UNIVERSITI PUTRA MALAYSIA

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FEP 2005 12

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SERDANG, SELANGOR

2005

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BY

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A Project Report Submitted to the

Faculty of Economics and Management

University Putra Malaysia

In

Partial Fulfillment for the Degree of Master of Economics

April 2005

ACKNOWLEDGEMENT

I wish to express my sincere gratitude and heartfelt appreciation to my supervisor Prof. Dr. Khalid Abul Rahim for his invaluable guidance, contractive comments, continuous encouragement, advice and suggestion throughout the development of this project and for reviewing this project paper with constructive criticisms.

I am very grateful and would like to express my appreciation to the lecturer and professors. The knowledge they taught is invaluable. I must say the knowledge and experience that I learn from them are very useful for me to accomplish this project paper.

A special thanks to the staff of Department of Environment (DOE) for their kind co-operation and assistance in obtaining the data. I would like to forward my gratitude to coursemates and friend for all their endless guidance and made this journey of knowledge colourful, interesting and worthy.

Last but not least, I also feel indebted to my beloved parents, grandmother, brother and my special sister (Zariyawati Binti Mohd Ashhari) for their continuous support and encouragement throughout my study in University Putra Malaysia.

ABSTRACT

This paper examines the link between health indicators and the environmental variables within a country widely dispersed on the economic development spectrum. While environment and income are seen to have an inverted-U shaped relationship (Environmental Kuznets Curve (EKC) hypothesis), it is also well established that environment and health are positively related. The main point of this study focuses on the implications of the relationship between health and income. In the early phases of income growth, the gains in health and the losses in environmental quality could cancel each other out and this challenges the idea that as incomes increase health would always improve. To empirically analyse these issues, the estimation of two-stage least squares model that focuses on the impact of income and the environment on health status, with environment being an endogenous variable is done. The results show that the environmental stress variable has a significant negative effect on health status. At the same time, gross national product (GNP) levels are shown to vary positively with health status. The Environmental Kuznet Curve is not found in this study, instead, it is found that the health gains obtained through improved incomes can be negated to a significant extent if the indirect effect of income acting via the environment is ignored. Research findings in this regard would be a useful policy instrument towards maximizing both the environmental and health gains that come with economic growth and development.

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1. INTRODUCTION

Is economic growth part of the solution rather than the cause of environmental problems? This question has been raised very often in recent years as empirical evidence in support of the Environmental Kuznets Curve (EKC) hypothesis mounts. The EKC (Grossman and Grossman) describes the relationship between declining environmental quality and income as an inverted-U, that is, in the course of economic growth and development, environmental quality initially worsens but ultimately improves with improvements in income levels. For instance, Torras and Boyce (1998) show that the level of air pollutants (sulphur dioxide and smoke) peak at a per capita income in the neighborhood of US $4000, after which they start falling.

One of the explanations for the EKC relationship is that the environment can be thought of as a luxury good. In the early stages of economic development, a country would be unwilling to trade consumption for investment in environmental regulation, hence environmental quality declines. Once the country reaches a threshold level of income, its citizens start to demand improvements in environmental quality and this leads to the implementation of policies for environmental protection and, eventually, to reductions in pollution. Increasing levels of pollution are thus strongly associated with both poor and developing economies, while declining levels of pollution are more commonly observed for their developed counterparts.

Another explanation of the EKC hypothesis is that countries pass through technological life cycles, as they move from agriculture-based economies to service-based systems. As the service sector is associated with lower environmental impact, this transition from high polluting to low polluting technology leads to less environmental stress. Hence, in the long run, pollution levels are expected to improve with incomes. This argument has been used to justify the pursuit of growth strategies that do not give due consideration to their effect on the environment.

In view of the above, the recorded health gains brought about by the improvement in income levels do not represent the total realisable health benefits from having higher per capita income. In addition, policies that pursue economic development cannot afford to ignore environmental issues, particularly in the early phases of economic growth. Cropper et al., 1997 is one of the first papers to analyse the link between the health indicators and the environmental variables within country widely dispersed on the economic development spectrum.

At the end of 1960s, environmentalists and the economists of Club of Rome (Meadows et al., 1972) have argued that limitation of environmental resources would prevent economic growth from continuing forever and suggested that a zero-growth or steady-state economy to prevent ecological change in the future. However, some other economists claimed that technological progress and substitution of human-made capital would reduce the exploitation and dependence on natural resources and allow an everlasting growth path (Beckerman, 1992).

The World Development Report (1992) has emphasized that some indicators of environmental degradation, such as carbon dioxide emission and municipal solid wastes increase with income, which imply that they worsen with economic growth. Other indicators fall as income increase, meaning that growth can improve environmental quality. In general, many indicators (e.g. sulfur dioxide and nitrous oxide emissions) give an inverted-U relationship with income, showing that environmental degradation gets worse in the early stage of growth, but eventually reaches a peak and begins to decline as income passes a threshold level.

There are two broad views regarding the relationships between economic growth and environmental degradation. Some studies emphasize that the higher the income level the greater would be the environmental degradation. (Daly, 1977 and Georgescu-Roegen, 1971), Hall et. al. (1986). However, Beckerman (1992,1993), Bartlette (1994) and Panayotou (1993) believe that after a point, income growth lowers environmental degradation. They point out that the relationship between environmental degradation and the income level is non-linear-positive up to a point and becoming negative after a threshold level of income has been achieved.

1.1 Problem Statement

During 1970s and 1980s, environmental quality of Malaysia worsened when population and per capita income grew rapidly (Vincent et.al. 1997). A larger population means more people are discharging pollutants into the air and water. Higher per capita income might be expected to result in greater pollution discharge per person, particularly when manufacturing accounts for much of the increase in income. The total human impact on the environment, which by definition is the product of population times per capita environmental impact, would seem necessarily to rise.

These studies therefore predict that rising per capita GDP in Malaysia in the late 1980s and early 1990s should have had varying impacts on environmental quality. Ambient quality in urban areas should have been improving, while per capita air pollution emissions at the national level should have been worsens.

The awareness on the environment and the enactment of environmental regulations are few of the reason for the recent interest in income effect on health. These regulations are designed to promote health, yet the resulting costs to the firm from complying may be passed on to the workers through layoffs, reduced working hours, or lower equilibrium wage rates (Mitchell, 1992). If low income is detrimental to one's health, then the beneficial health effects of environmental regulation may be offset.

The purpose of this paper is to test the hypothesis that larger economic and social gains can be attained by an economy if the growth strategy adopted incorporates rather than ignores, environmental concerns. This includes health as the intervening variable in the analysis. While environment and income are seen to have an inverted-U shaped relationship, it is also well established that health and environment are positively related. What does this imply for the relationship between health and income? Is it possible that in the early phases of income growth, the gains in health and the losses in environmental quality cancel each other out? And this challenges the idea that as incomes increases, health would always improve.

1.2 **Objective Of Study**

1.2.1 General Objective

The general objective of this study is to examine the interrelationship between income, health and environment within a country. It is because while the government wants to develop the country, these three indicators have to be taken into account to evaluate their impact on each other's in order to sustain growth in generally.

1.2.2 Specific Objective

i. To identify the relationship between health and environment.

ii. To determine the differential impact of several environmental stress variables on health.

iii. To determine the shape of the EKC curve and the health relationship.

1.3 Hypothesis (Expected Result)

The expected relationship between income and health is positive. Infant mortality and child mortality rate, are expected negative relationship with income growth. Inversely then life expectancy and income have expected to have positive relationship. In addition, the Environmental Kuznet Curve is expected not to be found in this study because of the limitation of emission data during the study period. At the same time, environmental stress variable will have expected negative effects on health.

2. LITERATURE REVIEW

2.1 Base On Study Approach

Different studies show varied behavior patterns of approach, even among the same group of pollution. De Bruyn and Heintz (1999) attribute the differences to the use of emission or concentration indicators; different estimation methods employed different sets of countries included in the panel; different method employed to transfer the national per capita income data to comparable monetary units; and the use of different variables besides income. Generally, the EKC hypothesis is weakened when one introduces more additional variables besides income. According to some authors, this suggests that in some cases the EKC simply could arise due to the omission the estimate. In panel data estimates some omitted variables are correlated with GDP and these variable are not common to all countries. Thus, omitted variables may result in biased estimate of the EKC in non-random samples of countries (Stern and Common, 2001)

2.1.1 Environmental Degradation

Furthermore, Stern et. al. (1996) observed that EKCs could result (at least partly) from a displacement of the most polluting industries from the rich countries toward the poorest ones, without the composition of consumption (and its pollution content)

varying substantially. On the other hand, techniques with most environmental degradation is not only explained by current flows of emissions or concentrations of pollutions, but also depends on prior environmental pressures that affect the capacity of assimilation and the resilience of ecosystems. This is particularly relevant when irreversible changes take place. The interdependence between economy and environment needs to be considered; if economic growth causes irreversible, or almost irreversible, environmental degradation, this may affect future growth.

Although the issue of pollution had received much attention, there is still lack of researchers realizing the importance of environmental degradation toward economic growth. The early attempts by Anastasios (1997), use empirical method to study the economic development and environmental pollution in terms of traps and growth. Increasing returns as a result of knowledge spillovers in the output production and pollution abatement sectors of an economy are simultaneously introduced into optimal growth model. It is shown that the stock of abatement knowledge exhibits threshold characteristic. Countries trapped in low growth regions because of lack of knowledge of pollution abatement.

2.1.2 Parameter

From an empirical point of view, although there is certain evidence that some environmental pressures have diminished in developed countries, none of the pollutions examined in the literature fulfills the EKC hypothesis unequivocally by Ekins (1997). In general, the outcomes are more favorable to this hypothesis for

pollutions with local and regional impacts and low cost of abatement. This is the case of atmospheric sulfur. But in this case recent evidence suggest that the EKC hypothesis is not clear because the result are sample dependent and very different depending on specific model considered (Stern and Common, 2001).

In principle, the disregard of this juxtaposition is a special case of parameter heterogeneity, which is a frequent problem in the cross-section growth context. It is questionable if the homogeneity assumption, that all estimated coefficients are country invariant, is appropriate for a broad spectrum of countries, saying from poor developing countries to rich and highly industrialized nations. Harberger (1987), for example, asks: "What do Thailand, the Dominican Republic, Zimbabwe, Greece and Bolivia have in common that merits their being put in the same regression analysis?" Possibilities to avoid the parameter heterogeneity problem include the use of specification, which allows varying coefficients, or as in this paper, the data limitation to just one single country.

Ettner (1996) indicates that increases in income significantly improve mental and physical health but increase the prevalence of alcohol consumption. Cost-benefit analyses of government policies that may reduce disposable income should take into account potential effects on morbidity. Despite extensive documentation of a strong positive correlation between health and income, the interpretation of this relationship has been subjected to controversy. Public health workers have often assumed this finding to be evidence that low-income persons suffer reduced access to one or more health inputs. This assumption automatically shifts the focus of policy and research to

the question of mediating factors. However, because the early studies were unable to establish that the association of income and health is causal, the basic premise of the ensuing policy debates is called into question. If so, then the correlation between income and health cannot be used to draw inferences about the structural income effect on health and this correlation should not be used as the basis for public health policy. To avoid this criticism, this paper derives consistent estimates of the structural effect of income on health using instrumental variable techniques, which eliminate all biases due to correlation of income with the error term in the health equation.

With regards to health, there exists a large literature that has analysed the relationship between income and health using cross-country data (for example, Gerdtham et al., 1992; Chakrabarti and Rao, 1999). A number of previous studies have found an economically and statistically significant relationship and negative income elasticity of infant mortality rate (see for example, Flegg, 1982; Parpel and {Pillai, Pritcheet and Summers, 1996). Similarly, research on life expectancy and income has shown that there is a positive relationship between increases in income and life expectancy, with income elasticity of life expectancy estimated to be significant and positive (Preston, 1980; Hill and King, 1992). Most of these studies include controls for other factors that affect health status such as the accessibility of health services and education levels of the population.

Bhargava et al, (2001) investigates the effects of health indicators such as adult survival rates (ASR) on GDP growth rates at 5-year intervals in several countries. Panel data were analyzed on GDP series based on purchasing power adjustments and

on exchange rates. The results showed positive effects of ASR on GDP growth rates in low-income countries. Webber (2001), has sought to establish the statistical impact of under nutrition on economic growth for a cross-section of 46 countries. The analysis was carried out using several variants of an augmented neoclassical growth model that included explanatory variables measuring the inputs of physical, educational and health capital. Education was measured at three levels: primary, secondary and tertiary. The results obtained were successful in the sense that all regression coefficients had the anticipated signs. It was possible to explain approximately 60% of the inter-country variation in economic growth between 1960 and 1990. Health was measured in terms of the intake of calories per head. This proxy had a positive sign although it had insignificant effect on economic growth. These results do not necessarily imply that the average health of a nation's workers has no impact on the growth of national output. It could be that investing in nutrition has a relatively insignificant effect on health. The results nevertheless emphasize that investing in reducing the extent of under nutrition will not significantly enhance economic growth.

2.1.3 Method of Estimation

It is important to stress that when there is negative correlation between the importance of an environmental problem and per capita income, this does not tell us much about the causes underlying this correlation. The estimates are usually based on a simple model that calculates the hypothetical total effect of per capita income on the level of emissions. It is assumed that this model reflects other structural models in which per

capita income affects factors (such as technology, the composition of economic products of environmental policies) whose changes, in turn, influence environmental pressure or quality as suggested by de Bruyn et. al. (1998). The virtue of the simple model is that the whole influence (direct and indirect) of per capita income on environmental pressure is captured in the estimate. The defect is that one cannot identify the cause of this relationship.

Most empirical studies on the EKC hypothesis use cross-country or panel data for their empirical estimations. However, this is criticized fiercely. It is argued that only single country studies could shed light on the question whether EKCs for different pollution really exist (Robert, 1997). An EKC found by cross-country or panel data estimations could simply reflect the juxtaposition of a positive relationship between pollution and income in developing countries with a negative one in developed countries and not a single relationship that applies to both categories of countries (Vincent, 1997). He claimed that the cross-country version of the EKC is just a statistical artifact and should be abandoned. In fact, as Stern et. al. (1994) have argued, "more could be learnt from examining the experiences of individual countries at varying levels of development as they develop over time".

2.1.4 Findings

The majority of this stress the importance of environmental policies in making possible the 'de-linking' between economic growth and environmental deterioration.

There is no evidence that this 'de-linking' arise in an endogenous way from the growth process, but rather a resolute environmental policy making future growth compatible with sustainable development is required, Ekins (1997), specially taking into account that studies support the EKC generally find inversion points that are a very long way from current income in the developing countries. This indicates that much higher levels of environmental degradation will be reached unless ambitious environmental policies are followed, Selden and Song (1994) and Stern et. al. (1996)

Research based on the estimation of empirical relationship between environment and development variables also seems to suggest the de-linking of environment pollution with economic growth. Grossman and Kruegman (1993) suggested an inverted U-relationship exists between the emissions of certain types of environmental pollutions and per capita GDP.

Kumar and Aggarwal (2001) analyze the change in land use pattern for 19 major states of India. By specifying a suitable model, cropped area, removal of forest cover (deforestation) and pasture area have separately been regressed on per capita income (PCI), yield and population density. Result from the analysis indicates the presence of EKC for crop area at round the certain income level and pasture area at lower income level.

Kaufmann et. al. (1998) found a U-shaped relationship between income and atmospheric concentration of SO and an inverted U-shaped relationship between spatial intensity of economic activity and SO concentration. Socio-political conditions are also found by Panayotou (1997) to have significant effects on environmental quality. Thus, while a faster economic growth may involve a higher environmental cost, a better institutional set up characterized by good governance, credible property rights, literacy, regulation etc. can strong public awareness against environmental degradation and help to protect the environment.

Phenomena like structural economic change and transition, technological improvement and rise in public spending on environmental R&D with rising per capita income level are considered to be important in determining the nature of the relationship between economic growth and environmental quality. Grossman and Krueger (1995), using cross-country city level data on environmental quality, found support for EKC hypothesis with peaks at relatively early stage of development. However, no such peak was observed for the heavier particles.

As the demand for environmental quality is income elastic, a strong private and social demand for a high quality environment in the developed countries would induce considerable private and public expenditures on environmental protection. Thus, whereas the rising portion of the EKC may be a manifestation of the substitution relationship between the demands for material consumption and environmental

quality; while the declining portion of the EKC may result as the substitution relationship turns to one of complementarily between the two of demand, (Dinda et. al. 2000).

However, Vincent (1997) and de Bruyn et al. (1998) failed to predict the income and environment relationship in a single country. On the other hand, Carson et al. (1997) found the opposite result in a single-country in the United State. Both Vincent (1997) and Carson at al. (1997) used cross-regional; studies, therefore they are also subject to the critiques of the cross-country approach. In fact, cross-country studies implicitly assume that all countries would follow the same pattern in order to infer the environment-income relationship of a single country over time. This assumption does not seem to be supported by empirical evidence. Similarly, in order to infer environmental degradation of the whole country over time, cross-regional studies implicitly assumed that all regions in a given nation would follow the same pattern. For some countries, however, regional differences can be very significant. Thus, the environment-income relationship may not only differ across nations, but also across regions of the same country.

Panayotou (1993) and Selden and Song (1994), presented initial evidence that some pollutants follow an inverted-U shaped curve with respect to income. This was widely interpreted (for example, World Bank, 1992) to mean that the surest way to improve a country's physical environment was to increase income levels. More recent works here focused on factors other than income as explanatory variables in analysing variations in environmental stress in different countries. Kaufmann et al. (1998),

Torras and Boyce (1998), Suri and Chapman (1998) and Agras and Chapman (1999) argue that the EKCs previously estimated could be due to important missing variables. Kaufmann et al. (1998) stressed the importance of spatial intensity of economic activity, Torras and Boyce (1998) explored the effects of social factors like civil rights, income inequality and education, while Suri and Chapman (1998) and Agras and Chapman (1999) found that trade-related variables and the price of energy had significant explanatory power. Most of the papers mentioned use linear or a log linear functional relationship between emissions and income. An exception was Galeotti and Lanza (1999), which studied the relationships based on the gamma distribution. The current state of the research on the EKC is unable to conclude if the EKC hypothesis is confirmed or rejected.

2.2 The Political Economy of Environmental Kuznets Curve (EKC)

The Environmental Kuznets Curve is a 'reduced-form' relationship in which the level of pollution is modeled as a function of per capita income without specifying the links between the two. Grossman and Krueger (1995) characterized these missing links as 'environmental regulation, technology and industrial composition'. In addition to eliminating the need for data on intervening variables, an advantage of the reduced-form approach is that it provides a direct estimate of the net effect of per capita income on pollution. Two features of Grossman and Krueger's underlying structural modal deserve mention. First, while the industrial composition effect, which