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Green Environment: Assessment of Income and Water Pollution in Malaysia

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Abstract

The objective of the study is to assess the relationship between income and water pollution in Malaysia by using the environmental Kuznets curve. Water pollution indicators were assessed on a number of measures: Biochemical Oxygen Demand (BOD), Cadmium (CD) and Arsenic (AS). The income level per capita that is real GDP (Gross Domestic Product) per capita was measured from the year 1996 to 2006 quarterly. The model has been used to include and refinement of some of the variables and addition of some new variables. It formulates a four-equation simultaneous model for empirical research.

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1. Introduction

Malaysia’s urban environment has been regarded as one of the least polluted areas in Asia. But the goal of achieving industrial country status by the year 2020 and the related rapid economic development have began to increase industrial pollution and the degradation of urban surroundings. Reduction of air
and water pollution and contamination by industrial wastes has turn to be more severe in Malaysia in recent years (Rafia et al, 2003). The rapid growth prior to the economic crisis in 1997 and during the period of economic recovery in a country had increased environmental pollution. Uncontrolled growth with regard for ecological rules remains to be the problem of the day (Sam, 2001). Thus, during the Seventh Plan period, to ensure the development was balanced and sustainable, the environmental and natural resource issues continued to be addressed. The relevant institutional, legislative and regulatory mechanisms were strengthened and efforts to integrate environmental considerations into development planning were intensified. During the Eighth Plan period, emphases were placed on addressing environmental and resource management issues in an integrated and holistic manner. In order to ensure that development is sustainable and resilient steps were taken to identify prudent, cost-effective, and appropriate management approaches that yield multiple benefits. Efforts were continued to address air pollution, mitigate degradation of rivers, and improve marine and groundwater quality. Efforts were also made to promote environmental performance measurements and market-based instruments as engaging communities in addressing environmental and natural resource issues (Eight Malaysia Plan, 2001). Kuznets study (as cited in Yandle et al, 2002) produced the presidential address, entitled “Economic Growth and Income Inequality” at the sixty-seventh annual meeting of the American Economic Association. The theory proposed that as per capita income increases, income inequality also increases at the beginning but then, after some reversing point, starts decreasing. The theory suggested that the income disparity first increases and then reduces as countries experienced economic growth. This is due to countries had to shift from agricultural to industrial sectors in order to have growth. A new application of the Kuznets Curve as a tool of analysis has been devised in 1991 by Grossman and Krueger. It has been employed to depict the relationship between environmental quality and income changes. Evidence shows that as countries develop, some measures of the quality of life might at the beginning deteriorate but then improves. Munasinghe (1999) expressed that as development and industrialization progress the EKC statistical relationship proposes that environmental damage increases. The use of less efficient and comparatively dirty technologies greater is the emission of pollutants. Nevertheless, with higher and higher income improved air quality, cleaner water, and a mostly cleaner habitat become more valuable to people.

According to the report of the United Nations Development Programme (1997), Malaysia’s rapid economic growth has caused environmental degradation. Urbanization, industrial growth, and transportation all lent to air pollution. In 1995, vehicles led to 75 per cent of air pollution, while power stations and the burning of domestic and industrial fuels accounted for about 20 per cent and burning of household and industrial wastes accounted for 5 per cent of air pollution. Transboundary atmospheric pollution has added to critical haze troubles. Water quality, also, has deteriorated. In a keynote address Zaharatun (2004) stated that rapid development has produced gaps in the precision of pollution. Extremely dense population in urban centres has converted rivers into open sewers. Cities are substantially responsible for being polluters of aquatic environment with sewage and municipal wastewater, industrial effluent and polluted urban. Likewise, the farming residents pollute the aquatic environment residuals of fertilisers and pesticides, and animal wastes with that flow to the water body within used variation water. River water quality is degraded by sediments from land clearance and solid wastes. Water pollution affects water supply services, harms human health and demolishes aquatic lives and habitat. Under this circumstance, it is necessary to study this relationship that exists between economic growth and environmental pollution and whether the relationship follows the Environmental Kuznets Curve. The general objective of the study is to examine the relationship between economic growth and different indicators of water pollution in Malaysia and to make improvements in the EKC model through an extension and introduction of simultaneity of variables.
The most important significance of this study is that this is the first empirical study on Malaysia that examines the relationship between economic growth and different indicators of air and water pollutants from the 1990s to 2006. Vincent’s (1997) study covered the year 1987 to the year 1991. But unfortunately the data are not available and as such these could be included in this study. Otherwise this study could be made to cover the period for 1987 to 2006. However this study has used the quarterly data to have a closer look to understand the true relationship between environmental pollution and economic growth.

2. Literature Review

Heilbroner and Thurow (1987) stated that economic growth is a function of population and per-capita consumption. It is an increase in the production and consumption of goods and services. Even if economic development is successfully performed, it is combined with various problems. In the process of economic development can it be separated from environmental degradation or not? The hypothesis of the environmental Kuznets curve (EKC) is a good starting point for this question. According to Toru Iwami (2001), the EKC assumes that up to a turning point the growth of the income per capita goes along with a decline in environmental quality. Then, this relationship is reversed in the sense that the income growth coincides with the reduced environmental damage. With a result of an optimistic view of the future, if this hypothesis is valid the development policy undertaken will be endorsed. If it is valid, then in the countries concerned it is necessary to reconsider various factors which effect the environmental situation.

A paper by Grossman and Krueger (1992) engendered the academic debate on the EKC on the effect of the North Atlantic Free Trade Agreement on environmental quality. There is an inverted U-shape relationship between environmental degradation and economic growth based on this hypothesis. As income levels increase, pollution worsens but usually improves once income crosses some threshold level. Using panel data from the Global Environmental Monitoring System, the reduced-form relationship between national GDP and various indicators of local environmental conditions has been examined by Grossman and Krueger (1994). The indicator variables relate to urban air pollution and contamination in river basins. They find that in very poor countries while increases in GDP may be associated with worsening environmental conditions, air quality appears to benefit from economic growth once income reached some critical level. Magnani (2000), investigated the public environmental expenditure in selected OECD countries between 1980 and 1991 supporting the hypothesis formulated in the paper in which relative income and income inequality effect environmental public policy decisions. For this OECD sample, income inequality shows the expected negative correlation with environmental concern as predicted by the theoretical discussion. Moreover, as being suggested, when the necessary income elasticity term is satisfied, the result of empirical analysis coherent with such suggestions accepted the hypothesis that public interest for the environment grows with per capita income. Countries where growth in per capita income is accompanied by increase in income inequality such as the United States in the 1980s are the ones that may witness a negative effect of economic growth on public environmental expenditure. Managi (2006) stated that economic growth and the decrease of environmental degradation are compatible in accordance to the Environmental Kuznets Curve (EKC) hypothesis. It has been suggested that an inverted U-shaped relationship between economic performance and environmental pollution, empirically, an economy is associated with smaller levels of pollution after some threshold income point. One possible reason for the empirical evidence of an EKC is increasing returns to pollution abatement. This happen due to the abatement efficiency increases with an increase in the scale of abatement. As this efficiency gain makes abatement less valuable, pollution might reduce as more abatement is attempted. Over a period of more than 150 years, Markandya et al (2006) studied the association between per capita GDP and emissions for twelve Western European countries. The investigation also searched at the effect of pollution regulations on the pattern of the income and pollution
relationship. The study found an inverted U-shaped relationship between income and pollution. The estimated turning points of most countries are reasonable and valid at both the aggregate and country levels. Moreover, environmental regulations are found to lower the EKC and the turning point of the curve also will shift to the left and to the right.

Bartz and Kelly (2008) suggested some of the following test of the theory: Firstly they took information not related to the pollution–income curve by developing a theoretical model to a developed economy. Secondly, starting from a less developed economy and comparing the pollution–income relationship with that in the data, they developed the model. The results are mixed. Some support the theory that there is an inverted U-shape result for less developed countries which do not abate pollution. Nevertheless, the model forecasts pollution peaks at a level of per capita income much lower than that found in the United States data due to abatement is comparatively inexpensive. The study found evidence of a structural break in preferences in the early 1970s for some pollutants. Thus, the model performs better for two of three pollutants when the structural break is added.

3. Theoretical Framework and Model Specifications

The main source of data concerning environmental degradation to economic growth in Malaysia is the Department of Statistics Malaysia and Department of Environment Malaysia. The data covered the period from 1997 to 2006 due to non-availability of data from the Department of Environment (DOE). DOE was established in 1983 and all the data regarding ambient air and water pollution are published only from year 1996. Therefore this study can only have the data from the year 1996 to 2006. The data on GDP covered the period from 1996 to 2006 are in nominal terms (thousands of Malaysian Ringgit). All monetary terms with regard to GDP per capita and local government expenditure are deflated by the Consumer Price Index with the base year of 1987. Water pollutants and socio-economic variables used in the models are Biochemical Oxygen Demand (BOD), Cadmium (CD) and Arsenic (AS).

The relationships between water quality and per capita income were tested in this study by employing ambient concentrations data for water quality in Malaysia. A study by Stern (1998) stated that where simultaneity exists, use of ordinary least squares to approximate single equation relationships might give a biased and erroneous estimate. In order to approximate the more reliable environment-income relationship it is, therefore more appropriate to employ simultaneous-equation model. deBruyn (2000), however, noted that because of the difficulty in model specification and getting the needed data, the simultaneous relationship between economic growth and environmental quality has not been employed by any empirical studies so far. Therefore, in order to estimate the relationship between pollution and GDP per capita in Malaysia this study also applies the simultaneity model of income and the environment in line with its structural relationship. It is testing for exogeneity with the Hausman test and estimates the simultaneity model using the two-stages least squares method. For capturing this simultaneous relationship four equations have been formulated in this study. These are i) pollution equation, ii) income equation, iii) government pollution abatement expenses equation, and iv) population density equation. By using simultaneous approach and additional variables in these equations the present study therefore has developed an improved model to study the relationship more closely to conclude if it follows the Environmental Kuznets Curve (EKC) in Malaysia.

The model is:

\[ \text{CD, AS, BOD} = f(\text{GDP without secondary industry share (¥), abate, ind, PD, MV, T}) \]

It leads to the following working model:

\[ CD = f(¥, \text{abate, ind., PD, MV, T}) \]

\[ AS = f(¥, \text{abate, ind., PD, MV, T}) \]
Equations of the model are:

Equation 1: Environmental Pollutants = f (Income, Government pollution abatement expenses, Secondary industry share, Population density, Number of motor vehicles, Time)

Equation 2: Income (GDP)/Y = f (Pollutants, Local labor, Foreign labor, University graduates, Government spending, Foreign Direct Investment, Fixed capital, Time)

Equation 3: Abatement (abate) = f (Fixed capital, Secondary industry share, Pollutants, Time)

Equation 4: Population density (PD) = f (Pollutants, Time)

Equations (1), (2), (3) and (4) designate the simultaneous equations for the model.

\[
\log \text{CD}_{ijQ} = \alpha_0 + \alpha_1 \log \text{Y}_{ijQ} + \alpha_2 (\log \text{Y}_{ijQ})^2 + \alpha_3 \log \text{abate}_{ijQ} + \alpha_4 \log \text{ind}_{ijQ} + \alpha_5 \log \text{PD}_{ijQ} + \alpha_6 \log \text{MV}_{ijQ} + \alpha_7 T + \alpha_8 T^2 + \alpha_9 T^3 + \varepsilon_{ijQ}
\]

\[
\log \text{AS}_{ijQ} = \alpha_0 + \alpha_1 \log \text{Y}_{ijQ} + \alpha_2 (\log \text{Y}_{ijQ})^2 + \alpha_3 \log \text{abate}_{ijQ} + \alpha_4 \log \text{ind}_{ijQ} + \alpha_5 \log \text{PD}_{ijQ} + \alpha_6 \log \text{MV}_{ijQ} + \alpha_7 T + \alpha_8 T^2 + \alpha_9 T^3 + \varepsilon_{ijQ}
\]

\[
\log \text{BOD}_{ijQ} = \alpha_0 + \alpha_1 \log \text{Y}_{ijQ} + \alpha_2 (\log \text{Y}_{ijQ})^2 + \alpha_3 \log \text{abate}_{ijQ} + \alpha_4 \log \text{ind}_{ijQ} + \alpha_5 \log \text{PD}_{ijQ} + \alpha_6 \log \text{MV}_{ijQ} + \alpha_7 T + \alpha_8 T^2 + \alpha_9 T^3 + \varepsilon_{ijQ}
\]

\[
\log \text{Y}_{ijQ} = \beta_0 + \beta_1 \log \text{CD}_{ijQ} + \beta_2 \log \text{AS}_{ijQ} + \beta_3 \log \text{AS}_{ijQ} + \beta_4 \log \text{PD}_{ijQ} + \beta_5 \log \text{MV}_{ijQ} + \beta_6 T + \beta_7 T^2 + \beta_8 T^3 + \beta_9 T^4 + \varepsilon_{ijQ}
\]

\[
\log \text{Y}_{ijQ} = \beta_0 + \beta_1 \log \text{AS}_{ijQ} + \beta_2 \log \text{AS}_{ijQ} + \beta_3 \log \text{AS}_{ijQ} + \beta_4 \log \text{PD}_{ijQ} + \beta_5 \log \text{MV}_{ijQ} + \beta_6 T + \beta_7 T^2 + \beta_8 T^3 + \beta_9 T^4 + \varepsilon_{ijQ}
\]

\[
\log \text{Y}_{ijQ} = \beta_0 + \beta_1 \log \text{BOD}_{ijQ} + \beta_2 \log \text{BOD}_{ijQ} + \beta_3 \log \text{BOD}_{ijQ} + \beta_4 \log \text{PD}_{ijQ} + \beta_5 \log \text{MV}_{ijQ} + \beta_6 T + \beta_7 T^2 + \beta_8 T^3 + \beta_9 T^4 + \varepsilon_{ijQ}
\]

\[
\log \text{abate}_{ijQ} = \lambda_0 + \lambda_1 \log \text{K}_{ijQ} + \lambda_2 \log \text{ind}_{ijQ} + \lambda_3 \log \text{CD}_{ijQ} + \lambda_4 T + \lambda_5 T^2 + \lambda_6 T^3 + \lambda_7 T^4 + \varepsilon_{ijQ}
\]

\[
\log \text{abate}_{ijQ} = \lambda_0 + \lambda_1 \log \text{K}_{ijQ} + \lambda_2 \log \text{ind}_{ijQ} + \lambda_3 \log \text{AS}_{ijQ} + \lambda_4 T + \lambda_5 T^2 + \lambda_6 T^3 + \lambda_7 T^4 + \varepsilon_{ijQ}
\]

\[
\log \text{abate}_{ijQ} = \lambda_0 + \lambda_1 \log \text{K}_{ijQ} + \lambda_2 \log \text{ind}_{ijQ} + \lambda_3 \log \text{BOD}_{ijQ} + \lambda_4 T + \lambda_5 T^2 + \lambda_6 T^3 + \lambda_7 T^4 + \varepsilon_{ijQ}
\]

Analysis and Interpretation of Results

In selecting the equations of the model, in this analysis we have used both quadratic and cubic equations for the model. Whenever the cubic term is found statistically insignificant it has been dropped.
from the equation finally selected. For the Environmental Kuznets Curve (EKC) to exist coefficient of $Y$ has to be positive and coefficient of $Y^2$ has to be negative in the quadratic equation. Similarly for cubic equation $Y$ has to be positive, $Y^2$ has to be negative as well as $Y^3$ has to be negative as a sufficient condition for EKC to exist.

4.1. Single Equation Method

4.1.1. Equation 1: Pollution Equation

\[
\begin{align*}
\log CD_{nQi} &= -2.3819 + 56.8715 \log Y_{nQi} - 34.6931 (\log Y_{nQi})^2 + 0.6352 \log abate_{nQi} - \\
&- 4.6362 \log ind_{nQi} - 5.8386 \log PD_{nQi} - 1.6261 \log MV_{nQi} - 0.3917 T_2 - 1.0139 T_3 - \\
&- 1.2386 T_4 + \epsilon_{nQi} \\
\log AS_{nQi} &= 235.8941 + 19.2564 \log Y_{nQi} + 4.0732 (\log Y_{nQi})^2 + 0.0899 \log abate_{nQi} - \\
&- 6.7912 \log ind_{nQi} + 38.9377 \log PD_{nQi} - 24.5781 \log MV_{nQi} - 0.5795 T_2 - 1.5189 T_3 - \\
&- 2.1299 T_4 + \epsilon_{nQi} \\
\log BOD_{nQi} &= -27.2179 + 1.3866 \log Y_{nQi} - 0.5949 (\log Y_{nQi})^2 - 0.264 \log abate_{nQi} - \\
&- 0.2929 \log ind_{nQi} + 2.8061 \log PD_{nQi} - 1.5432 \log MV_{nQi} - 0.0311 T_2 - 0.0751 T_3 - \\
&- 0.1079 T_4 + \epsilon_{nQi}
\end{align*}
\]

4.2. Simultaneous Equation Method:

In this model simultaneity of pollution and population density has been considered. So Equation 1, Equation 2, Equation 3 and Equation 4 designate the simultaneous equation to the model. Based on Hausman test, all pollutants were found having simultaneous relationship with income. Therefore all pollutants were included in the model.

4.2.1. Equation 1: Pollution Equation

\[
\begin{align*}
\log CD_{nQi} &= 448.3516 + 115.3773 \log Y_{nQi} - 110.8392 (\log Y_{nQi})^2 + 1.6025 \log abate_{nQi} - \\
&- 1.6773 \log ind_{nQi} - 89.9.59 \log PD_{nQi} + 45.0976 \log MV_{nQi} + 0.3999 T_2 + 0.8763 T_3 + \\
&+ 1.5932 T_4 + \epsilon_{nQi} \\
\log AS_{nQi} &= 108.3967 + 58.8377 \log Y_{nQi} - 39.9935 (\log Y_{nQi})^2 + 0.4445 \log abate_{nQi} - \\
&- 6.8833 \log ind_{nQi} + 14.0882 \log PD_{nQi} - 10.7440 \log MV_{nQi} - 0.3789 T_2 - 1.0299 T_3 - \\
&- 1.3651 T_4 + \epsilon_{nQi} \\
\log BOD_{nQi} &= -37.8905 + 1.9976 \log Y_{nQi} - 0.0974 (\log Y_{nQi})^2 - 0.0682 \log abate_{nQi} - \\
&- 0.6255 \log ind_{nQi} + 7.4004 \log PD_{nQi} - 4.0924 \log MV_{nQi} - 0.0801 T_2 - 0.1909 T_3 - \\
&- 0.2757 T_4 + \epsilon_{nQi}
\end{align*}
\]

4.2.2. Equation 2: Income Equation

\[
\begin{align*}
\log Y_{nQi} &= 4.6668 + 0.0360 \log CD_{nQi} - 0.0809 \log LL_{nQi} + 0.4727 \log FL_{nQi} + \\
&+ 0.0335 \log U_{nQi} + 0.0583 \log G_{nQi} + 0.0364 \log FDI_{nQi} + 0.0527 \log K_{nQi} + 0.0090 T_2 + 0.0535 T_3 + 0.05781 T_4 + \epsilon_{nQi} \\
\log Y_{nQi} &= -0.2576 + 0.0978 \log AS_{nQi} - 1.0587 \log LL_{nQi} + 0.1382 \log FL_{nQi} + \\
&+ 0.1441 \log U_{nQi} + 0.1881 \log G_{nQi} + 0.1999 \log FDI_{nQi} + 0.1352 \log K_{nQi} - 0.0387 T_2 - \\
&- 0.0324 T_3 + 0.0390 T_4 + \epsilon_{nQi} \\
\log Y_{nQi} &= 5.8712 - 1.2260 \log BOD_{nQi} - 0.2495 \log LL_{nQi} + 0.1590 \log FL_{nQi} + \\
&+ 0.0548 \log U_{nQi} + 0.3039 \log G_{nQi} + 0.0086 \log FDI_{nQi} + 0.1263 \log K_{nQi} - 0.0623 T_2
\end{align*}
\]
4.2.3. Equation 3: Abatement Equation

\[
\log \text{abate}_{n,Q_j} = 1.6821 - 1.7848 \log K_{n,Q_j} + 1.1158 \log \text{ind}_{n,Q_j} + 0.7562 \log \text{CD}_{n,Q_j} + 0.1126 T_2 + 0.0289 T_3 - 0.1247 T_4 + \nu_{n,Q_j}
\]

\[
\log \text{abate}_{n,Q_j} = 4.2064 - 1.3337 \log K_{n,Q_j} + 2.7080 \log \text{ind}_{n,Q_j} + 1.0049 \log \text{AS}_{n,Q_j} - 0.0071 T_2 - 0.1013 T_3 - 0.2255 T_4 + \nu_{n,Q_j}
\]

\[
\log \text{abate}_{n,Q_j} = -66.4468 - 0.2510 \log K_{n,Q_j} + 3.7532 \log \text{ind}_{n,Q_j} + 17.9747 \log \text{BOD}_{n,Q_j} - 0.1615 T_2 - 0.2358 T_3 - 0.2777 T_4 + \nu_{n,Q_j}
\]

4.2.4. Equation 4: Population Density Equation

\[
\log \text{PD}_{n,Q_j} = 4.3619 + 0.0170 \log \text{CD}_{n,Q_j} + 0.0054 T_2 + 0.0109 T_3 + 0.0164 T_4 + \nu_{n,Q_j}
\]

\[
\log \text{PD}_{n,Q_j} = 4.3106 + 0.0071 \log \text{AS}_{n,Q_j} + 0.0054 T_2 + 0.0109 T_3 + 0.0164 T_4 + \nu_{n,Q_j}
\]

\[
\log \text{PD}_{n,Q_j} = 4.4259 - 0.0428 \log \text{BOD}_{n,Q_j} + 0.0054 T_2 + 0.0109 T_3 + 0.0164 T_4 + \nu_{n,Q_j}
\]

This estimation was done under two methods that are single equation method and simultaneous equation method. Before directly regressing environmental Kuznets curve in future studies, it is necessary to consider the simultaneity between income and pollution. This study finds that the differences between the single polynomial equation model and the simultaneous equations model do exist. Most of the estimated coefficients are significant and coherent with the expected signs. Physical capital (coefficient of 0.0527 for CD, 0.1352 for AS and 0.1263 for BOD) and foreign labor (coefficient of 0.4727 for CD, 0.1382 for AS and 0.1590 for BOD) majority share positively to the Gross Domestic Product. On the other hand, local labor (coefficient of -0.0809 for CD, -1.0587 for AS and -0.2495 for BOD) majority share negatively to the Gross Domestic Product in the equation. This exhibits that foreign labor is one of the contributor towards economic growth in Malaysia compared to local labor.

However the share of foreign human capital in production is not significant (foreign labor: t-statistic of 1.2519 for CD, 0.7378 for AS and 0.1590 for BOD) in the model although labor is an essential factor in production compared to physical capital (t-statistic of 5.5978 for AS and 4.5170 for BOD). This presents that the economic development in Malaysia depends mainly on capital-intensive industries. This can be seen as there is a positive significant relationship between physical capitals per capita with economic growth. The one indicator of pollutant emissions, BOD (coefficient of -1.2260) are negatively associated to the GDP and one measure, BOD (t-statistic of 3.0148) indicate significance on income. This is coherent with the theory that as pollution level increases income reduces. Thus, this study can conclude that there is a little significant effect of water pollutants on income in Malaysia as BOD are the indicators that indicate significant effect. It could be due to BOD as the primary shares of air pollutants that decrease income in Malaysia which primarily comes from industrial activities.

The coefficients of government expenditure are positive (coefficient of 0.0583 for CD, 0.1881 for AS and 0.3039 for BOD) and all are highly significant (t-statistic of 2.7842 for AS and 6.3773 for BOD). This exhibits that government spending has contributed as one of the primary determinants of economic
growth in Malaysia. Foreign direct investment has a positive (coefficient of 0.0364 for CD, 0.0199 for AS and 0.0866 for BOD) significant effect (t-statistic of 1.8717 for CD and 1.9362 for AS) on income. It shows that foreign direct investment is one of the determinants that increase the economic growth in Malaysia. Most of the coefficients (coefficient of 0.3335 for CD, 0.1441 for AS and 0.0548 for BOD) of university graduates show positive relationship with income. This indicates that university graduates contribute to economic growth in Malaysia. The secondary industry share and the physical capital are the two important determinants of the pollution abatement expense. Most of the coefficients of the secondary industry share (coefficient of 1.1158 for CD, 2.7080 for AS and 3.7532 for BOD) have a positive relationship and significant effect (t-statistic of 1.9179 for AS and 2.8545 for BOD) with pollution abatement expense.

5. Conclusions

By using the existing theoretical framework, this study uses the theory that economic growth and pollution are jointly determined. Concerning this issue, this study firstly constructs a simultaneous equations model. Secondly, in order to measure the presence of simultaneous relationship between income and pollution exists; a Hausman test is employed. In some of the pollutants indicators, the outcomes show that the simultaneity between income and pollutant emission do exists. Therefore, to estimate the simultaneous equations model, the two stage least square method is applied. Several different outcomes between a single polynomial equation model and a simultaneous equations model have been found. This issue indicates that in future EKC works, the requirement of examining the simultaneity between income and pollution should be considered. In some of the pollution indicators emissions in Malaysia the EKC relationship is found. Besides, consistent with the expectation, most of the estimated coefficients in income equations, abatement equations and population density equations are significant. Although this study has found that economic growth has a light impact on air and water pollutions and pollutions also not the main contributor that reduces income in Malaysia but still Malaysia needs to tighten and be stringent with certain policies. This study recommends for a future studies to include variables such as air pollution, solid waste treatment, hazardous waste and noise in the city. Moreover, factors such as Gini index of income distribution can be taken into account to measure the equality of income distribution in Malaysia. It is necessity also to look for reliable data beyond 1996 for more reliability of the results. Hence, in any of these ways a further extension could be established.

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