Growing Green?: A Comparison Across Southeast Asia

This paper examines the effects of ASEAN's rapid growth on pollution emissions. Its methodology, however, differs from traditional approaches. The traditional accounting method for pollution evaluates emissions from production for domestic consumption and exports. Numerous studies suggest, however, that ASEAN economic expansion is driven primarily by domestic consumption and efficiency gains from capital technological imports. Given this, the paper examines from relationship between economic growth and pollution from consumption: i.e. emissions from production for domestic consumption and imports. The results show significant differences in the relationship between growth and emissions depending on the accounting method used. Additionally, the paper shows that under a consumption-based accounting approach, while all ASEAN countries except Indonesia have increased carbon efficiency, emissions in all countries have risen.

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Growing Green?: A Comparison Across Southeast Asia

By: Christopher Napoli

Southeast Asian nations have grown remarkably over the past two decades. Even with the setback of the 1997 Asian Financial Crisis and the 2008 Global Financial Crisis, average growth in the Association of Southeast Asian Nations (ASEAN) region between 1990 and 2010 has been 5.1%.[1] As a result of the sustained growth, GDP/capita in the region has increased from 1,813 USD to 5,098 USD between 1990 and 2010.[2] ASEAN's impressive growth rates have made the region a model for many of the world's developing nations.

While much work has been done to explore the causes of ASEAN growth, to date, very little research has examined the effects of ASEAN economic expansion on pollution emissions in the region. The conventional wisdom suggests that rapid growth in poor countries will initially cause pollution emissions to increase, but that once a certain level of development is reached, emissions will reduce as countries become rich enough to afford the costs associated with environmental protection. This perceived relationship between growth and pollution emissions is termed Environmental Kuznets Curve, and can be visualized as an inverted-U.

This paper will examine the effects of ASEAN's rapid growth on pollution emissions. Given data availability, the analysis will only include ASEAN5 countries, consisting of Indonesia, Malaysia, Philippines, Singapore, and Thailand. Its methodology, however, will differ from the conventional approach. Traditionally, when examining the relationship between a country's emissions and growth, the variables used in the analysis are emissions produced in a country and GDP, or total output. Employing these variables, however, misses an important point: much of the pollution created in emerging countries is the result of production for exports. As a result, the ASEAN population is not consuming many of the products contributing to its pollution emissions.

This point is significant given that an overwhelming number of studies have suggested that ASEAN's growth is not primarily export driven, but driven by domestic consumption and imports. Employing a Granger causality test, Ahmad and Harnhirun have argued that "there is no statistical evidence of a long-term relationship from exports to economic growth in the ASEAN region", and that growth is due to a variety of other factors "such as production for the domestic market, inflows of foreign capital and technology, rapid growth of the service sector, and the growth of labour productivity".[3] Similarly, in a country study on Malaysia, Kallafalla and Webb show causality working in the other direction: between 1981 and 1996 growth fuelled by domestic consumption in Malaysia caused exports to increase.[4] Last, Ismael and Harjito, using data from 1966 to 2000 and also using a Granger causality test shows that there is feedback

[1] ASEAN6, IMF World Economic Outlook Database, GDP percentage growth constant prices

[2] ADB "ASEAN 2030. Toward a Borderless Economic Community" (2012) Found at: http://www.adbi.org/files/2012.03.30.proj.material.asean.2030.highlights.pdf p.25

[3] Ahmad, J. and Harnhirun, S. "Co-integration and Causality between Exports and Economic Growth: Evidence from the ASEAN Countries" The Canadian Journal of Economics / Revue canadienne d'Economique, Vol. 29, Special Issue: Part 2 (Apr., 1996)

[4] Kallafalla, K. and Webb, A. "Export–led growth and structural change: evidence from Malaysia" Applied Economics, 33:13, 1703-1715 (2001)

or bidirectional causality between exports and economic growth only in Indonesia and the Philippines.[5] For the other ASEAN countries, exports are not the primary driver of growth.

Given the importance of domestic consumption and technological imports on economic growth in ASEAN countries, this paper will examine the relationship between GDP growth and pollution emissions from production for domestic consumption. An equation helps to clarify the difference between 'traditional approach' used by the United Nations Framework Convention on Climate Change and other international bodies, and the 'consumption approach' in this paper.

Traditional approach of calculating total pollution emissions in a country:

$T = Dd + De$

where;
T = total emissions of a country
Dd = emissions in a country from production for domestic consumption
De = emissions in a country from production for export

By contrast, pollution emissions from domestic consumption are calculated as follows:

$C = Dd + Fd$

where;
C = total emissions as a result of domestic consumption
Dd = emissions in a country from production for domestic consumption
Fd = emissions from the production of imports

This paper's findings show that the carbon efficiency of ASEAN states depends heavily on the accounting method used. Under the traditional approach, Singapore is the only ASEAN country that has become more carbon efficient since 1990. By contrast, when using a consumption-based approach, the results suggest that all countries with the exception of Indonesia are becoming more carbon efficient. Note that for the purposes of this paper, 'carbon efficiency' is defined as the amount of pollution emitted per unit of GDP produced – when a country emits less pollution per unit of GDP produced it is becoming more carbon efficient. Additionally, the paper shows that under the consumption-based accounting approach, Singapore's carbon efficiency is greatly reduced, such that the country's emissions continue to rise with increased GDP/capita.

The conclusions of this paper warrant attention for three reasons. First, they suggest that when assessing the effect of pollution emissions on development, it is important to consider the accounting method used, as this can significantly change the results. In cases where growth is caused by imports, and not exports, the pollution from imports should perhaps be seen as the principal externality from growth, and thus should be incorporated into the emissions calculation. Second, by disaggregating pollution emissions based on emissions from domestic production, imports and exports, one can better understand in which areas countries are making

[5] Ismael and Harjito "Exports and Economic Growth: The Causality Test for ASEAN Countries", Jurnal Ekonomi Pembangunan Vol. 8 No. 2 (2003)

improvements in carbon efficiency. Last, by showing the role that pollution from exports and imports plays in the development of ASEAN countries, this paper adds to the debate over the potential effects of carbon border tax adjustments. Given the large role that exports play in ASEAN emissions, but the small role they appear to play in contributing to growth, one may conclude that unilateral border tax adjustments by rich nations might have a significant effect on emissions reductions, without substantially compromising growth in the region.[6]

The paper is divided into three sections. Section 1 offers a theoretical framework for examining the relationship between economic growth and pollution emissions. Specifically, it describes the logic behind the Environmental Kuznets Curve theory. Sections 2 and 3 compare growth and emissions indicators using the traditional and consumption accounting approaches for pollution. The results show that under a traditional approach, only the wealthiest country in the sample, Singapore, and the least wealthy, the Philippines, are becoming more carbon efficient. Under the consumption approach, however, all countries with the exception of Indonesia are becoming more carbon efficient. Alongside changes in carbon efficiency, the section will show that the Environmental Kuznets Curve can evolve differently depending on the accounting method used. This find is useful given the controversy surrounding the Environmental Kuznets Curve theory, and its suggestion that states should focus on growth as this will eventually lead to reductions in pollution emissions. The paper's conclusions suggest that while domestic emissions may decrease with wealth, they may simply be replaced by emissions from imports.

Theorizing the Relationship between Growth and Pollution Emissions

For years, pollution was seen as an unfortunate, necessary bi-product of economic expansion. As an economy grows, so must its output and thus pollution. As a result, the only way to curtail pollution emissions was to also slow growth. This is idea changed in the 1990's with the popularization of the Environmental Kuznets Curve, often described as an inverted-U.[7] In 1955, the original Kuznets curve was developed to explain how income inequality increases during the first phase of a country's economic growth, but then decreases after a certain level of GDP/capita is reached.[8] According to the logic, growth will eventually cause an increase in wages for the poor. Increases in wages will allow households to be able to afford the necessities of life, bringing them above the poverty line, thus creating a more equal society. Using the same logic, the goal of a society should be to promote economic growth because as per capita income rises in a country, people become more sensitive to prevention of pollution, and eventually become rich enough to pay the costs associated with pollution abatement. Thus, even though growth in countries may initially cause environmental degradation, this relationship will reverse once societies reach a certain level of development.

[6] For more on the prospects for unilateral action on border taxes see Napoli, C. "A Decentralized Approach to Emissions Reductions" Carbon & Climate Law Review (forthcoming 2013)
[7] Grossman, G.M. and Krueger, A.B. "Economic Growth and the Environment", The Quarterly Journal or Economics, Vol. 110, No. 2 (May 1995)
[8] Van Zanden, J. L. "Tracing the Beginning of Kuznets' Curve: Western Europe During the Early Modern Period", The Economic History Review, New Series, Vol. 48 No. 4. (Nov. 1995)

One of the earliest and most authoritative arguments for the validity of the Environmental Kuznets Curve Theory came from Gene Grossman and Alan Kruger. Grossman and Kruger's study was based on three factors: the scale effect, composition effect, and technique effect. The scale effect measures the impact of trade through the expansion of economic activity while holding both the output and input coefficients constant. The composition effect isolates changes in environmental quality caused by shifts in the output structure, while holding the input coefficients and the size of the economy constant. In effect, the composition effect looks at the industry structure of the economy at a certain level of income. Last, the technique effect measures the impact of only changing input coefficients (i.e. improving technology for production).

For the purposes of the trade-environment debate, it is the last two factors that are most significant. If lax environmental standards alone determine comparative advantage the composition effect would result in trade increasing pollution, as pollution intensive industries shift to countries with lax environmental legislation. If however, increases in wealth shift the industry structure such that it is more services oriented, and thus cleaner, emissions will decrease. Additionally, the technique effect can further reduce emissions as highly industrialized countries will be able to afford more expensive, environmentally friendly production processes.[9]

Grossman and Kruger's findings argued that "economic growth brings an initial phase of deterioration followed by a subsequent phase of improvement."[10] Thus, in the long run, the composition effect results in a shift towards cleaner industries, and the technique effect outweighs the scale effect. The economists suspected that the eventual improvement "reflects, in part, an increased demand for (and supply of) environmental protection at higher levels of national income."[11]

Building on these findings, in 2001 Antweiler et al. examined the relationship between GDP/capita and increases in environmental protection. The findings suggest "that a 1% increase in the scale of economic activity raises pollution concentrations by 0.25% to 0.5% for an average country, but the accompanying increase in income drives concentrations down by 1.25-1.5%."[12] The results of both studies suggest that the most effective global environmental policy is increasing the wealth of countries.

Antweiler et al. even concluded that pollution havens do not result from international trade is because "trade flows are determined by factor endowment considerations and not by differences in pollution abatement costs."[13] According to the study, because high income countries have a comparative advantage in producing capital intensive products (the most environmentally

[9] For more see: Olaf Unteroberdoerster. "From Estimation to Simulation: Assessing the Links between Trade and the Environment", Working Paper Series Vol. 98-15, The International Centre for the Study of East Asian Development, Kitakyushu (1998). p. 2 and Grossman, G.M. and Krueger, A.B. "Economic Growth and the Environment", The Quarterly Journal or Economics, Vol. 110, No. 2 (May 1995)

[10] Grossman, G.M. and Krueger, A.B. "Economic Growth and the Environment", The Quarterly Journal of Economics, Vol. 110, No. 2 (May 1995), p. 369

[11] ibid.

[12] Antweiler, W. et al. "Is Free Trade Good for the Environment?", The American Economic Review, Vol 91, No. 4 (Sep. 2001), p 878.

[13] ibid., p 877.

unfriendly), international trade does not relocate pollution to poor countries, but actually relocates it to rich countries that have the money and desire to invest in environmentally friendly methods of production.[14] Similar evidence of the Environmental Kuznets Curve theory has been found in the work of Shafik (1994), Lopez (1994), Panayotou (1995).

Despite many proponents, the Environmental Kuznets Curve has been criticized by many. In 1995, Arrow et al. argued that in order for the Environmental Kuznets Curve to be true, one must assume economic growth is sustainable, and that environmental damage cannot reduce economic activity sufficiently to stop the growth process.[15] Similar criticisms have been offered by Dasgupta et al. (2002), and Stern (2004).

Despite the drawbacks of the Environmental Kuznets Curve, it is a useful model for two reasons. First, it offers a framework for contextualizing the relationship between pollution emissions and economic growth: it is clear that with no growth there will be little pollution; by contrast, pollution abatement is considered a luxury good, and countries must be rich enough to afford its high costs. Given this, one can hypothesis that there might be a point after which increased growth actually leads to reductions in pollution emissions. The second reason the Environmental Kuznets model is useful is that it has had important policy implications. Specifically, it has justified the omission of large emerging economies – especially large global polluters like China and India – from Kyoto-style emission reduction commitments. It has also justified the pro-growth agenda's in rich countries as the best way to combat environmental degradation.

An important, but often overlooked, component of the Environmental Kuznets Curve theory is how pollution emissions are attributed to countries. The proceeding section will show that the relationship between a country's growth and its emissions depends heavily on how one accounts for the emissions embodied in trade.

Growth and Emissions using the Traditional Accounting Approach

As stated in the Introduction, all ASEAN5 countries grew substantially between 1990 and 2010. The economies of Singapore and Malaysia roughly tripled in size (3.0 and 2.93 respectively); the economies of Thailand and Indonesia more than doubled (2.28 and 2.26 respectively); and the economy of the Philippines almost doubled (1.93).[16]

Regarding pollution emissions trends over the time period, when using the traditional accounting method [T = Dd + De] there was a large divergence among ASEAN5 members. As Appendix A shows, Malaysia's total emissions increased by 227% between 1990 and 2008, the most of any ASEAN5 member. More modestly, Indonesia and Thailand experienced an increase in emissions of 162% and 182%, while emissions in the Philippines and Singapore only increased 85% and 49% respectively.

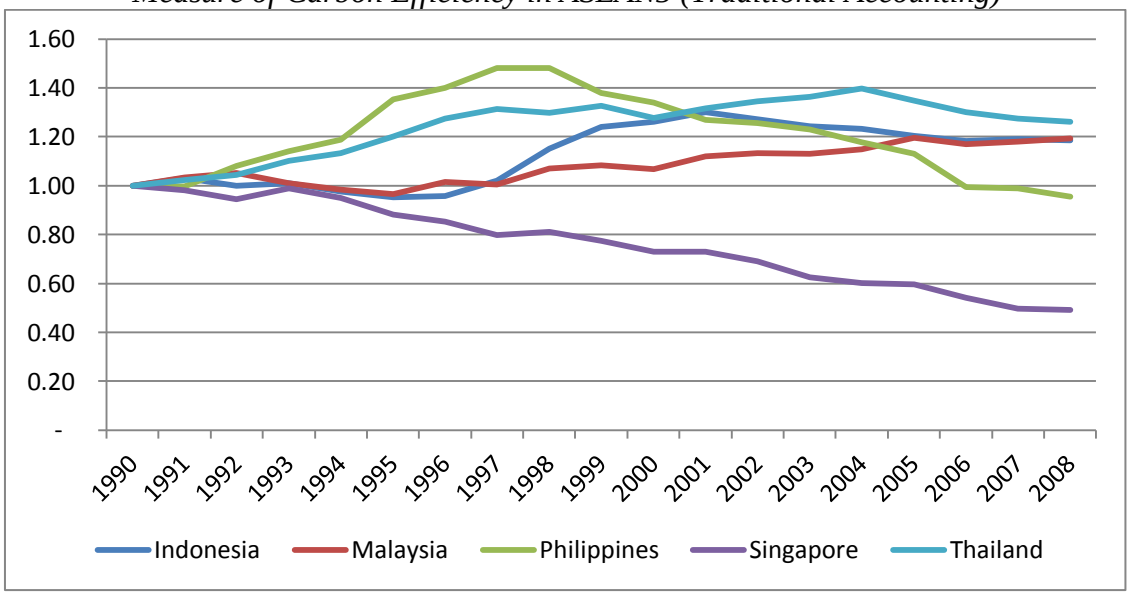
[14] ibid., p 896.
[15] Arrow, K., et al. "Economic growth, carrying capacity, and the environment", Science, 268 (1995)
[16] UN Stats: GDP, constant 2005 USD

Upon first glance, the figures are somewhat in line with the Environmental Kuznets Curve theory. The poorest country that also experienced the smallest increase in economic growth, the Philippines, also had the lowest absolute increase in pollution emissions; while the only developed country, Singapore, experienced a relatively small increase in emissions despite its impressive growth during the period. One may conclude that Singapore's ability to grow its economy without large increases in emissions is presumably because the country is rich enough to absorb the costs of stringent environmental regulation. Indonesia, Thailand, and Malaysia all saw high levels of growth and emissions, and all have GDP/capitas between 2,000 USD and 8,200 USD, which is the take-off period in Grossman and Kruger's model.

When looking at emissions on a per capita basis (See Appendix B), results also conform to the logic of the Environmental Kuznets Curve. The richest country, Singapore, has the highest emissions per capita, but has seen its emissions per capita decrease by 16% between 1990 and 2008; while the poorest country, the Philippines, has seen its per capita emissions rise by only 6%. Malaysia (117%), Thailand (161%) and Indonesia (88%) all experienced large increases in their emissions per capita, typical of high growth countries in their take off phase of development.

Looking solely at absolute changes in emissions, however, can be misleading. As a country grows, even if its emissions rise, it might be becoming more 'carbon efficient' in its production. As stated, 'carbon efficiency' is defined as the amount of pollution emitted per unit of GDP produced. The chart below shows which countries are becoming more carbon efficient by looking at the evolution of the ratio between total pollution emissions and GDP, using 1990 as a base year. As the table shows, only Singapore has become significantly more carbon efficient, meaning that the country's emissions per unit of GDP produced has decreased over the time period. Thailand (27%) has seen the largest decrease in its carbon efficiency, followed by Indonesia (19%) and Malaysia (18%). These figures are consistent with the Environmental Kuznets Curve logic, which would suggest that Singapore, in being the richest country with the capacity to create and enforce the most stringent environmental legislation, would be the most carbon efficient ASEAN country. The results of the Philippines somewhat contradict the Environmental Kuznets Curve logic. Between 1990 and 1998, the country became less carbon efficient, which was to be expected. Between 1998 and 2008, however, the country improved its carbon efficiency. This feat is bizarre given that the country maintained a relatively strong growth rate and had a low overall level of development in the period.

Measure of Carbon Efficiency in ASEAN5 (Traditional Accounting)



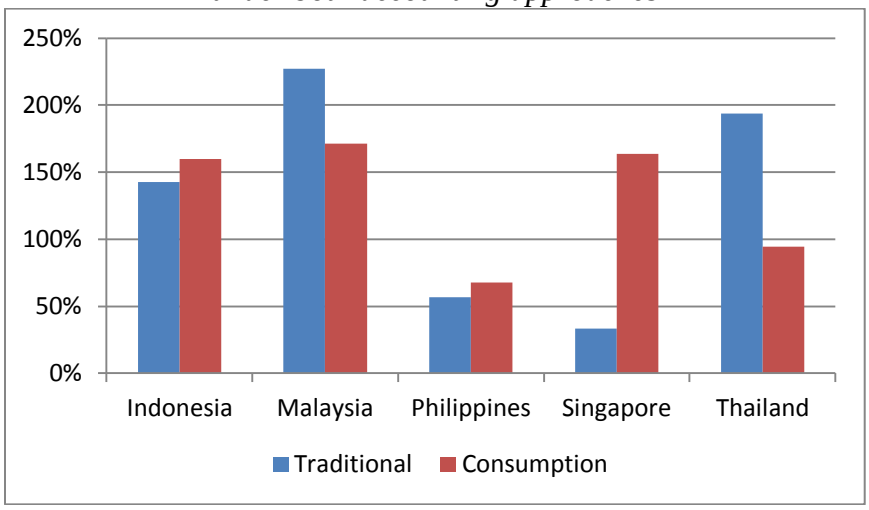
Own Calculations, Dataset from Peters et al (2011)

Calculating Emissions Using a Consumption-based Approach

As stated in the Introduction, the conventional approach for measuring pollution emissions from growth is misleading because the calculation includes emissions from production for domestic consumption (Dd) as well as emissions for production for exports (De), but exports may not be the primary driver of ASEAN growth. Numerous studies have suggested that the primary driver of ASEAN growth is a combination of domestic demand, increases in productivity, and foreign capital and inputs. Given this, accounting for the carbon content in domestic production (Dd) as well as foreign imports (Fd) may offer a better indication as to whether ASEAN countries are 'growing green'.

When employing the alternative approach, one notices stark differences in the evolution of overall emissions, emissions per capita and carbon efficiency of ASEAN countries. In terms of overall emissions, under the consumption-based approach each ASEAN member with the exception of Indonesia and the Philippines experiences a significant change in its rise in emissions between 1990 and 2008 emissions. Malaysia still has the largest overall rise in absolute pollution, but the increase was only 171% (compared to 227%). Likewise, Thailand's total emissions under the consumption based approach drop to 94% from 194% over the time period. The most significant change under the new approach is seen with Singapore. When accounting for pollution from imports, the country experienced the second highest increase in its total emissions (163% compared to only 33% under the traditional approach).

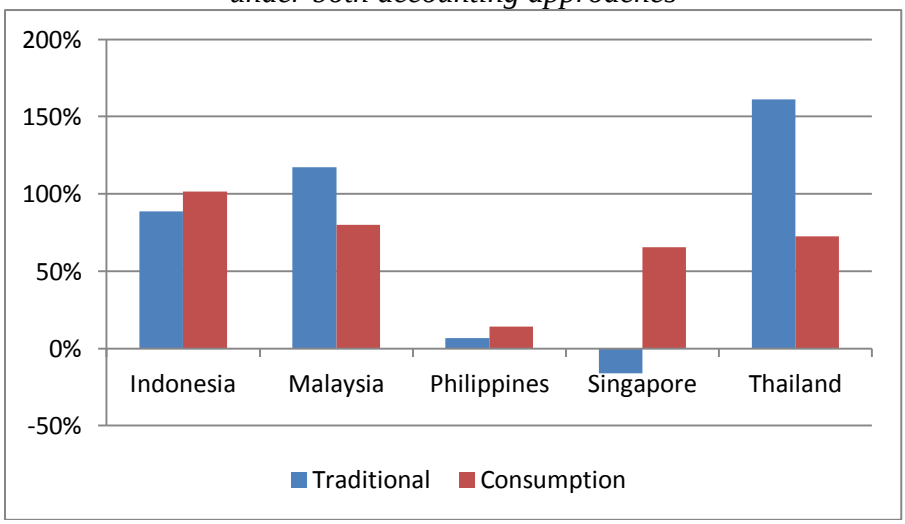
1990-2008 % change in total MtCO2 emissions under both accounting approaches



Own Calculations, Dataset from Peters et al (2011)

In terms of emissions per capita, under the consumption based approach, the results are similar. Indonesia and the Philippines experience only marginal increases, while Malaysia and Thailand see significant decreases in their rise in emissions. Once again, the most important change is seen with Singapore, where emissions are seen to rise by 66% despite having fallen by 16% under the traditional accounting approach.

1990-2008 % change in total MtCO2 emissions per capita under both accounting approaches

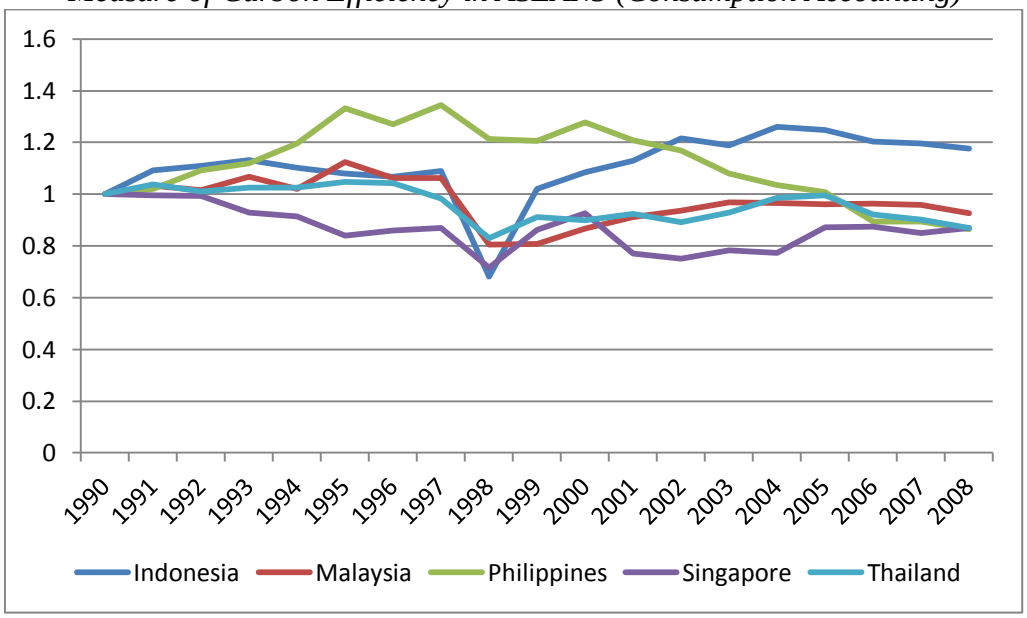


Own Calculations, Dataset from Peters et al (2011)

Regarding carbon efficiency, as the table below shows, under the consumption accounting approach, every ASEAN country with the exception of Indonesia has become more carbon efficient, meaning that GDP has risen faster than MtCO2 emissions. This find is quite different

compared to the traditional accounting approach where only Singapore and the Philippines become more carbon efficient. Also, it should be noted that Singapore's carbon efficiency greatly decreases under the new accounting. Under the traditional approach, Singapore was seen to have improved carbon efficiency by 51%, while under the consumption-based approach, the efficiency gain is only 13.4%, which happens to be roughly the same gain achieved by Thailand and the Philippines.

Measure of Carbon Efficiency in ASEAN5 (Consumption Accounting)



Own Calculations, Dataset from Peters et al (2011)

The analysis above shows the importance that imports and exports play in the carbon emissions of ASEAN countries. Under the traditional approach, the logic of the Environmental Kuznets Curve is validated. The richest country, Singapore, experiences the smallest increase in its overall MtCO2 emissions, and sees a decrease in its emissions per capita. By contrast, the high growth emerging countries, Indonesia, Malaysia, and Thailand, see large increases in both their overall emission as well as their emissions per capita, while the poorest that saw the lowest growth rates, the Philippines, also achieved the smallest rise in emissions and emissions per capita. By contrast, using consumption-based accounting, all countries saw increases in their emissions, with the richest countries having the highest increase.

The large difference under each accounting approach begs two questions. First, what implications might a consumption-based accounting method have for the Environmental Kuznets Curve, which, as stated, measures the relationship between GDP/capita and pollution emissions? Second, if carbon intensity in imports and exports are so important, how do they compare to carbon intensity of production for domestic consumption?

Regarding the first question, the largest change is seen with the Environmental Kuznets Curve for Singapore. Under the traditional approach, the country's GDP/capita rose without large increases in emissions, as the Kuznets Curve logic might predict given the nation's wealth.

Under a consumption based approach, however, increases in GDP/capita have corresponded with increases in total emissions in Singapore. For the other countries, there are only marginal differences under the consumption-based approach (See Appendix C for full graphs): Malaysia and Thailand have a gentler slope as GDP rises, while the slope for the Indonesia and the Philippines is steeper. One might expect these results given the findings above: using the consumption based approach, Malaysia and Thailand saw the largest reductions in both emissions and emissions per capita, Indonesia and the Philippines saw emissions and emissions per capita rise more quickly.

In terms of the relationship between carbon intensity from trade (imports and exports) and intensity from production for domestic consumption, there are three important findings. First, under each approach, the share of a country's total carbon coming from imports and exports has not changed dramatically between 1990 and 2008. Emissions from imports have consistently represented between 34% and 41% of total emissions from consumption. Likewise, under the traditional accounting approach, emissions from exports have ranged between 32% and 37% of total emissions from production over the time period.

Second, as a group, ASEAN has become more carbon efficient in both its production for domestic consumption (Dd) as well as its imports (Fd) and exports (De). Carbon efficiency has improved by 27% in production for domestic consumption, while carbon efficiency has improved by 33% for imports and 45% for exports.[17]

Last, while there have been significant improvements in carbon efficiency on all three levels for ASEAN as a whole, there is significant divergence amongst members. For example, efficiency gains in domestic production ranged from 6% to 30%, while gains for imports ranged from 20% to 46%, and exports 28% to 62%. Interestingly, all countries made the largest efficiency gains in their exports.

Disaggregated Carbon Efficiency Gains

	Fd	Dd	De
Indonesia	0.46	0.30	0.57
Malaysia	0.20	0.29	0.34
Philippines	0.32	0.36	0.63
Singapore	0.28	0.06	0.62
Thailand	0.41	0.23	0.28
TOTAL	0.33	0.27	0.45

Own Calculations, Dataset from Peters et al (2011)

Conclusions

The analysis above offers three broad conclusions. First, accounting methods matter and should be considered when determining the relationship between economic growth and pollution emissions. Given the stark differences in a country's total emissions under the traditional

[17] Data is for the period 1996 to 2008 due to data availability.

approach and the consumption-based approach, there is a strong case to be made that country's growing as a result of imports should incorporate pollution from imports into their emissions calculation. Not doing so may understate the actual carbon content in their growth.

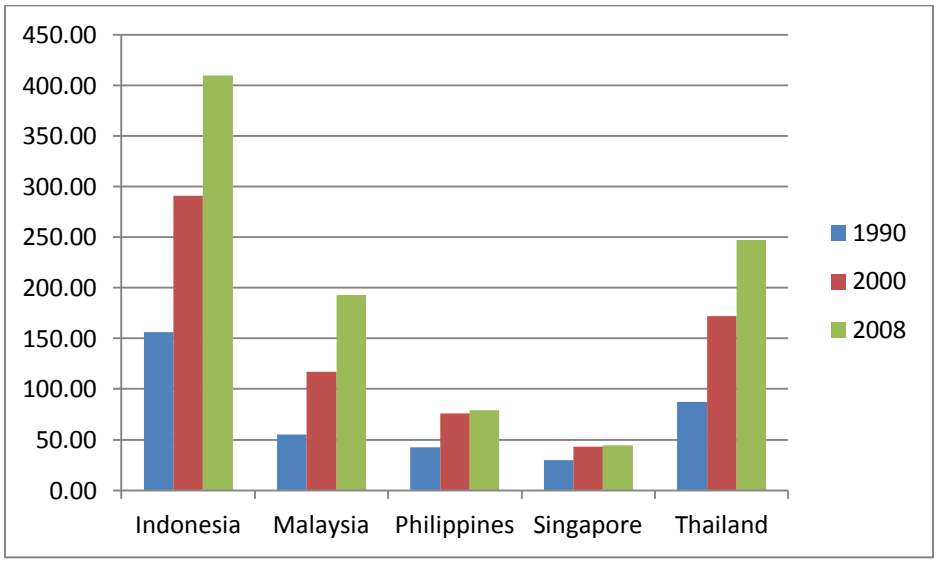
Second, both rich and poor countries in ASEAN have improved carbon efficiency at the aggregate level (and in each disaggregated level, Dd, De, and Fd) but these improvements have not corresponded with overall reductions in pollution emissions under a consumption-based approach. In effect, increases in carbon efficiency have simply meant that both rich and poor countries are increasing their emissions overall, but at lower rates. In the case of emerging ASEAN countries, the increases in emissions have been fuelled by domestic consumption. For the sole rich country, Singapore, the emissions increase is due to pollution from imports. This find suggests that, contrary to the Environmental Kuznets Curve logic, perhaps when a country reaches a certain level of GDP/capita, while its domestic emissions will decrease, these may simply be replaced by even larger emissions from imports. Of course, a larger sample size would be needed to justify this hypothesis.

Last, while exports matter for ASEAN pollution emissions, if they do not matter for growth, one can assume that unilateral border tax adjustments by countries towards ASEAN may have significant effects on emissions reductions, without substantially harming growth prospects. More research should be performed on other emerging regions of the world to see if exports contribute to a large portion of emissions but are not the causal factor for growth. If so, this would give a larger argument for the unilateral imposition of carbon border tax adjustments by large importers as an alternative to Kyoto-style emissions reduction agreements.[18]

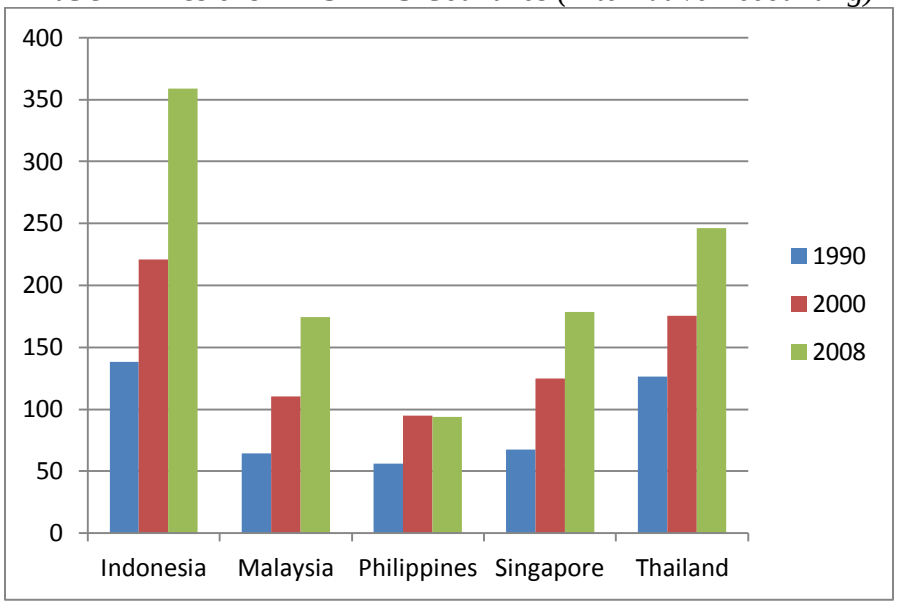
[18] Napoli, C. "A Decentralized Approach to Emissions Reductions" Carbon & Climate Law Review (forthcoming 2013)

APPENDIX A – MtCO2 Emissions

MtCO2 Emissions in ASEAN5 Countries

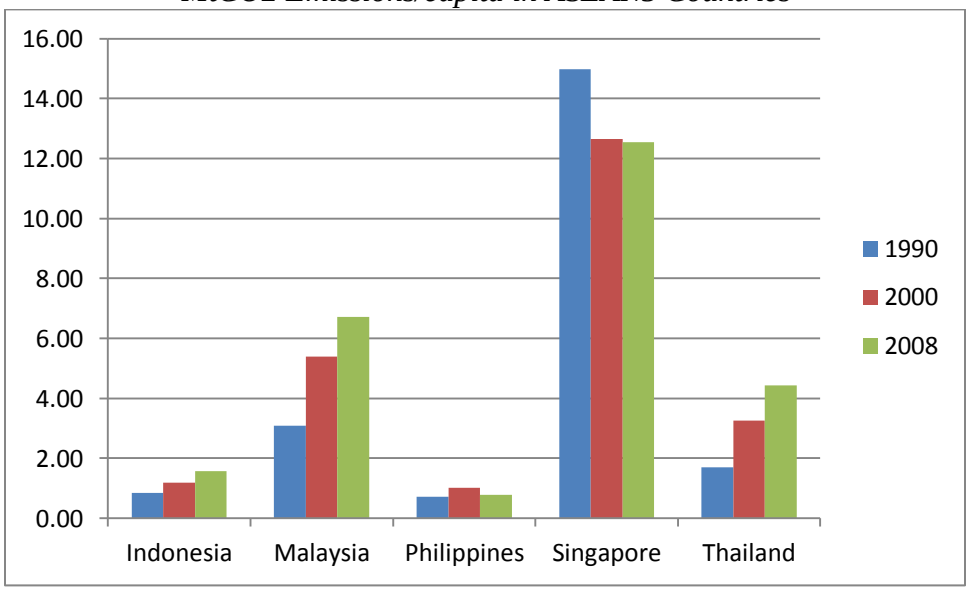


MtCO2 Emissions in ASEAN5 Countries (Alternative Accounting)

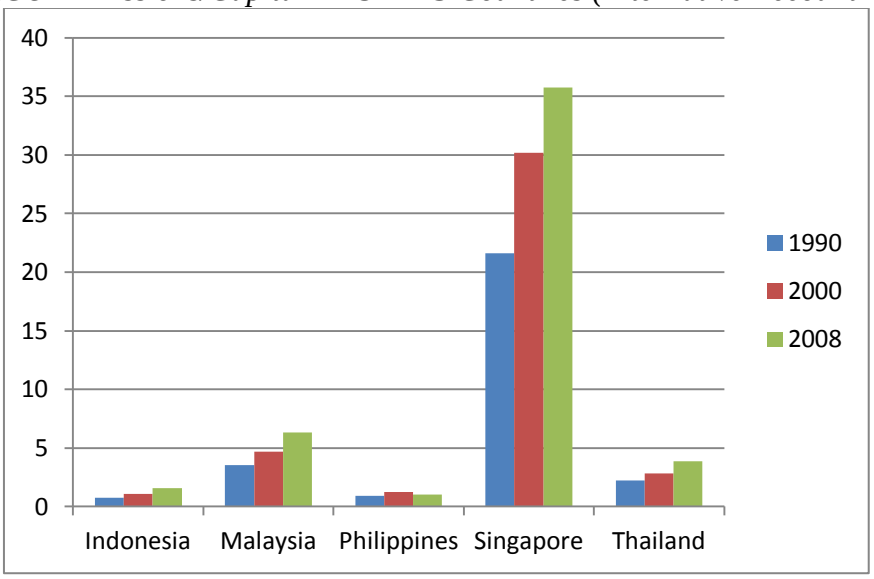


APPENDIX B – MtCO2 Emissions/Capita

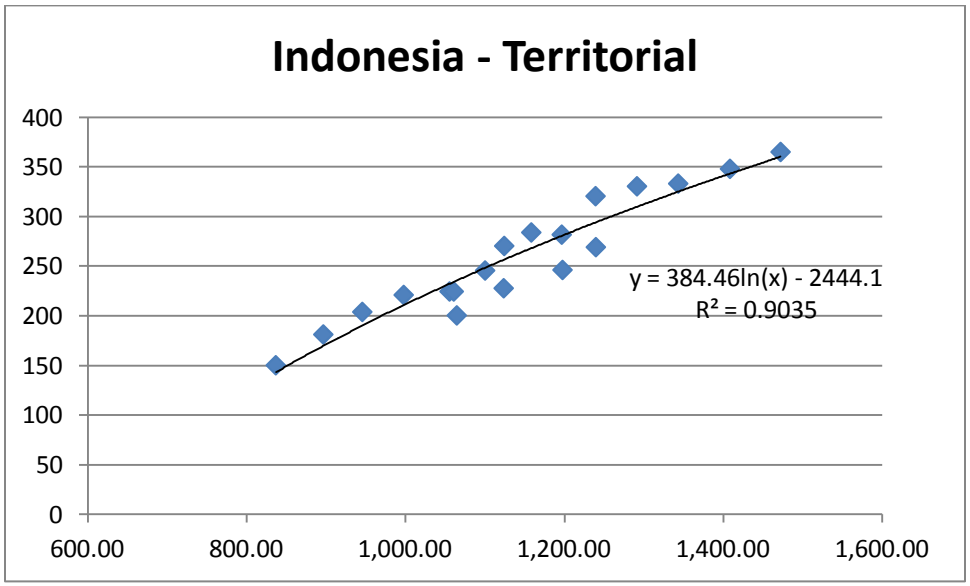
MtCO2 Emissions/capita in ASEAN5 Countries

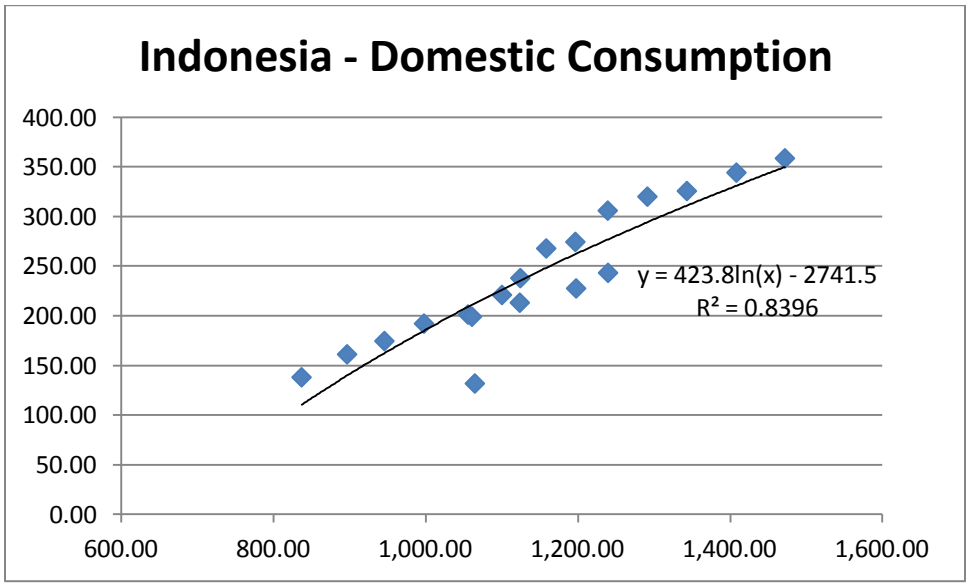


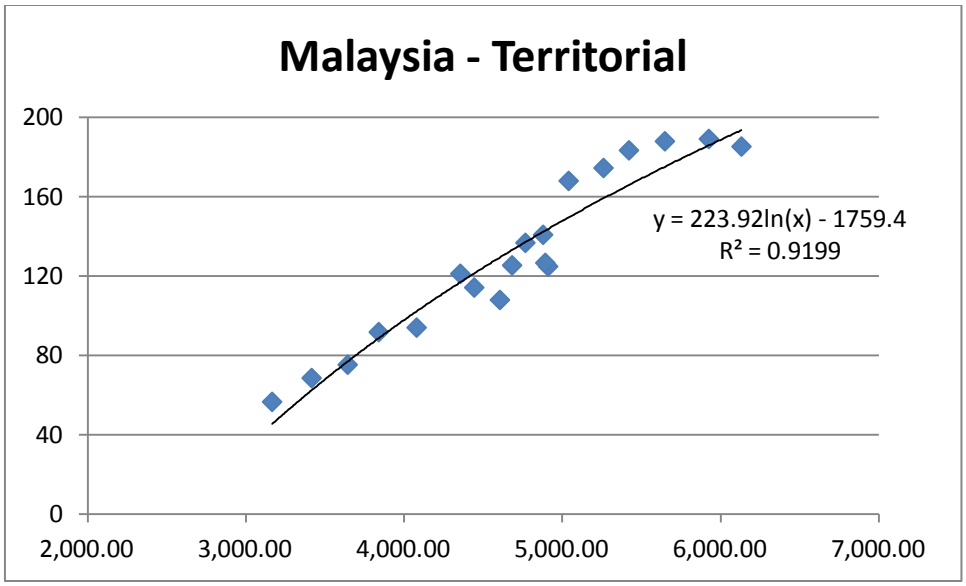
MtCO2 Emissions/Capita in ASEAN5 Countries (Alternative Accounting)

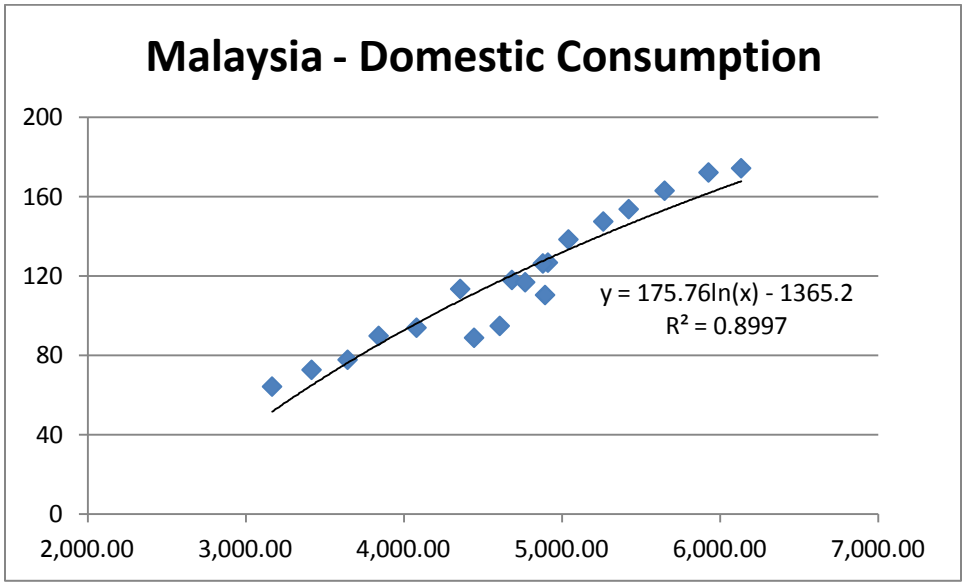


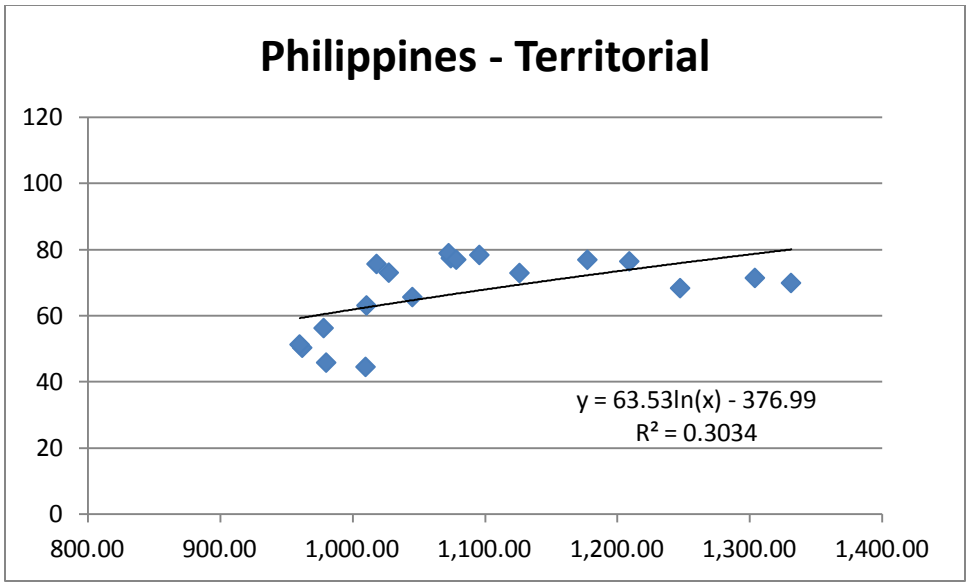
APPENDIX C – GDP/Capita and MtCO2 emissions Scatter Charts






Malaysia - Territorial
200
160
120
80
40
0
2,000.00
3,000.00
4,000.00
5,000.00
6,000.00
7,000.00
y = 223.92ln(x) - 1759.4
R² = 0.9199


Malaysia - Domestic Consumption
200
160
120
80
40
0
2,000.00
3,000.00
4,000.00
5,000.00
6,000.00
7,000.00
y = 175.76ln(x) - 1365.2
R² = 0.8997


Philippines - Territorial
120
100
80
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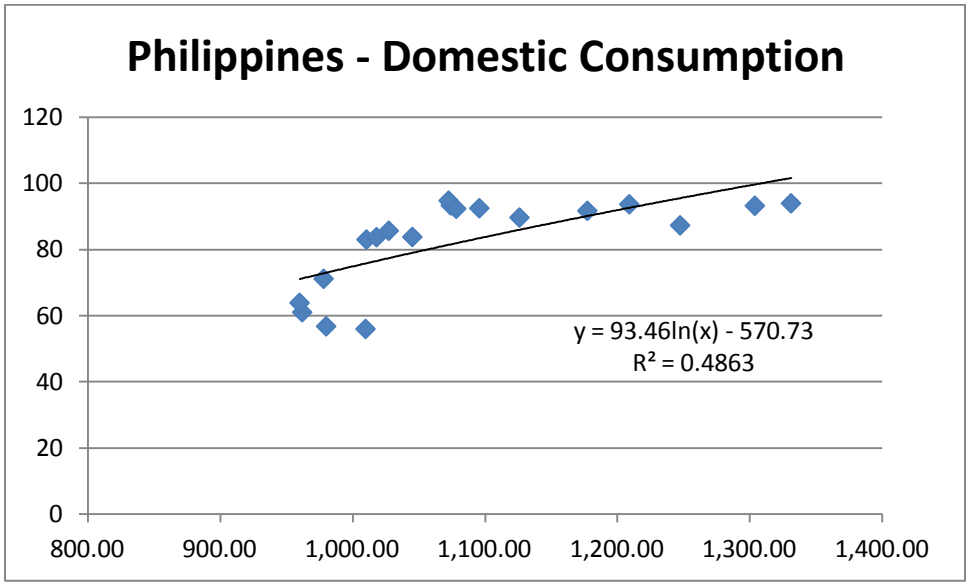
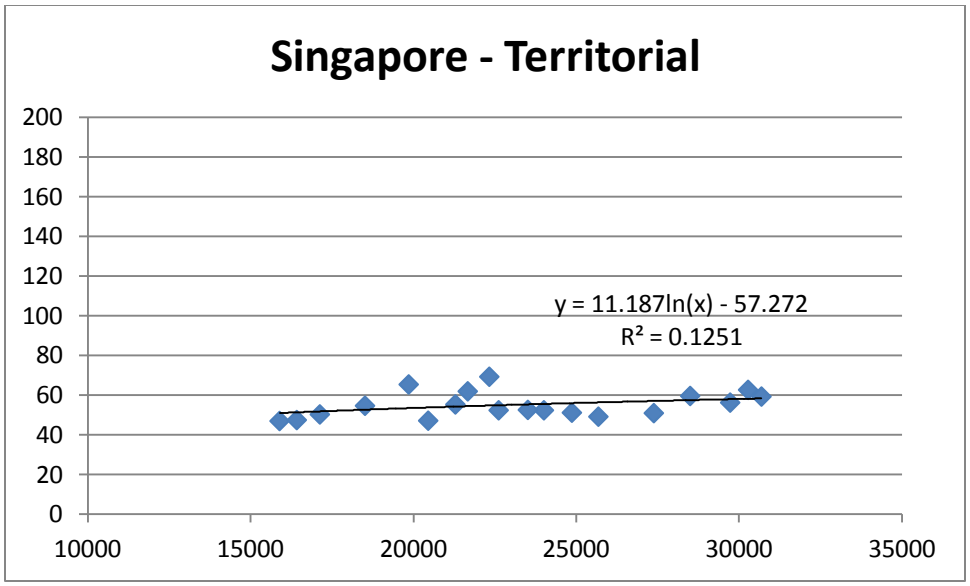
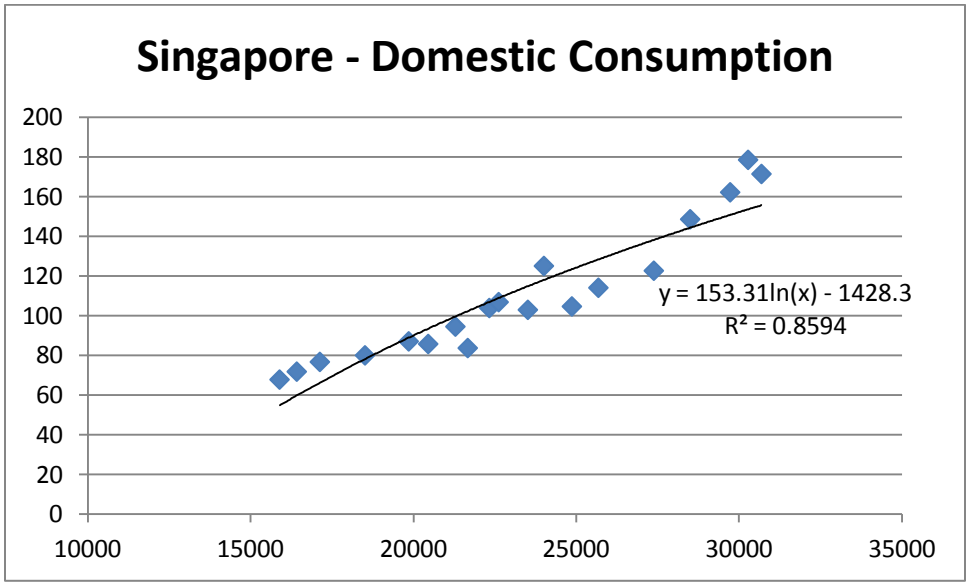
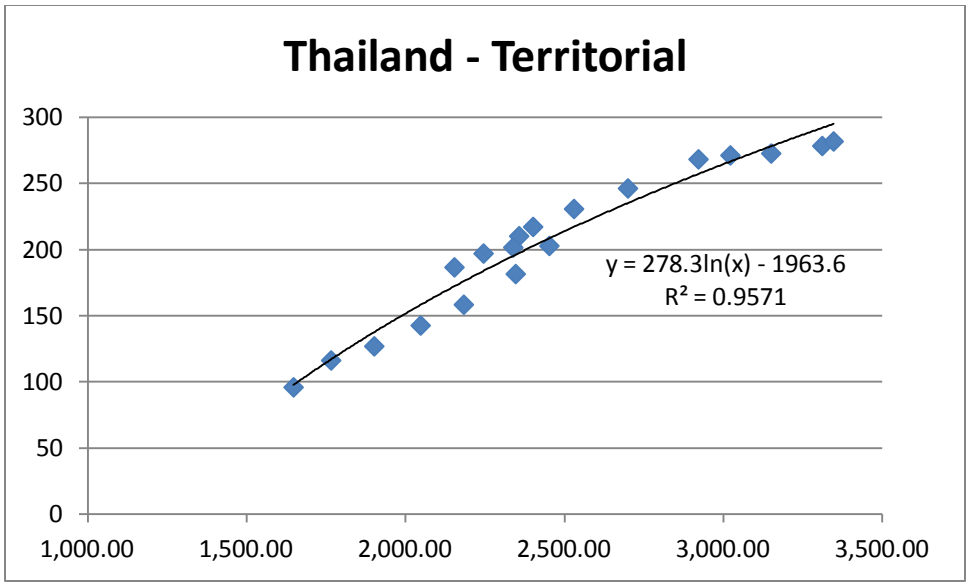
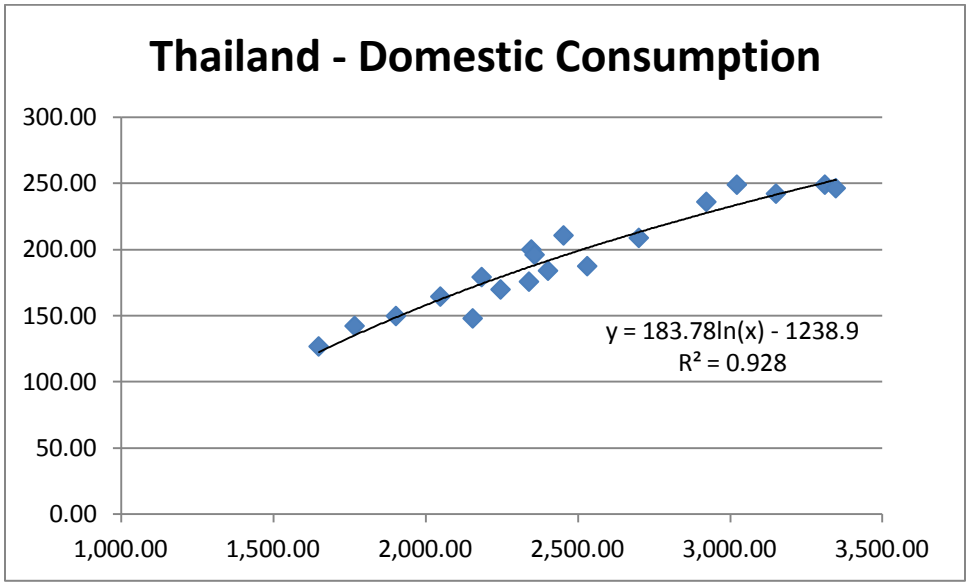
20
0
800.00
900.00
1,000.00
1,100.00
1,200.00
1,300.00
1,400.00
y = 63.53ln(x) - 376.99
R² = 0.3034


Philippines - Domestic Consumption
120
100
80
60
40
20
0
800.00
900.00
1,000.00
1,100.00
1,200.00
1,300.00
1,400.00
y = 93.46ln(x) - 570.73
R² = 0.4863


Singapore - Territorial
200
180
160
140
120
100
80
60
40
20
0
10000
15000
20000
25000
30000
35000
y = 11.187ln(x) - 57.272
R² = 0.1251


Singapore - Domestic Consumption
200
180
160
140
120
100
80
60
40
20
0
10000
15000
20000
25000
30000
35000
y = 153.31ln(x) - 1428.3
R² = 0.8594


Thailand - Territorial
300
250
200
150
100
50
0
1,000.00
1,500.00
2,000.00
2,500.00
3,000.00
3,500.00
y = 278.3ln(x) - 1963.6
R² = 0.9571


Thailand - Domestic Consumption
300.00
250.00
200.00
150.00
100.00
50.00
0.00
1,000.00
1,500.00
2,000.00
2,500.00
3,000.00
3,500.00
y = 183.78ln(x) - 1238.9
R² = 0.928