2007

Exploring the Causality between the Pollution Haven Hypothesis and the Environmental Kuznets Curve

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Research Honors 2007
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Abstract: In recent years, increased economic development, globalization, and liberalization of international trade have been linked by economists and environmental scholars as possible causes for specific trends in pollution. One of the most studied and controversial hypotheses is the Environmental Kuznets Curve Hypothesis (EKC), which states that a country's pollution concentrations rise with development and industrialization up to a certain point, after which they fall again as the country uses its increased affluence to reduce pollution concentrations again. If true, plotting pollution concentrations against income per capita will yield an inverted U—the EKC. Another controversy is the manner in which the more affluent countries reduce their pollution concentrations. Two possibilities are likely: One is that the more developed countries adopt cleaner technologies to produce their goods. The other less hopeful possibility is that developed countries simply specialize more and more in the production of products of cleaner industries, while the less affluent or developing countries take over production of products from dirtier industries. This suggests that the cleaner environment in developed countries comes at the expense of a dirtier environment in developing countries. This is the essence of the Pollution Haven Hypothesis (PHH). This paper looks for evidence of an EKC across 36 countries over time. It also looks for evidence as to whether these changes over time are consistent with the PHH. Sulfur Dioxide (SO2) is used as a measure of pollution concentrations for the EKC, while five dirty manufacturing industries are used to measure the level of dirty trade in developed and developing countries. Linear regression models and descriptive statistics are utilized. Overall, there is very little evidence to suggest that an EKC exists. There is no evidence to support the PHH.

I. Introduction

Does economic growth increase or decrease pollution levels in the environment? Recently, economists have been trying to solve this question by analyzing trends and patterns of pollution across countries and over time. One hypothesis is that a country's pollution concentrations rise with economic growth and industrialization up to a certain point, after which the country uses its increasing wealth and development to reduce pollution concentrations again. If true, plotting pollution concentrations against income per capita will yield an inverted U curve—or what has been called the Environmental Kuznets Curve (EKC).

A related issue is the manner in which the more developed or affluent countries reduce their pollution concentrations. That is, assuming that the EKC hypothesis is correct, there are two main theories about how developed countries clean up their environments. The first possibility is that they adopt cleaner technologies to produce their goods. This is certainly the most hopeful possibility, and the most beneficial in trying to clean up globally. It suggests that at some point in the future all countries may be on the downward sloping side of the EKC, and that increasing development implies a cleaner global environment.

However, a second possibility is that the developed countries begin to specialize in the products of clean industries, and import the products of dirty industries[1] from developing countries. In a sense, they are simply exporting their pollution to these developing countries. This is certainly the less hopeful possibility because it suggests that cleaner environments in more developed countries come at the expense of dirtier environments in developing countries,

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[1] I use the term dirty industries broadly to indicate any type of industrial production that adds a reasonable amount of pollution to the environment, whether it is air pollution, water pollution, etc.
In this study I use five "dirty" manufacturing industries and measure the trade in their output. However, in the general discussion throughout this paper, I use the term dirty industries broadly to encompass any pollutant-intensive industry.

which are therefore "pollution havens." This possibility is called the Pollution Haven Hypothesis (PHH).

This paper looks for evidence of an EKC across countries and over time. Furthermore, it attempts to find evidence as to whether changes in the EKC over time are consistent with the PHH. The results of this paper provide inconclusive evidence for both the EKC and PHH. Although there seems to be slight evidence for the possibility of an EKC, the findings fail to support the PHH (and, if anything, suggest the opposite). I present my study in the following format: First, I review the literature on the topics of both the EKC and the PHH, followed by an explanation of the theory behind each of them. Next I present an empirical model to test my hypothesis, followed by the results of the testing. Finally, I present a conclusion including avenues for future research.

II. Literature Review

There are several recent studies examining both the EKC and the PHH. One of the most important foundational studies for the EKC is "Economic growth and the Environment" by Gene M. Grossman and Alan B. Krueger (1995). In their study, Grossman and Krueger use a reduced-form relationship between per capita income and various environmental indicators, particularly sulfur dioxide, particulate matter, water quality indicators, and fecal contamination of rivers (1995). They find evidence that environmental quality deteriorates with economic growth up to a certain level of development, after which, environmental quality begins to improve with further economic growth and development. For several measures of environmental quality, sulfur dioxide in particular, they find significance evidence for an inverted U shaped relationship between income per capita and environmental degradation. This implies that although countries at lower income per capita levels experience decreases in environmental quality, due to

economic growth, countries at higher income per capita levels actually experience increases in environmental quality. Grossman and Krueger also investigate the "peak turning points" of the inverted U relationship between income per capita and pollution, and find that, for the air pollutants, the peak level of pollution occurs at an early point in a country's economic development. They refer to present day Mexico and Malaysia as two countries that are at the approximate peak turning point in pollution levels (1995).

Grossman and Krueger suggest several possible reasons for this result. The main reason according to them is that citizens in countries with high incomes insist that government policy pay more attention to aesthetic factors such as a cleaner environment (Grossman and Krueger, 1995). In this way, policy in high income countries enforces stricter environmental regulations which help to keep the environment clean. One result of environmental regulations is that more developed countries may be using cleaner technologies. The other possibility they suggest is that the regulations may lead high income countries to stop producing pollution-intensive goods and instead begin to import them from lower income countries that have less environmental regulation. My study, similarly to Grossman and Krueger (1995), investigates a possible inverted U relationship between pollution levels and income per capita. I attempt to explain why some countries experience an increase in pollution followed by a decrease. Their study provides me with a foundation with which to base my own paper.

Another study about the EKC is "Confronting the Environmental Kuznets Curve," by Dasgupta, Laplante, Wang, and Wheeler (2002). This study looks at findings of a possible EKC and examines how certain factors affect the shape and position of the curve. One of the most important insights their paper offers is that the EKC does seem to exist and can change its shape based on several variables. One of the variables, environmental regulation, may smooth out the

inverted U and reduce the amount of pollution across all countries at high and low income levels. (Dasgupta, et. al, 2002). Through regulation, the pollution "peak turning point" on the inverted U may fall over time after regulations have been implemented. Dasgupta et. al (2002) also point out that more efficient environmental regulation is possible in developing countries such as China, Brazil, and Mexico with newer and cleaner production technology (Dasgupta, et al, 2002).

A useful study on the PHH is "Unbundling the Pollution Haven Hypothesis" by M. Scott Taylor (2004). Taylor discusses the theory behind the PHH by linking a country's characteristics to predictions of trade flows of dirty production. He investigates theoretical and empirical models that try to explain the PHH. One model identifies two main factions in the trade of dirty industries: North and South, or developed and developing countries. According to Taylor, the pollution levels in each faction are a result of the composition of trade between the two. He argues that the North become cleaner at the expense of the South as the North "ships" its dirty industries to them.

The more lenient pollution regulations of the South allow them to import dirty industries (from the North) and increase their economic growth. The North benefits by getting rid of their local pollution, since a clean environment is a higher priority for them than for the South. His study validates a study of the PHH and the possibility that it might have an impact on countries' environments.

Two other recent studies on the PHH are "Pollution Havens and Foreign Direct Investment: Dirty Secret or Popular Myth" (2001), by Beata Smarzynska and Shang-Jin Wei, and "Globalization and Dirty Industries: Do Pollution Havens Matter?" (2003) by Jean-Marie Grether and Jaime de Melo. Smarzynska and Wei attempt to find evidence that multinational

firms, particularly heavily polluting ones, are in fact relocating to environments with less stringent regulations. They try to overcome previous obstacles in measuring environmental standards of countries, but still find very little evidence supporting the PHH. Grether and de Melo provide evidence on the impact of globalization on the environment, examining the trade flows of five heavily-polluting industries that might indicate pollution havens. Overall, they find some evidence for pollution havens, since four out of the five polluting industries they measure moved from developed to developing countries from 1980-1989. (Grether and de Melo, 2003).

Jeffrey A. Frankel and Andrew K. Rose discuss the effect of trade on the environment in their paper "Is Trade Good or Bad for the Environment? Sorting out the Causality" (2004). They attempt to determine the effect of trade on countries' environmental cleanliness. They find evidence for an EKC for three measures of air pollution including SO_2. They suggest that trade can promote economic growth and can indirectly play a role in environmental quality. They conclude that trade can reduce pollution at high income levels but increase it at lower levels (Frankel and Rose, 2004). They also find no evidence for the PHH. Finally, they find that the "race to the bottom," or specialization in dirtier industries driven by trade, is offset by the positive "gains from trade" (Frankel and Rose, 2004).

A study combining both the EKC and the PHH by Matthew Cole is titled "Trade, the Pollution Haven Hypothesis and the Environmental Kuznets Curve" (2003). Cole's analysis initially establishes a relationship between pollution and income per capita. The relationship he finds is an EKC, which he uses to locate fairly exact income level turning points for the curve. He estimates the EKC with ten different air and water pollutants as measures for pollution. Cole's study is unique because he combines the EKC theory with the PHH, by suggesting that trade in dirty industries may explain why developed countries pollution levels fall over time. He

uses measures of dirty imports and exports to represent the PHH. However, Cole finds little evidence for the widespread occurrence of the PHH. Cole (2003) concludes that pollution havens are only temporary. Cole (2003) concludes by arguing that the downward slope of the EKC at higher levels of income may be due to other factors unrelated to trade in dirty industries.

III. Theory

In the following section I lay out the theory for the EKC and PHH. The EKC relates two variables, pollution concentration and GDP/CAP.

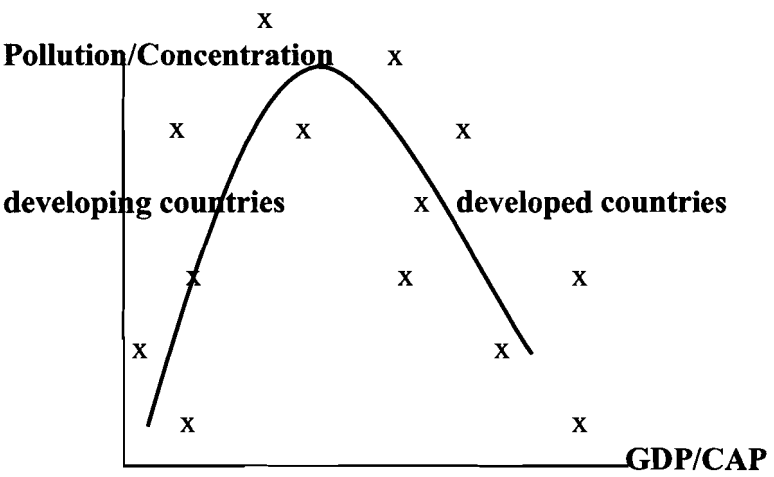


Figure 1: General Graphical depiction of the EKC

As seen in figure 1, the EKC is in the shape of an inverted U. This is because, after a certain level of development, countries' pollution concentrations begin to decrease as GDP/CAP continues to increase. The first possibility for this result is that more affluent countries adopt cleaner and more environment-friendly technology. It is possible that after a certain level of development, countries become more concerned about the environment. Therefore, as countries

become more developed, they use cleaner technology in the production process to reduce pollution levels in their environment.

The other possibility for the EKC is that developed countries specialize in cleaner industries. Instead, the dirty production may be taking place more in less developed countries. These developing countries are considered pollution havens because dirty production shifts there from developed countries. If this is the case, much of the shift in dirty production may have to do with increased globalization, increased regulation, and comparative advantage.

According to theory, globalization opens up the possibility of specialization in countries with comparative advantages in the world economy. For instance, if the United States government enforces stricter environmental regulations costing domestic industries more to produce their goods, those industries may locate to less developed countries with lower regulation standards. It may be cheaper to produce identical goods in countries because they have a comparative advantage in the industry. More developed countries may experience an increase in their imports from dirty industries, while developing countries should experience an increase in their exports from those industries. Exports in developed countries should fall while exports in developing countries should increase.

Globalization and liberalization of trade allows countries to trade more freely from one country to another. Because of this, some countries' industrial and manufacturing compositions are much more dynamic than they were a couple decades ago. Nowadays it is possible for a country to effect change in its environment by importing or exporting the goods of dirty industries.

IV. Data/Empirical Model

For my model, I test to see if there is a possible EKC in the world economy across several countries and years. Therefore, I include thirty-six countries over three different years: 1990, 1995, and 2000.[2] Eighteen of the countries have a Gross National Income per Capita (GNI) greater than 10,725 US dollars, while eighteen of them are below that amount. According to the World Development Indicators, that specific GNI per Capita constitutes the cutoff between a developed and developing country.

Table 1: List of Countries

Developed Countries	Developing Countries
Australia	Argentina
Austria	Brazil
Canada	Chile
Denmark	China
Finland	Colombia
France	Costa Rica
Germany	Czech Rep
Ireland	India
Italy	Mexico
Japan	Morocco
Korea, Rep	Pakistan
Netherlands	Paraguay
New Zealand	Peru
Portugal	Poland
Spain	Romania
Sweden	Saudi Arabia
Switzerland	Turkey
United States	Uruguay

The countries in Table 1 provide a reasonable balance of developed and developing countries to test for an EKC. If there is evidence for an EKC, theory predicts that the developed countries lie on the downward sloping side of the curve since they are reducing pollution concentration levels. Theory also predicts that developing countries lie on the upward slope of the EKC because they

[2] I was unable to find data for Germany and the Czech Republic for 1990 since they were different countries then.

produce more goods from dirty industries as they develop, increasing pollution concentration levels.

I measure pollution levels using Sulfur Dioxide (SO_2), which I obtain from the Earth Trends Data Source. SO_2 is a local and fairly dirty pollutant which should be appropriate for this study[3]. A pollutant such as Carbon Dioxide (CO_2) would not work well because it is a global pollutant and is difficult to obtain accurate measurements of pollution concentration levels within any individual country.

I use a linear regression for the EKC. I present my variables and expected signs for the EKC regression in Table 2.

Table 2: Variable Definitions and Expected Signs for EKC

Dependent variable:	
SO_2/1000sqkm	
Independent Variables:	**Predicted Signs**
GDP/CAP	+
GDP/CAP^2	-

The EKC model is based upon two main components in Table 3: a measure of pollution concentration, SO_2 and GDP/CAP. I measure SO_2 per 1000 square kilometers to take into account the land area of the specific countries. Although a larger country may be producing more pollution than a smaller one, the smaller country may have more pollution per square kilometer than the larger country. The theory of the EKC states that pollution levels rise with GDP/CAP at low levels (of GDP/CAP) and fall with GDP/CAP at high levels. Using the variables GDP/CAP and $(GDP/CAP)^2$ should produce the inverted U of the EKC if it exists.

[3] Although I do acknowledge that having only one pollutant limits the breadth of my results, I do so for clarity purposes.

To test for the PHH, I use foreign trade manufacturing data from the UN Comtrade Database. I choose the five specific dirty manufacturing industries cited by Jean-Marie Grether and Jaime de Melo (2003).[4]

Table 3: List of 5 Manufacturing Industries

Paper and Paperboard
Inorganic Chemicals
Non-Metallic Minerals
Iron and Steel
Non-Ferrous Metals

Table 3 shows the five manufacturing industries I use in my study. To determine if the PHH exists, I look at trends in exports, imports, and net exports for these five industries in 1990, 1995, and 2000 for developed and developing countries. If the PHH is the reason developed countries' pollution falls as they develop further, evidence should show decreased net exports from these industries in developed countries. Developed countries should export less and import more of the goods of these dirty industries, while developing countries should export more and import less.

This study uses a limited number of countries (thirty six) mostly due to data availability. Also, I only use one pollutant and five manufacturing industries, which limits the breadth of this study and the conclusions that can be drawn from it. Finally, I use pollution emissions to measure pollution levels per country. This is problematic in some ways since it does not take into account the possibility of air pollution moving between countries. Emissions only measure the quantity of pollution produced per country, which assumes that domestic pollution is the only form of pollution in a given country, which is certainly not true.

[4] Because of limits on specific data availability on the Comtrade Database, I use some industries that are closely related to the actual industry to which Grether and de Melo refer.

In order to account for the changes in pollution levels over time, the EKC regression includes three years (1990, 1995, 2000). I use dummy variables for 1995 and 2000. Using interaction terms, I account for changes in the effect of GDP/CAP in the different years.

Regression for EKC:

$SO_2/1000sqkm = a_1 + b_2(GDP/CAP) + b_3(GDP/CAP)^2 +$
$b_4 Year1995 + b_5(Year1995*GDP/CAP) + b_6(Year1995*GDP/CAP)^2 +$
$b_7 Year2000 + b_8(Year2000*GDP/CAP) + b_9(Year2000*GDP/CAP)^2.$

This can be broken down according to year as follows:

1990: $SO_2/1000SqKM = a_1 + b_2 (GDP/CAP) + b_3 (GDP/CAP)^2$
1995: $SO_2/1000SqKm = (a_1 + b_4) + (b_2+b_5)(GDP/CAP) + (b_3+b_6)(GDP/CAP)^2$
2000: $SO_2/1000SqKm = (a_1 + b_7) + (b_2+b_8)(GDP/CAP) + (b_3+b_9)(GDP/CAP)^2$

V. Results

Overall, my findings are very weak. That is, I find little evidence for the EKC. However, previous literature finds mixed results in support of an EKC, so my results, although disappointing, are not necessarily inaccurate. I present the results of my EKC regression in Table 4:

Table 4: EKC Regression Results: SO2/1000sqkm as dependent variable

Variable	coefficient	t
(constant)	1589.522	1.104
GDP/CAP	.165	.638
GDP/CAP^2	-2.88E-6	-.342
Year95	937.934	.459
(Year95*GDP/CAP)	-.099	-.276
$(Year95*GDP/CAP)^2$	2.09E-6	.181
Year2000	701.497	.341
(Year2000*GDP/CAP)	-.008	-.023
$(Year2000*GDP/CAP)^2$	-4.76E-7	-.385
R^2	.027	
Adjusted R^2	-.056	
Fstat	.321	
Significance level	.956	
Sample Size	94	

*No variables are significant at the .1 level

As Table 4 indicates, the signs of the coefficients are all correct, especially for GDP/CAP and (GDP/CAP),[2] even though none of the coefficients are significant at even the .1 level. The correct signs of the coefficients are more apparent in the EKC regressions:

1990: SO_2/1000SqKM=1589.522 + .165 (GDP/CAP) + -2.88E-6(GDP/CAP)^2
1995: SO_2/1000SqKm= 2527.456 +.066 (GDP/CAP) + -7.90E-7(GDP/CAP)^2
2000: SO_2/1000SqKm= 2291.019 + .157(GDP/CAP) + -3.36E-6(GDP/CAP)^2

The regressions show the signs of the coefficients more clearly. The coefficient values of the 1995 and 2000 dummy variables (from Table 4) are added to the original constant, GDP/CAP and (GDP/CAP)^2 coefficients to obtain year specific effects. In all three years, GDP/CAP and (GDP/CAP)^2 have the correct predicted signs. However, the results of the coefficients need to be taken with caution since they are not statistically significant. One explanation for the insignificant coefficients is that there is little evidence supporting the EKC. It is possible that developed countries are not cleaning up their environments. Or, some may be doing so while others are not. Most previous studies provide mixed results, so mine are not necessarily surprising. It may be that while some countries are following the predicted trend, others are not doing so and skew the overall findings for an EKC. I provide a graph of my results for the EKC in Figure 1 in Appendix A[5].

I run two more regressions separating developed and developing countries to estimate the shape of the EKC further. In particular, I examine the downward and upward slopes separately to determine if either or both of them exist. In the first regression, I use the very least developed countries in my study, with GDP/CAP less than 8,000 US dollars, to determine if those countries

[5] Although it does not provide strong evidence for an EKC, it appears that the graph shows a slight inverted U shape around 20000 GDP/CAP. There are outliers that are most likely skewing the results, but even so, the graph provides some evidence (although not necessarily reliable because no coefficients are very significant) for the EKC.

show the upward slope of the EKC.[6] In the second regression, I include only the most developed countries in my study, those that have a GDP/CAP greater than 20,000 US dollars, to determine if those countries show the downward slope of the EKC. This would follow the theory of the EKC. Both regressions are presented below:

Table 5: Testing for EKC slopes: SO2/1000SQkm as dependent variable

	Variable	Coefficient	t
Regression 1:	GDP/CAP	.402	1.262
Testing upward slope of EKC	R^2	.032	
with least developed countries	Sample Size	48	
Regression 2:	GDP/CAP	-.045	.821
Testing downward slope of EKC	R^2	.002	
with most developed countries	Sample Size	23	

*Neither coefficient significant at .1 level

In Table 5, both coefficients have the correct signs, but neither of the GDP/CAP coefficients is significant even at the .1 level. As was true for the estimate of the full EKC, the signs are suggestive of the proper shape, but the coefficients are not significant.

Although the coefficients for the EKC regressions are not significant, there does seem to be a slight indication of an inverted U. Therefore, it is reasonable to see if the PHH may be partially responsible for explaining the shape. I use descriptive statistics to measure trade patterns in the five dirty manufacturing industries. If trade in the products of dirty industries is occurring according to the PHH, then at low levels of GDP/CAP developing countries should be increasing their exports and decreasing their imports of those goods, while at higher levels, developed countries should be decreasing exports and increasing imports.

I examine descriptive statistics for exports/GDP, imports/GDP, and net exports/GDP. I separate developed and developing countries to examine differences in their trade patterns. I present the mean trade values for 1990, 1995, 2000, and an average for all three years, below:

[6] I use only the least developed countries in my study to try to find evidence for the upward slope of the EKC. I use only the most developed countries to try and find evidence for the downward slope.

Table 6: Mean Values for Five Industry Aggregate Trade Data

	Year	Exports/GDP	Imports/GDP	NetExports/GDP	N
Developed Countries	1990	.0289	.0249	.0040	16
	1995	.0361	.0290	.0070	17
	2000	.0286	.0217	.0049	17
Developing Countries	1990	.0159	.0130	.0028	17
	1995	.0234	.0223	.0011	18
	2000	.0211	.0217	-.0007	18

In Table 6, the values for developed countries give no evidence for a decrease in exports or increase in imports. The mean value of netexports/GDP for developed countries increases between 1990 and 2000. Although netexports/GDP should be decreasing over time, there is no evidence that indicates this. The mean values of exports/GDP and imports/GDP for developed countries move in the same direction (when they should be moving in opposite directions) which provides no evidence for the PHH for developed countries. Developing countries also provide mixed results. The mean value for netexports/GDP falls consistently between 1990 and 2000 when it should be increasing over time. It actually becomes negative, indicating that trends opposite the PHH are occurring. The mean values for exports/GDP and imports/GDP for developing countries also move in the same direction over time, once again providing no evidence for the PHH.

V. Conclusion

I want to acknowledge some shortcomings of my data. One ongoing debate is whether pollution concentration or pollution emissions give a more accurate representation of pollution levels within a country. Concentration is an ambient measure of pollution levels within a country; however, the measure may be based on emissions that have blown in from neighboring countries. Emissions are a measure of pollution levels from domestic production within a

country. They do not represent the actual level of pollution since emissions can drift to neighboring countries. I use pollution emissions based on data availability,

Furthermore, I only include thirty six countries in my study which might be enhanced with more observations. This is mainly due to data availability. Also, although the Republic of Korea is one of the thirty six countries I consider, I do not include it in any regression or in the descriptive statistics because it is an extreme outlier that skews my data and makes the results difficult to interpret. Finally, I only use one pollutant and five dirty trade industries, so my results are only based on a limited measure of pollution observations.

While there is not much evidence for the EKC or the PHH, this is not necessarily a negative outcome. If this paper did find more evidence for the PHH, it would suggest that the environment is not improving with economic growth; instead, some countries are becoming cleaner at the expense of others. Therefore, finding little evidence for the PHH is actually a more hopeful outcome for the environment.

This paper presents a relatively new way of thinking about both of them. The possibility of a cause and effect relationship between the EKC and PHH is gaining interest due to increasing environmental concerns over the last few decades. Economists are trying to formulate new ways to explain pollution trends in our environment. The EKC hypothesis, although plausible, is not supported in this study. Other techniques such as panel techniques may still show evidence for the EKC. Since this paper finds little evidence for the EKC, making further predictions is difficult even if it does exist.

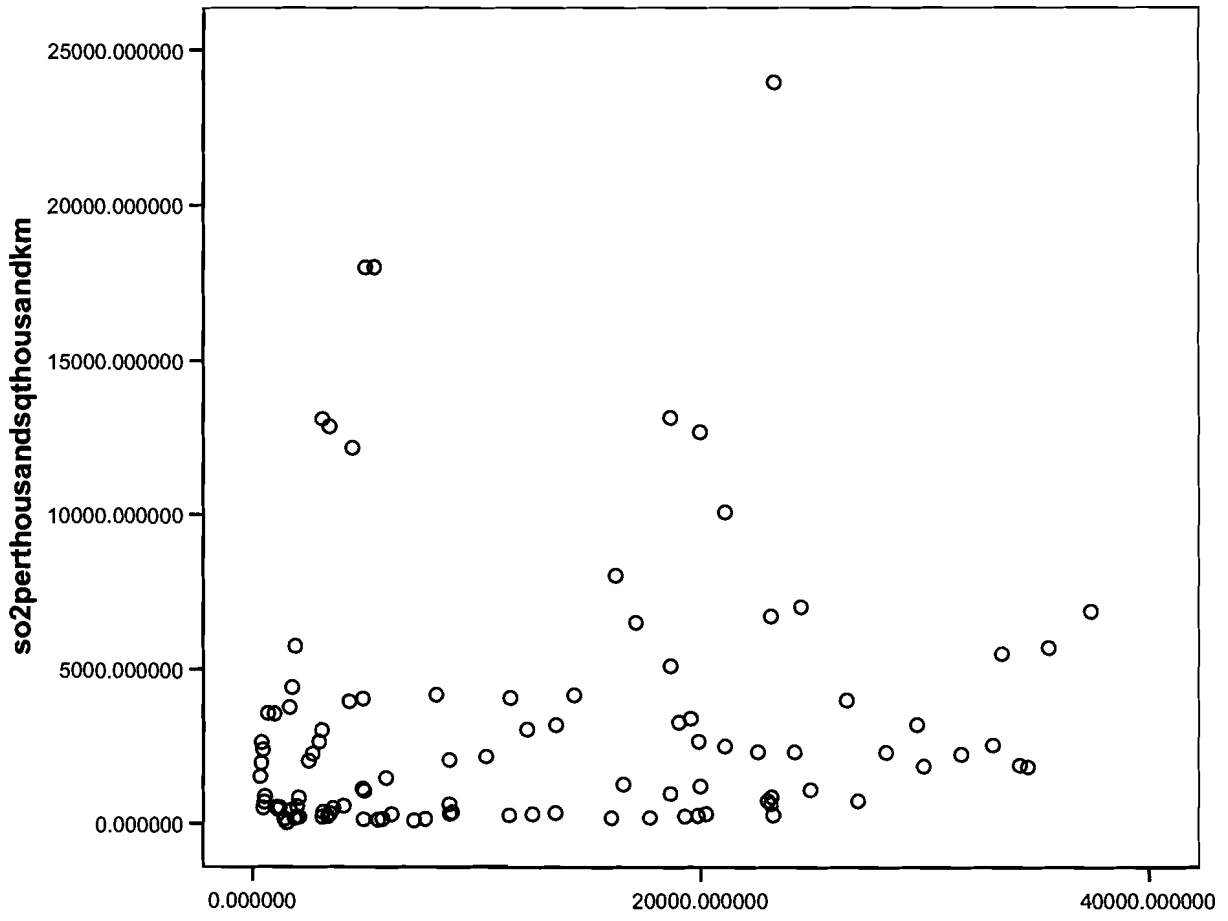
On the other hand, it seems as though economists are extremely fascinated by the idea of both the EKC and PHH, given the growing amount of literature on both of them. There has been very little evidence for the PHH, however, it continues to draw the attention of economists and

scholars of all different disciplines. Certainly, the theory deserves continued attention and development. One problem with trying to determine the PHH is that past studies provide no consistent way of measuring the trade flows of dirty production. Another problem is trying to determine what pollution-intensive industries to measure and whether those industries should be measured as an aggregate or separately. If these issues can be overcome, there may be a better chance of finding evidence for pollution havens. That is not to say that there is not any evidence at all. The Republic of Korea, for instance, is a country I left out of my regressions because it was an extreme outlier. Its SO_2 emissions per 1000 square kilometers is extremely high. Although it is considered a developed country (by measurements of the World Development Indicators), it is still extremely unusual for a country of its relatively small size to produce such large amounts of pollution.

So, do pollution havens exist? It is hard to know for sure, although research does not support the theory. However, more refined empirical models and better data availability in the future may indicate countries that experience an increase in dirty production. For both the EKC and PHH, there are several variables that may effect how much evidence there is for each, including countries' infrastructures, government regulation, and technological advances. Although this study found little evidence for the EKC and no evidence for the PHH, it is not a negative result. It follows previous literature, which also finds very little evidence for either theory. Furthermore, if the PHH does not exist, it implies that dirty industry production is not just "trading places" among countries, but could be decreasing overall. Finally, if the EKC does exist, we can only be hopeful that it is because countries are adopting cleaner technology and not by the occurrence of pollution havens.

Appendix A

Figure 1: Graph of the EKC model (excluding Korea Republic)



Works Cited

Akbostanci, Elif. "Pollution Haven Hypothesis and the Role of Dirty Industries in Turkey's Exports." Ed. G. Ipek Tunc and Serap Turut-Asik. Turkey: 2004. Economic Research Center.

Cole, Matthew A. "Trade, the Pollution Haven Hypothesis and the Environmental Kuznets Curve: Examining the Linkages." Ecological Economics 48 (2004): 71-81. Elsevier <www.elsevier.com/locate/ecolecon>.

Dasgupta, Susmita, Laplante, Benoit, Wang, Hua, and Wheeler, David. "Confronting the Environmental Kuznets Curve." Journal of Economic Perspectives 16.1 (2002): 147-168.

"EarthTrends Environmental Information: Climate and Atmosphere Searchable Database." World Resources Institute. 2007.

Frankel, Jeffrey A. and Andrew K. Rose. "Is Trade Good or Bad for the Environment? Sorting out the Casuality." Review of Economics and Statistics 87.1 (2005).

Grether, Jean-Marie, and Jaime de Melo. "Globalization and Dirty Industries: Do Pollution Havens Matter?" Centre for Economic Policy Research Discussion Paper No. 3932 (2003).

Grossman, Gene M., and Alan B. Krueger. "Economic Growth and the Environment." The Quarterly Journal of Economics. 110.2 (1995). Pg. 353-377.

Mathys, Nicole A. "A Simple Test for the Pollution Haven Hypothesis." Graduate University of Lausanne, 2003.

Nahman, Anton, and Geoff Antrobus. "The Environmental Kuznets Curve: A Literature Survey." South African Journal of Economics 73.1 (2005): 105-120.

Smarzynska, Beata K., and Shang-Jin Wei. "Pollution Havens and Foreign Direct Investment: Dirty Secret or Popular Myth?" World Bank Development Research Group. Policy Research Working Paper 2673 (2001).

Taylor, M. Scott. "Unbundling the Pollution Haven Hypothesis." Advances in Economic Analysis and Policy 4.2 (2004).

Taylor, M. Scott, and Arik Levinson. Unmasking the Pollution Haven Effect. Vol. #9905576. United States: 2006.

"United Nations Commodity Trade Statistics Database." United Nations Data. 2007

"World Development Indicators." World Bank. 2005.