to a very limited extent provide better environmental quality due to the following reasons. On the one hand, according to the EKC these countries are generally situated on the upward part of the curve as pollution is assumed to grow with raising income levels while at the same time their technological levels are likely to be rather low. On the other hand, most low- and middle-income countries are assumed to lack the means and the interest to spend resources on environmental quality. Moreover, at this level of economic development the type

of the political system (democracy or autocracy) per se should not play a decisive role as the median voter in low- and middle-income countries should not demand environmental quality due to the reasons outlined above and thus a democratic government has not to respond to it.

A possible consequence one could draw at this point would be that low- and middle-income countries have to grow rich before they will be able to clean up. However, this consequence ignores other possible influence channels that may alter those countries' ability to provide better environmental quality. One such channel could be a country's international political integration and its interaction with a country's political system. Up to this point, only national factors have been examined as being decisive for the provision of better environmental quality. However states do not act in a vacuum, they are influenced by other states, by economic pressures and dependencies and international actors. Consequently, it has been argued that international integration also influences the capacity and interest of states to provide environmental quality (Antweiler et al. 2001; Frankel and Rose 2005; Neumayer 2002; Ward 2006). However, the mechanisms how international integration is supposed to affect a country's ability to provide environmental quality might also depend on the political system of the particular country. The extent of its international integration and thus the provision of environmental quality might depend on the fact whether the country is democratic or not. The next sections specify the mechanisms how international political integration and its interaction with a country's political system could influence the provision of environmental quality. In terms of clarity of the argument firstly the impact of international political integration on environmental quality is analyzed and then the interaction with the political system is incorporated.

2.2 International political integration and environmental quality

Although states are sovereign actors they often cooperate together on the international level through regimes, treaties and through membership in international organizations. This is also true for the field of environmental protection: there exist for example a tremendous number of treaties dealing among other things with air or water pollution, with trade in toxic waste or endangered species etc. The concept of international political integration as understood in this paper hence encompasses a country's membership in international regimes that deal with environmental purposes.

The perhaps most prominent definition of international regimes describes them as “sets of implicit or explicit principles, norms, rules, and decision-making procedures around which actors’ expectations converge in a given area of international relations” (Krasner 1983: 3). However this definition causes several difficulties for empirical research as it covers a wide range of international agreements including non-explicit or non-formalized agreements, which are difficult to identify and measure (Tooze 1990; Porter et al. 2000). Consequently, my analysis relies on a more narrow definition of regimes as “multilateral agreements among states which aim to regulate national actions within an issue area“ (Haggard and Simmons 1987: 495). According to this definition regimes are formalized forms of international cooperation implying that international cooperation could also take place outside the scope of regimes.

The general purpose of regimes is to enable or facilitate cooperation at the international level and thereby to enable countries to solve problems, which they often are unable to solve independently, and hence to realize benefits from international cooperation (Keohane 1984). Regimes can enable cooperation between states by reducing transaction costs, by limiting uncertainty, by widening the shadow of the future, by increasing reputational costs or by allowing credible commitments (Keohane 1984; Abbott and Snidal 1998; 2000). However, the benefits of cooperating at the international level come with certain costs, such as a loss in sovereignty as international regimes constrain governments’ autonomy over decision-making. Furthermore, regimes entail costs as governments have to spend resources for negotiating, ratifying and for complying with the particular regime (Abbott and Snidal 2000). Following a rational choice perspective, membership in a particular international regime is therefore only rational for a country if the benefits of cooperation outweigh its costs (Moravcsik 2000). Consequently, low and middle-income countries should only join a particular environmental regime if the cost-benefit calculation of joining results in an incentive to do so. This however implies that by joining a particular regime, a country’s government in order to enjoy the benefits from cooperation in principle accepts that the regime at question sets limits or influences the country’s actions in this issue area.

Membership in international regimes is supposed to influence the behavior of a particular country due to several reasons. First and most important, members of a particular regime should obey the corresponding rules. For instance, in the case of the Montreal Protocol, which was designed to reduce chlorofluorocarbons (CFC) emissions, member countries should stop

emitting ozone-depleting substances. Therefore, formalized regimes promote cooperation as they raise the reputational stakes for renegeing on agreements and enhance the legal liabilities (Keohane 1984). Thus, for example emitting ozone-depleting substances while being a member of a treaty, which bans these substances, has negative consequences for the reputation of this country. In addition, according to the particular treaty non-compliance could even be sanctioned meaning that the organization responsible for the treaty can demand from the particular country to enforce the treaty rules³. Taking these two arguments together this implies that by deciding to join a particular regime a country binds itself to its rules and thus is supposed to implement and follow them.

Furthermore, international regimes create norms on good behavior or rather what constitutes bad conduct (Ward 2006). Thus, for example due to the Montreal Protocol the emission of CFCs is negatively stigmatized. Abbot and Snidal (2000: 425) subsume these possibilities under “techniques ranging from litigation and sanctions to persuasion, normative appeals, and shaming”. International regimes also allow for information transfer, which is especially important for low and middle-income countries. Due to new information and knowledge on environmental pollution, awareness of environmental quality as an important public good could be created or knowledge on abatement possibilities could be distributed (Porter et al. 2000). From all this follows that in general membership in international regimes, treaties and organizations is expected to positively influence the ability of low and middle-income countries to provide environmental quality. Consequently, my first hypothesis is:

H1: Low- and middle-income countries that are members in more environmental regimes provide higher levels of environmental quality.

This first hypothesis states a general relationship between membership in international regimes and environmental quality. However, as mentioned above this relationship could also depend on the political system of a country. Consequently, the next section analyzes the interaction between international political integration and its political system with regard to the provision of environmental quality.

³ Although the individual influence of a particular regime will vary according to its exact institutional design – e.g. a regime with a strong institutional foundation (secretariat, enforcement mechanisms etc), a higher degree of independence and which is supported by a major power should be more influential (Boehmer et al. 2004) – the general influence of regimes is supposed to be positive independent of its institutional design.

2.3. Interconnection with the political system

Until now the analysis has treated all countries equally and hence has neglected the role of the political system of a particular country. However, it can be argued that countries with different types of political systems also vary with regard to the extent of their international integration and their ability to provide environmental quality. Hence, the political system could affect the ability of a country to provide environmental quality, as the intensity of its international political integration is likely to be dependent on the political system of the particular country. Consequently, it is argued in this section that democratic countries are integrated in the international system to a greater extent than their autocratic counterparts implying that democratic countries should be members in more international treaties. Therefore, following from the overall positive influence of international integration on the provision of environmental quality, established in the preceding section, I argue that it follows that democratic countries will because of their higher levels of international integration also provide better environmental quality.

The reasons why it is argued that democratic countries are stronger integrated at the international level are the following. First, citizens in democracies in contrast to citizens in autocratic countries are able to express their preferences and to put pressure on their governments to behave according to these preferences (Neumayer et al. 2002). With regard to the environment, people in democratic countries can thus articulate their interest and also have the possibility to demand that their government acts accordingly, for example by joining international treaties (Payne 1995). In addition, Neumayer et al. (2002) argue that in democracies environmental non-governmental organizations (ENGO) and other actors are able to lobby for environmental purposes. They can thus influence both the public and the government by campaigns or other forms of information provision in order to reach more cooperation with regard to environmental problems⁴. This argument is supported by Neumayer (2002a) who can show that citizens of democratic states receive more information on environmental pollution than citizens of autocratic states.

Second, democratic countries tend to be more transparent than autocracies and therefore they can more easily and credibly commit themselves to international cooperation (Remmer 1998; Gaubatz 1996). Similarly, Abbott and Snidal (2000) argue that strong domestic legal

⁴ However, it has to be stated that the same argument does also apply to other actors like business groups, which could lobby and try to influence the government in opposite ways than environmental groups.

institutions and traditions should increase international credibility. Hence democracies as they usually have stronger legal institutions should more easily commit themselves and thus can be expected to cooperate more often on the international level. Third, it can be derived from the literature on the democratic peace theorem that democracies tend to cooperate more on the international level than autocratic countries. This is because democracies are supposed to be used to solve their domestic conflicts by cooperation and accordingly they are assumed to project their cooperative behavior also to the international realm (Russett et al. 1999; Russett and Oneal 2001). Altogether, the argument that democracies display more international environmental commitment is empirically supported by Roberts et al. (2004), Fredriksson and Gaston (2000) as well as Neumayer (2002a; 2002b) who show that democracies not only tend to ratify more international environmental agreements but that democracies are also faster in ratifying these agreements.

Altogether these arguments imply that on average democracies should be better integrated into the international system than autocratic countries meaning that they should join more international regimes than autocracies. In the section before it has been argued that countries, which have joined more environmental regimes, are expected to provide higher levels of environmental quality. Combining these two arguments leads to the expectation that democracies due to their better international integration should provide higher levels of environmental quality. This is the basis of my second hypothesis.

H2: Democratic low and middle-income countries are supposed due to their higher levels of political integration to provide better environmental quality than autocratic low and middle-income countries.

This proposition is further supported by the empirical literature dealing with the relationship between the political system and the provision of public goods (Barrett and Graddy 2000; Bernauer and Koubi 2006; Deacon 1999; Deacon 2003; Torras and Boyce 1998). This literature shows that in general democracies tend to be better providers of environmental quality⁵. The underlying theoretical argument, why democracies should provide more public

⁵ However there also exist empirical studies in which democratic political systems are related to worse environmental quality (Midlarsky 1998). These findings are backed by the argument that autocracies might supply more public goods as usually their leaders have a longer planning horizon. As most environmental problems develop slowly and often become apparent only in the distant future, democratic leaders who might be

goods to their population than autocracies, goes as follows (Deacon 1999; Deacon 2003; McGuire and Olson 1996; Olson 1993): In an autocracy there is mostly a small elite in power and this elite tries to extract as much resources for personal wealth out of the respective country as possible. Therefore, if the provision of a particular good requires that the costs are largely borne by the elite, and the benefits however are enjoyable by everyone, it is unlikely that this particular good will be provided. In the case of environmental quality it can be argued that as the costs of the provision are to a great extent borne by the industry, which has to regulate its pollution intensity, the ruling elite will face the main costs, as they are most likely the ones in charge of the main industrial activities. However, as the benefits of clean air or water are enjoyed by all citizens, environmental quality is likely to be underprovided in autocracies. In contrast, in democratic countries governments seeking (re)-election are more likely to provide public goods to their citizens in order to convince the median-voter to (re)-elect the party in power.

In summary, the theoretical part of this paper postulates that due to increasing international political integration, low and middle-income countries are able to provide better environmental quality than could be expected according to their national income level. Furthermore, it is argued that democratic low and middle-income countries are better integrated into the international system and are thus able to provide higher levels of environmental quality than their autocratic counterparts.

3. Research Design

In order to test the above made theoretical arguments, this paper pursues a quantitative statistical approach in the form of a time-series cross-section analysis. The sample consists of all low and middle-income countries, for which data was available. According to the World Bank a country is classified as a low- or middle-income country if it has a national income level below 3,465 US Dollars per capita. In general, the time span of the analysis is limited due to the availability of data on environmental quality to the period of 1950-1999. However, depending on the country the data availability varies considerably leading to an unbalanced

more myopic as they face frequently re-elections might not be interested in facing the short-term costs of providing long-term environmental quality (Congleton 1992; Midlarsky 1998). In addition, some studies claim that in mature democracies public goods are underprovided because special interest groups gained a disproportionate influence on the government. Therefore governments often provide private goods to these interest groups instead of providing public goods to the whole population (Midlarsky 1998; Olson 1982).

panel structure. Altogether, the sample encompasses 110 countries leading to 3036 observations in total.

Concerning the operationalization of the different theoretical concepts it firstly has to be decided how to measure the dependent variable of my analysis, namely environmental quality. In the literature different measures of environmental quality are employed (Bernauer and Koubi 2006; Ward 2006; De Soysa and Neumayer 2005; Neumayer 2003; Sigman 2002; Grossman and Krueger 1995). In line with Bernauer and Koubi (2006) and Grossman and Krueger (1995) I decided to use SO₂ as a measure of environmental quality as it has several advantages compared to other measures. Firstly, in contrast to water pollution SO₂ is not only of importance to the region surrounding the particular river or lake but rather to the whole population of a country, as high levels of SO₂ constitute great risk for the health of all citizens within this country. Furthermore, in contrast to for example CO₂ abatement technology is easily available. This means SO₂ emissions are reducible however only at a certain cost, which implies that in order to reduce emission levels the willingness to do so is a prerequisite. Finally, data availability is more comprehensive for SO₂ as compared to other air pollutants such as fine particulate matter or as compared to combined indices such as the concept of national footprint or genuine savings.

The first independent variable of the analysis – membership in international regimes – is operationalized by employing a yearly count of each country's membership in environmental regimes. The data on membership stems from the Center for International Earth Science Information Network (CIESIN) at Columbia University⁶. With this data it is possible to distinguish between the treaties a country has only signed and those treaties, which a country has ratified. Consequently, two variables were created, cumulated ratification, which measures how many treaties the particular country has ratified up to this year and cumulated signatures, which measures accordingly how many treaties this country has signed up to this year. This distinction between ratification and signature should be important as a country commits itself to a greater extent when ratifying a treaty than by only signing it. The second independent variable is the political system of a country, which is measured using the combined democracy and autocracy score of the POLITY IV dataset, which ranges from -10 (most autocratic) to +10 (most democratic). In order to capture the interconnection between a

⁶ <http://www.ciesin.columbia.edu/>

country's political system and its international integration, the political system variable is incorporated as an interaction term together with the variables measuring political integration.

As outlined in the theoretical section, according to the Environmental Kuznets Curve there exists a strong effect of a countries national income level on its environmental quality. In order to capture the inverted U-shaped relationship postulated by the EKC, GDP per capita as well as its square term are included in the regression model as control variables. Finally, a time trend is incorporated to capture time effects. Combining all different variables this leads to the following regression model:

$$SO_{2it} = \beta_0 + \beta_1 * \text{international political integration} + \beta_2 * \text{political system} + \beta_3 * \text{interaction term} + \beta_4 * \text{GDP per capita} + \beta_5 * \text{GDP}^2 + \beta_6 * \text{time trend} + e$$

where SO_2 is the log of the SO_2 emissions in country i at time t , $\beta_1 - \beta_6$ are coefficients, and e is the error term. All regression models are estimated using fixed effects. This is indicated as the Hausman test reveals a systematic difference between the estimations using fixed and those using random effects. In addition, the use of fixed effects is appropriate, as the data in the sample is not randomly drawn from a larger population.

4. Results

Does ratification or signing of environmental treaties actually influence environmental quality in low- and middle-income countries? Table 1 shows the results using a fixed effects regression model with cumulated number of ratifications as the main independent variable. The results show that the number of ratified treaties has a strong and statistically significant negative effect on the yearly SO_2 emissions of a country. Hence, as postulated in hypothesis one the more environmental treaties a country has ratified the higher its level of environmental quality measured by its SO_2 emissions. Both GDP and its square term show the signs expected according to the inverted U-shape of the Environmental Kuznets Curve however only GDP per capita is significant. This can probably be explained by the fact that for most countries in the sample the scale effect might still dominate the composition and technology effect meaning that an increase in income implies an increase in production, which then leads to an increase in pollution. Consequently, in this sample only a linear positive effect of national income on SO_2 pollution can be detected.

(Table 1 about here)

The same picture as in table 1 arises if cumulated signatures are incorporated into the regression model instead of cumulated ratifications. The results in table 2 do not differ except that the coefficient for cumulated signatures is even higher as the coefficient for the ratifications. This is somewhat surprising as it could be expected that a country takes those treaties more seriously which it has ratified than those treaties it has only signed as ratification constitutes a stronger commitment. Altogether, the results in table 2 also speak in favor of hypothesis one, which gives confidence in the result that those low- and middle-income countries, which are member to more international environmental regimes and thus are politically better integrated into the international system, also show higher levels of environmental quality.

(Table 2 about here)

In a second step, two further independent variables are integrated into the regression model, a country's polity score and its interaction with a country's international political integration, in order to evaluate hypothesis two. The results, which are displayed in table 3, show no deviations for the variables, which have already been incorporated in the regression models above. The interaction term is negative and statistically significant implying that countries, which have ratified more environmental treaties and having a higher polity score, have lower SO₂ emission indicating higher levels of environmental quality. However, in contrast to the predictions of hypothesis two the net effect of a democratic political system on SO₂ emissions is positive indicating lower levels of environmental quality. This clearly speaks against hypothesis two, which states that democratic low- and middle-income countries are expected due to their higher levels of international integration to provide better environmental quality than their autocratic counterparts.

(Table 3 about here)

In order to check whether the result with regard to the positive net effect of the political system on SO₂ emissions really implies that democratic low- and middle-incomes exhibit lower environmental quality or if it is rather due to the fact that the assumption does not hold that these countries are better integrated into the international system, I explicitly try to test

this assumption. Therefore, a fixed effects regression model is calculated using the yearly number of ratified treaties per country as the dependent variable. The results in table 4 however clearly support the assumption that democratic low- and middle-income countries are better integrated into the international system. The coefficient of the political system variable is positive and highly significant indicating that the more democratic a country is, the more environmental treaties it has ratified. From this follows that the results in table 3 are not driven by this assumption but rather it implies that although democratic low- and middle-income countries are better integrated into the international system the net effect of a democratic political system on a country's environmental quality is negative. A result that definitely requires further attention and research.

(Table 4 about here)

Additionally, the results in table 4 reveal another interesting insight. In contrast to the inverted U-shape of the Environmental Kuznets Curve national income exerts a U-shaped influence on environmental treaty ratification. This implies that countries with very low GDP per capita as well as middle-income countries tend to ratify more environmental treaties than countries with GDP levels in between these two extremes. This could probably be due to the fact that for those countries in between the two extremes the economy and thus the manufacturing sector is starting to grow which results in increasing GDP per capita. However, if the manufacturing sector is starting to develop it might be very costly to enforce environmental standards or regulations and hence these countries have no strong incentives to join international environmental agreements.

5. Conclusion

Do low and middle-income countries have to grow rich until they are able to provide environmental quality? This paper intended to evaluate whether low and middle-income countries, which are politically more integrated into the international system, are able to provide better environmental quality than could be expected according to their national income levels. Furthermore, it was assessed whether the political system of low and middle-income countries plays a decisive role concerning the provision of environmental quality. It was hypothesized that democratic countries are better integrated into the international system and due to this stronger integration they were assumed to provide higher levels of

environmental quality. In order to test these theoretical arguments a time-series cross-section regression approach was chosen.

Altogether the results can only partly support the theoretical propositions of this paper. In contrast to expectations, democratic low- and middle-income countries although they are better integrated into the international system do not provide higher levels of environmental quality but rather have significantly higher SO₂ emissions. However, the results yield strong support for the major hypothesis of this paper: low- and middle-income countries which are better integrated into the international system – measured by the number of environmental treaties a country has ratified – have significantly lower SO₂ emissions indicating that they are better providers of environmental quality. Consequently, it seems that strong international integration can at least partially compensate the negative influence of growing national income with regard to low- and middle-income countries. Hence, these countries can provide better environmental quality even before growing rich.

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Appendix

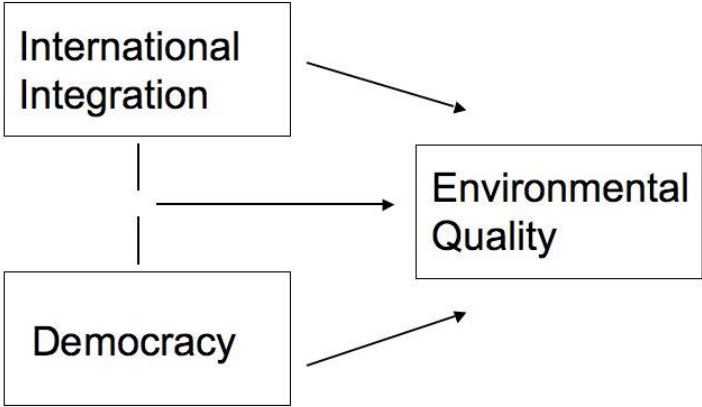


Figure 1

Table 1: Fixed effects regression model: SO₂ emissions (cumulated ratifications)

GDP per capita	0.001 (0.000)***
GDP ²	-0.000 (0.000)
Cumulated ratification	-0.024 (0.005)***
Time trend	0.049 (0.002)***
Constant	-94.539 (4.774)***
Observations	3178
Number of countries	110
R-squared	0.36
Standard errors in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%	

Table 2: Fixed effects regression model: SO₂ emissions (cumulated signatures)

GDP per capita	0.001 (0.000)***
GDP ²	-0.000 (0.000)
Cumulated signing	-0.029 (0.005)***
Time trend	0.058 (0.003)***
Constant	-113.463 (6.238)***
Observations	3178
Number of countries	110
R-squared	0.37
Standard errors in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%	

Table 3: Fixed effects regression model: SO₂ emissions (interaction with the political system)

GDP per capita	0.001 (0.000)***
GDP ²	-0.000 (0.000)
Polity score	0.020 (0.005)***
Cumulated ratification	-0.026 (0.006)***
Interaction	-0.001 (0.000)*
Time trend	0.047 (0.003)***
Constant	-91.53 (4.993)***
Observations	3039
Number of countries	105
R-squared	0.36
Standard errors in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%	

Table 4: Fixed effects regression model: treaty ratification

GDP per capita	-0.003 (0.000)***
GDP ²	0.000 (0.000)***
Political System	0.063 (0.012)***
Time trend	0.374 (0.005)***
Constant	-730.971 (9.009)***
Observations	3188
Number of countries	110
R-squared	0.76
Standard errors in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%	

List of countries in the sample

Afghanistan	Malawi
Albania	Mali
Angola	Mauritania
Armenia	Mexico
Azerbaijan	Moldova
Bangladesh	Mongolia
Benin	Morocco
Bhutan	Mozambique
Bolivia	Myanmar
Brazil	Nepal
Burkina Faso	New Guinea
Burundi	Nicaragua
Cambodia	Niger
Cameroon	Nigeria
Central African Republic	North Korea
Chad	Pakistan
Chile	Panama
China	Paraguay
Colombia	Peru
Congo, Dem. Rep.	Philippines
Congo, Rep.	Rwanda
Costa Rica	Senegal
Djibouti	Sierra Leone
Dominican Republic	Somalia
Ecuador	Sri Lanka
Egypt	Sudan
El Salvador	Swaziland
Eritrea	Syria
Ethiopia	Tajikistan
Gabon	Tanzania
Ghana	Thailand
Guatemala	Togo
Guinea	Tunisia
Guinea-Bissau	Uganda
Haiti	Uzbekistan
Honduras	Yemen
India	Yugoslavia (Serbia and Montenegro)
Indonesia	Zambia
Iran	Zimbabwe
Ivory Coast	
Jordan	
Kenya	
Kyrgyzstan	
Laos	
Lebanon	
Liberia	
Libya	
Madagascar	
Malaysia	