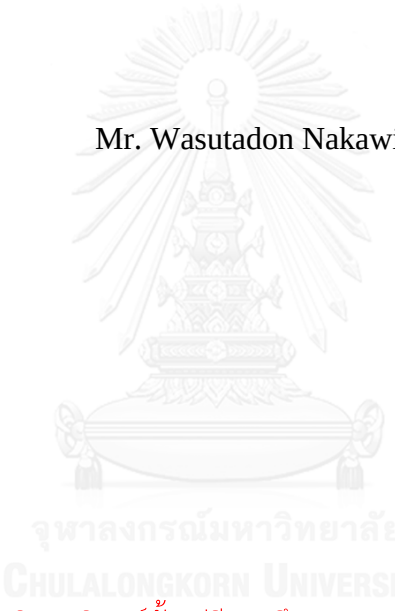
INTERNATIONAL TRADE, ENVIRONMENTAL CONCERNS AND SOCIAL INTEGRITY

Mr. Wasutadon Nakawiroj



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วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาเศรษฐศาสตรดุษฎีบัณฑิต
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Thesis Title	INTERNATIONAL TRADE, ENVIRONMENTAL CONCERNS AND SOCIAL INTEGRITY
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วิทยานิพนธ์ชุดนี้มีวัตถุประสงค์เพื่อทำการศึกษาความเชื่อมโยงระหว่างการค้าระหว่างประเทศและการพัฒนาที่ยั่งยืน โดยเฉพาะอย่างยิ่งในประเด็นทางสิ่งแวดล้อม โดยพิจารณาองค์ประกอบทางสังคมในฐานะปัจจัยที่ส่งผลต่อความสัมพันธ์ดังกล่าว ซึ่งได้ทำการพิจารณาทั้งมาตรการทางกฎเกณฑ์และปัจจัยด้านจิตสำนึกทางเศรษฐกิจของหน่วยเศรษฐกิจและบุคคล ซึ่งอาจรวมเรียกว่าเป็นความเข้มแข็งทางสังคม ทั้งนี้ บทความวิจัยชิ้นแรกที่ปรากฏในวิทยานิพนธ์ได้ทำการศึกษาทั้งเชิงวรรณกรรมปริทัศน์และเชิงประจักษ์ในประเด็นที่เกี่ยวข้องกับผลของการพัฒนาเศรษฐกิจผ่านแนวคิดระบบตลาดที่มุ่งเน้นการค้าระหว่างประเทศเป็นปัจจัยขับเคลื่อนการเจริญเติบโต โดยผลการศึกษาเชิงประจักษ์ได้แสดงให้เห็นว่าการขยายตัวของรายได้ประชาชาติต่อหัวนั้นสามารถนำไปสู่จุดวกกลับของระดับมลภาวะได้จริงในบางกรณี แต่การพัฒนารายได้เพียงลำพังนั้นไม่อาจนำไปสู่การแก้ไขปัญหาทางสิ่งแวดล้อมที่สำคัญในบางกรณีได้ ผลการศึกษาในส่วนที่สองแสดงให้เห็นว่า กิจกรรมทางเศรษฐกิจในประเทศมีความสัมพันธ์กับระดับมลภาวะในการผลิตเพื่อการค้าที่สูงขึ้น และระดับการพึ่งพาภาคอุตสาหกรรมของประเทศมีผลในทางบวกต่อระดับมลภาวะนี้อย่างมีนัยสำคัญในทุกกรณีที่ได้ทำการศึกษา โดยคุณภาพของการบริหารจัดการสิ่งแวดล้อมในประเทศมีความสัมพันธ์เชิงลบต่อระดับมลภาวะดังกล่าวในบางกรณี ส่วนประสิทธิภาพของการบังคับใช้กฎหมายนั้นมีผลลบต่อระดับมลภาวะในทุกกรณี และผลการศึกษาในส่วนที่สามพบว่ารัฐที่มีระดับการพึ่งพาภาคอุตสาหกรรมในระดับสูงนั้นมีแนวโน้มที่จะมีความล่าช้าในการบังคับใช้กฎหมายที่สืบเนื่องจากความตกลงนานาชาติทางสิ่งแวดล้อมต่างๆ อันเนื่องมาจากภาระต้นทุนที่ภาคอุตสาหกรรมในประเทศเหล่านั้นจะต้องแบกรับ ซึ่งข้อเสนอแนะเชิงนโยบายของวิทยานิพนธ์ชุดนี้สนับสนุนการใช้มาตรการทางกฎเกณฑ์ กฎหมาย ข้อบังคับและความตกลงทางสิ่งแวดล้อมตลอดจนการส่งเสริมการมีจิตสำนึกทางเศรษฐกิจ สังคมและสิ่งแวดล้อมของหน่วยเศรษฐกิจต่างๆ ในการลดผลกระทบทางสิ่งแวดล้อมจากการค้าระหว่างประเทศลง เพื่อมิให้เป็นอุปสรรคต่อกรอบแนวทางการพัฒนาที่ยั่งยืน

สาขาวิชา เศรษฐศาสตร์ ลายมือชื่อนิสิต .....

ปีการศึกษา 2557 ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

ลายมือชื่อ อ.ที่ปรึกษาร่วม .....

5385909229 : MAJOR ECONOMICS
KEYWORDS: INTERNATIONAL TRADE / SUSTAINABLE DEVELOPMENT / SUSTAINABILITY / ENVIRONMENTAL ECONOMICS

WASUTADON NAKAWIROJ: INTERNATIONAL TRADE, ENVIRONMENTAL CONCERNS AND SOCIAL INTEGRITY. ADVISOR: PROF. TEERANA BHONGMAKAPAT, Ph.D., CO-ADVISOR: ASST. PROF. KAEMTHONG INDARATNA, Ph.D., 156 pp.

This dissertation is an attempt to verify and assess the linkages between international trade and aspects of Sustainable Development, particularly the Environmental Dimension. In an attempt to bridge the three dimensions of Sustainable Development, the Social Dimension's aspects of rules and regulations and the considerations regarding the economic preferences of agents and public-mindedness, collectively termed as "social integrity", are addressed as potential instruments that can reduce environmental imbalances. The empirical part of the first research article suggests that economic growth can improve the situation for certain measures of well-known pollution, but may not provide satisfactory improvements in all cases. The second empirical analysis observed that domestic economic variables are strongly associated with higher trade-induced production pollution levels, where industrial sector dependency contributes strongly to pollution in all estimated scenarios. Domestic environmental quality is significantly correlated to lower production pollution in trade in certain cases, while efficient rules of law are associated with lower pollution in all cases examined. Finally, the estimation results in the third part of the dissertation shows that countries with higher levels of industrial sector dependency tends to be significantly slower in ratifying major multilateral IEAs, possibly due to the cost pressures facing domestic producers. The dissertation argues in favor of the use of rules and national & international regulations, as well as demand-side measures to encourage agents' public-mindedness and beyond-material considerations, in addressing modern trade-related pollution problems.

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Student's Signature .....
Advisor's Signature .....
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CONTENTS

Page

CHAPTER 1
INTRODUCTION

1.1 IMPORTANCE AND LINKAGE OF THE ARTICLES

This dissertation aims to study the potential links between aspects of Sustainable Development, which are represented by three dimensions: Economic, Environmental and Social. In line with the research topic of the dissertation, the Economic Sphere will be represented by international trade, as trade is one of the important components driving economic expansion and growth. It is the curiosity of the dissertation on whether, how and where international trade fits into the paradigm of Sustainable Development, and how it is related to other components of sustainability.

Quantitatively, this dissertation will address the supply-side of the issue, which concerns the production of goods and growth, through econometric analyses on the problems of pollutant emissions, production pollution in trade, and compliance with major IEAs, which are prominent topics in the modern multilateral economic system.

As the most popular questions in the matter would revolve around the characteristics of the relationships between economic progress and sustainability, the first article addresses the conceptual link between economic development, particularly via international trade (as a key driver of growth), and sustainability (focusing on the Environmental Dimension), and acted as a contribution to the dissertation's literature review part. In the empirical part, it uses the Environmental Kuznets Curve (EKC) to examine the emission problem for five major pollutants, which are CO2, SO2, N2O, CH4, and f-gases, to determine whether and how economic development, which is a major goal of trade, can influence the environmental outlook for different types of emissions. This is meant to study the nature of the relationship between economic progress and environmental degradation, and to see whether growth can correct environmental imbalances by itself over time.

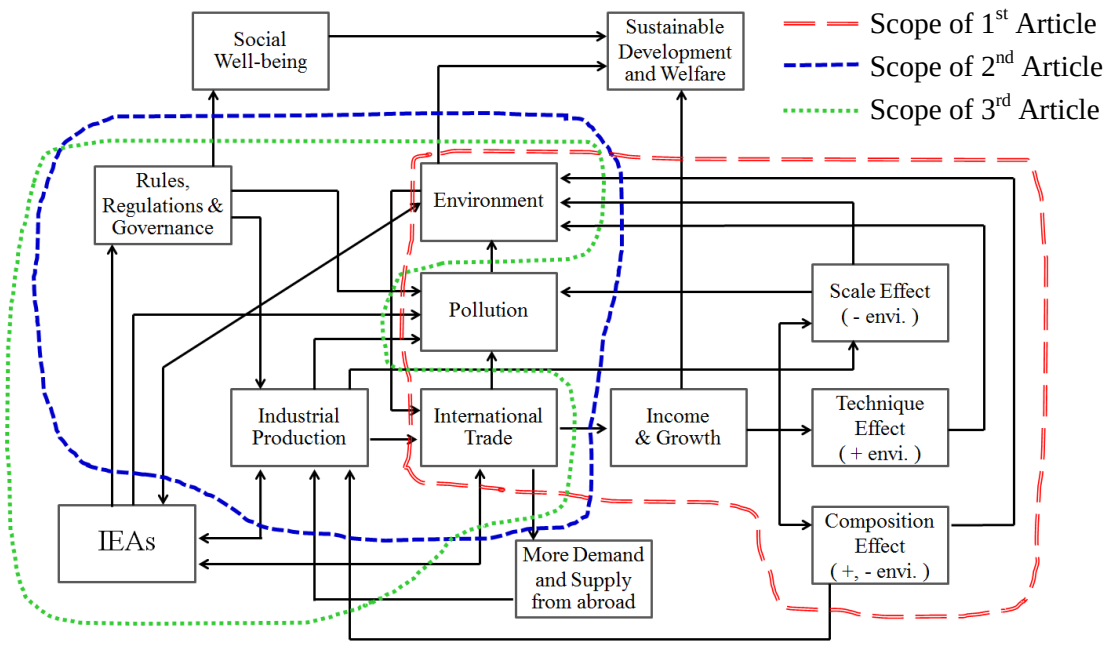
Afterwards, in order to look deeper and more directly into the pollution issue, the element of exports and imports is introduced into the LHS variable, resulting in the "trade-induced production pollution" variable, which represents the estimated overall amount of pollution generated during the production of goods that are traded internationally, and separate estimations are conducted for imports and exports. Using the panel data analysis (fixed effects), the paper's objective is to examine the presence and direction of the relationship between domestic environmental and social performance (the latter is represented by the governance indicators). As the first article and the literatures argue in favor of the use of rules and regulations to keep the pollution problem in check, this issue is addressed in the second article by looking at the significance and sign of the governance variables. The second article deals with the production of traded goods in all sectors and estimates the overall amount of pollution generated in the process.

Finally, as the preliminary policy implications advocate the use and enforcement of rules and standards, it would be incomplete to look only at domestic relationships. The international community can have considerable influence on environmental actions of countries via international environmental agreements (IEAs or MEAs), which are amongst the most important rules and regulations advocated by many pro-sustainability literatures. These international treaties are counted as multilateral environmental standards, and would affect international trade by generating costs and possibly lowering the volume of trade. In a similar fashion to the second article, the third article attempts to examine the relationship between domestic factors and the speed of IEA ratification (or other legally equivalent actions), which measures international environmental compliance.

As such, the three articles would revolve around the relationship between trade and the environment, with respect to regulation and governance (the "social integrity" component) which are the frequently advocated solution to the environmental problems.

At any rate, as the issue of infinite growth remains a topic of dispute, it is also recommended that looking only at the production and regulation of goods may not be sufficient – after all, environmental imbalances are also driven by the ever-increasing consumption demand which pushes the economy closer to resource constraints. It is recommended that policies deal not only with the supply-side issues of production and industrialization, but also the demand-side issue of consumption. This dissertation takes a look at these issues as well, in order to complete the picture.

Picture 1.1 – The conceptual framework and the scope of coverage for each article



Picture 1.1 illustrates the relationship between the issues of Sustainable Development, trade and economic development, and the environment. The separated line with long sections denotes the area of coverage for the first article (Chapter 3.), which deals with the relationship between economic growth (augmented by trade) and the environment (in terms of pollution). The areas within the line with middle-length sections is covered by the second article (Chapter 4.), which examines the relationship between domestic Economic, Environmental, and Social characteristics, and pollution induced by trade-oriented production. Lastly, the dotted line signifies the scope of the last article (Chapter 5), examining the prominent international environmental

agreements that have strong implications on international trade. Most of the components of Sustainable Development are addressed in detail, with the exception of the social dimension, which will be represented mainly in terms of governance and domestic regulatory quality. Each of the three articles will address the different facets of the issue.

1.2 BACKGROUND AND THE IMPORTANCE OF THE PROBLEM(S)

At the time of this dissertation's conception, concerns about the global ecosphere is gaining worldwide attention, due to the emergence of many prominent environmental problems, particularly the global warming phenomenon and other associated problems. Global climate change, thinning polar ice caps, rising sea levels, and contamination of harmful chemicals in the natural environment are amongst the problems we face. We once thought that expansion and advancement were boundless as long as our technological capabilities permit them, but we were wrong. The deterioration in the global ecosphere that began with the wake of the Industrial Revolution and the ensuing modern industrial age of mass production is beginning to take serious toll on human livelihood.

While the death rates caused by natural disasters have declined during the previous century, which can be attributed to better preparation and precautionary measures, the frequency of such disasters and the number of people affected have increased considerably, especially in the previous decade, and it is predicted that the problem will worsen considerably if no significant changes are made in the way we run our economy. The creation of pollution and waste is adversely affecting the global ecosphere, and natural resources are being used up at a rate faster than the environment could replenish them (Brundtland & The World Commission on Environment and Development, 1987). From the social perspective, we have long relied on economic progress to end poverty and bring greater welfare to people around the world. This has been achieved in many cases, but the success remains partial, as the argument for social benefits of a strictly wealth-maximizing

development depends on the trickle-down effect, where wealth is equitably circulated throughout the economy eventually, while, in reality, this is often not the case (Bhongmakapat, 2010, 2011a).

An important concern for today's economy is that environmental aspects are often left out in economic and trade-related affairs, at least in practice. Despite the increasing environmental awareness among the general public, environmental degradation and malpractices still continue. Modern economic development is still associated with non-negligible degrees of environmental (and social) side-effects, and it appears as though the link between the environmental and economic dimensions remains weak; despite much progress in the global economy and significant attempts to conserve the environment, the modern development paradigm still seems to put profit and growth first and foremost, and is willing to trade away environmental well-being for those goals.

Another important aspect of the global economy is the society. Normally, we often look at the society as the recipient side (being affected by changes in the other two spheres). Now, however, we wish to see whether societal aspects can be transmitted into environmental characteristics. For this reason, we examine "social integrity" which is the governance aspect of the Social Sphere (rather than the entire Sphere). This aspect will be represented by various several governance indicators. On the other hand, as the research agenda deals with the environmental problems derived from over-production and "excessive" levels of economic wants, the issue of agents' preferences will also need to be examined.

Nevertheless, Schumacher (1973), Bhongmakapat (2010, 2011a, 2011b) and Bhongmakapat and Indaratna (2009-2010) suggest that there are a number of other mental or ethical factors that can influence agents' actions beyond the simple use of rules and regulations. A reasoning for this is that fear of punishment (disincentives) can only prevent undesirable behaviour and infringements, and will ensure desirable behaviour only to a minimum required scale, but will not ensure socially beneficial behaviour (especially those associated with selflessness, altruism, self-restraint,

moderation) beyond what is required by the law. For example, a law on deforestation may prevent the cutting of trees, but will not encourage people to rehabilitate the forest or plant new trees to compensate those lost. Moreover, it will fail to deter the former as well if the actual implementations are not effective.

Law & punishment and public-mindedness are like two sides of the coin. Providing disincentives to undesirable behaviour will discourage such actions, but will not lead to increased frequency of desirable or selfless ones, while public-minded agents may perform extra amounts of socially desirable actions (sometimes despite additional costs to the individual) even when no rules or requirements are placed.

At any rate, while it would be incomplete to look only at the "supply-side" of the issue (seeking to limit the creation of pollution and controlling the modes of production) without mentioning the "demand-side" (that economic agents must, by themselves, learn to moderate their economic activities as well), most of the latter issue is plagued by data constraints and the present lack of reliable methodology to measure or assess them. Assessing this demand-side will be a daunting task which would require detailed understanding of human preferences (which often require interdisciplinary knowledge from several fields). Cross-country qualitative analysis of preferences will prove to be elusive, as in reality economic agents would differ vastly in terms of preferences and choices of action; one person may choose to pollute a river if it gains him/her enough profit, while another would not take such action even if it gives him/her more payoffs than any other alternatives. This difference in how a person gives weight to various spheres, which can vary drastically between one individual to the next, is the essential point of the demand-side assessment in this issue, and can be a challenging theme for future research to work on. Nevertheless, this issue will be addressed in some detail the later sections of the paper.

As such, this paper attempts to address and establish a general link between international trade and Sustainable Development, using both quantitative analysis and qualitative study. It focuses on the supply side of the issue (production, regulation, growth, trade, which is then related to the environment), which can be captured by

existing econometric models with relative ease, but, as the analysis cannot be complete without looking at the demand side (preferences of agents), the thesis will also employ a qualitative study to address the demand-side issues.

1.3 RESEARCH OBJECTIVES

1.) To study the links and relationships between international trade and sustainability, using both qualitative and quantitative methods, and to provide information on related issues.

2.) To learn whether countries' domestic economic, environmental and governance performances are related to their environmental behaviour in trade and in major international agreements affecting trade, and to examine the significance and direction of these relationships.

3.) To examine how demand-side considerations can support the use of rules and regulations in promoting sustainability.

4.) To provide policy implications and suggestions to the parties concerned, namely national governments, polluters, and international organizations.

1.4 SCOPE OF THE STUDY

The timeframe of this study focuses on the period between 2000 and 2010, in order to balance between recency and data availability. The first article uses panel data between 1990 – 2011, the second article looks at 2001 and 2010, and the third article examines four major IEAs situated around the year 2000. Data availability becomes a constraint for certain variables in the entries following 2010.

The scope of the study is focused on several important aspects of the topic. Quantitative analyses are employed in dealing with prominent issues with available statistics, such as pollution and emission (which are amongst the well-known side-

effects of growth). This is because the articles are designed to cover at as many countries as possible and require decent data coverage for a large number of countries, where detailed, country-specific statistics exist for certain topics and not others (for example, statistics for issues that are subtle, area-specific or difficult to quantify, such as the degree of ecosystem collapse, may not exist for all countries). At any rate, this limitation can be circumvented to a fair degree with the EPI index, compiled by YCELP and CIESIN, a comprehensive indicator which accounts for a variety of measurements of environmental performance (Hsu et al., 2014).

This dissertation examines a portion of the Social dimension, rather than the entire dimension. While Sustainable Development takes into consideration the entirety of the Social Sphere, in particular the poverty and income distribution problems, this dissertation examines some aspects of the sphere, which can be termed as "social integrity". The term is used in reference to the issue of governance and regulations (on the national level), and will also take into account economic agents' preferences related to beyond-economic goals and the conservation/consumption of resources (derived from public-mindedness), in order to make the analysis more complete and not limited to the supply side of the topic. Income distribution and poverty issues are left for future research.

The empirical part of the first article examines the "turning-point GDP per capita levels" for 5 major air pollutants to see how prominent emissions react to projected changes in the income level. In doing so, it argues that economic development alone will not be sufficient in tackling the pollution and global warming problem, and we may need other measures to promote clean growth instead of waiting for the downward sloping part of the curve to take effect. The second article includes the rule of law variable in the model, and observes that it is associated with lower production pollution levels in trade, suggesting that the presence of effective legal enforcement may improve the environmental situation, at least for certain measures of pollution, while the third article examines the degree of compliance with IEAs. On the other hand, qualitative factors affecting preferences are also addressed.

The scopes of each article will be mentioned in the respective chapters corresponding with each of the articles.

1.5 POTENTIAL BENEFITS OF THE STUDY

1.) This dissertation is an attempt to link together the elements of Sustainable Development, in the hopes that economic development can be consistent with sustainability prescriptions through the understanding of the relationships between the issues at hand. The paper and its articles provide some understanding on the potential linkages between trade and sustainability, arguing that economic progress can improve the outlook on some environmental problems, but not all, while industrialization creates strong upward pressure on pollution and dissuade environmental cooperation, and that the presence of effective rules and regulations are required to keep environmental side-effects in check.

2.) The literature review provides information on the definition of Sustainable Development and sustainability concepts, and can serve as a source of information and research agenda that future papers can build on. The methodology and research questions employed in this dissertation can be expanded, improved upon, and addressed further, in order to deepen the understandings of the linkages between international trade and Sustainable Development.

3.) To fulfill its research objectives, the research constructed a set of LHS variables, defined as "trade-induced production pollution" for a given country's export and import scenarios. This indicator is compiled using the Trademap data on exports and imports (The International Trade Centre (ITC), undated) and the cross-sector pollution data (Hettige, Martin, Singh, & Wheeler, 1995). In the future, it would be interesting to see a greater number of in-depth indicators linking trade and the environment, possibly in a sector-specific manner which takes into account detailed technological differences across different locations.

4.) The study is one of the papers that argue in favor of the use of rules, regulations and standards to improve the global and local environmental outlook, rather than viewing economic development by itself as an adequate measure to handle environmental imbalances. Hopefully, the paper and its results will inspire interest and discussion in the matter, and the study's implications can be considered for the purpose of future policymaking as well as for educational purposes.

1.6 STRUCTURE AND PUBLICATIONS

As per the requirements of a PhD doctoral dissertation, this dissertation will be comprised of three articles that are related to the research topic. The chapters that appear in this dissertation are the revised and adjusted versions of their respective articles.

The first article, "An Essay on Sustainability, Modern Economics, and Implications for International Trade" was presented at the 2nd International Conference on Advancement of Development Administrative 2013 (ICADA 2013), and appeared in the conference proceedings. It was originally constructed as a comprehensive literature review paper for the purpose of the conference, and the empirical part testing the Environmental Kuznets Curve (EKC) was later added soon after the conference presentation in order to provide quantitative elements to the article. Given its original nature, it was designed to contribute to the literature review part of the overall dissertation. The Third Chapter of this dissertation is a revised/modified version of the presented article.

The second article, titled "Trade and Sustainability: How Strong are the Empirical Linkages between Trade Structures and Sustainability Performance?" was presented at the SIBR - Thammasat 2014 Bangkok Conference, and was accepted for publication in the International Journal of Economic Policy in Emerging Economies, a Scopus-indexed journal. It focuses on the empirical aspects of pollution in trade, classified by sectors of production. The corresponding chapter in this dissertation is the revised and adjusted version of the article.

As the preceding two articles had already fulfilled the presentation and publication requirements, the third article, “What Determines International Sustainability Compliance?: A Case Study of Nations’ Signing and Ratification in Multilateral Environmental Agreements”, is included directly into the dissertation paper as the third research chapter, and has not been presented or published in another place. This paper deals with countries’ cooperation in international environmental agreements.

CHAPTER 2
LITERATURE REVIEW

This section will address mainly the issues of Sustainable Development paradigm and the environmental concerns that underline the importance of this study, and to clarify the primary concern of why development paradigms (currently emphasizing on economic progress) must take into account the aspects of sustainability. The logic presented in this section will be employed throughout the paper and is the basis for the upcoming three chapters. The relationship between Economics/trade and the environment will be addressed extensively in the Third Chapter (which is the first presentation research article, as it was designed explicitly for this purpose). Literatures dealing with model specifications or specialized topics are covered within their respective chapters.

One of the first questions that are often encountered when addressing Sustainable Development is about its definition, such as what it refers to and how it functions. The concept of modern Sustainable Development comes from the 1987 Brundtland Report, which is defined as "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs", suggesting that economic development and growth must not neglect environmental and social considerations. The concept underlines the existence of three interdependent dimensions of the world.

The Economic Dimension: Growth, income, business, industrialization, profit, globalization, trade, technological advancement

The Environmental Dimension: Ecosphere vitality and resilience, pollution, climate change, natural resources, biodiversity, conservation of natural capital, energy usage

The Social Dimension: Income distribution, peace, conflict, welfare, equitability and access to resources, poverty reduction

Such imbalances are still widely present, even in the 21st Century. Calkins (2008) presented four main problems with the conventional capitalist paradigm: persistence of socioeconomic imbalances, short-run maximization of production and consumption, severely imbalanced distribution of income and resources, and severe cynicism towards human nature (as conventional economic thinking views that humans are inherently and invariably selfish), while Palmer, Cooper, and van der Vorst (1997) disagrees with the notion of viewing Sustainable Development merely as a wealth-maximizing incentive which places development at a much higher priority relative to actual sustainability. In addition, widespread socioeconomic problems can persist even in economies with high growth and wealth creation, due to unbalanced development (Bhongmakapat, 2010, 2011a, 2011b; Calkins, 2008; Mongsawad, 2010). At any rate, it is unlikely that such problems will subside by themselves, and active measures may need to be taken. The Brundtland report encourages the use of rules and regulations, both in the domestic and international scale, while Mongsawad (2010) emphasizes the role of governments in strengthening social institutions to deal with market failures. It is stressed in van Zeijl-Rozema, Cörvers, Kemp, and Martens (2008) that Sustainable Development will require governance in order to be successfully implemented, due to its complexity and characteristics. Also, the obstacles to an efficient and equitable economic development can be attributed to corruption (affecting the quality of policies in the public sector) and wealth seeking activities with low to no regards to public welfare or long-run consequences (Bhongmakapat, 2010, 2011a). The advocacy of such regulatory measures is discussed in detail in the Third Chapter's literature review section.

When discussing the relationship between growth and sustainability, one must keep in mind that the problem is the imbalanced manner of economic growth which focuses solely on economic benefits, rather than growth itself (Isarangkun & Pootrakool, 2002). While growth in a limited world is likely finite, development can be made possible, while taking into account the rates of environmental consumption and replenishment (consumption vs. regeneration, or emission vs. absorption) in order to allow sustainable progress (Daly, 1990), where the destruction or exhaustion of natural resources are related to excessive production and consumption activities

(Puntasen, 2007). Palmer et al. (1997) considered the notion of Sustainable Development to be characterized by four aspects: Futurity (taking into account the needs of future generations), Environment, Equity (taking into account the needs of the present generation and the poor), and Public Participation.

Note that there are two main forms of sustainability: “weak sustainability” and “strong sustainability”. The two terms are divided by their views on the overall stock of capital, where capital is divided into two types: natural and man-made (Daly, 1990; Dietz & Neumayer, 2007; Ekins, Folke, & Costanza, 1994). Weak sustainability views both natural and manufactured capital as substitutable/exchangeable, and is concerned with the conservation of total capital, and accepts the trade-off of lowered natural capital if it is compensated with higher amounts of man-made capital (i.e. the use of natural capital is acceptable as long as it generates manufactured capital in return). Strong sustainability, on the other hand, regards the natural capital as irreplaceable and advocates its conservation, even if exhaustion can generate more man-made capital. Weak sustainability is derived from the viewpoint that natural and manufactured capital are almost identical, both in terms of characteristics and welfare effects (Ekins et al., 1994). Additionally, two more categories of sustainability can also be identified, which are “very weak sustainability”, where constant per capita consumption is a sufficient indicator, and “very strong sustainability”, which mandates that all environmental capital must be strictly preserved (Hediger, 2006).

In certain scenarios, the welfare generated by natural and manufactured capital may be substitutable, and the weak sustainability condition can be sufficient, however, in general, strong sustainability is to be preferred over weak sustainability, as manufactured capital can almost always be reproduced when lost, as long as production capabilities exist, while natural capital exhaustion is often irreversible (Ayres, van den Bergh, & Gowdy, 1998; Ekins et al., 1994). Ekins et al. went on to argue that complete substitution may never occur as the creation of many manufactured capital would require natural capital nonetheless.

Viewpoints on measures to be taken to ensure Sustainable Development involve actions on different scales. While the Brundtland Report advocates the use of national and supranational regulations and policies to deal with persistent problems, Ayres et al. (1998) points out that agents' actions will tend to be decentralized, and the decision process mainly takes place amongst smaller economic units. Bagheri and Hjorth (2007) proposes that the implementation of sustainability initiatives would also require the social learning process and active participation of the public, as Sustainable Development is viewed as success in promoting adaptive capabilities as opposed to traditional concepts of planning. Similar advocacy on learning progress is also proposed by van Zeijl-Rozema et al. (2008) which argues that the implementation of Sustainable Development and the goals can vary depending on the characteristics of the state and society. In addition to conventional institutional measures, the paradigm's success will ultimately require the participation of individual agents (as human capital), who should also take into account the concepts of morality and considerations towards the society, not acting merely out of self-interest (Bhongmakapat, 2010, 2011a; Indaratna, 2007). These moral and ethical concepts are required to foster governance in the governmental and political level, to insure that policies are enacted in the best interests of the people (Bhongmakapat, 2010, 2011a; Mongsawad, 2010). Finally, any and all resource conflict caused by shortage of natural capital must be met by a peaceful, non-violent solution, as armed or violent actions will only deteriorate the environmental and social conditions further (Salehyan, 2008).

Next, we compare the viewpoints of several paradigms of interest: the conventional capitalistic paradigm (often referred to as "Economics-as-usual"), the Sustainable Development paradigm (Sustainable capitalism), the Sufficiency Economy Philosophy (a society-oriented market economy favouring balanced growth), and the Self-sufficiency Paradigm (Minimalism). It is noteworthy that the latter two are often mistaken for one another, while, in reality, their viewpoints are highly divergent on many important issues, especially the views on market economy, globalization and participation in such economic environments.

The philosophy of Sufficiency Economy is a framework which advocates moderated growth, as opposed to short-term growth maximization. The philosophy acknowledges the adverse effect of imbalanced development that can impose social, environmental, and even economic adversities on the society if development goals are too focused on short-term income growth (Calkins, 2008; Isarangkun & Pootrakool, 2002; Mongsawad, 2010; Puntasen & Rees, 2008; The Chaipattana Foundation, undated a). The paradigm is skeptical towards the conventional goal of income and profit maximization, and is concerned with the social and environmental side-effects of globalization, but does not reject it, instead viewing globalization as a source of both economic benefits and greater risks (which will mostly be borne by the people, much of them are poor or underprivileged). On the household level, Sufficiency Economy can promote prudent allocation of resources. Chalapati (2008) suggests that this can be achieved through education, with the hope of reducing rural poverty problems and enhancing a nation's human capital for both local and global needs, and Indaratna (2007) proposes that human and people are the most important aspect of development, and that human potential and ethical considerations should be promoted to the fullest extent, both at the national and international level, to ensure Sustainable Development. The paradigm should serve as a contribution to both societal well-being and Sustainable Development on a wider scale through networking (Isarangkun & Pootrakool, 2002).

Another paradigm of interest is the modern Self-sufficiency paradigm, which is a minimalist framework which opposes the capitalistic system and globalization. A noteworthy example of the framework of Self-sufficiency is "The Simpler Way" approach, as proposed by Trainer in his series of articles (Trainer, 1990, 2009, 2011), which corresponds to the "very strong sustainability" viewpoint, where natural capital is not substitutable by man-made process and preservation is to be made through a zero-growth economy.

While it is not difficult for the average person to confuse Sufficiency Economy with Self-sufficiency (given their names), this is a misunderstanding. While both paradigms promote self-reliance and lower dependence on the capitalistic

market, in order to enhance economic resiliency for households and individuals, the extent of this self-reliance aspect differs considerably, between the two paradigms. This is one of the points where they are separated from one another - the Sufficiency Economy paradigm adheres to the concepts of moderation and consideration of causal relationships (reasonableness), where total self-containment, autarky, or the complete lack of external linkages are viewed as a breach of these concepts (The Chaipattana Foundation, undated b) while the school of Minimalism advocates that agents or households should be totally self-reliant (Trainer, 1990, 2009, 2011). Minimalists may argue that this is necessary to protect ecosystems and the environment, which are viewed as irreplaceable, and that any capitalist system will not solve any major global problems.

The Table 2.1 (divided into 3 parts) illustrates the comparison between the four economic paradigms, with respect to their viewpoints on different issues.

Table 2.1 – Comparisons of Economic Concepts with regard to Sustainability.

Comparison of Economic Concepts with regard to Sustainability				
	Conventional Capitalist Paradigm	**Sustainable Development (Sustainable Capitalism)**	**Sufficiency Economy**	**Self-sufficiency (Minimalism)**
Main Objective	Profit and growth maximization	Environmental preservation and reduction of negative externalities	Ensure social well-being and welfare of households/ community/society	Relinquishment of unnatural activities towards a simple lifestyle
Orientation (wrt. 3 Spheres)	*Economic Sphere* (as paramount and, in some cases, the sole objective)	*Environmental Sphere* (permits growth, but places the envi. As top priority)	*Social Sphere* (focuses on moderating the Economic Sphere to mitigate social adversities)	*Environmental Sphere* (disapproves growth and views that people are weary of the burdens of the economy)
Views on the Economic Sphere	Economic progress is a paramount goal. Business and expansion are vital to the livelihood of human society.	Economic progress is beneficial to mankind, but rapid expansion is currently destroying the environment.	Economic progress is desirable, but must be attained with prudence with proper care and moderation.	Economic progress is unnatural and undesirable, and should be abandoned for the sake of a simple lifestyle.
Views on the Environmental Sphere	The ecosphere is a pool of natural capital that can serve as useful sources of input, and generate jobs and profit.	The ecosphere is an irreplaceable stock of capital that must be protected, or otherwise, mankind will ultimately bear the costs.	The ecosphere is a pool of capital that can be drawn on. At any rate, excessive use is discouraged since exhaustion will generate social problems.	The ecosphere is both a valuable asset to mankind and is also a goal in itself. Mankind should learn to embrace this as the new, correct way of life.
Views on the Social Sphere	Businesses will function better in economies where social structures promote enterprises and facilitate investments.	The social sphere is another dimension that cannot be overlooked. Social protection must be made together with environmental protection.	The welfare of the people, up from the household level to the national level must be shielded from disruptions caused by imbalanced development.	By adopting a non-competitive way of life close to nature, social qualities will be enhanced and happiness can be enjoyed in the society.

Comparison of Economic Concepts with regard to Sustainability (continued)				
	Conventional Capitalist Paradigm	**Sustainable Development (Sustainable Capitalism)**	**Sufficiency Economy**	**Self-sufficiency (Minimalism)**
Views on Growth	Is skeptical towards the concept of limits to growth and relies on technology and gains from economic growth to solve problems in other spheres	Is concerned with the looming possibility that there might not be much more room left for "economic-growth-as-usual"	Supports economic growth and advancement, but recommends a steadier pace to ensure stable development, even if some rapidness is sacrificed	Denounces growth as unnecessary and detrimental, with some schools advocating zero-growth economy or even abandonment
Views on International Trade	Trade is a major engine to growth and will create new business opportunities. As such, trade should be promoted as much as possible.	International Trade, albeit useful and important, is also associated with costs and may correspond to environmental and social malpractices abroad.	Contrary to popular misconception, SE supports trade as the outlet for products and a channel of distribution. At any rate, communities must not rely solely on trade and must be able to support itself.	International trade serves little purpose, is redundant and wasteful as people incur costs and use up resources in procuring items that can be produced & consumed locally.
Views on Globalization	Globalization is a valuable advancement that allows countries and businesses to benefit from a greater network of production & consumption.	Globalization contributes much to the well-being of mankind, but also exacerbates the scope and scale of environmental damages coming from commercial mass-production.	Globalization is an inevitable trend, and, as a result, economic agents should learn to adapt and live within it in a prudent and careful manner.	Globalization brings people further in the wrong direction, as people are supposed to live as simply as possible and globalization is to be rejected.
Views on Investment	Investment contributes to future growth and the stock of capital. Investment brings progress and better standards of living in the host economy.	When an enterprise invests in the host economy, it must always take into account the environmental and social well-being in the local economy.	Investment helps economic livelihood and enhances living standards, but an investment decision must be made on the basis of reasonableness and proper risk assessment.	Mainstream capitalistic investments are unnecessary and people should only invest to replace damaged capital or equipment.
Views on Regulations	Regulations create excessive costs and deter growth.	Regulations are crucial in protecting long-run welfare.	Regulations must protect the interests of community/society.	Regulations might be replaced with simpler social structures.

Comparison of Economic Concepts with regard to Sustainability (continued)				
	Conventional Capitalist Paradigm	**Sustainable Development (Sustainable Capitalism)**	**Sufficiency Economy**	**Self-sufficiency (Minimalism)**
Views on Profit	There is no evil in seeking profit, as long as one does not break the law. Profits will ultimately help the society and are the lifeline of the economy.	While profit is essential for businesses, maximization must be done with respect to environmental and social necessities, taking them into account at all times.	Profit is desirable and helps the welfare of local households and enterprises. Yet, excessive profit seeking will create unwanted risks and adversities.	The need for profit is unfounded as people should produce what they need and consume what they produce.
Views on Production	Greater production generates greater amounts of income. Production levels should be optimized to ensure maximum profit levels.	Production modes must be adjusted to be more environmentally & socially friendly. Excessive production is discouraged if it becomes detrimental to the environment.	People can produce and trade products according to their expertise to gain income. Nevertheless, an economic unit must be able to support itself to some degree during adversities.	People should produce everything they need by themselves. No external trade is necessary.
Views on Distribution	The trickle-down effect will eventually facilitate the flow of wealth to the poor and the underprivileged. Therefore, wealth-seeking activities are in the best interests of the society.	Equitable distribution is unlikely to occur by itself, and proper social and/or institutional structures are needed to achieve equitability.	The poor and the underprivileged should be empowered through local collaborations and SMES, so that they will be able to depend on themselves to some degree.	A society will be fairer for all if it does away with the corporate structures and capitalistic way of life.
Implementation	Private sectors and corporations have the incentive to conduct business in line with this economic concept.	Initiatives and practical actions must start from supranational bodies and agreements, in order to ensure serious action, since the environmental challenge has become a global issue requiring worldwide collaboration.	In contrast to the framework of Sustainable Development (a top-down approach), the Sufficiency Economy concept is best applied bottom-up, starting with individuals and expanding into communities and onto societal level.	Minimalism or Self-sufficiency will likely begin only with individuals or communities wishing to do so, at any rate, institutional changes will be difficult as it clashes with the modern structure of capitalism.

Arguably, the conventional capitalistic paradigm corresponds to weak sustainability, where natural resources can be spent or used up to a considerable degree as long as they can generate manufactured capital as compensation for their usage. Nevertheless, the adequacy of this approach is becoming increasingly questionable with greater frequencies of natural disasters and the rapidly deteriorating environmental conditions worldwide. The frameworks of Sustainable Development and Sufficiency Economy correspond most to the definitions of strong sustainability, allowing conditional, moderated growth in a market-based capitalist system, where the implementations of SD tend to be focused more on dealing with environmental or ecological imbalances, while SE implementations are more focused on correcting social imbalances. The strict Self-sufficiency framework, on the other hand, follows the implications of the very strong sustainability concept, advocating zero growth and prioritizing ecosystem preservation and minimalistic values as the dominant priority.

These issues presented in this chapter underline the importance of the Environmental and Social Dimensions, and acknowledges their potential contribution to economic well-being, as well as the reality that economic actions and development courses will inevitably affect these two spheres. This paper considers growth and trade to be useful and beneficial instruments of welfare and the quality of life, yet, the pursuit of these economic goals must not come at the gross expense of the environment or social well-being, as economic progress is ultimately not the only contributing factor of human welfare.

This section visited the main issues of Sustainable Development, discussing that Sustainable Development is a possible and perhaps crucial objective. Its implementation would require cooperation from different sectors, and both regulatory and individual measures are to be taken. In addition, sustainability takes two forms, which are the weak sustainability and strong sustainability, based on the assumptions regarding the interchangeability between natural and manufactured capital. This dissertation is in favor of the strong sustainability approach, as not all natural capital can be satisfactorily compensated by man-made capital, and some functions of the global ecosphere would require the continued presence of natural capital (i.e. natural

environmental stabilization mechanisms - which humans can poorly replicate with present technological capabilities - or the diversity of species, which cannot be replicated by manufactured capital). Afterwards, the chapter examines the core values and differences/similarities between different economic frameworks that are related to modern sustainability outlook (the conventional capitalistic paradigm is the base case, while the other three are proposed alternative frameworks for dealing with environmental and social imbalances). The discussion of the relationship between international trade, economic theories, and environmental concerns will be addressed in the next chapter.

For the purpose of this research, it is hoped that some positive relationships between economic development (especially through trade-related aspects), environmental quality, and social integrity (governance) are present – a set of hypotheses to be tested, yet the paper takes into account the reality that economic and environmental interests may frequently clash, or that trade-offs may be present in many cases. We explore these issues through different facets on the upcoming chapters.

CHAPTER 3
ECONOMIC GROWTH, TRADE, AND ENVIRONMENTAL CONCERNS

BASED ON THE 1ST ARTICLE – PRESENTED AT THE ICADA 2013 INTERNATIONAL CONFERENCE (NIDA)

"An Essay on Sustainability, Modern Economics, and Implications for International Trade"

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Abstract

Given the alarming situation of environmental and social problems, despite notable progress in the global economic performance over the years, there have been numerous concerns from academic, public and business sectors, prompting reflections and adjustments in the economic paradigm - the way we run our global economy. Seeking to facilitate increased understanding about the issue and linkages between economic progress and sustainability, this paper conducts a comprehensive literature review on existing work that deals with the relevant relationships and proposed solutions. The main issues under discussion are the potential, theoretical and observed contribution of modern economics on sustainable development, as well as the role of international trade, as a key important facilitator of growth and economic progress, in shaping the outcome in the three Dimensions. It is observed that the conventional arguments supporting the maximization of economic progress, liberalization and income, while not without merits, are still not fully applicable in all cases with respect to the real-world necessity in the three dimensions of sustainability, which are the Economic, Environmental and Social Dimensions. This paper consists of a comprehensive literature review part, which examines the different viewpoints, and

the empirical evidence part, which estimates the turning point income per capita level for 5 types of chemical emissions (CO2, SO2, CH4, N2O, and F-gases). Using the original EKC regression for the time period between 1990 and 2011, the results have suggested that the level of emissions (flow of pollution) decreases at a high, yet attainable (albeit difficult) levels of GDPK, in the cases of SO2 and CH4, while N2O and F-gases do not follow the inverted-U curve (i.e. not well-behaved). We also observe that CO2 does have a turning point of its own, but the level of per capita income needed to satisfy such condition is prohibitively (if not impossibly) high. Therefore, the result suggests that economies cannot rely only on *Economic* progress to solve their *Environmental* problems, and that rules and regulations may be needed to shift the EKC curve downward for all income levels, rather than simply moving along the curve. The result supports the pro-regulation argument.

3.1 INTRODUCTION

3.1.1 The Modern World – Opportunities and Challenges

The modern global economy benefits from the presence of extensive networking, connectivity, as well as ample economic and business opportunities that contribute to better standards of living of much of the global population. Economic growth and progress characterizes the global community of today, and is considered to be one of the most important goals in much of the world. As the prospects of domestic production, consumption, and networking are limited, nations and enterprises rely on trade to drive the economy forward, where it contributes to the expansion of consumption and production capabilities, and is relied on as a future remedy of poverty and other adversities we face.

At any rate, the world is still plagued with many problems, and some of these are becoming more frequent and more severe, possibly due to human actions. Some of the most evident of these problems are non-economic, but are environmental, and include the issues of global climate change, exhaustion of natural resources, a rise in the number of endangered species, and the concentration of pollutant substances. In

addition, social problems are also present in the forms of inequitable distribution of income, exploitation of the poor and underprivileged, as well as the more subtle issues of consumerist mindset which contributes to some of the well-known social problems such as rising crime rates and decline in morality. While parts of the global economy are doing well with respect to the Economic sphere, this is currently at the expense of the other two spheres (Environmental and Economic). Questions have risen on whether this development trend can continue indefinitely, and what might be the alternatives to the current development paradigm? Nevertheless, it will be unfair to blame all of the problems on the economy and trade, especially without looking at the benefits they have contributed to; despite the cons, the pros of modern economic development must not be overlooked. This gives rise to an important question: "Can economic growth, spearheaded by international trade, be made a force that contributes to Sustainable Development, or, at least, conforms to it, rather than be left merely as a channel for income enhancement?"

3.1.2 Objectives

As was mentioned, the world is comprised of three overlapping dimensions, which are the Economic, Environmental, and Social Dimensions. Yet, these dimensions are often regarded separately, both in theory and (even more so) in practice. In addition, while many environmentalists claim that globalization and trade are responsible, at least partially, for the rapid degradation of the environment and its consequences, free-traders and free market advocates justifies both as engines to growth and disagrees with the interference of environmental measures that may impede them. As a result, a conclusion often remains elusive between the two factions. In this light, this paper aims to examine the issues related to the link between modern economics, international trade, and Sustainable Development.

This chapter has two parts; the first part is a comprehensive literature review which was designed to augment the Literature Review Section of the main dissertation, whereas the second part of the article is an empirical econometric analysis, using a quadratic function model to estimate the turning-point GDP per capita levels for five major categories of pollutant substances.

The first section of the paper will conduct a comprehensive literature review on the related issues, in line with several preceding papers, such as Esty (2001), Jayadevappa and Chhatre (2000), and Arrow et al. (1995), where the first part will deal with the topics of 1. Sustainable Development and its general lessons/implications, 2. the role and contribution of economics in the promotion of Sustainable Development, and, 3. an outlook on modern international trade and its relationship with sustainability components.

3.2 LESSONS AND CURRENT PROGRESS

3.2.1 What We Have Learned from Sustainable Development

The seminal Brundtland Report of 1987 illustrates an important message that our world is comprised of three spheres or dimensions: the Economic, Social, and Environmental Dimensions. This concept is fundamental to the understanding of the Sustainable Development concept. Despite being individual components, they are not separate and can be said to be dependent on one another, as all of them are necessary aspects of the global community and are needed to maintain livelihood of the human society; if one sphere were to fail, it is very likely that the other remaining two spheres will be adversely affected. Presently, however, concerns have been raised on whether the Economic Dimension has been over-prioritized while the Environmental and Social Dimensions are not receiving proper considerations.

The Brundtland Report mentioned a wide range of problems that are present in the global economy, many of which are still prevalent even after more than two decades of the Report's conception. Given the emphasis on the Economic sphere, and the relative lack of attention towards the other two, numerous environmental and social problems are attributed as side-effects of imbalanced economic development. An additional concern is that, given the connectedness of the three spheres, environmental and social problems will likely translate back to economic costs and hindrance.

Table 3.1 – Examples of Problems Related to the Three Dimensions.

	Affected Sphere		
	Economic	**Environmental**	**Social**
Root Sphere	Examples of Problems		
Economic	Financial crises, Public debt, Asset bubbles	Poverty-led abuses of public natural resources	Resource conflicts, Inequality/poverty, Crime
Environmental	Resource depletion, Pollution costs, Natural disasters	Vicious cycles, Desertification, Chain effects	Forced Relocation, Food security issues, Homelessness
Social	Unproductive values, Corruption & Fraud, Low HR quality	Low public-mindedness, Overexpansion of human communities	Violence, Narcotics, Moral decays, Discrimination

Source: Author's Compilation

In the Brundtland Report, a number of inter-dimensional problems are addressed, these range from environmental deterioration caused by necessity, out of impoverishment and lack of income (as other economic alternatives are not present), to political unrests and national conflicts or disputes that are the result of environmental problems or resource scarcity, and so on. Imbalances in a given

dimension are not confined to their own spheres, but will likely affect the other two dimensions as well.

Some of the prominent modern-day problems experienced by the human society are listed in the Table 3.1. The column "Root Sphere" here refers to the sphere where the problem originates, while "Affected Sphere" denotes the sphere affected most seriously by the problem. Some problems are concerned mainly with their respective spheres, such as economic crises, while others may translate into significant impacts on the other dimensions. For example, a number of economic imbalances may be the cause of environmental and social problems (Grossman & Krueger, 1995), such as occurrences of public resource exhaustion driven by economic necessities, mentioned in the Brundtland Report, or resource conflicts (possibly resulting from the scarcity of water or other vital factors of production), which can also be traced back to economic or financial motives. In addition, environmental imbalances can ultimately generate economic costs (Arrow et al., 1995). An example of this is when resource depletion impedes the production process and disrupts economic activities, where another notable example is the occurrence of pollution (including the resulting natural disasters), which generates costs in the forms of damage and losses, including the incurred expenses to mitigate the adverse effects resulting from such events. It should be noted that equitable intergenerational utilization of resources (especially non-renewable resources or ones that require a long time to replenish) is needed if Sustainable Development is to be achieved, and will not likely be achieved through the maximization of present-period consumption (Weiss, 1992). Economies should also avoid taking actions that lower the welfare of future generations (Pearce, Atkinson, & Dubourg, 1994). These recommendations suggest that economies and agents should be optimizing their use of resources (with respect to beyond-income goals) rather than maximizing such utilizations outright in their lifetimes.

In addition to the environmental issues, economic disturbances may also result from social imbalances as well. These problems would range from explicit problems such as war, conflict or widespread violence, to corruption and unfair practices, which incurs unproductive costs to agents and enterprises. Even unproductive or detrimental values can also affect economic competitiveness, productivity, and efficiency. An interesting point of note is that the intensely (and excessively) competitive environment may also generate undesirable social effects, especially on the individual level affecting agents, and may even lead to sub-optimal outcomes for the society (Bhongmakapat, 2010, 2011a; Payutto & Evans, 1994). These examples demonstrate that the three dimensions are connected and may have profound effects on one another.

3.2.2 The Current Achievements and Failures of Sustainability Actions

The agenda of Sustainable Development is arguably successful in triggering public awareness on environmental and social concerns. People are made more aware of the importance of the beyond-profit dimensions of the world, and these waves of awareness resulted in awareness and advocacy of numerous frameworks that helped in shaping the modern economy of the 21st Century, despite certain limitations and shortcomings. An example of this is the "Triple Bottom Line" framework, first outlined by John Elkington in 1994. This approach that emerged as a response to the Brundtland Report became a guideline that influenced the business practices of numerous enterprises around the world (Down to Earth Project (Danone), 2012). Following the emergence of the Sustainable Development agenda, corresponding research projects and government initiatives were launched, much likely due to the increased public awareness, knowledge, as well as a fair degree of curiosity on the subject.

At any rate, this does not mean that the task is done for sustainability advocates (in particular the supporters of "strong sustainability", which underlines the importance of environmental capital conservation due to their exhaustible and irreplaceable nature). A number of issues still remain, and some can be potentially

threatening to the livelihood of the human society and economy. Hauff (2007), summarizing the achievements of sustainability actions 20 years after the launch of the initial Brundtland Report, expressed the concern on six issues that needs to be addressed despite notable progress made during the 20 years of the agenda, these are 1. the prevention of armed conflicts, in particular the use of nuclear weaponry 2. the alleviation of poverty, 3. the need to rethink the concept of growth dependent on finite resources 4. the need to address the climate change problem and move towards a low-carbon society 5. the efforts to promote worldwide food security, and 6. the moderation of urban consumption and the effects of urbanization on natural resources, especially soil quality. It has been noted that much imbalances are present in the environmental and social dimensions. Corruption and inequitable distribution of income, as well as over-usage of environmental resources remain important problems in various parts of the world, obstructing development (Bhongmakapat, 2010, 2011a). As such, it can be argued that the warnings of the Brundtland Report remain in place, despite the Sustainability agenda's success in raising awareness and prompting initiatives. In addition, it is worrisome that a majority of countries, regardless of their good intentions and the presence of some practical action, are still moving away from sustainability practices (Fiala, 2008; Moran, Wackernagel, Kitzes, Goldfinger, & Boutaud, 2008).

Of course, these problems may be viewed as normal side-effects of economic development, which will eventually subside when adequate growth and technological progress becomes available, yet, some would argue that the strictly income-oriented economic paradigm is the very cause of the problems, which will persist as long as the global economy continues to function in this manner. Opinions are frequently varied in this issue, even amongst "sustainability advocates". Lélé (1991) recommended that joint efforts between the pro-growth and environmentalist factions are needed, and, in order to practically implement the agenda of Sustainable Development, the two groups will need to work together beyond the scope of theories and assumption-based models. Empirics are important in dealing with the issues, and both factions will need to accept the inadequacy of existing conventional economic theories.

There are credible reasoning and arguments present in all sides of the Sustainable Development debate. Yet, advocates of the conventional economic and business paradigms also need to consider the possibility that some measures of environmental degradation or pollution will not be decreasing with income levels, and that economic development alone will likely leave persistent imbalances unchecked. It is even possible that the relationship will always be increasing regardless of income as well. In addition, where attainable "turning points" of environmental degradation do exist, the accumulated levels of deterioration may have already been very high, as was noted in Andreoni and Levinson (2001), and Muradian and Martinez-Alier (2001).

Nevertheless, opponents of the "economics-as-usual" will also need communication strategies that will facilitate mutual understanding and lead to compromising solutions, preferably ones that are acceptable even for different groups of people, from globalization advocates to environmentalists. These issues are discussed in the following sections.

3.3 ECONOMICS AND SUSTAINABILITY – THE FOCAL ISSUES

3.3.1 The Role of Economics in Contributing to Sustainability

It is not a surprise to observe vastly differing opinions between individuals on whether, how, and to what extent economics can play a role in promoting sustainability. Some would strongly advocate the role of the economy in correcting environmental and social imbalances, arguing that economic progress can provide solution to a majority of existing problems, while others would argue that economics should be responsible for its own progress rather than be dedicated to the alleviation of problems in other spheres, and some would dismiss the relationship altogether. In addition, opinions would differ even amongst advocates of Sustainable Development, most frequently with respect to the methods of action and practical guidelines. The Brundtland Report in 1987 suggests that economies should make use of rules of law, standards, policies, incentives, as well as other regulatory instruments, which are

available options in the modern capitalistic market-based system. In a different viewpoint on sustainability, some skeptics of the capitalistic system such as Trainer (1990, 2009, 2011) strongly rejects such solutions as being utterly inadequate, and proposed an entirely different set of development paradigm, favouring a minimalist approach advocating a zero-growth society. On the other hand, starkly contrasting the minimalist view is the advocacy of profit as the single, dominant objective of business enterprises, as suggested by the legendary economist Milton Friedman (1970), who argued that the best way that corporations can contribute to the society is to focus on their profit-making activities (while, of course, adhering to the rules of law and not infringing ethical norms of the society), rather than diverting their resources to pursue other non-profit goals. Another Nobel Laureate, Joseph Stiglitz, is concerned with the negative side effects of globalization, ranging from unfair practices in economic activities, to social and environmental imbalances caused by the very process which he criticizes as unfair (Stiglitz, 2006).

Opinions would also differ with regards to obligations. If we follow Friedman's 1970 arguments, the responsibility to preserve the environment and deter social problems would not disappear, but rather fall on regulatory bodies and the enforcement mechanisms, as businesses are set to operate within the constraints of rules and law, but not beyond such specified responsibilities. If the more strict concept of corporate social responsibility is held, then businesses would have a more direct obligation to contribute to sustainability (or, at the very least, not undermining it). Here, as always, one can expect to observe varied opinions on different topics of the issue. The debate exists on detailed topics, such as the degree of government interventions of the price mechanism, and large-scale conceptual issues such as global development paradigm alike. This section is meant to illustrate the diversity of viewpoints on the sustainability issue, not unlike the discussion on "weak versus strong sustainability" addressed in the previous chapter.

Nevertheless, one thing that most people do seem to agree in common is that, when problems are present, they are usually the side-effects of market activities in the form of externalities. These market imperfections can be dealt with through the use of regulations, serving as part of the adjustment mechanism (Arrow et al., 1995; Bhongmakapat, 2010, 2011a; Ekins et al., 1994; Esty, 2001). After all, markets tend to be imperfect in dealing with issues running beyond economic efficiency, thus prompting the need for prudent measures (Krugman, 2010). Given the importance and necessity of such instruments, however, the use of environmental regulations is not always supported, particularly when it comes to multilateral trade. In line with his previously mentioned arguments, Friedman denounces government controls and advocates a free-market system driven by voluntary cooperation, arguing that optimal outcomes will be ensured when the system is that of a free economy. A similar argument against non-market measures are also stressed by Tilton (1996), arguing that resource allocation should be taken care of through market mechanisms, and that public interventions should only be used when necessary, as improvements rather than replacements. On the other side of the argument, Stiglitz (2006) pointed out that economic expansion can lead to inequitable practices, an occurrence frequently observed in developing countries, and suggested that welfare and equity should be the ultimate goal of development. Bhongmakapat (2010, 2011a), in addition to his support on the use of regulations and taxation to dissuade undesirable behaviour, stresses the importance of "mind development", which is related to the formulation of human actions and economic decisions. He argued that as agents' actions and choices are derived from their preferences, these preferences of individuals can collectively influence economic outcome in the society. In addition, one can view economic actions as derived from matters of incentives (Lloyd, 2010) and undesirable economic behaviour can therefore be corrected or reduced by setting the incentives and disincentives accordingly, while socially and environmentally desirable behaviour can also be encouraged in a similar manner (Arrow et al., 1995; Goklany, 1995; Lloyd, 2010).

The debates on how to correct the environmental and social side-effects of economic development will continue, yet the policy recommendations from each side are clear. For free market advocates, the need for rigorous controls is often dismissed in favor of a business-friendly environment and to promote competitive entrepreneurial efficiency, while sustainability advocates, economics-as-usual critics and environmentalists would support instruments that can keep corporate activities in check to limit undesirable side-effects or negative externalities. The degree and extent of such measures vary from the promotion of more efficient enforcement of existing laws, to the introduction of new and more strict rules and regulations (which may also be potentially unattractive from the economic point of view), to the more in-depth measures to promote the public-mindedness and sustainability awareness of individuals and economic agents (which may be achieved by education, or even ethical concepts or religious institutions).

The economy and the ecosphere are affected by the collective economic actions of entities in various scales – nations, corporations, policymakers, consumers, producers, firms and households. These bodies are, in turn, formed from the individual persons who are the smallest economic units, acting in accordance with their internal maximization problems. One consideration is that the aspects of utility and preferences are usually regarded as exogenous, and tends to be taken for granted, in part due to the difficulty to accurately measure them, especially across individuals. While this is very useful when formulating models, it says little about the "appropriateness" of a person's utility function. Preferences by themselves pose no harm, but as the actions derived from them can have different results on the society and the environment. For example, different consumption behaviour can generate different impacts on the environment, especially when the collective actions of agents are accumulated. Given the real-world settings where externalities and market imperfections are present, the human mind and preferences become an influential factor in driving market outcomes (Bhongmakapat, 2010, 2011a). Another assumption that differs from real-world reality is the simplifying assumption that all agents are identical in terms of preferences, since individuals would differ drastically from one person to another. This simplification may fail to explain why environmental and

social imbalances are rampantly present or persistent in some economies, but are rare or almost non-existent in others. An alternative line of work, proposed by Bhongmakapat (2011b) categorizes economic agents into three groups according to a set of relative preferences between "material/economic" benefits (which can include profits, monetary gains, consumption, luxuries, accumulation of wealth, and so on), and "happiness" or societal gains (comparable to non-profit aspects such as one's own peace of mind, societal quality, environmental quality, feelings of contentment, etc.) which proxies the satisfaction derived from non-material and non-economic factors. The latter item can often include actions that are not economically profitable, but generates social benefits which are not necessarily confined to oneself. This is a qualitative aspect of the issue, which, unfortunately, may remain difficult to quantify with large-scale statistics, given the detailed nature of the human mind. Nevertheless, this is an issue that should not be neglected, due to the importance of the human mind in economic activities, and is worthy of future inquiries and attention. The main idea of this issue is that some agents would care mostly or totally about material or immediate benefits, while others would attempt to balance between material and beyond-profit goals, and a small number of agents would dedicate their preferences to beyond-profit goals and are willing to sacrifice economic progress to attain such goals. Pollution and environmental/social deterioration tend to be caused by the first type of strictly materialistic agents.

In reality, economic agents would respond differently to a given situation. For instance, one agent may choose to reconsider or abandon a lucrative business opportunity if it destroys the local environment (and choose a less profitable but more environmentally-friendly alternative), whereas another agent would see little reason in conserving the environment when an income opportunity is present. There are some individuals and corporations who are willing to accept lower income or profit if it means helping the society, those who place financial success as the sole top priority, accepting some environmental and social side-effects as inevitable tradeoffs, and those who will accept the risk of penalties or loss of reputation in favor of higher profits and financial yields. For supporters of the economics-as-usual concept, the second type of individuals may be the most desirable type, since they are

economically and financially efficient, and the third type is useful if they can be regulated. On the other hand, sustainability adherents would be of a different view, seeing the first type as the most desirable type of individuals, the second type tolerable but not commendable, and the third outright dangerous.

Arguably, deterrence mechanisms should be present and prudent in order to dissuade profitable but environmentally or socially harmful activities. If enterprises are expected to commit to beyond-profit goals, some would still remain idle and continue to operate in a usual manner, prompting the use of rules to deter harmful practices anyway. But, if beyond-profit goals are rejected by firms, then the only way to protect the environment from excessive activities and externalities would need to originate from the regulatory bodies, as no other institutions would endorse this objective. In a sense, regardless of the norms of corporate social responsibility, the presence and effectiveness of rules and regulations are important in safeguarding the environment.

At any rate, profit by itself is not by any means evil, and is part of the human economic activity. Yet, it is the way through which profit is gained that is the object of concern. The competitive system naturally eliminates unsuccessful and unprofitable players, who are considered the “losers” in competition, and only the most efficient enterprises can survive. If all agents are public-minded, and are similarly environmentally conscious, then there would be nothing wrong with this natural selection of businesses. If profitability and competitive advantages, however, can be gained through activities that generates significant damages or are the result of other questionable actions, then the firms who find themselves at a heavy disadvantage would be ones who rely on cleaner or more sustainable practices (which are prone to higher costs). In such a case, public-minded firms will likely to be screened out as “incompetent firms” due to their higher costs, which are actually derived from their environmental and social concerns, and only the firms with detrimental but cheaper modes of operation will remain in the competition. This can collectively magnifies the imbalances occurring as negative externalities, and can

slowly become a norm or a culture of environmental and social negligence, due to competition in costs.

Firms' survival is determined by their "efficiency", yet an individual firm and the society may have different definitions on this term, as agents may tend to look at efficiency with respect to their own costs and benefits, while the society takes into account the beyond-profit goals that affect the well-being of the public as well. In the arguments of economists Bhongmakapat and Indaratna, it will be in the best interests of the society if agents and firms were to define the criteria of efficiency as "global" or holistic, rather than "local" (confined to self) or based entirely on self-interests. This argument is of the position that individuals and businesses should consider the welfare of stakeholders, rather than focused solely on the benefits to be enjoyed by the agent itself. This goes beyond the normal notion of stockholders versus stakeholders in that all agents, and not only businesses, should reflect well the consequences of their economic actions on the society. Moreover, the methods and means by which goods are produced are as important as the products themselves (Bhongmakapat & Indaratna, 2009-2010; Esty, 2001). It can then be argued that the methods of production must be, in the words of Schumacher (1973), of a "non-violent" nature, meaning that production activities in the economic sphere should not lead to the destruction of degradation of the balance in the other two dimensions. At any rate, while a number of corporations and enterprises remain focused mostly on profits, many others are already moving towards more sustainable business practices (in different degrees depending on the characteristics of each firm). The actions of firms and the business sector is an important factor in determining sustainability achievements, since the private business sector is arguably the most important and influential element in the modern global economy, and most market-based economies, where the collective actions of business units will determine the outcome in the three dimensions. This may suggest that, as individual beliefs and preferences are translated into the actions of individuals and their business enterprises, the concepts of sustainable growth are to be taken into consideration and should not be neglected.

3.3.2 The Relationship between Economic Growth and the Environment

Amongst the most important issues in the modern world is the debate on "growth in a finite world", which is concerned with the potential courses of action that the global economy should take. The world is comprised of three interdependent spheres, which are the Economic, Environmental, and Social Dimensions, where one sphere can affect the other two. At one point, there will be a certain limit on how much more damages the global ecosphere will be able to take, where, after such a point, rampant imbalances in the environmental sphere will generate catastrophic costs on economies and societies in the form of natural disasters, gross scarcity of resources, and a highly volatile or unstable ecosystem (Arrow et al., 1995; Brundtland & The World Commission on Environment and Development, 1987; Ekins et al., 1994). All of these will prove to be highly damaging to the human civilization itself. As a result, given the concern over this possibility, questions of whether we are over-utilizing our resource supplies and overheating the global ecosphere have risen. Opinions on the possibility of growth are also varied. For optimists, positive growth can be maintained with some adjustment costs, permitting a sustainable global economy with economic progress (Arrow et al., 1995; Brundtland & The World Commission on Environment and Development, 1987; Gradus & Smulders, 1993). Trainer (1990, 2009, 2011), however, would reject the concepts of modern economics and advocate a self-sufficient minimalist approach. Some would propose that continued growth may be feasible, but that the accumulation of wealth and material advancements should not be considered the sole and ultimate goals of development, and that people should place increased emphasis on the beyond-income and materialistic goals, such as achieving an ethical and sustainable society through the development of the human mind and preferences (Bhongmakapat, 2010, 2011a). Here, it has been proposed that a desirable course of action for individuals is to reduce the mental reliance on material possessions, which will serve to limit greed and minimize detrimental behaviour caused by excessive pursuits of self-interest (Bhongmakapat, 2011b).

An important tool for studying the relationship between economic progress and environmental or social quality is the Kuznets Curve (for social and income distribution issues) and its variant, the Environmental Kuznets Curve (EKC, used to assess the relationship between economic progress and the environment). These curves are also known as the Inverted U-Curve, due to their shapes. At any rate, it is noteworthy that the original Kuznets Curve, based on a paper by Kuznets (1955), deals with the relationship between income and inequality, a social aspect, and it suggests that, in earlier stages of development, inequality is expected to increase with income growth. However, it also points out that, after the income levels reach a certain point, inequality begins to decrease as income rises. The curve implies that certain social problems, in this case, inequality, may need to go up with economic expansion for a certain time period, in order to reach a desirable state of economic development where both economic and social conditions are satisfactory. In a sense, it can have an implication for low and middle-income nations to endure certain imbalances while improving their income levels to converge with developed countries, which will then be coupled, eventually, by decreased occurrences of social imbalances. In a similar fashion, the curve can be re-designed to address environmental issues as well (in particular, pollution and emissions). This is straightforwardly called the Environmental Kuznets Curve, and replaces inequality with pollution levels or the amount of emissions. Both strains of the Kuznets Curve imply that developing countries are faced with significant challenges with respect to all three spheres, both in terms of environmental degradation and social problems, coupled with mediocre economic progress. Many research papers and debates are focused on the EKC, with both supporters and critics. One concern is about the EKC's validity in the case of various substances, as it is possible that this eventual decreasing relationship will be true for some measures of pollution, but may not hold for others, whereas many papers would argue in favor of the EKC and its implications. Andreoni and Levinson (2001) argues in favor of the EKC, but on the condition that abatement procedures must be in place to deal with the pollution problem, otherwise the turning point will be too high to be considered practical. Grossman and Krueger (1995), using the data on the measurements of air and water quality, confirmed the patterns suggested by the EKC, arguing that environmental quality does not always degrade as

a direct result of rising income, and that income improvements would first deteriorate environmental quality before eventually improving it, which means that numerous types of environmental degradation would follow the pattern described by the curve. They have also pointed out that the "turning point" of income in the EKC would likely occur at a threshold of around $8000, using 1985 as a base year (ibid.). This result is also confirmed with their prior work, which observed that sulphur dioxide and smoke behaves consistently with the EKC (Grossman & Krueger, 1991). Levinson (2001) gave a corresponding implication that it is not necessary for pollution to increase as a result of economic growth. Given these results and implications, it seems that economic progress through income can provide at least some improvements on the environmental outlook. It then becomes a concern whether this implication is universal, or whether this growth can semi-automatically lead to environmental improvement.

Normally, progress in economic growth and income (and trade which contributes to them) can affect environmental quality by three major channels. These are 1. The Technique Effect: As income increases, the accumulation of wealth and economic progress enables the use of cleaner methods of production, and allows the creation and adoption of more environmentally-friendly technologies and processes, which is a positive contribution of income on environmental quality, 2. The Composition Effect: As income increases with economic growth, consumers would shift their preferences towards cleaner products (possibly due to awareness and the relaxation of economic constraints that confine consumption choices to cheap but dirty products), which is also a positive effect, and 3. The Scale Effect: As the economy expands, the coupling expansion in economic activities, production, consumption and other supporting activities would result in rising pollution levels and greater impacts on the environment, which is almost always a negative effect on the ecosphere (Esty, 2001; Grossman & Krueger, 1995). In this sense, the gross effect of economic development on the environment will depend on the interaction of the three effects. The Technique Effect contributes positively to environmental quality, while the Scale Effect always contributes negatively to the environment. The Composition Effect may aid the Technique Effect, but it is possible that the shift may also go in

favor of goods that produce high levels of production, thus creating a negative environmental impact, if such goods are associated with the economy's comparative advantage. The potentially offsetting effects of the three effects may result in the movement of environmental degradations not strictly following the EKC pattern.

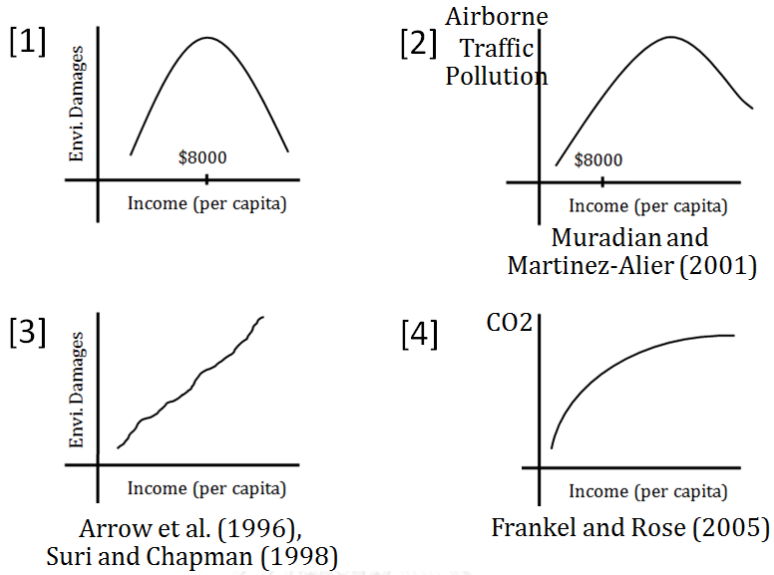
If most environment-income relationships follow the suggestions of the EKC curve, then it can be argued that economic growth can provide a concrete solution to environmental imbalances. This appears to be valid in many cases. Yet, there are a number of limitations and exceptions that prevent the universal validity of the EKC policy recommendations or the actual implementation of the solutions (most likely due to the very high levels of turning point income or the absence of it altogether). Most importantly, many empirical studies and assessments would show that not all pollutant types would follow the inverted-U relationship described by the EKC (as some types of pollution or environmental deterioration are actually increasing with income), or that the turning-point income levels would be prohibitively high. Harbaugh, Levinson, and Wilson (2002) presented their results challenging the generality of the EKC, arguing that the pattern of the relationship may not necessarily follow the inverted-U curve, and when it does, the turning-point income levels may be too high for many countries to reach, at least in the near future. This occurrence, therefore, dampens the argument that economic growth alone is a sufficient solution to environmental problems. Suri and Chapman (1998) provided an example of an environmental hazard that is not decreasing with income, in the case of energy consumption in export and import activities. They observed that, while one might expect higher rates of pollution in countries with mediocre income levels, and lower rates of environmental degradation in industrialized, wealthy economies, no country would seem to reach the downward-sloping part of the curve for the case of energy usage – only the flatter part of the curve is reached at most. Several other types of environmental degradation seem to be non-decreasing with income. Another prominent example is the case of garbage or emissions from automobiles (Muradian & Martinez-Alier, 2001), which obviously increases with the expansion of economic and urban activities.

These limitations challenge the implicit interpretation of the EKC that economic growth and income improvement by themselves can be counted on as a satisfactory solution to preserve global environmental quality. The viewpoint that growth is the key to the abatement of environmental and social problems may not be valid (Arrow et al., 1995; Lélé, 1991; Trainer, 1990). It is noted that, in order for the turning points to be attainable, environmental regulations are needed (Andreoni & Levinson, 2001). Stern, Common, and Barbier (1996) reviewing several empirics of the EKC, had pointed out mixed results and suggested that the embedded assumption that economic progress and growth can contribute directly and rather seamlessly to environmental improvement, which is a concerned shared by Esty (2001). Also, in line with Arrow and others, they are concerned that policy prescriptions may be misled towards the emphasis of growth-based policies in an attempt to reach the downward-sloping part of the curve, while Gale and Mendez (1998) examines the notion of factor endowments and argued that the labor and land abundance of an economy is associated with lower levels of pollution, while capital abundance generates upward pressure on pollution. In a sense, this implies that countries with heavy industrialization may incur large amounts of pollution. An additional concern is that, despite the tendency of the relationship to follow the EKC pattern, it is still possible for environmentally-conscious developing countries to outperform more advanced economies in terms of environmental quality, and that the theory behind the curve remains incomplete (Stern, 2004b).

Finally, a concern exists that some measures of environmental degradation may not follow the inverted U-shape, meaning that they may not have a turning point at all (Arrow et al., 1995; Frankel & Rose, 2005; Muradian & Martinez-Alier, 2001). This concern is also expressed in Harbaugh et al. (2002) that exceptions exist as some pollution types are not increasing with income, and some (such as airborne particles) are not decreasing with growth. It is worrisome that the major types of pollution that are associated with chronic or persistent environmental problems tend to be the ones that normally increases with income, without an achievable turning point, such as CO2 or garbage/waste from urban areas. In particular, if such pollutants damage the environment (say, deplete ozone layers, contaminate or reduce the quality of water

supplies, or contribute to global warming) in an exponential manner, the effects can be catastrophic over time.

Picture 3.1 – Illustration of the Conventional EKC and the possible variants



Picture 3.1 is an illustration of the different occurrences of the EKC, both the well-behaved original and the exception cases. [1] is an instance of the conventional, well-behaved EKC, characterized by an initially positive relationship between income growth and pollution, followed by an inverse relationship when income exceeds the turning-point income level. In this example, the direction of the relationship is reverted at a speculated GDP per Capita threshold of $8000 (Grossman & Krueger, 1995), and this representation of the income-pollution relationship in an EKC-consistent manner is expected to hold for many types of environmental hazards. When such a well-behaved curve is observed, it is likely through the contribution of the Technical Effect, as well as the Composition Effect (perhaps at a slightly smaller degree, given its potential ambiguity which depends on the country's comparative advantage). The relationship in [2] is a variant of the curve that will likely hold for certain persistent pollution types with high turning-point income levels. Pollutants behaving in this manner will exhibit an increasing relationship with income even at relatively high levels of income. While not unlike the case of [1], this type of relationship may prove to be much more problematic if the turning point is located at prohibitively high levels of GDP per capita (beyond the abilities of most countries to

attain), and the substances are potentially harmful to the global environment. This is a representation of cases where some measures of pollution would persist up to "very high" levels of income, according to Muradian and Martinez-Alier (2001). [3] represents a potential concern that some types of pollution or environmental hazards may not have a turning point at all, meaning that they may not be decreasing with income at all, and, finally, [4] shows a possible shape of the relationship where the rates of pollution may or may not decrease as income expands, but, according the Frankel and Rose, there has been "…no evidence that the Kuznets Curve ever turns down on its own" (although it is noteworthy that they do advocate the well-behavedness of EKC for most other forms of pollutants – a comforting finding) (Frankel & Rose, 2005).

It can be argued that the Environmental Kuznets Curve is not without merit, but the income-as-a-solution-to-pollution implication may not hold for all types of hazards, especially the prominent and persistent ones. Growth can be associated with, or lead to, a reduction in environmental degradation in numerous categories, but this does not mean, however, that income by itself is able to remedy or reverse all forms of environmental degradation. Income is an aspect of the Economic Dimension, and other factors can help or worsen the environmental problem as well. More importantly, a vital concern is that, even if the EKC is valid and the turning points attainable for all pollution types and degradation, the accumulated damages that occurred during the initial phases of development may have already taken their toll on the vitality of the local and global ecospheres. High-income economies may be able to enjoy decreasing emission levels or even a gross reduction in pollution, but there is always the danger of overusing or over-polluting the ecosphere prior to reaching that point, which can result in permanent or irreversible environmental damage that can persist even when a high-income, environmentally friendly economy is eventually established. Coupling this concern is the question of how long the global ecological balance will be able to hold out, given mankind's relentless economic and industrial activities.

Supporters of limitless growth would attribute the possibility of continued growth on economies' potential to improve productivity, technology, and natural capital management capabilities that permit positive and sustained growth despite global limitations and adversities (Arrow et al., 1995; Goklany, 1995; Grossman & Krueger, 1995). Improvements in productivity and technological advancements can lower the input requirements and the need to exhaust limited natural capital in production processes, enabling more outputs to be produced with having to use up as much inputs as in the past. If technological capabilities can push the production and consumption boundaries outward and enable mankind to tap into a larger pool of exploitable resources, then finite growth becomes possible. Yet, strict environmentalist thinkers like Schumacher was of a different viewpoint. He warned that with the emergence of some technological advances, mankind will deal further damages to the environment and inflict greater amount of harm on the global ecosphere, as a result of increased capability to harvest environmental capital and transform them into material gains to satisfy self-interest. This process will result in worsening problems in the Environmental Sphere (Schumacher, 1973). Of course, in the midst of different opinions on growth, a large number of literatures would suggest that a present course of action is to rethink and adapt the way our economies consume and produce (Bhongmakapat, 2010, 2011a; Brundtland & The World Commission on Environment and Development, 1987; Hauff, 2007; Payutto & Evans, 1994; Trainer, 1990, 2009, 2011). After all, the discussion may not be sufficient if we were to look only at the supply side – we might need some reflections on the demand side, concerning consumption and consumers as well.

The discussion on environment versus economic progress implicitly concerns the nature of human preferences. When improvement opportunities are possible, or when given the choice, agents are often faced with the alternatives between dedicating development to reduce environmental and social costs, perhaps receiving the same levels of material gains, or to have greater levels of production, consumption and profit, without significant improvements in the Environmental and Social Dimensions. However, most existing economic models would simplify the human preferences, viewing all agents as being identical in terms of consideration

(Bhongmakapat, 2010, 2011a, 2011b), whereas real world agents would have vast differences with regard to their relative weights on material advancements and that of "the mind" (which signifies beyond-profit preferences such as social-mindedness, charity, or the willingness to sacrifice some self-interests and financial gains in favor of the greater good) (Bhongmakapat, 2011b). The consideration of such preferences and the differences between agents are important as these factors will eventually be reflected in their choices, which then determine the ensuing collective economic activities, development patterns, and the potential improvement or deterioration of the environment and the society. This is an important reason that explains why some agents neglect the environmental and societal needs of the local and global economies, while others would dedicate themselves to the beyond-profit goals, even when their financial or business gains are lost in the process. After all, the simple notion of consumption is asserted to be different from actual welfare, which is derived also from many non-material aspects (Bhongmakapat, 2010, 2011a, 2011b; Ekins et al., 1994; Payutto & Evans, 1994).

As if to fill the environmental and social gaps of mainstream economics, where it does not seem to fare too well, multiple lines of alternative economics have emerged. These are usually aimed to address the side effects of "Economics-as-usual". While some would view these alternative frameworks simply as mutually exclusive replacements to conventional economics, perhaps it may be more constructive to regard them as complements, rather than strict substitutes; the considerations of the alternative schools may or may not be implemented in full, but it will be useful to consider their implications to improve the existing economic paradigm. Modern mainstream economics may succeed in promoting income and technical efficiency, but still appears insufficient in solving the problems created by its material-centric development (Bhongmakapat, 2010, 2011a; Payutto & Evans, 1994; Puntasen, 2007; Schumacher, 1973). It should be noted that many alternative economic frameworks would promote a balanced approach to the Environmental and Social Dimensions. Examples of such economic modules include the disciplines of Development Economics and Gender Economics (mainly Social), and Environmental Economics, which have been successfully integrated into modern economics, as well

as Happiness Economics (mainly Social), the Sufficiency Economy Philosophy (Social and Environmental), Buddhist Economics (Environmental and Social). By joining together the already-popular branches of conventional economics (such as Financial Economics, International Economics, Macroeconomics and Microeconomics) together with the wisdom and implications of the alternative branches, the global economy can better hope to be one with balanced development in all dimensions of sustainability.

3.3.3 Sufficiency Economy and Sustainability

The Philosophy of Sufficiency Economy, bestowed to the Thai people by His Majesty the King, is amongst the branches of economic paradigms that addresses the need to link economic activities with social aspects and well-being, and through its implications of resource management, can be linked, to a significant degree, to the use and management of environmental resources as well. The first component of Moderation can be said to correspond to the economic objective of "optimization", as opposed to mere "maximization" of benefits (such as income, profit or utility), now that agents must operate with respect to Environmental and Social qualities, and the welfare of others. This component is also beneficial in purely economic terms, as agents will be able to avoid excessive risks and financial problems that come with myopic maximization preferences or imprudence. The second Component, Reasonableness, or the due consideration of causal relationships, requires that agents take into due consideration the available information and consequences of their economic actions (such as the effects of resource consumption on well-being or the society), while the third component of Resilience (also known as the Immunity component) promotes resiliency for both agents and economies alike. In addition, the two Necessary Conditions, Knowledge and Morality, are also required to facilitate the best results.

In summary, Moderation discourages excessive uses of resources that can backfire in terms of environmental degradation, as well as excessive profit seeking activities with low to no regard to societal welfare. It corresponds to the optimization of benefits/satisfaction with respect to dimensions that run beyond economic efficiency per se.

Reasonableness urges agents not to view their own benefits as complete, but rather view themselves as parts of the larger society, whose actions will inevitably affect others in some way. Also, one's own actions will come with side-effects, risks, and costs, especially when agents make such decisions in a myopic mindset. When economic actions, great or small, are taken with prudence, it will reduce the likelihood and magnitudes of risks and damages.

The component of Resilience underlines the need for economies and agents to have proper measures to deal with contingencies or unexpected events, at least to some degree. In terms of the Economic dimension, excessive risk-taking or profit-hunting are not desirable, while the implications of this component on the Environmental sphere is linked to environmental insulations, as the environmental quality must be preserved in order to avoid future disasters that are caused by massive degradation. Similarly, the Society must be able to cope up with various changes and challenges without significant hindrances.

Thus, it can be argued that, as Sufficiency Economy is part of Sustainable Development, the necessary conditions of Knowledge and Morality, which facilitates an equitable economy, should be, at least to a certain significant degree, a requirement for Sustainable Development as well. After all, the conservation of environmental quality and efforts towards social equitability cannot be implemented satisfactorily in the absence of public-minded and socially responsible agents (which is the focal point of the Morality Condition). On the other hand, even the best intentions will need at least a fair and adequate degree of Knowledge (and technical know-hows) to put them into practice with full or satisfactory benefits. In a sense, this goes together with the Technique effect mentioned before, as Sufficiency Economy acknowledges the

potential of technology and knowledge in promoting more sustainable outcomes, while morality and social responsibly can be linked to the Composition effect. At any rate, the technology to be used must be appropriate and affordable to the agents, so as to avoid incurring other undesirable economic or social contingencies to the households.

3.3.4 The Relationship between Growth and Society

The original Kuznets Curve was focused on the relationship between the Economic and Social Dimensions, in particular the issue of inequality, which is a social aspect. The conventional Kuznets Curve was one of the earlier attempts to examine the link between the Economic and Social Spheres. This rationale was later expanded to deal with various environmental issues, which gave rise to the Environmental Kuznets Curve. Kuznets (1955) made a note regarding the relationship between growth and inequality, that much of his implications were based on speculative views, hoping to spark interest and ensuing research efforts, which his theory had succeeded in accomplishing. The curve serves as a useful guideline, despite some shortcomings, for those wishing to examine the basic relationship between economic progress and various imbalances. The Kuznets Curve and its associated results are supported by numerous literatures (Barro, 2000; Panizza, 2002), where income inequality are expected to go up in earlier stages of development, and are reduced as income reaches certain advanced levels. Similar to what one might expect, at any rate, it should be noted that inequality itself may have adverse effects on growth (Aghion, Caroli, & García-Peñalosa, 1999; Barro, 2000), and economic progress can be promoted when the problem of inequality is dealt with.

Still, similar to the EKC, the Kuznets Curve also has its limitations, most importantly the possibility that the relationship illustrated by the curve remains imperfect. The validity of the KC theory depends on a phenomenon known as “the Trickle-down Economics”, where economic gains enjoyed by individuals in the upper income range are gradually diffused throughout the economy, through payments and flows of money and capital, which ultimately generates economic benefits for the less

wealthy and improve the welfare of the poor. Real world economic policies and development action plans are sometimes conducted in this manner (especially in practice), relying on the rationale that, by promoting the accumulation of wealth by the rich, the society as a whole ultimately gains and the poor can enjoy better living standards as a result. If the transmission is successful, then it can be argued that wealth accumulation by the rich will eventually provide a solution to poverty. There are many cases, however, particularly in developing countries or in economies where poverty is persistent by structure, where the phenomenon does not seem to hold true (Bhongmakapat, 2010, 2011a; Qureshi, 2008). In addition, even if the trickle-down phenomenon holds in the long run, the adjustment time needed to ensure (relative) economic equality can be very long, and it is possible that certain structural problems in the economy may prevent the diffusion of income altogether (Bhongmakapat, 2010, 2011a). These possibilities, coupled with real-world observations, would suggest that, not unlike the environment-income case, economic growth by itself may fail to provide satisfactory solutions to social and income distribution imbalances. As a result, facilitative measures and redistribution will be useful in ensuring the socially desirable outcome (Aghion & Bolton, 1997), but the redistribution policies employed should not be distortive in nature (Barro, 2000), and, as the simple pursuit of heightened growth, in the hopes that it would automatically lead to the reduction of inequality, will not be the best developmental alternative, and other policy actions such as the promotion of education or health services will be more effective in this respect (Qureshi, 2008). In particular, it has been suggested that, as countries have differing economic, social and structural characteristics, the ability of the poor to enjoy the gains from economic growth should not be viewed as identical across countries (Ravallion, 2001). It then can be argued that it is inadequate to rely on growth as an automatic solution to social imbalances as well.

Of course, economic development and income growth facilitate new business and financial opportunities that result in an upward pressure on welfare and social quality, but we also observe cases where social quality remains mediocre despite economic progress, as well as cases where social problems actually emerge as a result of imbalanced or skewed development which pursues material growth at the expense

of other societal aspects. This does not mean that economic growth is evil, of course, but rather that growth by itself, while beneficial in material terms, may not necessarily be sufficient in ensuring societal well-being. Preferably, growth should be coupled by measures that can directly improve productivity and the people's quality of living, such as improvements in education, healthcare, financial literacy, public infrastructures, accessibility of such public services, or redistributive measures to complete the trickle-down phenomenon. If the yields from growth (which is also enhanced by trade) can be used to provide accessible services to the society, then growth can be a powerful driver of equality and welfare. Note that this is largely in terms of economic opportunity, at any rate, but the more subtle problems such as crime or moral degradation can also be dealt with in a similar manner, despite some additional difficulties. Here, regardless of the existing papers' differing viewpoints towards the ability of income growth in reducing socio-economic inequality, a common point can be observed in that additional coupling measures are to be utilized to ensure "better" results (in terms of social quality). A number of literatures would also emphasize the importance of education as well.

After a lengthy discussion on the linkages between Economics and elements of Sustainability, this research argues that, while the actual link between economics-as-is and sustainability remains somewhat weak in practice, there also exists much potential for economics to contribute to sustainability. It becomes an issue of "positive versus normative". The fundamental concept of Economics is the management of (finite) resources for the benefit of humans, who possess potentially unlimited wants, while the Earth can be considered a large but finite resource pool to be shared across many generations. This, perhaps, stresses the importance of sustainable management of the world's finite resources, and, as the three dimensions cannot be totally separated from one another, economic activities and development initiatives should not neglect to consider the Environmental and Social Dimensions as well.

3.4 THE ROLES AND CONCERNS OF INTERNATIONAL TRADE

3.4.1 International Trade and the Global Economy: Benefits and Costs

The previous section was focused on the overall effects of economic growth and the Environmental and Social Dimensions. Such relationships are also affected by trade, amongst other things, as trade is an important driver of income in a modern economy where domestic economic activities are not enough to maintain rapid growth. As such, the relationship between economic growth and income on sustainability issues is derived from trade. In addition, most of the work dealing with the relationship between sustainability and international trade are focused on the role of trade, as a facilitator of growth, and the environment. This section, however, will address the direct relationship going from trade to the other two dimensions, rather than the effects of trade-generated income growth on the two spheres, which were mentioned in the preceding section.

The modern system of international trade is a multilateral system which promotes liberalization and free trade, advocating the reduction and eventual abolishment of barriers. This is based on the concepts of economic and production efficiency, variety in consumption, and the enabling of new business opportunities. Economic interdependence and interaction through trade may also be considered as a factor that reduces the occurrence of severe national conflicts. Undoubtedly, international trade and liberalization of trade is beneficial to the human society (dominantly through the Economic Dimension). At any rate, the free trade regime is also criticized in several aspects, often around the concern that it exacerbates the existing environmental and social imbalances, similar to how income-oriented development is viewed with some skepticism. Arguably, the benefits of free trade will also depend on the assumptions or model formulations (Ekins et al., 1994), and welfare losses generated by trade will almost always occur to certain groups of agents when trade is liberalized, whereas free trade advocates would attribute such losses as an inevitable cost of improving efficiency and productivity. Where positive economic consequences may clash with negative environmental and social impacts, an uneasy

atmosphere is often present between free trade advocates and environmentalists, similar to the friction between free-market proponents and sustainability adherents (who may also be moderate capitalists or entrepreneurs who disagree with the profit-only approach to businesses). Here, the concern is often based on the environmental impacts of trade through the Scale Effect. At any rate, a supporter of free trade can also be an advocate of sustainability, while it is possible for a protectionist to dismiss sustainability concerns. This particular issue is also important, as viewing trade as unconditionally harmful may not lead to the best feasible conclusions. Instead, perhaps trade should be viewed as a contributor to growth, whereas growth and trade are potential but conditional instruments of sustainable development. The multilateral system, however, will need some improvements to cope up with the negative side effects of economic expansion and production, in order to reduce the environmental impacts of globalization.

The discussion becomes a bit more complicated when trade is introduced into the picture. Modern international trade is characterized by a system of liberalized and free trade, with the removal of tariffs and barriers, which is a system that has been established with notable success during the previous century. In this light, differing opinions would persist in the trade and sustainability relationship, as, in practice, the expanded opportunities offered by increasing trade enhances income, but also generates environmental pressures through the Scale Effect at the same time. The paradigm of export-led production is also viewed with some skepticism in this respect. Here, it is possible to revisit the EKC once more, since trade is a key contributor of national income, and trade liberalization is, after all, a major attempt to promote growth and increase income levels (Esty, 2001), but the interpretation of the EKC in this matter should also be done with caution, as its implications can lead to the misunderstanding that anything that contributes to higher income will always be good for the environment (at least in the long run). Esty also points out that it is dangerous for countries to ignore pollution levels until middle income levels are reached, while Jayadevappa and Chhatre (2000) are of the position that the EKC does not address the mechanisms of the process running between economic growth and the environment, which is an argument against the generalization of the curve. Gale and

Mendez (1998) examined the factor endowment issue of countries and argued that increased levels of economic activities will correspond to greater levels of environmental damages, which is an argument consistent with the Scale Effect. Moreover, as trade is associated with transportation activities which consumes energy and generates notable amounts of pollution, the pressure of trade on environmental impacts may not be decreasing with income. This issue is addressed in Suri and Chapman (1998), as even the advanced economies are not reaching the downward-sloping part of the relationship between income and energy consumption in trade-related transportation activities. Here, despite the introduction of trade, the consideration of the Technique, Composition and Scale Effects can still be applied in addressing the environmental impacts, due to trade's contribution to national and international income.

On the other hand, Frankel and Rose (2005), supporting the EKC relationship, argued that the negative impact of trade on the environment is miniscule, and that it is unlikely for the "race-to-the-bottom" phenomenon in terms of standards is unlikely to occur, which contradicts Esty's concern on the issue. They also confirm the ability of trade to function in an EKC manner, which augments income and leads to the eventual reduction of environmental threats, but, with the expection of CO2, in which case the cautionary argument made by Esty (2001), Arrow et al. (1995), and Suri and Chapman (1998), that some measures of pollution may not be decreasing with income, prevails. Also, a paper by Copeland and Taylor (2004) takes a supportive position towards free trade, stating that protectionism will obstruct improvements in income that facilitates improvements in standards offered by the technique and (more conditionally) composition effects. They also disagree with the concerns of excessive environmental deterioration from trade, and points out that trade is majorly helpful rather than harmful towards the environment. This viewpoint in defense of trade is also supported by Perroni and Wigle (1994), which promotes the liberalization of trade as a driving factor of efficiency in resource allocation, and that the concerns over trade and environmental consequences should be separated, as they argue that the actual harms inflicted is very small and the correlation is mild. Trade liberalization and its associated benefits are also advocated in similar manners in Antweiler,

Copeland, and Taylor (1998). Also, Grossman and Krueger (1991) advised that the benefits of free trade should not be overlooked, despite the validity of many concerns.

A number of literatures take a passive or mixed stance. For example, Muradian and Martinez-Alier (2001) argued that trade should not be blamed altogether for environmental imbalances, as even an autarkic system can incur environmental degradation, but it is rather the responsibility of nations to have adequate policy tools and instruments to deal with environmental problems. It may be drawn from this argument that the fault falls not on the Economic Sphere per se; rather, it is the details of the process and the lack of effective measure to moderate adverse side-effects of economic activities that are to be blamed. On the other hand, it appears that domestic environmental regulations and environmental restrictions on trade are viewed with a different light. Jayadevappa and Chhatre (2000) disagreed with using trade restrictions to correct environmental imbalances, but acknowledge the relationship between environmental quality across nations through channels of trade and specialization.

Here, a major concern is placed on the aspect of protectionism, where it is worried that environmental concerns may be used as barriers or excuses to limit trade. This issue is one of the major arguments that oppose the inclusion of environmental issues into the framework of trade. Ederington and Minier (2003) affirms that environmental measures are sometimes used as barriers to trade and generates observable effects on imports, where Copeland and Taylor (2004) disapproves the use of protectionist measures since it can result in countries forgoing the development and environmental benefits from trade. The benefits of trade and liberalization are acknowledged through their potential to promote efficient allocation of resources (Weiss, 1992), again not unlike the advocacy of the technique effect. This line of argument corresponds with Paul Samuelson's cautionary remark that protectionism "…breeds monopoly, crony capitalism, and sloth" (Dixit, Grossman, & Samuelson, 2005), which points out the economic and distributional costs of protectionist measures. Similarly, Bhagwati and Srinivasan (1995) also disagrees with the environmental justification of protectionist policies.

An important discussion exists on the issue of proposed solutions. Some would argue that environment policies should be put in place, and trade needs to be adjusted, perhaps with regulations put in place, to serve that goal (Arrow et al., 1995; Ekins et al., 1994; Esty, 2001), while others may argue that environmentalists are too pessimistic in their arguments as that trade poses only minor effects on the environment, and that trade measures should not be restrictive, even for the purpose of environmental protection (Perroni & Wigle, 1994). Proponents of trade would also state that trade can help the pollution outlook for numerous types of pollution substances while contributing positively to growth (Frankel & Rose, 2005).

From the literature, it can be drawn that, while the opinions are mixed, and while there are environmental concerns coming from the Scale and Composition Effects, the positive effect of trade in enhancing income and eventually contributing to improvements in technology, living standards and infrastructures are not to be overlooked either. Additionally, if economic progress leads to improvement in education, there will be a positive effect on sustainability as the population becomes aware of the issues at hand, and are able to utilize or develop cleaner methods of production. Improvements in the quality of human capital will facilitate the operation of cleaner industries that contribute both to further growth and environmental quality. This is one channel through which trade, through income, can positively promote sustainable development. On the other hand, pollution issues the correspond to the Scale Effect is a significant factor that affects environmental quality in various places, and will need to be evaluated alongside the economic gains of trade. It then depends on the shapes of the relationships between income and the various measures of environmental hazards; where the relationship is well-behaved and follows the EKC pattern, it then suggests that income can contribute significantly to environmental quality (as the positive effects of income growth are able to offset the negative effects and are translated into adequate improvement that can bring down the pollution or degradation levels). If a turning point income can be achieved with relative ease, it suggests that the benefits of economic development and/or trade openness are significantly stronger than the negative Scale Effect for that particular measure of environmental degradation. Where turning points are high or the curves are not well-

behaved, however, it means that income growth and the corresponding development policies alone will likely to be inadequate in addressing the problem. One can expect that trade and income improvement will be able to address some environmental issues, while exacerbating certain other types of threats that are not decreasing with income. In the latter case, other measures will be needed to alleviate negative environmental pressures.

Noteworthily, the Social Dimension can see improvement when income increases, given that the phenomenon of trickle-down economics is able to take place, so that income is not confined only to the upper echelons of the economy. Here, trade augments income, and if gains from the ensuing economic improvement are utilized in ways that provide widespread benefits, then improvements in the Social Sphere are to be expected. Again, education and the presence of better infrastructures can be beneficial. On a separate issue, sectoral shifts that occur when a country opens up to trade may also leave some labor and capital vacant, at least in the short run. If the factor market is efficient, the problem should not persist in the long run and resource usage can adjust to changes in the production structure, in line with comparative advantage patterns. At any rate, this can cause temporary joblessness and unemployment in the sectors affected, but at the same time production in sectors where the country has comparative advantage can increase. Education and efficiency in job market allocation can reduce the negative social side effects of trade in this respect. Advocates of trade would argue that this occurrence is beneficial and allows for a more effective use of factors. At any rate, there may be upward pressures on inequality (Burtless, 1995). Feenstra and Hanson (2001) noted that the wage gap between skilled and unskilled labor may widen in countries that participate in the process of "global production sharing". This increased wage gaps between the two types of labor may be attributed to technological changes and skill-intensiveness of different production activities (Feenstra & Hanson, 2001; Zhu & Trefler, 2005). Burtless (1995) notes that some may attribute post-trade inequality to openness, while some would consider technical change to be the responsible factor, and that this would lead to differences in policy considerations, where, nevertheless, protectionist measures are not a popular option regardless of the cause.

Normally, the rationale behind protectionist motives is to insulate several domestic production sectors, and their factor owners, from shocks caused by rapid liberalization which can result in (temporary) welfare losses to labor in these sectors. In developing countries, this is frequently a concern (Goldberg & Pavcnik, 2004), and is one of the prominent arguments in favor of barriers. Advocates of free trade would consider such losses to be temporary and are necessary for the economy to secure efficiency gains in the long run, whereas skeptics would be concerned as they are inevitable. At any rate, most papers in international trade, including Copeland and Taylor (2004), and Dixit et al. (2005) would warn against the use of protectionist policies on grounds that they hinder both progress and inefficiency, while it is possible that it will not be able to provide satisfactory solutions to the problems. In addition, as the global multilateral trading environment is governed by the WTO, which promotes the liberalization of trade and disapproves most forms of barriers to trade, the decision to simply raise barriers against trade is not a politically legitimate alternative, and would generate significant economic costs, both in terms of efficiency, and costs from reciprocative retaliation from potential trading partners.

Therefore, while trade may contribute to environmental and social imbalances at home, and while additional measures are to be taken to manage these problems, it may be argued that protectionist measures are neither the best nor most appropriate course of action, and policymakers should look to other measures when dealing with imbalances occurring in a post-trade outcome. In a sense, just because trade is related, at least in part, to adverse effects in the Environmental and Social Spheres, it does not suggest that protectionism is automatically justified, and, similarly, just because protectionism is not a desirable option, it does not mean that the impacts associated with trade-related activities are to be left unattended.

3.4.2 Trade and Sustainability: Looking Forward

The importance of this issue stemmed from the fact that the global economy since the 20th Century has been marked by an age of global interconnectivity. While such changes will create much benefit to the human society, the negative effects of

income-oriented growth will need to be mitigated, so that environmental stability and social well-being are not threatened. As was stressed many times in the earlier parts of the chapter, trade is an important and beneficial component of the Economic Dimension, but trade is also responsible, at least in part, to some environmental and social consequences. Therefore, if we are concerned about these other two spheres, the system of international trade will need to take them into consideration, and to look for ways to prevent imbalances from disrupting the global ecosphere and society. Of course, some may argue that environmental preservation is not the main objective of trade – but, while this is true, it should also be added that the activities related to trade should be implemented in ways that will not deal major damages to the environment, where and whenever possible. After all, environmental and social imbalances will ultimately incur costs that affect economic livelihood, if they are left unattended.

The EKC effects of trade are reflected in its income contributions, where the clashing Technique and Scale Effects of income then determines the direction and magnitude of environmental impacts. In this article, the EKC is an interesting theory to be tested on different cases of environmental hazards, as it seem to hold with some practicality for certain measures of degradation, but not others. Here, the characteristics of each pollution types may explain the validity of its EKC, or the absence of such a result. In detail, the driving forces behind environmental improvement are not wealth and income per se, but rather the initiatives and awareness to prevent the occurrence of widespread environmental damage or ecosystem collapse. This is particularly a concern for developing and less developed countries whose income levels are too low to take advantage of the downward sloping curve. The paper argues that coupling measures and considerations are needed, as it is not a prudent solution to leave environmental improvement only to wealthy economies.

In summary, the preceding trade-environment section is of the position that trade is potentially related to the environment due to its importance as a driver of income (which depends on whether one adheres to the EKC theory). It is possible for the EKC's implications to be expanded to project the effects of trade on the

environment as well, but this will need to be done with caution. If income is able to improve the environment in an EKC fashion, then it is likely that trade will also be able to contribute to such a relationship, through its role in enhancing income. Yet, if the EKC relationship does not hold or requires impractical levels of income to enable environmental improvement, it will show that the relationship between the Economic Dimension (via trade) and the Environmental Dimension remains weak for that particular category of environmental degradation, and such a result will raise the issue of whether economic progress should contribute more to environmental quality, which is currently facing non-negligible threats.

The relationship between trade and the Social Dimension is somewhat different; trade poses some degrees of concern on environmental quality, given the ensuing expansion of economic activities and mass-production, which generates pollution and prompts resource usage, while the social risks of trade may be less evident. In fact, traditional economists would argue that some types of social problems, including inequality, can be reduced through trade, at least in the long-run. This statement relies on economic progress to generate positive impacts on the society, given that the transmission mechanisms are able to run their course.

In the short-run, however, as trade liberalization will most likely lead to shifts in the production activities of the domestic economy, workers in some previously robust sectors will be affected as they will need to seek out jobs elsewhere. If this shift affects a major production sector, the unemployment consequences can be significant, and the following socio-economic problems can pose some challenges, especially if structural problems prevent the previously-employed workers from acquiring jobs in other sectors or activities. Some would argue that the fault in such a case falls on the previous prevalence of protectionist measures, which distorts the economy from its natural structure, while others may argue that the process of rapid liberalization is inappropriate in that it generates structural shocks on domestic agents. Yet, interestingly, trade openness may also reduce the size of a heavily polluting industry, inadvertently resulting in a cleaner overall environment, even at the temporary cost of labor reallocation. In any case, one may argue that liberalization

should be done with proper consideration regarding the social consequences, and some measures should exist to insulate the affected parties to some degree, so as not to excessively hamper their welfare and quality of life. In the modern multilateral environment, openness and reallocation of factors is an inevitable phenomenon, and, as such, the domestic economy will need to address these issues by providing these "losers from trade" with at least some forms of compensation. Ideally and conceptually, labor and factor owners should be able to enjoy their pre-liberalization levels of welfare (given that the factor payments were "fair"), in line with the do-no-harm principle of post-trade outcomes.

As outright protectionist policies can generate distortion in the economy, are associated with costs in terms of economic inefficiency, and will not be accepted by modern trading economies, it has been argued that their use should only be temporary and non-primary means, which should only be to shield domestic agents from the full impacts of immediate liberalization. Rather, efforts to conserve the environment and promote societal quality should be done by improving the quality and capabilities of domestic human capital, as it allows individuals to earn more, and hopefully, be able to make more efficient use of the methods of production that require fewer amounts of resources or generate less pollution. If this argument is to be followed, it means that the Technique Effect, and the Composition Effect, will need to be able to counter the negative side-effects of the Scale Effect. If we were to find a common ground between environmentalists and free traders, it can be argued that, as trade openness will usually increase production and pollution activities, the ensuing occurrence of pollution will need to be addressed through other mechanisms rather than simply forbidding or dismissing all trade.

3.5 EMPIRICAL EVIDENCES – METHODOLOGY AND RESULTS

(This section is added after the ICADA 2013 presentation and proceedings – for the purpose of the TU Workshop "Sustainable Development in ASEAN", and for the PhD Committee's assessment, in order to provide further depth and details to the original paper.)

Following the preceding literature review sections, we attempt to test how EKC fares with different pollutant types across a given period of time, using the data from the past two decades. This is done in an attempt to verify whether some of the well-known measures of pollution are well behaved, and thus whether income development can satisfactorily translate into lower levels of pollution, as some measures of pollution can decrease as income goes up, suggesting that the situation will improve over time, while other types of pollution that do not decrease with pollution will raise concerns that the damages associated with them will not subside over time.

3.5.1 The Scope of Study

In this empirical section, five types of pollutants/emissions are addressed. These are CO2, SO2, CH4, N2O, and F-gases, four of which are some of the most prominent greenhouse gases, where the estimations use the data for the years 1990 – 2011 for a range of 93 countries around the world. SO2 has 1408 observations from 1990 to 2005, and 88 countries are examined.

The characteristics of the 5 pollutant types in the study are as follows:

1. Carbon dioxide (CO2) is one of the key contributors to the global warming problem, and is associated with some of the most basic economic activities, such as electricity production, transportation activities, and the industrial sector. While CO2 is normally found in nature, it is concerned that human day-to-day actions are disrupting the balance of CO2 in nature due to the excessive amounts of CO2 produced, which in turn exacerbate the occurrence of climate change phenomenon.

The United States Environmental Protection Agency (EPA) recommends 4 measures to keep the emission of CO2 in check. These are 1.) the promotion of energy efficiency, through standards and the reduction of energy consumption, 2.) the (voluntary) reduction of energy consumption, 3.) the gradual shift from fossil fuels and carbon-rich energy sources towards renewable sources and fuels with lower carbon contents, and 4.) the technique of carbon capture and storage, which stores emitted CO2 in reservoirs that prevent them from entering the atmosphere (United States Environmental Protection Agency, undated).

2. Sulphur dioxide (SO2) is a major air pollutant generated mainly from energy production and industrial activities by plants. Power plants that operate on coal, oil, or other forms of fossil fuel release SO2 into the atmosphere, and contribute to occurrences of acid rain and human respiratory problems. There are certain proposals that advocate the use of SO2 as a cooling agent for the global atmosphere to counter the effects of global warming, but the adverse effects of acid rain, potential hazards to human health, and other unforeseen impacts will need to be assessed prior to actual implementation.

3. Methane (CH4) is jointly generated by agricultural, industrial, and household activities. It is also generated naturally through organic decomposition and the digestive process of livestocks, and is one of the well-known greenhouse gases. While it is a more potent source of global warming compared to CO2 (with approximately 20-30 times the potential to contribute to global warming compared to CO2 – for the period beyond 100 years), its emission amounts are smaller and poses notably lower overall contribution to the climate change phenomenon.

4. Nitrous oxide (N2O), another prominent greenhouse gas, is much more potent than CO2 and methane in contributing to global warming, and can reach up to 300 times the effect of the same mass of CO2 in expediting the global warming phenomenon (over a 100-year period). It is generated mainly from agricultural activities and nitrogen fertilizers.

5. Fluorinated gases, or F-gases, contribute to global warming, and are exclusively man-made, dominantly through industrial activities and many types of everyday appliances, such as refrigeration. It should be noted that, while they pose no threat to the ozone layer (unlike the extremely hazardous chlorofluorocarbons or CFC), they are still extremely potent as greenhouse gases, and can prove highly harmful to the climate change situation even in small amounts of concentration. They were created as the substitutes to the CFCs (that were banned by the Montreal Protocol) and are favoured due to their usage safety.

3.5.2 Methodology and Data

In line with the original specifications of the EKC methodology, as was referenced to in detail by Stern (2004a), this paper uses the panel regression specified as follows…

$$\ln(E/P)_{it} = \alpha_i + \gamma_t + \beta_1 \ln(GDP/P)_{it} + \beta_2 \ln(GDP/P)_{it}^2 + \varepsilon_{it}$$

…where E is the emission level, P is the population of a country (or region), and GDP is the Gross Domestic Product, measuring income and economic progress. In this sense, the equation is estimated in terms of emission per capita and GDP per capita variables. Other variants and minor extensions of the model also exist - we shall leave them to upcoming research.

In this spirit, we can solve the quadratic function to obtain the "turning point GDPK" that corresponds to the maximum value of emissions (in cases where the substance is well-behaved in line with the inverted-U curve, where the beta 2 is negative and beta 1 is positive – as this is the only condition that a maximum can exist).

It is noteworthy that, as Stern argues that the fixed effects model is a better alternative compared to the random effects model, in that the estimates are more consistent, this paper will use the fixed effects model in estimating the turning point levels of GDPK.

The turning point is calculated through the properties of the quadratic function, where…

$$\tau = \exp[-\frac{\beta_1}{2\beta_2}]$$

…where τ is the level of GDPK that corresponds to the turning point. The estimated values of τ for the scenarios and substances are reported in the following section.

The descriptive statistics of the variables employed are as follows:

Table 3.2 – Data and variable descriptions

Variable Name	Name	Obs. No.	Min	Max	Mean	Source
CO2K	Carbon dioxide emission per person (in tons)	2046 (1990-2011)	0.02059	49.62784	5.02568	EIA
SO2K	Sulphur dioxide emission per person (in tons)	1408 (1990-2005)	0.00034	0.23021	0.02516	SEDAC
CH4K	Methane emission per person (in tons)	2046 (1990-2011)	0.16403	8.67233	1.48373	WRI - CAIT
N2OK	Nitrous oxide emission per person (in tons)	2046 (1990-2011)	0.04780	6.54492	0.92652	WRI - CAIT
FGK	Fluorinated gases emission per person (in tons)	2046 (1990-2011)	0.0000001	1.06979	0.07296	WRI - CAIT
GDPK	GDP per capita (PPP) 2011$	2046 (1990-2011)	408.55	115,747.58	14,632.41	WDI
Density	Population density per square km. of land area	2046 (1990-2011)	1.41	7405.29	165.67	WDI
Urban	% of population living in agglomerations with more than 1m people	2046 (1990-2011)	3.34	100	22.16	WDI

The economic data are compiled by the World Bank's WDI Database. Environmental data are obtained from several sources, such as the U.S. Energy Information Association (EIA), The Socioeconomic Data and Applications Center (SEDAC, operating together with CIESIN), and the World Resource Center's CAIT Database.

3.5.3 Estimation Results

Table 3.3 – Turning point GDPK estimation results

	Turning-point GDPK (base model)	Turning-point GDPK (w Density + Urban)	Turning-point GDPK (w Density)	Turning-point GDPK (w Urban)
CO2	$173,122.99	$79,064.34	$94,028.34	$144,639.57
SO2	$4,461.38	$4,811.55	$4,439.48	$4,830.87
CH4	$7,770.61	$7,098.38	$5,985.50	$9,840.46
N2O	$8,777.56	$14,888.03	$7,252.59	$20,190.73
F-gas	$1,249,672.18	$287,065.71	$673,636.28	$511,552.01

From the empirical examination in Table 3.3, we have noted that, while all of the pollutants in this study exhibit characteristics consistent with the EKC (that is, all having turning points), some of the turning points can be easily attained in the real world. This paper's estimates are that sulphur dioxide has a low and attainable turning point GDPK (which suggests that there is hope that economic progress can reduce the emission levels of SO2), where the turning points for methane and nitrous oxide are higher, but still attainable. This also corresponds to the findings on S2O by Grossman and Krueger (1991), where S2O has a practical turning point. Carbon dioxide and f-gases, however, requires a much higher level of GDPK before the turning point is attained (especially in the case of f-gases, where the turning point is so high that it may be considered the same as not having a turning point at all), due to the nature of their creation which is strongly related to everyday human activities.

This goes in line with the concern expressed by Suri and Chapman (1998) that some measures of environmental hazards are not practically decreasing with income. This finding goes together with the fact that the production of certain pollutants are not going down even with higher economic progress (while, at any rate, the EKC results are subject to the conventional limitations of the Kuznets Curve methodology).

Carbon dioxide, one of the most prominent greenhouse gases, cannot be expected to decrease anywhere in the near future, with this paper's estimation results suggesting that it may require more than 2011$ 70,000 of income per capita (even in the lowest estimated case) to reach the downward part of the curve, which will be a very tedious goal, if not impossible, to achieve in the short and medium run. This is likely due to the nature of CO2's sources, many of which are caused by everyday human activities such as energy and electricity production and transportation activities. Here, it can suggest that the Scale Effect offsets the other two effects in the case of carbon dioxide (increased economic activities are more likely to generate higher demand for CO2-creating activities rather than lead to technologies to replace them), and that its reduction cannot depend on income and the associated changes alone. The reason for this is likely due to the fact that most human activities are related to the generation of carbon dioxide. This is one instance where income growth by itself will not be sufficient in bringing down pollution, and additional measures are required to bring down the curve for each income levels.

Sulphur dioxide has a much more attainable set of turning points, requiring the per capita income level of approximately 2011$ 4,000 to reach the turning point. Given the range of GDPK in the dataset, this is a favourable result that suggests improvement in the situation for SO2 over time. Arguably, the need to rely on SO2 producing activities can decrease over time as income is increased, perhaps due to the country moving away from dirty technologies towards cleaner ones, consistent with the Technique Effect.

Methane also has satisfactory turning point income levels, ranging from 2011$ 5,900 to 9,800. Countries are able to reach this turning point with relative ease, and, arguably, this is possibly due to lower reliance on livestock farming and certain industrial productions. With regards to methane emissions, income improvement, which is associated with the movement towards service sectors and tertiary industries can improve the methane emissions outlook.

Nitrous oxide has a middling range of turning point income, associated with approximately 2011$ 7,200 – 20,000 per capita. Numerous countries are able to achieve this income level, while others may require relatively long periods of growth to reach the downward turning point of the curve. Being jointly contributed by agricultural fertilizers and industrial activities, it seems to require some substantial amount of income before reaching the downward-sloping part of the curve. Arguably, the production of nitrous oxide corresponds with middle-income activities.

Finally, F-gases, the ozone-friendly successors to the CFC, are associated with exceedingly high turning points, requiring at least 280,000 2011 dollars per capita before finally reaching a downturn point. This, in practice, is similar to not having a real turning point GDPK level at all, and therefore it is impractical to rely on economic progress to address the F-gases concern. Estimation results suggest that the emission of F-gases is increasing with income for most attainable ranges of GDPK, and that increased economic activity would amplify the problem in this case. As F-gases are very potent greenhouse gases, even in small concentrations, coupling measures will be needed to keep their emission in check. Attempts to drive up economic income over long periods simply to reach the downward sloping part of the curve for fluorinated gases are out of the question.

When addressing such an issue, it is useful to keep in mind that, while the turning points are relatively attainable for some pollutants, the actual implementation to achieve such a cleaner state of economic activities does not simply occur solely by waiting for income to reach those turning points. It should also be noted that the downward pressure on environmental damages during the past several decades are due to the increases in environmental awareness and stricter environmental regulations rather than sharp increases in GDP per capita. This statement is most evident when looking at how chlorofluorocarbons are eliminated from the global economy. Historically, the CFCs' "turning point" and subsequent extinction did not occur through abrupt improvements in national income, but were achieved by the Montreal Protocol, which saw CFCs as severe and imminent threats to the ozone layer. The goals of the protocol were strict and demanding, but it successfully

eliminated the formal production and usage of the CFC with only a relatively small volumes of underground trade.

Of course, further studies can deal with more comprehensive sets of pollutants. This paper's estimation results are generally supportive of the EKC relationship patterns, but the paper remains skeptical towards the "laissez-faire" approach to pollution. Here, several noteworthy points are in place. For example, there exists the possibility that 1.) Not all substances will strictly follow the descriptions of the EKC or the inverted-U curve, and are need not well-behaved (the mild case of this is the exceedingly high turning point GDPK that we have observed). This goes according to the argument made by several research papers (Arrow et al., 1995; Frankel & Rose, 2005; Harbaugh et al., 2002; Muradian & Martinez-Alier, 2001), which outline the possibility that EKC need not hold properly for all pollutant types. In addition, 2.) "Contrary" to Frankel and Rose (2005), the curve for CO2 actually has a turning point, but as the level of income per capita that is needed to make the slope negative is too high to be relied on through the income-emission relationships (which is essentially the same as having no turning point in the feasible range), this paper's finding supports Frankel and Rose's argument that income by itself cannot remedy most of the problems posed by the stock and flow of carbon dioxide. 3.) The estimated turning point GDPK of f-gases is prohibitively high in all four estimations, and exhibits a pattern consistent with the concern expressed in Frankel and Rose (ibid.) that certain pollution types will not be decreasing with income, at least in the near future (yet, of course, the EKC may not be able to entirely capture the adaptability or technological capability to abate environmental harms – a limitation, but this observation is most likely due to the nature of usage of each substance).

In cases where the turning point GDPK is very high, it suggests that pollution levels will keep going upward for a long time before the turning point is reached. And, even after a country attains the sufficient level of GDPK, this does not mean that the accumulation of pollution will become negative; it only begins to increase at a smaller rate, but is still increasing. As a result, one might argue that the cumulative

amount (or stock) of pollutants being produced and released can be very high and can result in serious damages to the environment even after GDPK exceeds the turning point level. In addition, some categories of pollutants will not decrease with income anywhere in the near future, whereas the outlook in the global ecosphere is already worrisome. These arguments may reinforce the concern that economic development (which augments GDPK) by itself may not be sufficient in handling the pollution problem, and that coupling measures will be vital.

In addition, even if we were all able to reach the downward-sloping part of all curves (suppose that they do exist for all pollutants), it may still not be enough to keep the global environment safe. Due to the fact that many polluting countries still haven't reach the turning points for the substances, it generates concern that the pollution problems will worsen as countries strive to reach the turning point – when that point is reached, economies may need to tread with care, since, while it is the point where emission situations improve as income increases, it is also the point where the pollution level is at its worst, and this can accumulate over time (especially when we are talking about the flow of pollution rather than the stock – prolonged stays on the turning point can pose significant threats to the environment, since that is the point where emissions are largest or most threatening). And, as we are well aware, the global ecosphere is currently not in the best of health – it may not withstand further damages to the environment for long, even at the current degrees of environmental degradation (or even if we were to reduce the degradation, it may still be insufficient), let alone at future aggravated levels…

In relation to trade, we often count on trade and economic growth (which is augmented through trade) to be able to improve the environmental outlook. The findings suggest that such a link holds for some measures of pollution where trade and income growth contributes to environmental improvement, but economic progress and trade cannot be counted on as the main remedy to the emission problem for certain substances that are not decreasing with income, or have very high turning point income levels. Given the estimated turning points for CO2, it suggests that economic

progress, and trade, for that matter, cannot provide solution to the global warming problem on their own.

3.6 SUMMARY AND CONCLUSIONS

This paper takes a stance that, theoretically, trade augments income and, through income, better standards and practices are adopted, eventually contributing to sustainability. This can hold true in some real world cases, but, unfortunately, not all. In the modern world, however, many simplifying assumptions that back the traditional mainstream models may not fully hold (or, in some cases, may not hold at all), and it can be observed that there exists the potential possibility of pollution and harms being relocated to countries with lower standards (or worse, inferior enforcement capabilities). Even in high-income economies, some measures of environmental harms remain at large, as the Environmental Kuznets Curve (EKC or the Inverted U-curve) remains inapplicable to numerous types of major pollutants, most notably Carbon Dioxide, energy use, and garbage per capita, which are associated with massive industrialization and urbanization. While there are arguments from all sides of the discussion, each of them poses important information and materials for further discussion, and is not without much merit both for the proponents and skeptics of each school of thought. It can be argued that, if income and growth were to be a facilitator of sustainability in all three Dimensions/Spheres, economies will need to ensure that the Technique and Composition Effects actually occur. The implication that income will automatically promote Environmental and Social sustainability is not valid, as economies will require some coupling policies or actions to transmit economic progress into improvements in the other two Dimensions.

The debate on growth will most likely continue. The limits-to-growth and zero-growth schools of thought draw their arguments from the fact that the global resource pool, although large, remains basically a limited ecosystem, and global resource usage threatens to exceed that capacity. The indefinite growth school and the sustainable growth school are more optimistic in this respect, relying on the potential of technological improvements that increase production capacities at lower resource

usage and environmental costs. Within the latter group, opinions are branched with respect to the extent and attitude towards such continued growth – the indefinite framework regards economic progress and income as the paramount goal, which will ultimately help the two other dimensions of sustainability in a somewhat automatic fashion, while the sustainable growth school shares the concern held by the proponents of the limits-to-growth approach, in that economies will need to tread carefully due to the rather unstable global ecosystem and its limits. Sustainability adherents are not totally or uniformly opposed to income-oriented goals and free trade, as long as prudent measures (regulations, incentives, harmonization, collaborations, and compensations) are taken to ensure environmental and social integrity. Market-based mechanisms serve as important tools to ensure sustainability, but they will need to be used seriously and effectively, and relying alone on such measures may not be adequate in ensuring sustainable development.

Economies will need to take into account the Dimensions of Environment and Societies, as what happens in these spheres will eventually affect Economic performance, for better or worse, and whether we like it or not. As economies are comprised of smaller components and agents, their actions will collectively influence outcomes in the global economy and ecosystem. As a result, it may be both useful and interesting to learn more about how agents act and differ, especially with respect to the three Dimensions of Sustainable Development, in order to understand the motives behind actions (i.e. – to pollute or not to pollute, at what levels of profit or utility, and so on). Hopefully, future research and implications can emerge from such deeper levels of analysis, linking the micro-foundations of individual preferences to the bigger picture.

Trade, a prominent component of the Economic Sphere, can contribute to the theoretical link between economic progress and other dimensions of sustainability through increased income, but that alone is not sufficient. Trade's role in building up the productive efficiency of nations must not be limited to financial or corporate "efficiency", but should also cover the wider forms of efficiency, in terms of resource usage and conservation. Generally, trade encourages best and better practices, and,

hopefully, promotes preference towards cleaner goods (the Technique and Composition Effects), but also poses non-negligible potential threats via the Scale effect. The concerns on the negative impacts of trade are focused more on environmental costs rather than long-term social difficulties. Measures aimed at dealing with Environmental and Social costs in trade may appear to be more restricted than in normal economics, as initiatives that are deemed as protectionist policies are denounced by the WTO and many trade economists. As a result, other forms of non-trade (domestic and some international) policies should be used, instead, to correct any Environmental and Social costs that are associated with trade liberalization.

The empirical part, dealing with five types of major pollutants, suggests that the EKC does hold, but in some cases the high level of per capita income needed to satisfy the turning point can be too high to achieve with the current production capabilities (trying to boost the global production capacity to satisfy such an income level may also generate immense amounts of pollution and waste in the process as well). While it is theoretically possible to attain the high levels of turning point GDPK, the environmental situation and degradation at hand may not permit us to simply wait for income growth to alleviate our problems. While economic progress can provide a hopeful outlook for numerous pollutant types, we may need rules, regulations, and coupling measures/improvements when dealing with several substances whose emissions are not practically decreasing with income.

As a result from the literature review and the empirical assessment, it can be argued that we should not rely only on income or Economic progress to solve our Environmental (and also Social) problems (while, on the other hand, we should not use protectionism or other seemingly irrelevant economic-based actions to achieve environmental goals, as they would require a set of delicate, complex, and fragile relationships just to affect environment by a small extent). The Technique and Composition Effects, while beneficial, may be too slow to offset the negative impacts of the Scale Effect, especially for major measures of pollution (in particular those closely associated with industrial progress and production growth). Instead of letting income act by itself to reduce the pollution levels along the curves, (in case the

inverted-U curve theory holds, the effect may be slow and not without warnings, as was mentioned, but if it fails to hold, it means that income may not or will not be helpful at all in alleviating the pollution problem), a more direct coupling set of approaches, such as regulations or active improvements in environmental standards (for all income levels) may prove to be the more effective tools in handling the pollution problem.

The empirical section's results is also linked to trade in that, as trade is a major component of the economic progress which ultimately enhances income, relying on trade and wealth by themselves to alleviate some measures of pollution or improve the environment in some aspects may work, but they cannot provide satisfying or practical remedies to large-scale problems like global warming, which are contributed to by several environmental hazards that are not decreasing with growth within a feasible range of income.

All in all, this paper argues that sustainable development is feasible. At the same time, it is more or less the only option available in the long run, as opposed to the alternative of abandoning environmental and social qualities, which will most likely drag down or hinder economic progress with them. Environmental urgency is more or less justified, whereas social equity is not to be neglected either. Both free-marketeers and environmentalists will need to find a compromising common ground to share their mutual long-term perspectives, and make use of available tools, policy options, or regulations where available, as growth alone will not likely solve some of the most prominent environmental problems present today. In other words, growth may have a positive effect on the environment (in cases where the Technique Effect is significantly larger than the Scale effect, and is able to cancel out the latter), but it is the additional coupling measures (both supply-side and demand-side) that will bring down the turning points to an attainable level in cases where the difficulties prevent the downturn from occurring. This calls for some methods of action, or, perhaps, even a paradigm shift with respect in some respects of the economy.

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CHAPTER 4
LINKAGES BETWEEN COUNTRIES' DOMESTIC CHARACTERISTICS, SOCIAL INTEGRITY, AND PRODUCTION POLLUTION INDUCED BY TRADE

BASED ON THE 2ND ARTICLE – PRESENTED AT THE SIBR 2014 INTERNATIONAL CONFERENCE AND PUBLISHED IN THE INTERNATIONAL JOURNAL OF ECONOMIC POLICY IN EMERGING ECONOMIES (IJEPEE)

"Trade and Sustainability: How Strong are the Empirical Linkages between Trade Structures and Sustainability Performance?"

Wasutadon Nakawiroj

Abstract

This paper examines the relationship between countries' indicators of sustainability and their actual trading patterns, using a panel data approach incorporating all categories of trade in goods for a sample of 85 countries over a ten-year period. It is verified that environmental performance corresponds with lower trade-induced production pollution in numerous scenarios, while strong legal and contract enforcement discourages such trade-induced pollution in every scenario studied. It is observed that, for the global multilateral trading circle as a whole and developing countries, environmental quality at home is significantly linked with export-induced production pollution at home, as well as import-induced pollution elsewhere. For developed countries, however, environmental performance does not make much difference, whereas the rule of law remains effective in lowering pollution. On average, the aspects of environmental quality and legal enforcement are successfully transmitted into international trade, with some differences between country groups.

4.1 INTRODUCTION

This chapter is based on the author's 2014 work, entitled "Trade and Sustainability: How Strong are the Empirical Linkages between Trade Structures and Sustainability Performance?", which was presented at the SIBR-Thammasat 2014 SIBR Conference on Interdisciplinary Business and Economics Research, and accepted for publication in The International Journal of Economic Policy in Emerging Economies (IJEPEE).

The chapter is organized into two parts; the first part is an empirical study based on the aforementioned research article, representing the supply-side of the trade-sustainability consideration (production of traded goods), and the second part is a qualitative study on the demand-side issues (agents' consumption preferences). This is meant to address the aspect of "social integrity", which, as was mentioned earlier, is comprised of both supply-side considerations (rules and regulations that are applied to production activities), and demand-side considerations (related to economic agents' preferences and the subsequent actions, which are sometimes voluntary).

As the previous chapter addressed the overall nature and characteristics of the relationship between economic growth, significantly driven by trade, and environmental quality (or, inversely, deterioration), this chapter seeks to understand more about trade-related production and consumption, which are economically useful but can also generate environmental side-effects. The issue can be sorted into "supply-side" and "demand-side" considerations, where the supply side is concerned mainly with the production of goods, which are then consumed outside of the national border, and the demand-side deals with the issue of consumption and the actions derived from preferences of agents. The supply-side is a quantitative aspect and can be examined using econometric methods, where the demand-side involves qualitative aspects, especially regarding the human preferences which are difficult to quantify or collect. This chapter is then organized accordingly.

4.1.1 Supply-side Considerations

The previous Chapter addressed a number of literatures that are related to the issue of trade and Sustainable Development, and the environment. Apart from its effect on income (and the ensuing influences on the environmental outlook), international trade can affect environmental quality and ecosystem balance directly through the expansion of economic activities and transportation, which may generate additional amounts of pollution and energy usage, and would also require more natural resources as inputs. This is basically the Scale Effect at work, which may also be coupled by the Composition Effect in case the production structures are shifted towards production activities that generate high amounts of pollution. At any rate, this effect may also be partially countered if the post-trade production structures shift away from the dirtier sectors in accordance with comparative advantage.

As was mentioned in the previous chapter, growth can have a downward pressure on pollution, but sometimes these "turning points" are not practically attainable (such as in cases where turning points can be observed, but at a very high level of per capita income). Rules and regulations are needed in bringing down these turning points to feasible levels (Andreoni & Levinson, 2001) that can be reached "before it's too late". In any case, the ideal objective is to lower the environmental harms associated with activities in trade.

The argument is that, if we can make trade, and the associated activities, more environmentally friendly, then trade can continue or might even expand since they do not impose as much environmental costs (as it should not be forgotten that the world constantly faces a set of gradually shrinking environmental constraints that will ultimately generate economic disruptions or obstruct economic activities). At any rate, the first step is to examine the potential linkages between the domestic factors and some measures of pollution in trade.

4.1.2 Demand-side Considerations

On the other hand, while supply-side measures are efficient, they may not be totally sufficient when the large-scale problems in the Environmental and Social Spheres are persistent. It can be argued that economic activities and outcomes in the economy are the result of agent's preferences and consumption issues as much as the production side. In a way, what the consumers demand will shape the behaviour of the producers, and the two forces will then jointly determine the outcome in the economy. If the environmental side-effects occur from economic production in terms of dirty goods being produced and sold, then the consumption-side concerns will also need to be considered as well. Concerns have been raised that the seemingly more subtle issues such as greed and inconsideration do play important roles in producing unfavourable environmental and social outcomes (Bhongmakapat, 2010, 2011a, 2011b; Bhongmakapat & Indaratna, 2009-2010; Payutto & Evans, 1994; Puntasen, 2007). It has also been argued that the expansionist approach to economic development can ultimately be detrimental (Schumacher, 1973). This issue will be addressed in detail later in the chapter.

4.2 THE SCOPE OF STUDY

The chapter's empirical analysis focuses on the relationship between pollution generated by trade-related production activities (both at home, via exports, and abroad, via imports) and domestic Economic, Environmental, and Social indicators.

In terms of coverage, the empirical analysis examines a total of 85 countries, 30 developed economies and 55 developing countries, during the 10-year period between 2001 and 2010. It looks at all 97 categories of internationally traded goods, as classified by the Harmonized System (HS Codes), with the exception of "vacant" chapters, which are Ch. 77 and Ch. 98 (Chapter 77 is reserved for future international use, and Chapter 98 is reserved for miscellaneous national use). In this regard, the empirical analysis effectively takes into account the production pollution of all trade in physical goods.

In terms of definition of environmental impacts, this empirical analysis is focused on the pollution generated by the production processes of the said physical goods, in terms of overall production of toxic pollution associated with a given production sector (taking into account the air, water, and ground pollution impacts of each production activity). The design of the LHS variables are meant to determine how much overall pollution is generated in order to satisfy the demand for goods derived from (or induced by) international trade. Consumption, post-consumption, and transportation pollutions, the exact estimation of which are elusive in nature, are left for future research, and are areas where succeeding papers can build on, when and where data requirements are available.

The demand-side analysis, however, deals with the issue of preferences, which are often not quantified or collected as numerical data, especially in large-scale comparisons between a large number of individuals, due to their complex and subtle nature. As a result, it follows that the delicate issue of agents' preference in consumption should be addressed in qualitative terms.

4.3 EMPIRICAL RESEARCH QUESTIONS

The generation of pollution in commercial activities can be considered a tradeoff between environmental quality and income. When the domestic economy incurs pollution from the production of then-exported goods, it can be considered that it is, through trade, exchanging domestic environmental quality for economic gains. On the other hand, a country's consumption or input requirement patterns may induce the creation of pollution in other countries. Of course, this is not to say that trade is the sole contributor of pollution, but as the research agenda is interested in how trade is linked to environmental quality, which will lead to recommendations to ensure a favourable relationship between the two aspects, the paper will address the issue of pollution generated to satisfy the demand for traded goods.

From the environmental point of view, this study is interested in whether and how domestic environmental quality is translated into cleaner export and import patterns, while it is also interested in looking at the relationships between trade structures and other economic and some social factors.

Basically, the study is interested in the pollution levels generated by 1.) export production (where production pollution occurs at home), and 2.) import demand (where production pollution occurs in the rest of the world - RoW).

The empirical section of this chapter aims to answer the following questions:

1. "Do domestic linkages between national environmental, economic, and social factors and its trade-associated production pollution levels exist? If yes, what are the directions and significance of such relationships?"

2. "Apart from the linkages between a country's domestic characteristics and its export structures, what are the correlations between such domestic factors and the amount of pollution it induces abroad?"

3. "Are these linkages between domestic factors and production pollution in trade different between developed and developing countries?"

4.4 METHODOLOGY AND DATA

4.4.1 The Model

The empirical analysis examines the amount of pollution generated in trade-related production for a large number of countries over time, and includes both cross-sectional and time-series properties. Given the nature of the research questions and variables, the study uses the Fixed Effects panel regression to estimate the relationships of interest, in order to take into account the country-specific characteristics of each economy.

The relationships of interest are those between the characteristics of the domestic economy and 1.) the amount of pollution it creates at home, for the purpose of international trade, and 2.) the amount of pollution it stimulates abroad in order to satisfy its excess demands. In examining them, a detailed indication of trade-related pollution is required, and, consequently, the study constructs two such indexes for the purpose of the panel analysis. The relationships of interest can be summarized with the following equations.

$$l\_EX\_POLL_{i,t} = \alpha_0 + \alpha_1 l\_EPI_{i,t} + \alpha_2 l\_TRADE\_GDP_{i,t} + \alpha_3 l\_GDPK_{i,t} + \alpha_4 l\_IND\_GDP_{i,t} + \alpha_5 l\_URBAN\_POP_{i,t} + \alpha_6 GOV\_EFF_{i,t} + \alpha_7 RULE\_LAW_{i,t} + \varepsilon$$

$$l\_IM\_POLL_{i,t} = \beta_0 + \beta_1 l\_EPI_{i,t} + \beta_2 l\_TRADE\_GDP_{i,t} + \beta_3 l\_GDPK_{i,t} + \beta_4 l\_IND\_GDP_{i,t} + \beta_5 l\_URBAN\_POP_{i,t} + \beta_6 GOV\_EFF_{i,t} + \beta_7 RULE\_LAW_{i,t} + \delta$$

The equations listed above are used to determine the relationships between domestic economic, environmental and social characteristics and trade-induced production pollution, which is defined as the pollution generated in the production of goods which are traded internationally. Trade-induced production pollution is classified into pollution from exports and pollution from imports, which will be addressed in detail in the following section.

As was previously mentioned, the study examines 85 countries over a ten-year period between 2001 and 2010, where they can be classified into 30 developed economies and 55 developing countries. In addition to the overall panel which includes all 85 countries, which aims to examine the relationships in general, additional group-specific panels will also be employed to observe whether the signs and significance of the relationships are different between developing and developed countries. It should also be noted that, as the LHS variables, EX_POLL and IM_POLL, are to be used separately, an estimation is conducted two times for each of the country groups (once for the production pollution generated by exported goods, and once for the case of imported goods), yielding 6 panel estimates in total.

4.4.2 Data and Variable Description

The objective of the paper requires some measure of environmental costs of trade, and this is represented by the use of 2 left-hand side (LHS) variables, which are the EX_POLL and IM_POLL.

Table 4.1 - Data and Variable Descriptions

Variable Name	Name	Side	Definition	Source	Expected Sign(s) – *ex ante*
EX_POLL	Export-induced Production Pollution	LHS (1)	Amount of pollution (in pounds) generated by export-based production. This is borne by the Home country.	Compiled by author	n/a
IM_POLL	Import-induced Production Pollution	LHS (2)	Amount of pollution (in pounds) generated by import-based production. This is borne abroad by other countries.	Compiled by author	n/a
EPI	Environmental Performance	RHS	The comprehensive indicator of environmental performance. We use the score rather than rank.	YCELP & CIESIN	(-)
TRADE_ GDP	Trade Openness	RHS	The sum of export value and import value divided by the GDP of the same year.	Compiled by author	(+)
GDPK	GDP per Capita	RHS	A measurement of economic progress and advancement.	WDI	(+)
IND_GDP	Industrial Sector share of GDP	RHS	A measurement of the dependence of a country on its industrial sector.	WDI	(+)
URBAN_ POP	Share of Urban Population	RHS	A measurement of a country's level of urbanization.	WDI	(+,-)
GOV_EFF	Government Effectiveness	RHS	The quality of public services, policies, government credibility, and the perception of such qualities.	WGI	(-)
RULE_LAW	Rule of Law / Enforcement	RHS	The confidence and compliance to rules and laws, and the quality of a country's justice and legal systems.	WGI	(-)

The most important variables in this empirical analysis are the EX_POLL and IM_POLL variables, which are compiled by the author from several sources. The two variables differ in practice, as EX_POLL is the measurement of pollution that occurs at home and IM_POLL is the pollution that home induces in other countries, yet the construction of the two indicators are similar, in that they are the yearly collective sum of estimated production pollution associated with the production of exported goods (where the pollution occurs at home) and imported goods (where home's excess demand generates pollution in other countries or the rest of the world).

EX_POLL represents the sum of pollution generated in all production of goods in country i at year t. It represents the amount (in pounds) of land, water, and air pollution generated with the production of physical goods in a given year, for the purpose of exports. It is useful to note that domestic production can be categorized into production for domestic uses, and the production of exported goods to be consumed elsewhere. The study is interested in the amount of pollution generated by production in the latter category.

$$\begin{aligned} &Pollution\ from\ Overall\ Production\ at\ Home_{i,t} \\ &\quad = Pollution\ from\ Production\ for\ Domestic\ Consumption_{i,t} \\ &\quad + Pollution\ from\ Production\ of\ Exported\ Goods_{i,t} \end{aligned}$$

In a similar light, consumption activities at home are related to the generation of pollution elsewhere, in the locations where the goods are produced. IM_POLL measures such pollution which is borne in other countries when the home economy satisfies its excess demand by purchasing goods from abroad.

$$\begin{aligned} &Pollution\ Induced\ by\ Overall\ Consumption\ at\ Home_{i,t} \\ &= Pollution\ Induced\ by\ Consumption\ of\ Goods\ Produced\ Domestically_{i,t} \\ &+ Pollution\ Induced\ by\ \ Consumption\ of\ Goods\ Produced\ Abroad\ (Imports)_{i,t} \end{aligned}$$

Note that the first term is not related to international trade, but is rather a matter of domestic activities, and, as a result, the model will focus on the latter term, which corresponds to how the domestic economy inadvertently contributes to the creation of pollution abroad.

The formulas for the construction of the two LHS variables are similar to one another, even though the variables embody somewhat different sets of rationale. The biggest difference lies in their location where the pollution occurs. The two variables need not always, however, be increasing with one another. This is because the export and import structures of a country can incorporate different compositions of sectors, which corresponds to different levels of pollution that are induced by trade. As a result, it is possible for a country to generate high levels of pollution through export production, while the pollution it induces through import demand is low, and vice versa.

$$EX\_POLL_{i,t} = \sum_{j=1}^{n} (Value\ of\ Export_{j,i,t} * Production\ Pollution_{j,i,t})$$

$$IM\_POLL_{i,t} = \sum_{j=1}^{n} (Value\ of\ Import_{j,i,t} * Production\ Pollution_{j,i,t})$$

Here, it can be seen that the way that EX_POLL and IM_POLL are designed attributes increased trade-induced production pollution to several factors. The first factor is simply the increase in the volume of imports or exports, which is then multiplied by the per-dollar amount of pollution associated with each of the production sectors. At any rate, cleaner production sectors will not skew the pollution estimation by much, as the multiplying pollution term is small. It is possible that countries with larger trade volumes will not incur as much pollution as another country whose trade volumes are small, but focuses on heavily-polluting sectors. The second important factor is the levels of pollution generated by each sector, for the purpose of trade.

In constructing these two indexes, two major sources of information are required. The trade volume data is obtained from the ITC Trademap database, while the pollution levels by sector comes from Hettige et al. (1995). At any rate, the denominations of the two data sets are categorized differently, as the trade volume data is organized in Harmonized System, whereas the pollution data is classified in International Standard Industrial Classification codes. This requires the translation of data from one classification into the other. This paper takes a look at the 2-digit level for normal HS categories (where translation into ISIC is straightforward), and considers the product codes at the 4-digit level for HS categories that are comprised of multiple ISIC groups. Some of the product groups can be readily translated when the HS labels and ISIC labels match in terms of category name and contents of the group. On the other hand, some HS product codes are comprised of several ISIC groups. In such a case, the estimation of the pollution levels would look at each of the 4-digit subcategories of each 2-digit group, in order to decide where each of the 4-digit subcategories belong in ISIC format. The estimated pollution levels for each of the HS codes are then calculated according to the percentage of composition of each ISIC

category (for example, if an HS code is comprised of 4 ISIC product groups, then the calculated production pollution level for that HS category will be calculated from the weighted sum of the pollution levels in the 4 ISIC groups).

Again, it should be noted that EX_POLL and IM_POLL represent different aspects of trade and pollution, despite their similar calculation methods. EX_POLL represents the trade-off between domestic environmental quality and income gains through trade. IM_POLL has a slightly deeper meaning – its message is that domestic factors will inadvertently affect pollution in other countries (through trade).

The right-hand side (RHS) variable choices are selected to encompass the three dimensions of Sustainable Development – containing the Economic, Environmental and Social Dimensions – and link them directly to the issue of international trade. The Environmental Dimension is also represented in EX_POLL and IM_POLL, the LHS variables in the model.

Amongst the independent variables is the Environmental Performance Index (EPI), a comprehensive indicator of environmental quality constructed by the Yale Center for Environmental Law & Policy (YCELP), of Yale University, in a joint project with the Center for International Earth Science Information Network (CIESIN) of Columbia University (Hsu et al., 2014). The dataset begins at the year 2000, and incorporates a set of 232 countries, islands, and geographical classifications. The EPI can be considered a comprehensive indicator of domestic environmental quality, as it collectively represents overall environmental quality, both in terms of the ecosystem itself and the influences of current environmental quality in a given country on human health. It can be broken down into two major subcategories, which are the “Environmental Health” indicator, and the “Ecosystem Vitality” indicator. The first subcategory represents the effects of environmental conditions on child mortality and the health impacts of air pollution and water availability, whereas the second subcategory is used to measure the quality the ecosystem itself and the sustainability of primary production activities (agriculture, forestry and fishery sectors). Thus, the EPI is selected as a comprehensive measure of

the domestic Environmental Dimension, both in terms of issues and the number of countries covered, and can include many environmental concerns at the same time.

Table 4.2 – Composition of the EPI

	Subcategory	Topic	Indicators	Weight in EPI
EPI	Environmental Health (EH) (30% weight)	Environmental burden of disease	Child mortality	15%
		Effects of air pollution on humans	Indoor air pollution	3.75%
			Particulate matter	3.75%
		Water availability	Access to drinking water	3.75%
			Access to sanitation	3.75%
	Ecosystem Vitality (EV) (70% weight)	Effects of air pollution on ecosystem	SO2 emissions (per capita)	4.38%
			SO2 emissions (per GDP)	4.38%
		Effects of water on ecosystem	Change in water quantity	8.75%
		Biodiversity & habitat	Biome protection	8.75%
			Marine protection	4.38%
			Critical habitat protection	4.38%
		Agriculture	Use of agricultural subsidies	3.89%
			Regulation of pesticides	1.94%
		Forestry	Growing stock change	1.94%
			Forest loss	1.94%
			Forest cover change	1.94%
		Fisheries	Fishing stock overexploited	2.92%
			Coastal shelf fishing pressure	2.92%
		Climate Change	CO2 emissions (per capita)	6.13%
			CO2 per GDP	6.13%
			CO2 emissions per electricity generation	2.6%
			Renewable Electricity	2.6%

Source: YCELP & CIESIN; Hsu, Angel, Emerson, Jay, Levy, Marc A., de Sherbinin, Alex, Johnson, Laura, Malik, Omar, Schwartz, Jason D., Jaiteh, Malanding. (2014). The 2014 Environmental Performance Index. (Note that the EPI itself uses data from many sources in compiling the index.)

The Table 4.2, based on the formal definitions of the EPI methodology, shows that the EPI incorporates most of the major environmental concerns, including climate change, resource exhaustion, pollution, and the quality of the ecosystem, while also taking into account some measures of Social Dimension concerns, such as health and access to water and sanitation (captured in the EH subcategory). As a result, the EPI can be considered a good representation of the environment, while capturing some of the basic resource needs of the population.

In this research, the EPI scores, rather than the rank, are used, so that a country's changes in its own performance can be captured without needing to compare such performance with other countries.

Also, in order to represent the impacts of "social integrity" in the supply-side, this paper also employs the WGI Governance Indicators (Kaufmann, Kraay, & Mastruzzi, 2013) in the model. Here, two variables are selected; these are the "Government Effectiveness" and "Rule of Law" variables. The Government Effectiveness variable is straightforwardly defined; it represents the government's ability to design and implement policies, and provide infrastructures and civil services. The Rule of Law variable indicates how much agents conform to rules and laws, as well as the levels of confidence in the legal and enforcement mechanisms.

The WGI index also incorporates four other governance variables as well. These are the "Voice and Accountability", "Political Stability", "Regulatory Quality", and "Control of Corruption". The first two variables are focused on political issues. The Regulatory Quality variable is defined in terms of policy quality, and thus the Rule of Law variable is considered a more direct approach to the issue of domestic environmental enforcement. The Control of Corruption variable is concerned with the government sector and the principal-agent problem (whereas this study will focus on the environmental "cleanliness" of the private sector, which acts voluntarily in production activities rather than the political cleanliness *per se*). As a result, it is decided that the Rule of Law variable will be used as the most direct representation of the rules and regulations argument (including the *environmental* regulations, which

operate on agents' compliance with domestic laws and rules – when agents are confident in the quality of laws, they will refrain from illegal and infringing acts, due to the disincentive of costs that can be imposed with legal persecutions), whereas the Government Effectiveness is also included to represent the overall ability of the government, and to examine whether this effectiveness corresponds positively to pollution (meaning that, on average, government policies emphasizes on production growth, arguably) or negatively (which may suggest that government policies are directed mainly towards environmental conservation).

In addition to the Environmental and Social variables, the normal economic variables are to be included, as production pollution will likely be associated with economic factors. The selected variables are meant to represent the different parts of the economy. Note that they are mostly real sector variables, as the study is focused on pollution generated by production activities. GDP per capita (2005$), trade openness, industrial sector share of GDP, and urban population are variables related to economic progress, and are included in the model. These are meant to represent the different aspects of the real sector economy.

Table 4.3 – Descriptive Statistics

Variable Name	Name	Obs. No.	Min	Max	Mean	Source
EX_POLL	Export-induced Production Pollution (in pounds)	850 (2001-2010)	57,165,899,660	3,879,726,538,596,810	324,994,503,830,324	Compiled by author
IM_POLL	Import-induced Production Pollution (in pounds)	850 (2001-2010)	1,359,047,763,400	6,234,364,813,650,660	341,938,280,226,029	Compiled by author
EPI	Environmental Performance Index	850 (2001-2010)	32.54	80.53	55.67	YCELP & CIESIN
TRADE_GDP	Trade openness	850 (2001-2010)	13.46	442.14	74.23	Compiled by author
GDPK	GDP per capita (PPP) 2005$	850 (2001-2010)	133.27	87,716.73	14,356.95	WDI
IND_GDP	Industrial sector share (value added)	850 (2001-2010)	10.75	66.76	30.91	WDI
URBAN_POP	Share of urban population as percentage of total population	850 (2001-2010)	11.09	100	62.86	WDI
GOV_EFF	Government Effectiveness	850 (2001-2010)	-1.17	2.40	0.44	WGI
RULE_LAW	Rule of Law / Enforcement	850 (2001-2010)	-1.37	2.00	0.30	WGI

4.5 EMPIRICAL FINDINGS

Table 4.4 – Panel Estimation Results

	Result of the Panel Regressions (Fixed Effects, for Import / Export – generated pollution for all / developed / developing countries)					
	(1) IM_POLL, all	**(2)** EX_POLL, all	**(3)** IM_POLL, dev'd	**(4)** EX_POLL, dev'd	**(5)** IM_POLL, dev'ing	**(6)** EX_POLL, dev'ing
const	29.5934	26.2985	-6.6685	-19.4220	29.7319	26.7535
t	(19.5954) ***	(15.2874) ***	(-0.8483)	(-2.2087) **	(14.9936) ***	(18.0186) ***
l_EPI	-1.5838	-2.8280	0.2651	0.7326	-1.7253	-3.1620
t	(-6.2408) ***	(-8.7607) ***	(0.2650)	(0.6457)	(-5.1398) ***	(-11.7765) ***
l_TRADE_GDP	-0.1288	-0.1232	-0.5979	-0.2973	0.0176	-0.0629
t	(-1.4109)	(-1.1983)	(-5.9073) ***	(-2.2858) **	(0.1141)	(-0.4364)
l_GDPK	0.4587	0.6207	1.7975	2.1502	0.1572	0.2079
t	(3.8528) ***	(5.0329) ***	(10.1960) ***	(15.9916) ***	(1.4450)	(2.0132) **
l_IND_GDP	1.0579	2.8860	2.5245	3.6576	1.4747	3.7180
t	(4.7032) ***	(14.2186) ***	(5.2482) ***	(7.3912) ***	(6.6702) ***	(19.9778) ***
l_URBAN_POP	0.3051	0.3873	3.9167	4.3845	0.4595	0.6003
t	(1.7092) *	(1.9832) **	(13.7619) ***	(12.9717) ***	(2.2306) **	(3.9456) ***
GOV_EFF	1.5956	1.5244	0.6721	0.1205	2.0635	1.9155
t	(6.8651) ***	(6.1818) ***	(1.4640)	(0.2106)	(11.5814) ***	(9.4200) ***
RULE_LAW	-1.0225	-0.7663	-2.5226	-1.8832	-1.3825	-1.0945
t	(-5.1935) ***	(-3.2484) ***	(-5.4903) ***	(-3.2445) ***	(-7.1485) ***	(-4.4297) ***
R-squared	0.4801	0.6123	0.3831	0.4243	0.4067	0.6496
Adj-R sq.	0.4177	0.5657	0.2981	0.3455	0.3326	0.6058
Observations	850	850	300	300	550	550

Source: Nakawiroj (Forthcoming): "Trade and Sustainability: How Strong are the Empirical Linkages between Trade Structures and Sustainability Performance?" – Article accepted for publication in the International Journal of Economic Policy in Emerging Economies.

From the estimation results, some information on the relationships between the Economic, Environmental and Social Dimensions, and exports/imports can be observed. The correlation between trade-induced production pollution and several economic factors are particularly strong, especially the share of the industrial sector, which corresponds to increased production pollution in trade in all scenarios examined.

Environmental Variable: The linkages between better domestic environmental quality, collectively represented by the Environmental Performance Index (**EPI**), and lower levels of EX_POLL and IM_POLL are present in the overall scenario (for 85 countries) and the developing countries scenario (55 countries). This suggests that, on average, and for emerging economies, countries with better environmental quality at home tends to produce less pollution for its exports, and tends to induce lower amounts of pollution in their trading partners' ecosystems. In the case of developing countries, in particular, the EPI is strongly significant, suggesting at least some degree of linkages between environmental performance and trade (with respect to pollution generated for the purpose of trade). At any rate, the EPI does not show up as significant in the case of developed countries, which may indicate that the transmission or relationship between domestic environmental quality and production pollution in trade is weak in advanced economies.

Social Variables: One of the key findings of the study is that the quality and compliance with domestic rules of law (**RULE_LAW**) is related to lower levels of trade-induced production pollution in all cases examined. This is an important message that supports the rules and regulations argument. Of course, the presence of efficient rules and laws may not be able to eliminate pollution altogether, but it is useful since a prudent law and enforcement system would deter illegal or environmentally infringing activities, and where the mechanisms are effective, producers who resort to unlawful, unfair, or excessively damaging practices are kept out, leaving only the more socially considerate or law-abiding firms and producers. This variable captures the disincentives provided to the environmentally inefficient producers who may contribute to excessive pollution, whereas the issues of standards

and technological improvements are still in place, in the hopes of making the existing production activities in polluting industries cleaner over time.

The Government Effectiveness (**GOV_EFF**) appears to be, in accordance with its definition, oriented towards economic growth and expansion. It is observed that GOV_EFF is positively and significantly related to pollution in trade in the overall panel and the scenario for emerging economies. This is possibly and likely due to the governmental role in promoting economic growth through policies. In particular, the policy objectives of developing countries are often related to economic progress, where such countries advance economically through their industrial sector activities (in the absence of advanced or large tertiary production sectors). Poorer countries attempt to move away from primary production, agriculture, and natural resource gathering activities, towards a more robust and profitable industrial sector, where middle-income developing countries still rely much on these secondary activities. In addition, developing economies are often characterized by the inadequacy of infrastructures, and governmental actions to provide them often require industrial inputs that create pollution, many of which would need to be imported. As such, it is argued that economic expansion through governmental activities can be beneficial, but the side-effects of pollution are also to be considered. It can be observed from the panel result that this effectiveness of the government exhibits no significant relationship with production pollution in trade for the case of advanced economies.

Economic Variables: The economic variables are often statistically significant, and, whenever they do, they usually show up as positive. The industrial sector share of GDP (**IND_GDP**) is the most significant contributor to production pollution both in terms of exports and imports, where the relationship between the variable and both EX_POLL and IM_POLL are significant and positive in all cases examined, suggesting a strong linkage between industrialization and trade-induced production pollution in both directions. As to be expected, this is likely because a larger industrial sector is produces greater amounts of heavily polluting goods that are then exported *and* demand industrial inputs from abroad, many of which are associated with high levels of production pollution. The observation suggests that

industrialization at home does not only produce greater pollution at home, but mass-industrialization in one country also generates pollution abroad via trade.

The GDP per capita (**GDPK**) also exhibits positive correlation with trade-induced production pollution. It can be argued that, as the per capita income increases with economic progress, an economy engages in more economic activities and may produce and demand greater amounts of goods that are associated with higher production pollution. As such, pollution in trade, similar to other measures of pollution, can be considered a side-effect of economic development in this regard.

The share of urban population (**URBAN_POP**), another indicator of economic progress, is variably, but consistently, related to production pollution in trade. The degrees of significance vary across scenarios, but are significant and positive in every scenario. The positive relationship between urban population and production pollution induced by trade is particularly strong for the case of advanced economies.

A notable exception from the estimation results is the trade openness variable (**TRADE_GDP**), which is not statistically significant in the overall and developing countries scenarios. The degree of openness variable is associated with lower pollution levels in the case of developed economies, which may support the pro-liberalization argument in some cases. At any rate, this positive environmental linkage seems to be limited only to developed countries so far. At any rate, the fact that production pollution produced by exports are reduced when a developed country is more open to trade may prompt the concern of whether pollution is shifted the developing countries, but it appears that the import-induced production pollution, which are to be borne in other countries for the purpose of satisfying home's excess demand, is also negatively and significantly related to trade openness. This is a somewhat reassuring observation.

As a result, the empirical analysis yields the result that economic factors at home tend to be associated strongly with trade-induced production pollution, both in terms of export-generated pollution borne at home and import-induced pollution occurring in other parts of the world. Industrial sector dependency is the strongest contributor to such measures of pollution both at home and abroad, while rules and regulations in the form of laws can create significant downward pressures on the creation of pollution, which suggests that the presence of efficient rules and laws, being the supply-side of the social integrity term, can fill the existing gap between countries' domestic environmental performance and their production actions in international trade.

4.6 CONSUMPTION AND DEMAND-SIDE CONSIDERATIONS

The previous section uses quantitative measures to address the supply-side considerations of trade and the environment, and supports the presence of effective rules and regulations in decreasing pollution in trade, whereas this section will address the qualitative issues in the demand-side. As can be seen from the previous section, rules and regulations can satisfactorily deter pollution, and will likely obstruct pollutions and environmental degradation from the production side. Here, it should also be noted that the disincentives to environmentally hazardous actions may not be sufficient in ensuring the best outcome. Ideally, agents should be environmentally (and socially) mindful even when choices are voluntary and no penalties are present.

On the demand side, the presence of regulations alone will not likely succeed in promoting a public-minded society, as they can only deter outright harmful practices, but the additional efforts to contribute to better environmental quality are the result of voluntary decision-making process of agents, which may not be successfully promoted through aversion of costs alone. There are a number of considerations that can promote voluntary and instilled environmental improvement from the demand-side. These are mentioned in the succeeding parts of this section.

In this respect, there are two paradigms regarding the improvement of environmental situations – one relies on the ability of the economies to improve their production technology to make production activities cleaner and more environmentally friendly (recall the Technique Effect from literature review section and Chapter 3.), while another paradigm proposes that human material wants should also be limited in a voluntary manner by the agents themselves. The latter suggestion on the demand-side behaviour of agents emphasizes the importance of beyond-profit goals and disagrees with the profit-first approach to businesses, arguing that humans should learn to have enough, without being constantly bent on the pursuit of profits or material gains (Bhongmakapat, 2011b; Payutto & Evans, 1994; Schumacher, 1973). To complete the picture, this section addresses several considerations that can strengthen the demand-side aspect of social integrity.

4.6.1 Long-run Considerations on the Environment

It should be noted that the most important goal of Sustainable Development and environmental preservation is arguably not for the sake of conservation per se, but rather to permit future generations to enjoy the benefits of natural capital and a healthy ecosystem. The consumption of such capital stocks can be viewed in a similar fashion to normal intertemporal consumption decisions. This view is adopted in a number of environment-related papers, such as Endress, Roumasset, and Zhou (2005), Hazilla and Kopp (1990), Ng and Wang (1993), and Ng and Wills (2009). The concept is that if we were to consider our present generation as the period t equals, say, 1, then the future generations becomes the period 2, 3, and onwards. During an intertemporal decision to spend limited income across multiple periods of time, a rational and sensible individual would not spend the entirety of his/her resources on present consumption. The same rationale can be applied to natural resources and the ecosphere, where excessive pollution is akin to the act of consuming or eating away the vitality of the ecosystem. A difference between the normal intertemporal decision problem and that of the environment lies in the discontinuity of agents; in the normal scenario, it is often the same person who lives through different periods, but in the environmental application, different periods are now associated to different agents

across different generations, who, given the self-interest maximizing human tendencies, are likely to place more emphasis on the current period (themselves). This may be one explanation why consumption preferences of an average economic agent tend to create environmental costs in the future, as the satisfaction or benefits from consumption are enjoyed by oneself, where the more subtle long-run costs are transferred into a distant future.

Conceptually, this can make the society better off in the long run if agents are public-minded. Of course, similar to how forgoing some of today's consumption (so as to ensure more resources for a better standard of living in a future period) reduces some part of today's utility, the (voluntary) reduction of heavily polluting activities may reduce the consumption satisfaction of today's agents, but this can benefit the future generations as they would inherit a healthier ecosystem. If the global welfare across generations is considered to favor a stable allocation of resources over time (consumption smoothing), over a period of very high consumption followed by subsequent periods of low consumption or welfare, then it can be argued that some voluntary reduction of polluting activities can be welfare improving for the long-run. Yet, if agents are concerned only with their own present-generation utility, it will be unlikely for such an outcome to occur. This is why public-mindedness can play an important role in the demand-side of the issue (Bhongmakapat, 2010, 2011a, 2011b). Ng and Wills (2009) takes the view that the issue of cost structures are to be addressed, as the problem may occur from the market failure in managing the environmental capital rather than negligence or selfishness, whereas Payutto and Evans (1994) acknowledge the need to include environmental costs into economic decisionmaking, but stressed that the lack of ethics and morality in the society is one of the most important contributors to the problems.

4.6.2 Education

Arguably, education can serve as an indirect driver of sustainable growth and consumption. The contribution may come in two channels – education can, over time, promote technological improvement that can (hopefully) lead to environmental

improvement or lower pollution and degradation levels. On the other hand, education can promote awareness on environmental necessity. With improvements in education, people may reduce their environmentally harmful actions. This is due to both better income opportunities that act as better alternatives to resource exhaustion or unwitting degradation of the environment (which are acted out of poverty and extreme financial necessity in many cases), and greater awareness of the importance of environmental conservation. If education tilts the economy and workers away from primary productions and slash-and-burn activities, then the environment should see improvement, but if education tilts the economic structure towards mass industrialization or does not succeed in lifting the economy from the middle-income trap, then the employed technology (which are industry-oriented) may not necessarily result in environmental improvement.

4.6.3 Buddhist Economics

An alternative approach to resource management, known as "Buddhist Economics", is interested in the factors that determine aspects such as preferences and consideration. It views consumption activities as not an end in themselves, but suggest that the consequences of consumption or other economic activities are to be taken into account as well. In addition, the framework urges the inclusion of ethical and moral considerations into economic thinking. With respect to technological progress, Schumacher (1973) expresses concern over the conventional development of technology, and advocates the concept of "appropriate technology" where the desired characteristics are not profitability or the ability to conduct large-scale operations, but are rather the environmental and social aspects, such as environmental friendliness, affordability, and energy efficiency. It is to be noted that the school of Buddhist Economics is focused on the internal aspects of individuals, which are then translated into their decisions and actions. Where satisfaction is often termed collectively as utility, Buddhist Economics would classify this satisfaction further into two main categories: "*tanha*" and "*chanda*", where the first term is more akin to satisfaction derived from greed, lust, or craving, and is considered a harmful motive, while "chanda" is considered a positive aspect and a more desirable form of satisfaction,

often derived from the satisfaction in taking actions to benefit others (Payutto & Evans, 1994), or the satisfaction derived from "purer" forms of preference, such as being satisfied with one's occupation. The reason why this deserves mention in our qualitative section is the economic implications of the two different motives. Decisions driven by "chanda" (positive aspirations, such as to improve oneself, to help others, to uphold one's responsibilities) will likely lead to positive outcomes in the economy, and this type of socially-mindful motives or aspirations will dissuade agents from taking environmentally or socially harmful courses of action, while decisions driven by "tanha" (purely self-centered motives, often unrestrained, which are associated with "selfish" drives such as greed, self-interest, lust or cravings) will often result in negative environmental and social side-effects, both unwittingly and deliberately. In short, tanha is mainly concerned about oneself, and is a motive of selfishness that usually exclude the well-being of others and long run consequences (which are the most important concerns when discussing the Social and Environmental Dimensions of Sustainable Development). Puntasen (2007) expresses the concern that the modern capitalistic paradigm is focused too much on self-interest maximization and competition, which are subsequently aimed at material satisfaction and hedonistic pleasures.

It should be noted that the academic suggestions of Buddhist Economics need not always be religious or confined only to Buddhists, but can be adopted for use by Buddhists, people of all religious beliefs, or atheists alike. What we can take from the argument of Buddhist Economics in this regard is that different motives can produce drastically different outcomes, especially in beyond-profit areas where wealth and immediate gains are not present. This is one reason why the Environmental and Social Dimensions are often adversely affected by malpractices in the economic or business sectors. The collective outcome in the economy is, after all, derived from the actions of agents, who make decisions through influences of their preference and satisfaction patterns. As such, the internal motives of agents can no longer be dismissed as irrelevant.

4.6.4 Mind Development

Given the aforementioned importance of economic agents' preferences (or "the mind"), which have profound impacts on the consequences of development and determines the occurrence of undesirable side-effects, numerous scholars would argue that many of the present-day problems are to be remedied through "development of the human mind" (towards a more socially-considerate, ethical, and public-minded disposition), and that, unless the issue of the human mind is not addressed, some of the prominent present-day problems will not be solved (Bhongmakapat, 2010, 2011a, 2011b; Indaratna, 2007; Payutto & Evans, 1994; Puntasen, 2007). Here, the term "development" refers to the shift of preferences to include societal costs and benefits and long-run intergenerational consequences into the decision-making process, as opposed to myopic or selfish mindsets where self-interests and short-run gains dominate the preference patterns of the agent.

As most socially-desirable actions are voluntary, the development of human ethical, moral and social considerations will not only deter some forms of malpractices, but will encourage beneficial actions beyond the requirements of rules and laws. Many methods to mind development has been proposed, ranging from educational improvement, awareness campaigns, to meditation and minimalist trainings. At any rate, the most successful forms of mind development should be able to raise social and environmental awareness and lower agents' emphasis on material gains and self-interest. In a society where good practices are the norm, it is likely that these standards and economic culture will perform as *de facto* regulations that prevent socially or environmentally harmful practices and promote cleaner approaches to business, production and consumption.

The framework of Sufficiency Economy also plays a role in this regard (Indaratna, 2007; Puntasen & Rees, 2008). If agents act with moderation, they will optimize the volume of their activities (such as consumption) rather than maximizing them. When coupled with the second component of reasonableness or consideration of the causal relationships, the decision process of agents (consumption, production,

investment, or other economic activities, including the *means* selected to achieve their objectives) will take into account additional considerations, most importantly environmental constraints, social or public costs of action, and long-run considerations. The inclusion of these factors will lead to lower environmental harms, social costs and negative externalities, and reduce the risk of natural capital exhaustion, respectively.

From the preceding parts, it can be argued that social integrity, the joint presence of effective regulations (the mandatory part), and moral and ethical considerations (the voluntary part) can help in addressing the environmental concerns. At any rate, this is unlikely to be an easy objective, but will prove itself to be worthwhile in the long run.

To conclude this section, it is argued that, in order to improve environmental cleanliness in international trade, both supply and demand-side measures should be jointly considered. This is how and why the aspect of Social Integrity is important. On the supply side, rules, laws, regulations are needed to deter environmental (and social) malpractices, as businesses, producers and firms are expected to operate within the boundaries of the law in seeking profits. For agents operating within the regulatory constraints, it is important that these constraints are designed in ways that can actually deter malpractices that lead to long-run environmental harms, while, for agents with tendencies to conduct illegal practices, the enforcement mechanisms will need to be prudent, as agents operate on the balance of expected benefits and costs. At any rate, these standards, where possible, should not impose too much of a burden on the economy as well, as their purpose is not to destroy economic livelihood, but rather to preserve that of the environment.

4.7 SUMMARY AND CONCLUSIONS

1.) An important finding of this chapter's empirical analysis is the estimation result which shows significant and negative relationships between the quality of the rule of law and production pollution levels in trade in each of the

estimated cases. This supports the argument that an efficient legal system will be able to discourage environmental degradation from economic and profit-seeking activities. The public expectation of such effectiveness is also important as the financial and legal costs of malpractices are associated with high probability levels.

2.) Domestic environmental quality is significantly linked to cleaner trade structures in the overall scenario and the developing countries scenario, but this relationship is weak for the case of developed economies.

3.) In all estimated scenarios, higher degrees of industrial sector dependency are associated with greater amounts of trade-induced production pollution. For the case of exports, it can be seen that a country with larger industrial sector are likely to produce higher amounts of pollution as side-effects of its industrial production, thereby contributing to production pollution at home. On the other hand, the large industrial sector often means that more industrial inputs are demanded. These may be produced domestically (where, in such a case, the production pollution is not captured by the LHS variables of this model, as no international trade takes place), or it may be that such goods are produced in other countries. While this is beneficial in economic terms, it is associated with the side effects of pollution to be borne in other countries.

4.) The link between GDP per capita and trade-induced pollution is strong in the case of developed countries and in the overall panel. But the results suggest that this linkage is weak for developing countries.

5.) In the case of developed countries, trade openness is strongly and negatively associated with production pollution in trade, both for the case of exports and imports. As a result, this study acknowledges the possibility that trade liberalization can lead to a cleaner trade structure, in particular in the case of developed countries.

6.) The relationship between urbanization and pollution are positive and significant, suggesting that more urbanized countries tend to produce more export pollution, and will also induce higher amounts of pollution abroad. Government Effectiveness goes together with higher pollution levels in emerging economies, whereas this linkage is very weak in the developed countries scenario.

7.) The key finding of the empirical analysis is perhaps the observation that the rule of law is associated with lowered levels of pollution in trade; countries with better legal enforcement and greater confidence in the rule of law will likely produce less pollution at home and induces lower amounts of pollution in other countries. This supports the advocacy of rules, laws and regulations proposed by many studies, such as Brundtland and The World Commission on Environment and Development (1987), Esty (2001), Ekins et al. (1994), Arrow et al. (1995), Andreoni and Levinson (2001), and Bhongmakapat (2010, 2011a).

8.) It has been argued that rules and regulations, when they are efficient, can dissuade the occurrence of production pollution. At any rate, the consumption issues of agents should also be examined. This chapter argues that education and mind-development should be used jointly with use of rules and laws, when dealing with voluntary actions. Deterring malpractices is a necessary policy guideline, but the encouragement of prudent consumption values, social-mindedness and environmental considerations are also needed.

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CHAPTER 5
THE RELATIONSHIP BETWEEN DOMESTIC PERFORMANCE AND INTERNATIONAL ENVIRONMENTAL AGREEMENTS AFFECTING TRADE

BASED ON THE 3RD ARTICLE – INTERNAL RESEARCH PAPER

"What Determines International Sustainability Compliance?: A Case Study of Nations' Signing and Ratification in Multilateral Environmental Agreements"

Wasutadon Nakawiroj

Abstract

The paper examines the relationship (or any lack thereof) between countries' environmental, social, and economic performances at home, and its compliance in major international environmental agreements (IEAs), using the ordered logit model. It is observed that industrial sector dependency is the most important factor in determining the speed of ratification, affecting the willingness of compliance with the treaties in most cases examined, whereas the level of economic development significantly correlates to compliance in the case of the Kyoto Protocol, while environmental performance at home does little to encourage or affect compliance in the form of such agreements. Four major multilateral environmental agreements are examined (namely the Kyoto Protocol, the Rotterdam Convention, the Stockholm Convention, and the Cartagena Protocol). The issue of how fast, or whether, countries eventually ratify all of these major treaties conceived at the turn of the Century is also examined along with the case of individual treaties, yielding mostly similar and coherent results with the treaty-wise scenarios. As the paper is interested in the actual implementation and enforcement of the treaties, where states are bound by them, this study has focused on the ratification procedures in terms of speed and delays; a

country's speed of compliance are ranked in comparison to others, where the most "enthusiastic" ratifiers receive a higher rank in the ordered logit, and late-ratifiers or non-ratifiers receive a low compliance score. It can be argued that industrial sector dependency may significantly result in hesitation to comply with major multilateral environmental agreements, or the incentive to postpone the ratification process (or, in several cases, the absence of a binding ratification altogether).

5.1 INTRODUCTION

National governments may be able deal with local or regional standards with relative ease, given their jurisdiction over national bodies and the legal enforcement system, provided that they are efficient and equitable. Some environmental problems, however, occur on a very wide scale and transcend national boundaries, or are, by nature, the results of environmentally detrimental actions that many countries collectively contribute to.

The previous chapters have dealt with domestic environmental problems that occur in the home economy and are transmitted to other countries via trading behaviour or externalities, by looking at domestic indicators. The results have advocated the use of effective environmental rules, regulations, and standards throughout the sections, in line with the policy prescriptions of numerous existing papers. Looking merely at national environmental rules will not suffice, as many major environmental problems transcend national boundaries and will not joint cooperation from nation states. In addition, when attempting to understand the relationship between international trade and the environment, one must look at an important factor which affects trade – international environmental agreements. While they are often categorized as environmental, their provisions and implementations have direct (and often adverse) impact on international trade as they impose costs and may reduce economic competitiveness for production or increase complications in the transboundary movement of goods, depending on the scope of each treaty (effectively sacrificing some degrees of economic gain for environmental gain). Therefore, this chapter will focus on the international environmental agreements (abbreviated as IEAs or MEAs), which are amongts the most prominent sets of environmental rules.

The chapter will examine the relationship between domestic characteristics of countries and the time they take before ratifying a treaty (or taking another legally equivalent binding action), which binds the state to the will of the agreement in question. These IEAs serve as international rules and regulations made to deal with the environmental challenges.

The understanding of major IEAs is much needed when looking at the global multilateral trading community (especially the ones directed at trade or having strong implications/impacts on trade – as the WTO rules are clearly no longer the only ones affecting exports and imports). The selected four IEAs are categorized as environmental agreements, whereas their implications and contents are highly related to international trade and will most definitely affect trade through exports and imports (and the associated production) upon ratification and enforcement. These agreements will inevitably create costs for domestic producers when a treaty becomes binding, thereby affecting trade (likely in a negative manner – signifying a trade-off between trade volumes and environmental protection). As costs determine price and competitiveness, international trade will be affected when a treaty is ratified. For example, Aichele and Felbermayr (2013) estimated that compliance with the Kyoto Protocol will reduce exports of a committing country, possibly between 10 and 20 percent, and the industrial sectors will be effected most strongly by Kyoto commitment. The Rotterdam Convention is aimed directly at international trade with respect to the handling of hazardous chemicals. The Stockholm Convention generates costs associated with the handling and substitution of “persistent organic pollutants”, some of which are used in the production of traded goods, and the IEA also restricts trade in the 23 listed pollutants. The Cartagena Protocol is actively skeptical towards trade in living modified organisms (LMOs) and allows member countries to ban such imports on grounds of safety risks, and has notable implications on trade. As a result, when attempting to understand the link between trade and environmental issues, especially when rules and regulations are encouraged, such major IEAs should not be overlooked.

The previous chapter has observed that environmental performance at home can exhibit a non-negligible negative relationship with trade-related production pollution in the case for developing countries (and in the overall estimation, where a large portion of the countries are developing countries), meaning that countries' environmental performance at home may be associated with cleaner practices in the international community. This Chapter takes a look at whether environmental performance at home affects international environmental cooperation.

The speed and extent of compliance with international environmental agreements are attributed to many factors. These include international pressure (Fredriksson & Gaston, 2000), public participation and democracy (Fredriksson & Gaston, 2000; Neumayer, 2002; Verardi, 2004), technology transfer to developing countries, where such transfers can both increase and decrease the degree of cooperation (Qiu & Yu, 2009), environmental lobbying process and the number of legislator players (Fredriksson & Ujhelyi, 2006), as well as electoral cycles (Cazals & Sauquet, 2013), where developed countries have higher economic stakes and costs in ratifying an environmental agreement, while developing countries face lower costs due to their lower dependence on the business sector.

Instead of focusing on the political or governmental facets of IEA compliance, this paper categorizes variables according to each of the three dimensions that they belong to (Economic, Environmental, and Social), and examines how each of the dimensional characteristics of countries affect their compliance, or the lack thereof.

5.2 OBJECTIVE OF THE STUDY

A major objective of the study is to take a look at whether and how Environmental (EPI), Economic (Income, Trade, and Industrialization), and Social (Governance) Components at home are correlated to the speed of compliance in international treaties. This chapter will examine the relationship between a country's domestic environmental performance and its response towards major treaties. The governance (social) variables REG_Q and GOV_EFF are also taken into

consideration (the rule of law variable is omitted in this chapter as it reflects the quality and prudence of existing laws (such as the ones that will be conceived following the ratification of a treaty), in contrast to the formulation of new policies and governmental action).

Nevertheless, economic factors must always be considered as well. National decisions tend to be influenced by economic factors, which can range from concerns of economic competitiveness to domestic pressures from businesses that can potentially be affected if a treaty comes into effect. One can expect countries to consider not only the environmental effects (both at home or abroad) of ratifying a treaty, but also their economic and commercial interests as well. For example, exporters of fossil fuel will be much less inclined to bind themselves to the Kyoto Protocol, while LMO exporters have strong disincentive to participate in the Cartagena Protocol (Neumayer, 2002).

Participation in agreements, while a very important channel to ensure global environmental protection (Brundtland & The World Commission on Environment and Development, 1987), are basically the voluntary acts of nations, and, from the environmental point of view, the reduction of environmental harms (in particular the global warming problem caused by CO2 emissions) will be more effective if nations join an environmental agreement rather than having participatory nations pay the non-member countries not to pollute (Hoel & Schneider, 1997). Also, a successful IEA would require a quick course of action from countries, and delays in the ratification process are not desirable (Neumayer, 2002). At any rate, despite the voluntary nature of IEA compliance, nations can be pressured into participation by their own environmentally-conscious citizens, or can be pressured by the international community, as in the case of countries with high emission levels being pressured by other states to commit to the FCCC (Fredriksson & Gaston, 2000). Interestingly, there seems to be some diversity in how countries comply with IEAs, as smaller countries may be very quick in ratifying a treaty, while larger nations or major players may be slower in their action (Fredriksson & Ujhelyi, 2006).

A number of results from existing literatures are listed in the table (5.1).

Table 5.1 – Comparing the results from existing papers

Author(s) & year	**IEA(s) examined**	**Focal determinant(s) of interest**	**Result/Argument**
Bernauer, Kalbhenn, Koubi, and Ruoff (2008)	Various treaties from 1902 - 2005	Democracy	Contrary to theoretical expectations, the estimated effect of democracy on ratification is miniscule.
Cazals and Sauquet (2013)	48 agreements from 1976 – 1999	Electoral cycles	Developed countries' governments tend to ratify IEAs after election, due to the large economic costs associated with each ratification. On the other hand, developing countries (who have lower economic costs) are likely to ratify IEAs before the election period.
Fredriksson and Gaston (2000)	FCCC	CO2 emissions, Civil liberty	Countries with high CO2 emissions are more likely to be pressured by the international community to participate in the FCCC (external pressures), while countries with greater civil liberty are more likely to participate as a result of

			domestic pressure from the public.
Fredriksson and Ujhelyi (2006)	Model IEA, Kyoto Protocol	Environmental and industrial lobby groups and the number of political players	Environmental lobbying can raise the chances of IEA ratification, where the strength of this effect depends on the number of political players.
Neumayer (2002)	Kyoto Protocol, Rotterdam Convention, Cartagena Protocol, CITES, Montreal Protocol, CBD	Trade openness, WTO membership, Democracy	The impact of trade openness on ratification and compliance is present for some measures of openness (in particular, exports), whereas the effects of WTO membership are not negligible. Ratification is more strongly determined by factors such as income, democracy, and population.
Qiu and Yu (2009)	Model IEA	North-South technology transfer	Technology transfer can result in both increased and reduced incentives to participate in an IEA (tech transfer does not always lead to greater degrees of participation).
Verardi (2004)	Kyoto Protocol, Montreal Protocol, Rotterdam Convention, Cartagena Protocol	Political structure: majoritarian vs. proportional representation	Politicians in a proportional representation system are more likely to comply with IEAs compared to those in the majoritarian system.

5.3 METHODOLOGY AND DATA

5.3.1 The Model

The scope of this study examines four major environmental treaties, which are the Kyoto Protocol, the Rotterdam Convention, the Stockholm Convention, and the Cartagena Protocol, and uses the ordered logit model to run the estimation. A total of 107 countries are examined in a cross-section fashion (some countries were removed due to the lack of necessary data).

An ordered response model can be used when examining compliance to treaties, as the LHS variable represents different degrees of cooperation or compliance. Yet, the definition of the LHS variable can vary, ranging from the number of treaties signed or ratified, to other measures representing compliance. Verardi (2004) uses the ordered logit model to examine countries' compliance to environmental agreements, not unlike this paper. At any rate, Verardi focused on the effects of governmental characteristics of countries (particularly the behaviour of politicians in different systems: majoritarian versus proportional representation, where the latter system is associated with higher degrees of compliance) while this paper focuses on domestic environmental characteristics and other indicators of governance, and, while Verardi measures compliance in terms of "treaties signed" (from one to four), this study defines compliance in terms of the speed (or inversely and equivalently, delays) that countries take before ratifying the treaties. Neumayer (2002) addressed the issue of whether trade openness and WTO membership promote cooperation with IEAs, and suggests that openness can help in promoting cooperation, albeit only to a certain degree and should not be relied on as the main driver of compliance. Here, both Neumayer and Verardi are interested in the political and governmental aspects of the domestic economy, whereas the focal research questions were different; Neumayer focused on the impacts of trade openness, while Verardi was interested in how politicians from different systems behave.

The four treaties were selected due to three reasons. First, they are major, non-region-specific agreements with involvement from many countries around the world (in contrast to regional or smaller agreements involving mainly countries from a specific geographical location or in very small numbers). Second, the agreements were situated around the year 2000, where the values of the right-hand side variables were taken.

For the overall compliance scenarios (COMPL, SPEED), the equations are written as:

$$COMPL_i = \alpha_0 = \alpha_1 EPI_i + \alpha_2 GDPK_i + \alpha_3 TRADE\_GDP_i + \alpha_4 IND\_GDP_i + \alpha_5 REG\_Q_i + \alpha_6 DEV\_D_i + \varepsilon_i$$

$$SPEED_i = \alpha_0 = \alpha_1 EPI_i + \alpha_2 GDPK_i + \alpha_3 TRADE\_GDP_i + \alpha_4 IND\_GDP_i + \alpha_5 REG\_Q_i + \alpha_6 DEV\_D_i + \varepsilon_i$$

The difference between the two scenarios lie in the definition of the LHS variables (which are slightly different), where COMPL measures the speed and degree of compliance and separates non-ratifying countries who have signed the agreement from the non-ratifying countries who take no action whatsoever (no ratification and no signature) – see note in the data and variables section. SPEED is slightly different from COMPL in that it groups together the non-ratifying countries regardless of signature status.

For the treaty-wise scenario, the LHS variables will be changed from the overall compliance to treaty-wise compliance variables (KYO, ROT, STO, CAR) instead.

$$TREATY_i = \alpha_0 = \alpha_1 EPI_i + \alpha_2 GDPK_i + \alpha_3 TRADE\_GDP_i + \alpha_4 IND\_GDP_i + \alpha_5 REG\_Q_i + \alpha_6 DEV\_D_i + \varepsilon_i$$

Alternatively, the REG_Q variable can be used interchangeably with the GOV_EFF variable in a given estimation.

5.3.2 Data Description and Variables

Table 5.2 – Data and variable descriptions

Variable Name	Name	Side	Definition	Source	Expected Sign(s) – *ex ante*
COMPL	Overall Compliance for the 4 treaties	LHS1	(See description)	Compiled by author	n/a
SPEED	Speed of Compliance (see note)	LHS2	Modified COMPL - (See description)	Compiled by author	n/a
KYO	Degree of Compliance for the Kyoto Protocol	LHS3	4 if country's ratification is amongst the first one-third of the ratifiers.	Compiled by author	n/a
ROT	Degree of Compliance for the Rotterdam Convention	LHS4	3 if country's ratification is amongst the second one-third of the ratifiers.	Compiled by author	n/a
STO	Degree of Compliance for the Stockholm Convention	LHS5	2 if country's ratification is amongst the last one-third of the ratifiers.	Compiled by author	n/a
CAR	Degree of Compliance for the Cartagena Protocol	LHS6	1 if country only signs the treaty. 0 if no actions were taken.	Compiled by author	n/a
EPI	Environmental Performance	RHS	The comprehensive indicator of environmental performance - Score	YCELP & CIESIN	(+)
GDPK	GDP per Capita	RHS	A measurement of economic progress and advancement	WDI	(+)
TRADE_GDP	Trade openness	RHS	The sum of export value and import value divided by the GDP of the same year	WDI	(+,-)
IND_GDP	Industrial Sector Share of GDP	RHS	A measurement of the dependence of a country on its industrial sector	WDI	(-)
REG_Q	Regulatory Quality	RHS	The ability of the government to formulate and implement sound policies and regulations	WGI	(+)
GOV_EFF	Government Effectiveness	RHS	The quality of public services, policies, government credibility, and the perception of such qualities	WGI	(+)
DEV_D	Development Status	RHS	IMF Advanced Economies = 1	IMF	(+)

Note that variables from all the three dimensions are included. The Environmental Performance Index, compiled by the Yale Center for Environmental Law and policy, is selected to represent the Environmental Sphere, with the objective of verifying whether the link between domestic environmental quality and IEA compliance exists. GDPK (2005 International $), TRADE_GDP (the sum of exports and imports divided by GDP), and IND_GDP (industrial sector value added as a percentage of GDP) represent the Economic Sphere, while REG_Q (Regulatory Quality) and GOV_EFF (Government Effectiveness) represent some aspects of the Social Sphere and the political sector.

By intuition, we expect domestic environmental quality (represented by Yale University's EPI Index) to yield a positive sign, whereas the significance and magnitude of the variable will be tested. The rationale is based on the hypothesis that environmentally conscious countries are more likely to be aware of environmental concerns, which can possibly extend to the international level.

Income per capita can affect IEA compliance in both ways, as a richer country becomes more interested in environmentally cleaner practices, due to both increasing awareness and affordability. This change can be made possible via the Technique Effect and Composition Effect (Esty, 2001; Grossman & Krueger, 1991). On the other hand, wealthier, more developed countries rely more on their business sectors and economic interests, which can be eroded away or affected after a new environmental treaty enters into force. This paper will test how the two forces cancel out. Trade openness may correspond in a similar manner, depending on the relative size of a country's dependence on a heavily polluting production sector, and international environmental pressures. The size of the industrial sector, however, can be expected to be negatively correlated to the willingness to cooperate, as the rising costs imposed on businesses and industries will likely be a significant disincentive to ratification, or, at least, delays the ratification process.

Governance indicators REG_Q and GOV_EFF are expected to yield positive contribution to the ratification speed of IEAs. The inclusion of these variables follow the expectation that better governance is more likely to result in better environmental concern and compliance, which extends to the international scale and expedites the ratification process by which the treaties enter into force. This is analogous to the other authors' use of democracy indicators, as these variables are meant to represent the situation where government operates efficiently and effectively cares for the welfare and needs of the public.

Table 5.3 – Descriptive Statistics

Variable Name	Name	Obs. No.	Min	Max	Mean	Source
COMPL	Overall Compliance for the 4 treaties	107	0	4	2.56	Compiled by Author
SPEED	Speed of Compliance (modified COMPL)	107	0	3	1.61	
KYO	Degree of compliance for the Kyoto Protocol	107	0	4	2.92	
ROT	Degree of compliance for the Rotterdam Convention	107	0	4	2.72	
STO	Degree of compliance for the Stockholm Convention	107	0	4	2.94	
CAR	Degree of compliance for the Cartagena Protocol	107	0	4	2.77	
EPI	Environmental Performance	107	29.10	76.20	50.82	YCELP & CIESIN
GDPK	GDP per capita	107	137.50	72,865.10	11,131.57	WDI
TRADE_GDP	Trade openness	107	20.00	366.00	83.21	WDI
IND_GDP	Industrial Sector Share of GDP	107	12.36	72.12	31.87	WDI
REG_Q	Regulatory Quality	107	-2.11	2.12	0.18	WGI
GOV_EFF	Government Effectiveness	107	-1.96	2.17	0.17	WGI

As an ordered logit analysis, the left-hand side variable needs to be ranked. This study ranks countries' degree of compliance with the international environmental agreements in two ways. This is explained in the upcoming section.

5.3.2.1 Overall Compliance – COMPL and SPEED

Compliance is measured by looking at the gap between the date of a treaty's adoption, and the date that a country ratifies or takes another legally equivalent action that binds the state to the will of a treaty. Afterwards, the countries are ranked in terms of the delay it takes before ratifying (or otherwise binding itself to the will of) a treaty. As signing a treaty merely expresses intention (which is not yet binding) and a country has an obligation only to not take actions that would undermine the purpose of that given treaty, but national legal compliance would require ratification; signature without ratification does not demonstrate strong commitment. As such, this study is of the view that "actions speak louder than words", and thus ratifying a treaty (or eq.) is much more important than simply signing it.

The first LHS variable, COMPL, is obtained by looking at how long it takes for a country to be bound by all four major treaties under study (as of April 2015). Afterwards, the number of months is ranked and those that are bound by all four treaties are divided into three groups (tertiles) according to their speed of compliance.

- A COMPL value of "4" indicates that a given country is ranked in the first tertile (it is in the first 33%) of the countries who have ratified or bound themselves to the Kyoto Protocol, The Rotterdam and Stockholm Conventions, and the Cartagena Protocol. This is considered a good display of compliance to international environmental cooperation.

- A COMPL value of "3" indicates that a country is ranked in the second tertile of the group of countries who have bound themselves to the four treaties. This indicates that a country is willing to comply with international environmental standards, despite some initial reluctance.

- A COMPL value of “2” indicates that a country is ranked in the third tertile of the group of countries who have bound themselves to the four treaties. This indicates that a country is reluctant in binding itself to an environmental agreement, but eventually complies.

- A COMPL value of “1” indicates that a country does not bind itself to all of the four treaties under study, and only 3 out of 4 is legally binding as of 2015. The way the COMPL variable is set up penalizes the absence of legal effect, and, as a result, a country which quickly binds itself to the other three treaties can still receive a low compliance ranking if it neglects to enforce the remaining treaty (this stems from the norm that all of the four treaties are expected to be ratified, or eq., by every country).

- Finally, a COMPL value of “0” means that a country has yet to ratify (or eq.) 2 or more treaties out of four. This indicates low willingness to comply to international environmental standards.

The alternative LHS variable, SPEED, is a variant of COMPL made with a slightly different categorization. SPEED is ranked from 3 to 0 as countries failing to ratify all four treaties by 2015 are categorized as “0”, instead of the prior classification into separate categories 0 and 1. The value of SPEED represents the tertile that a country’s speed of compliance falls into; 3 means that a country ratifies (or eq.) all four treaties before most other countries, 2 means that the time it takes before being bound by all four treaties are in the middling range, and 1 means that a country takes longer than most other countries to bind itself to all four treaties, yet they eventually comply with all of them.

5.3.2.2 Treaty-wise Compliance – KYO, ROT, STO, and CAR

These are used in separate estimations in order to take a deeper (but narrower) look at the relationships between domestic characteristics and international environmental compliance, but are estimated in the same spirit as their comprehensive counterparts COMPL and SPEED.

A treaty-wise compliance variable is categorized in a similar manner to the COMPL variable; the first one-third fastest ratifiers receive a ranking score of 4, the second tertile is marked with 3, and the slowest ratifiers are given 2. Again, 1 is for those who have signed the agreement but have not taken any real actions to enforce it, which signifies some degree of compliance, but is not a very enthusiastic course of action. Finally, 0 represents the lack of any action towards the agreement – no ratification (or eq.) and no signature. This means that a country takes no action whatsoever towards the treaty in question.

5.3.2.3 Right-hand Side Variables (RHS)

The right-hand side variables represent the domestic characteristics of a country. These represent different dimensions of the country. The economic dimension is represented by the variables GDPK, TRADE_GDP, INDUS_GDP and DEV_D, where the environmental dimension is represented by the EPI, which is a comprehensive environmental index. The social dimension is represented by the governance variables REG_Q and GOV_EFF, signifying the quality of regulation and the effectiveness of the government, respectively.

5.3.3 The Treaties

In this study, four major IEAs are selected for study. These are (1) The Kyoto Protocol – dealing with the topic of climate change, (2) The Rotterdam Convention – addressing the issue of chemicals and pesticides in international trade, (3) The Stockholm Convention – dealing with persistent organic pollutants, and (4) The

Cartagena Protocol – which focuses on biosafety and biological diversity (and limits the transboundary movement of LMOs). The data was taken from the United Nations Treaty Collection Database (UNTC).

These four treaties (out of 50 present in the UNTC Database) were selected due to several reasons. The definition of a major international environmental treaty employed by this study refers to an environmental treaty which is participated by countries from around the world, and not confined only to certain geographical regions or group of countries, as opposed to treaties that are "regional" or group-specific in nature.

The second criterion is the timing of the agreement. As agreements normally take many years before ratification (or another equivalent national legal action) takes place (normally more than 3 years, but not frequently exceeding ten), treaties that can be analysed in this fashion must have been conceived some time ago. At any rate, due to data constraint, this study focuses only on the major treaties that are adopted around the year 2000. Lastly, all of these treaties have considerable impacts on trade, given their nature and contents.

5.4 FINDINGS

Table 5.4 – Ordered Logit Estimation Results

Result of the Ordered Logit Estimations – REG_Q Case (The odds ratio and z value are reported.)

	Overall		Treaty-wise			
	(1) COMPL	(2) SPEED	(3) KYO	(4) ROT	(5) STO	(6) CAR
EPI	1.016535	1.009747	0.980395	1.018774	0.995809	1.034067
z	**(0.551)**	**(0.339)**	**(-0.6101)**	**(0.585)**	**(-0.111)**	**(1.162)**
GDPK	0.999996	0.999999	0.999966	1.000015	1.000044	1.000009
z	**(-0.196)**	**(-0.045)**	**(-1.802) ***	**(0.467)**	**(1.851) ***	**(0.425)**
TRADE_GDP	0.995709	0.995212	1.001301	1.001301	0.997304	1.001301
z	**(-0.872)**	**(-0.865)**	**(0.217)**	**(0.352)**	**(-0.766)**	**(0.246)**
IND_GDP	0.946674	0.940823	0.970543	0.950184	0.958199	0.979317
z	**(-2.997) *****	**(-3.317) *****	**(-1.567)**	**(-2.255) ****	**(-2.020) ****	**(-1.012)**
REG_Q	1.417649	1.517403	2.174285	1.805071	1.354863	0.958966
z	**(1.200)**	**(1.345)**	**(1.916) ***	**(2.031) ****	**(0.887)**	**(-0.126)**
DEV_D	2.074666	2.008122	1.023369	0.584382	0.396333	0.684614
z	**(0.951)**	**(1.062)**	**(0.039)**	**(-0.547)**	**(-1.157)**	**(-0.563)**

Result of the Ordered Logit Estimations – GOV_EFF Case (The odds ratio and z value are reported.)

	Overall		Treaty-wise			
	(7) COMPL	(8) SPEED	(9) KYO	(10) ROT	(11) STO	(12) CAR
EPI	1.024085	1.019284	0.990149	1.030661	0.9995	1.030145
z	**(0.778)**	**(0.679)**	**(-0.318)**	**(0.970)**	**(-0.013)**	**(1.061)**
GDPK	0.999998	1	0.999957	1.000013	1.000035	1.000004
z	**(-0.096)**	**(-0.007)**	**(-2.223) ****	**(0.402)**	**(1.351)**	**(0.168)**
TRADE_GDP	0.996207	0.996008	1.002002	1.002102	0.997603	1.001301
z	**(-0.796)**	**(-0.758)**	**(0.335)**	**(0.629)**	**(-0.744)**	**(0.231)**
IND_GDP	0.946201	0.941576	0.967248	0.94857	0.957145	0.979121
z	**(-3.070) *****	**(-3.243) *****	**(-1.730) ***	**(-2.488) ****	**(-2.086) ****	**(-1.023)**
GOV_EFF	1.225072	1.310357	2.328676	1.594085	1.620768	1.136553
z	**(0.554)**	**(0.658)**	**(2.291) ****	**(1.370)**	**(1.365)**	**(0.366)**
DEV_D	2.069485	1.964229	0.789544	0.534726	0.314522	0.615266
z	**(0.926)**	**(0.961)**	**(-0.408)**	**(-0.604)**	**(-1.284)**	**(-0.717)**

Using Regulatory Quality (REG_Q) as the RHS variable representing governance, it has been observed that the speed of ratification, or, in other words, the willingness to comply with the major IEAs examined in the study, tends to be negatively correlated to a country's level of industrial sector share, quite possibly due to economic or political pressures associated with higher costs of environmental measures needed to conform to the agreement.

From the Model 1, higher industrial sector dependency corresponds to decreased willingness to comply with the four major agreements. In other words, countries with larger industrial sector tends to be reluctant in ratifying all of the agreements, leading to slower ratification process or the lack of action altogether. Also, similar to the first model, the Model 2 shows that industrial sector share and dependency may create hesitation for the state to be bound by the commitment of the agreements.

Individually, the Kyoto Protocol poses a slightly different result (Model 3). The estimation in Model 3 shows that, rather than the industrial sector dependency, the impeding factor in this case is the GDP per capita, where countries with higher income tends to be less compliant with the treaty. Here, governance plays a role, as countries with better regulatory quality are more likely to proceed faster with the ratification process. The relationship between compliance and the two RHS variables are only mildly significant, however.

The Rotterdam and Stockholm Conventions (Models 4 and 5, respectively) yield similar estimation results, where, again, industrial sector dependency hinders the ratification process. Regulatory quality is significant for the Rotterdam Convention scenario, whereas the GDP per capita is a more important factor for the Stockholm Convention case. The ratification of the Cartagena Protocol, on the other hand (Model 6), does not seem to depend on any major factors in particular.

By conducting a separate estimation, replacing REG_Q with GOV_EFF, Industrial sector dependency remains an important factor that delays or hinders the compliance process. Joint compliance for the four agreements is significantly and negatively correlated with INDUS_GDP, similar to the REG_Q case (Model 7). The sign and significance of the RHS variables also remain consistent when COMPL is replaced with SPEED (Model 8).

When examined individually, the estimation results are slightly different, but the outlook remains similar to the REG_Q case. For the Kyoto Protocol (Model 9), GDPK remains a significant factor associated with delayed compliance, whereas government effectiveness is a contributing factor (similar to REG_Q in the earlier estimation). The interesting finding for the GOV_EFF model is that INDUS_GDP is now significant and negative, albeit mildly.

For the Rotterdam scenario, industrial sector dependency produces the same effect, while governance (now represented by GOV_EFF) becomes insignificant. INDUS_GDP becomes the only significant variable in the case of the Stockholm Convention as well. The Cartagena Protocol, on the other hand, remains unresponsive to the RHS variables, similar to the REG_Q estimation (see Models 11 - 13). The Cartagena Protocol, however, does not respond satisfactorily to any particular factor, regardless of the model specification.

It can be argued from the estimation results that a country's reliance on its industrial sector may significantly affect its decisions in international environmental agreements, which is not counter-intuitive; higher levels of dependency can lead to hesitation and delays. This supports the argument that developed countries are concerned with their business and industrial interests that may be affected by IEA ratification (Cazals & Sauquet, 2013). On the other hand, the trade/GDP ratio showed up as not statistically significant for the four IEAs; this is similar to the findings obtained by Neumayer (2002), which reported similar lack of statistical significance for the Kyoto Protocol, Rotterdam Convention, and the Cartagena Protocol. Countries relying heavily on industrial productions are rarely the first to take actual actions, and

often take considerable amount of time before ratifying a treaty (or taking equivalent legal actions), while some industrialized countries do not put the treaty into force at all (sometimes despite prior signature which demonstrates interest and some degree of compliance).

Several concerns remain in place.

1. While many countries eventually bind themselves and enforce the treaties, most of the less prominent agreements remain regional or group-specific affairs, and are not comprehensive (either in terms of geographical areas, or the scope of issues). Multilateral framework in countries in developing parts of the world are not bound by the same environmental protection standards that developed countries adhere to (in particular, European countries are parties to many treaties dealing with issues that developing countries have yet to address), meaning that their environment remains more vulnerable (despite lower cost requirements and relatively benign industrial atmosphere).

2. A number of countries are not participating in the major treaties. In some cases, such countries would only sign an agreement without ratifying it, even after a considerable amount of time, and, occasionally, a country may not take any action whatsoever. Of course, countries may argue that a treaty and its implications are not in its best interests, yet, this points out the fact that economic livelihood and competitiveness (often in the form of costs and burden that businesses have to bear) remain a vital factor that affects decision even in environmental treaties. In other words, decisions to protect the environment are still significantly influenced by economic incentives.

3. It remains a somewhat separated issue as to how effective a treaty' parties will be in enforcing the will of the treaty after the ratification process. A ratification (or eq.) expresses the state's will to be bound by an agreement, but how well it fulfills that objective is a different matter and will need to be examined long after the treaty is put into effect. This is where the quality of the rule of law plays a major role.

Table 5.5 – Supplementary estimation results for the binary logit models

Result of the Binary Logit Estimations
(reported in the odds ratio format)

	REG_Q	GOV_EFF
EPI	1.054769	1.074633
z	**(1.363)**	**(1.912) ***
GDPK	0.999985	1.000001
z	**(-0.622)**	**(0.046)**
TRADE_GDP	0.995865	0.996768
z	**(-0.856)**	**(-0.724)**
IND_GDP	0.943121	0.941918
z	**(-2.750) *** **	**(-2.756) *** **
REG_Q, GOV_EFF	1.474456	0.741901
z	**(0.863)**	**(-0.550)**
DEV_D	0.304209	0.482915
z	**(-1.320)**	**(-0.754)**

The previous section had dealt with the relationship between economic, environmental & social domestic characteristics and how they affect the speed of compliance. An additional section is added to see how these characteristics are linked to whether a country takes any serious action at all (ratification or other equivalent measures versus signature without legally binding procedures, or the lack of any action). This is done via a simple binary logit model where Y = 1 if a country ratifies or enforces all four treaties at some point, with Y = 0 if not all of the four treaties are legally binding (as of April 2015). In other words, all countries who ratify all of the four treaties receive Y = 1, regardless of speed. The difference between the main analysis and the supplementary model is that the supplementary binary logit model takes a look at the ratify/not ratify decision, to determine whether a practical action is taken at all.

This supplementary analysis shows that, industrial sector dependency remains an important and significant factor in deciding whether major environmental treaties are adopted at all, and adds to the main analysis' findings. In addition to its role in determining the speed of ratification (or eq.), the share of the industrial sector also determines the likelihood that legal procedures will actually occur.

Interestingly, the GOV_EFF scenario shows that, in contrast to the results of the main estimation, there is actually a scenario where EPI is correlated to the decision of countries whether to take legally binding actions (ratification or eq.), or to avoid doing so. Combined with the results of the first part, it can be argued that, from the estimation results, better EPI or domestic environmental performance might be linked to higher probability of participating in major environmental treaties (albeit only very mildly), but it is unlikely that the speed of compliance will be affected; countries with better environmental performance may be slightly more likely to engage in legally binding actions at some point, but may not be the fastest parties to take action. At any rate, it should be noted that this finding is not present in all cases, and remains not very significant nevertheless. The link between domestic environmental quality and international environmental compliance through treaties can be said to remain considerably weak.

5.5 CONCLUSIONS

This paper examines the issue of international environmental compliance, in the form of multilateral agreements, looking at the relationship between countries' willingness to take action and their domestic characteristics. Estimation results show that an economic factor, the level of industrial sector dependency, is the most influential factor that affects countries' willingness to take action in international environmental agreements. The degree of dependency on the industrial sector is inversely correlated to the speed that a country takes action in binding itself to the will of major environmental agreements. A country with higher share of industrial value added tends to be slower in agreeing to be bound by an environmental agreement (ratification, accession, acceptance, or approval), possibly due to the burden of increasing costs associated with better practices mandated by the treaties, or the need to let domestic industries adjust themselves a bit before putting a treaty into effect.

Also, income (mildly significant in some cases) and the level of economic development (not significant) are not as influential as the level of industrial sector dependence in this study.

Interestingly, the relationship between environmental performance and international environmental compliance is weak in determining the speed of ratification or other equivalent measures. In other words, countries with better environmental performances are not necessarily the quickest to enforce environmental treaties. Yet, there is also an indication that environmental performance may have some impact on the decision to take action (albeit very mildly), as it is possible, but still not a certainty (depending on the estimation scenarios), that a country with better environmental performance may be more likely to take eventual action rather than remaining idle, after all. Nevertheless, from the estimation results, this evidence remains rather weak and may not hold in many cases. Thus, it can be argued that environmental performance at home is unlikely to pose significant impact on a country's position on major international environmental agreements.

From the estimation results of the two studies, one may argue that the link between environmental performance at home and environmental actions abroad is somewhat strong in the case of trade and production, but remains weak in the case of international compliance in the form of treaties.

Governance (in, this case, regulatory quality and government effectiveness) can promote compliance for certain individual treaties, but are not very influential in augmenting the speed of action in the big picture. This does not mean that such measures are useless, however, as the process of ratification and entry into force is the first step; corresponding domestic laws and their enforcement procedures must still be prudent in order to ensure that the purpose of the treaties are fulfilled. At any rate, the majority of countries eventually agree to be bound by major environmental treaties (whereas a small number of countries, often the major players with economic interests at stake, remain idle). This may have been due to implicit international pressures in treaties with sufficient awareness and impact, and the risk of social disapproval both at home and abroad, or even the states' own attempts to promote/pertain an image of a clean, environment-conscious economy in instances where the costs of compliance are limited and the benefits of doing so are perceived as exceeding the economic costs.

CHAPTER 6
SUMMARY, CONCLUSIONS, AND POLICY IMPLICATIONS

6.1 CONCLUSIONS OF THE STUDY

The dissertation set out to examine the link between international trade, Economic actions, and sustainability components in various countries. This research is interested in how the Environmental Dimension is linked to the economy and its economic and social characteristics. The first research article conducted a comprehensive literature review of the issues at hand, along with estimations of the Environmental Kuznets Curve (EKC) for 5 prominent types of pollutant substances, and argues that:

- Theoretically, international trade can improve the environmental outlook, but indirectly. Trade is an important component of the economy, and improving the economy will gradually improve environmental outlook in that given economy.

- This is because three effects of income on the environment are at work. The Technique Effect reduces pollution and promotes cleaner environment through the use, availability, and affordability of cleaner technologies. The Composition Effect may reduce consumption of cheaper goods made with environmentally harmful modes of production as economies gain from its comparative advantage, but it is also possible that emissions will go up if the sector it specializes in is a major contributor of pollution. The final effect is known as the Scale Effect and refers to the situation where increasing volumes of economic activity contribute to rising pollution and worsening environment.

- The Environmental Kuznets Curve suggests that the relationship between income and environmental degradation is positive at first. Upon reaching a certain turning point, however, the relationship becomes negative and

increasing income after such a point is associated with lower levels of environmental degradation (i.e. emissions).

- Economic development and trade can contribute to a better environmental outlook for numerous substances; as income improves (augmented by trade), countries are more likely to pass the turning points and enjoy lower emission levels.

- Yet, the chapter's estimation results for the EKC suggests that, in line with the concern outlined by the literatures reviewed, the turning point GDP per capita levels are high for some substances. For example, Carbon dioxide, a major contributor to the global climate change problem, would require a GDP per capita exceeding approximately 70,000 dollars per person, which would take a very long time into the future before the turning point GDPK is reached.

- In addition, the turning point is not the position where all problems cease to exist. It is simply a point where reductions occur after the economy had endured rising pollution levels for a long time. It also means that if a low-income country aims to raise its income level, it will contribute more pollution during the transition. If it gets stuck somewhere in between (i.e. middle income trap, for example), the overall pollution level will be high.

- Finally, given the more fragile state of the global ecosphere (for example, the issues of global warming polar ice caps destruction – which will affect the human society and economic well-being directly), the global economy may not have adequate time to wait for income and growth alone to solve all emission and pollution problems.

- As a concluding remark for the article, this chapter argues that, while trade and growth are beneficial, both in economic and environmental terms, economies will also need to rely on other solutions when dealing with

prominent environmental problems caused by substances with high turning points. Many supporting literatures promote the use of effective rules, regulations, and economic incentives (rather than growth from expansion and trade) when dealing with persistent environmental problems.

The Third Chapter deals with the definition of sustainable development and examined the associated topics, followed by an estimation of the EKC for the major pollutants. Chapter Four aims to look at the question of "whether and how environmental and social performance at home is transmitted to a country's behaviour in trade?" to determine whether the linkage between domestic environment and trade is strong or weak, and what affects pollution induced by international trade (with respect to production of physical goods). All categories of physical goods are examined for a majority of countries active in world trade.

The article focuses on the amounts of "trade-induced production pollution", which is the amount of pollution generated by the production of the goods meant to be exported and imported. Exported goods generate pollution at home, while imported goods generate production pollution abroad in the manufacturing countries (which we treat as elsewhere or the rest of the world). Using the estimated amount of trade-induced production pollution (for both imports and exports) as the LHS variable, it runs the panel regression (fixed effects) with RHS variables such as the Environmental Performance Index (EPI), government effectiveness, the rule of law, and other economic indicators. The results show that:

- Environmental performance and legal enforcement in a country is negatively correlated to pollution coming from trade-induced production.

- The pollution-environmental performance relationship is significant in the case of developing countries (for both the export and import scenarios), whereas it remains insignificant in the case of developed countries.

- However, the quality of the rule of law is associated with decreased pollution levels in *all* scenarios estimated, whereas the relationship is always positive and significant for industrial sector dependency.

- Trade openness lowers production pollution in the case of developed countries, supporting the pro-liberalization argument. Estimation results suggest that trade openness is useful for developed countries.

- In terms of sustainability, there is a strong link between better social integrity at home (rule of law) and lowered pollution levels in trade. This means that countries with better law and legal enforcement procedures (and higher public trust in these procedures) are likely to generate lower amounts of export-induced production pollution *at home* (as home is the producer of goods to be exported), and are also likely to induce lower amounts of import-induced production pollution abroad (as domestic excess demand corresponds to production in other countries).

- A limitation of this study is that it only deals with pollution generated from the production of exported and imported goods. Data constraint prevented a detailed and accurate measure of other more subtle forms of trade-related pollution, such as the precise amount of pollution generated from the transportation of goods in different categories to various destinations, or the pollution generated after the goods are disposed. Future research can look into these issues, which will require a very detailed observation and data collection.

- The most important message of this chapter is that economic progress, in particular, industrialization, tends to be associated with higher production of pollution in various forms. The link between better environmental performance at home and a cleaner behaviour in trade remains weak for developed countries, but the presence of an effective legal system is vital in discouraging pollution, leaving only the most efficient producers in the

industries where pollution is inevitable, rather than allowing anyone to conduct dirty modes of manufacturing with undesirable environmental results.

- Also, the factors related to the mindset of agents and their subsequent economic actions can be considered as very important as well. It can be argued that different motives of agents would lead to different economic outcomes and varying degrees of environmental and social imbalances. Thus, the promotion of ethical and moral concerns amongst economic agents should help in improving the sustainability outlook, since economic actions, such as consumption decisions, are voluntary acts which occur in agents' pursuit of utility and satisfaction. The relative weight (for example, self-interest versus social benefits, short-run gratification versus long-run sustainability, or material versus mind) of agents' satisfaction and preferences will be crucial in shaping the economic, environmental, and social outcomes.

Lastly, the Fifth Chapter (Article Three) uses the ordered logit model to examine whether domestic environmental performance affects international environmental compliance in ratifying treaties. It looks at four major environmental treaties that are situated around the year 2000, and determines the level of compliance through the speed or the delay that countries take before taking a binding action (ratification or other equivalent measures). The estimations are made both in the collective scenario (taking a look at how much time a country takes before all four treaties are legally binding on the state, compared to other ratifying countries), and the scenarios for individual treaties. Estimation results suggest that:

- Industrialization (industrial sector dependency or share) is significantly and negatively correlated with the speed and degrees of compliance in most scenarios. In a supplementary estimation, it even contributes to the difference between the group of countries that eventually ratify all the treaties at some point, and the group that refrains from ratifying some or all of the treaties.

- Environmental performance at home, the main variable of interest, does not affect the speed or degree of compliance. Therefore, the paper argues that the pass-through between domestic environmental quality and international environmental compliance remains weak, and countries with better environment at home are not necessarily the most enthusiastic ones to take actions in multilateral agreements. At any rate, there is a scenario in the supplementary estimation suggesting that environmental performance is significantly related to the difference between countries who take action and the ones that remain idle. The relationship is only mildly significant and is not present in all cases, however. Industrial sector share remains the most important factor in determining both the speed and presence of international environmental compliance.

- Trade openness (reliance on international trade) plays no visible effect on participation and compliance. Countries with very different levels of trade exhibit similar traits when considering environmental agreements.

- Better regulatory quality expedites compliance for certain treaties (the Kyoto Protocol and the Rotterdam Convention).

- Given the estimation results, it is likely that compliance in major environmental treaties (ones that are not confined to a geographical region or specific group of countries) occur largely due to international pressures that implicitly compel nations to cooperate, while hasty compliance is discouraged if a country has a large share of industrial sector value creation at home, as cleaner environmental standards would generate costs that befall domestic producers and enterprises. Regulatory quality at home helps in certain cases, but this is not universally applicable. We argue that, in order to orchestrate worldwide collaboration in environmental matters, the multilateral community or supranational environmental bodies will need to be strong, influential, and committed in securing cooperation from individual countries, as nations can sometimes be reluctant in imposing

significant costs on their own businesses and manufacturers (to ward off future environmental hazards elsewhere) on their own.

This dissertation concludes that, as Sustainable Development is increasingly becoming a necessity, where trade and economic growth can help the environment, but only to a limited extent by themselves, governance and the use of rules and regulations (domestic and multilateral) are to be advocated as a tool in correcting existing problems and dissuade socially undesirable or harmful behaviour through the mechanism of incentives and disincentives. Profits, growth, and business opportunities can still be pursued and are not malignant by themselves, but the process must take into account the "non-financial" aspects (the Environmental and Social Dimensions) as well.

It is acknowledged that economic progress enhances the quality of life (which makes it a desirable objective) and trade can solve some of the pollution problems (as presented in Chapter 4). Yet, the pollution estimation warns that we cannot rely solely on economic growth to solve all environmental problems, especially ones caused by major pollutants. *Rules, regulations, and standards must be employed (prudently, practically, and effectively) along the way to lower environmental harms for countries of all income levels and stages of development (akin to shifting the curve downwards rather than simply moving along it).*

The quality of domestic environment and environmental performance at home is linked to countries' trading behaviour in some cases, where better performance is correlated to lower production of pollution both at home and elsewhere. Trade openness can contribute to a cleaner production structure in some cases (developed countries), thereby partially supporting the pro-liberalization argument in this respect. Yet, the presence of an effective legal system and law enforcement makes a more significant difference, as environmental performance may not always translate into cleaner trade – laws and regulations need to be in place to bridge the gap between domestic environment and trade. On the other hand, consumption-side considerations and measures should also be present (voluntarily by the agents themselves).

Industrialization contributes significantly to the generation of pollution in trade, as countries relying heavily on the industrial and manufacturing sectors produce more pollution domestically, and also stimulates pollution abroad as it demands more of the goods that generate extensive pollution in their production processes. Also, heavy industrialization also discourages international environmental compliance, and may even stall the process altogether. This is likely due to attempts to protect industrial interests that may be hampered when an IEA is signed. In an implication sense, this may suggest that, domestically, a middle-income country should attempt to escape the middle-income trap to lower its dependence on the industrial sector (possibly by investing in education and human capital that allows the service sector and cleaner activities to emerge) in order to refrain from relying too much on the heavily polluting activities. Internationally, as goods and products will inevitably need to be produced somewhere, industrial and manufacturing activities (which are economically useful and remain a necessary activity in the global economy) should be made cleaner and more environmentally friendly, under the supervision of effective rules, regulations, and standards, taking into account the increasing needs and fragility of the global ecosphere. Trade will reflect the characteristics of the domestic economy, therefore a more environmentally friendly economic structure at home will facilitate cleaner trade and ensure the best practices in compliance with Sustainable Development.

While protectionism is not favourable, it does not mean, also, that the production process of articles to be traded can resort to environmentally harmful practices just because trade is to be liberalized. The purpose of free trade is, and has always been, to ensure welfare and promote economic well-being of people in different parts of the world, and therefore allowing environmentally harmful practices to continue unchecked may defeat the original purpose of international trade, if environmental problems deteriorate up to degrees where economic gains is no longer adequate to ensure a satisfactory living standard.

This dissertation argues that “social integrity”, the combination of supply-side measures such as rules and regulations, and demand-side considerations such as public-mindedness, environmental awareness, and ethics, which are aspects in the Social Dimension, can be used as a means to correct the environmental imbalances generated as a side-effect of trade, globalization, and income-oriented development. The demand-side component of the issue is more difficult to capture, as consumers’ choices are the product of the internal utility maximization problem of agents, which is derived from their internal preferences and translated into actions.

6.2 LIMITATIONS OF THE STUDY AND FUTURE AGENDAS

6.2.1 Chapter 3

The empirical analysis of the third chapter is an attempt to test the Environmental Kuznets Curve (EKC), and, as a result, may subject to the limitations of the EKC methodology. Taking into account the fact that the EKC examines mainly the relationship between income and environmental hazards in a straightforward way, this article is followed by two succeeding articles that probe deeper into the relationships between economic activities, trade, and the environment.

The study can also be further expanded to include a greater variety of environmental hazards across different periods of time.

6.2.2 Chapter 4

As the chapter’s research question revolves around pollution generated by trade, two indicators were constructed using available trade and pollution data. These indicators, EX_POLL and IM_POLL, have their own limitations that should be noted in order to interpret the generality of the findings accurately. Firstly, the measure of pollution addressed in the empirics of the chapter is the “trade-induced production pollution”, which means that it does not represent the total pollution coming from

each and every production activities at home, but focuses only on the pollution generated for the purpose of trade.

While it is likely that lowered amounts of EX_POLL and IM_POLL are the result of lower amounts of trade in products that generate high levels of production, signifying a cleaner structure of trade-related production, it is also possible in few cases that lower values of these variables can also occur when a country suddenly shifts to the situation where it produces and consumes the "dirty" goods domestically and by itself, without trading them, in which case the POLL variables will report lower values, similar to an improvement towards cleaner trade structure. Similarly, as the variables are focused on trade-induced production rather than total domestic production (which is subject to data constraint, especially when dealing with a very large number of countries over time), it is also possible that production pollution produced through FDI can go under the radar.

An additional consideration in this respect is the less-than-ideal assumption (due to data constraint) that production technology generates the same amount of pollution in various parts of the world, and that the pollution output in each sector is constant over time. In reality, production of the same types of goods in different parts of the world can generate different amounts of pollution, and the pollution output for each sector in each country can change as time passes. This limitation is due to the fact that currently available datasets usually do not collect individual pollution estimations for sectors 01-99 for each and every country, and it will be considerably harder for such a dataset to annually record the individual movements or changes in pollution output for each sector in every country.

Finally, the measurement of pollution output in pounds is a generalization of pollution generated, and may not fully reflect the severity of different air, ground, and water pollution types.

Future studies can improve upon this work by constructing improved versions of these indexes that take into account the technological changes for each individual sector in each country over time. This is where future estimations can expand on, when a comprehensive pollution dataset that takes into account technological differences for goods and services across different regions and time (taking into account the different amounts of pollution generated by the same industries in various parts of the world over time) becomes available.

6.2.3 Chapter 5

Chapter 5 looks at four major IEAs situated around the year 2000 (due to most other environmental treaties participated only on the regional or group-specific scale rather than global). It can be interesting for additional papers to examine other environmental treaties, using different sets of right-hand side variables. Other models can also be used in addressing this research question in the future.

6.3 POLICY IMPLICATIONS

The policy suggestions section will be divided into three parts: domestic policymakers, international organizations, and polluters. The policy implications display the importance of social integrity in bridging the dimensions of the economy and the environment.

6.3.1 Domestic Policymakers

Supply Side: Cleaner trade should be achieved with several joint measures. The pollution generated in trade is the result of numerous activities. Firstly, production and consumption of goods generates pollution, in a sense much akin to the domestic equivalent of such activities. The difference is that, as trade amplifies the volume of production and consumption, the amount of pollution generated by “dirty” activities are also magnified. Another important component of pollution in trade is related to transportation and the associated energy consumption and emissions.

In this respect, protectionism, while seeming to offer immediate solution to the pollution problem by limiting trade, and the related activities that generate pollution, is perhaps not a satisfactory or practical solution, both from the economic and political points of view – protectionism results in economic inefficiency and distortion of economic resources that may have been used for other beneficial activities, and it does not guarantee that the environment can improve by granting more monopoly power to domestic producers. The existing multilateral trade system also discourages such practices, making protectionism a politically infeasible option, especially in the long run.

The contribution of pollution and environmental harms of international trade comes from two components, the volume of economic activities, and the amount of pollution (or degradation) generated by each "unit" of activity. As was mentioned, formally limiting the volume of trade in a protectionistic manner (for example, through tariffs) is not an attractive option. On the other hand, it is possible (albeit difficult) to reduce the level of environmental hazards by lowering the "per unit" creation of production and consumption activities – if tariffs or trade restrictions cannot be used to lower the volume of trade, which corresponds to pollution, then, as the overall amount of pollution in trade is the volume of trade x the ratio of pollution generated, the solution should be to find ways to reduce the latter ratio. This corresponds to the rationale of the Technique Effect, but instead of relying on income to accomplish the effect, this paper argues in favor of the utilization of environmental measures to achieve the same effect as the Technique Effect of income development, without needing to wait until income levels are sufficiently high – countries of different income levels can, and should, implement sound environmental policies to ensure cleaner production structures.

In other words, protectionist measures will become less necessary if we can make production and consumption activities more environmentally friendly, as free-trade volumes of trade is multiplied by smaller ratios of pollution (or degradation) per instance of activity. This can potentially be achieved by means of environmental rules, regulations, and standards that reduce the environmental effects of production,

consumption, and post-consumption activities. This is the advocacy of (supply-side) "social integrity", which is the prudent use of environmental rules. In a sense, the reliance on such rules aiming to ensure cleaner environmental outcomes is not too different from how a country would deal with its domestic production and consumption to preserve its own environmental quality, as trade can be viewed merely as a magnifying factor for existing rates of pollution generation in this respect. If production and consumption modes of a given type of good remain dirty and environmentally harmful, then environmental deterioration will take place even in the absence of trade (in which case environmental degradation is confined to the domestic ecosphere), but the expansion of its production through trade will serve to further exacerbate the environmental effect.

If the economic activities associated with a given good are clean and environmentally friendly, then the volume of production and consumption becomes less of a concern, as the pollution ratio to be multiplied is relatively small. In such a case the remaining consideration is mainly about transportation. Again, as the protectionist limitation of trade is not feasible, modes of transportation should be regulated in terms of environmental impacts (much like any other domestic or transboundary activities) so as to prevent excessively polluting methods from disrupting the national and global balance (as the collective pollution generated by high volumes of transportation is also a major contributor to pollution). The purpose of such a policy implication is to put downward pressure on pollution levels generated by transportation activities.

Should it be unwise to place environmental protection as the objective of *trade* policies, given the economic and institutional considerations of the issue, then *environmental* and regulatory policies should be astute in areas where trade policies are unable to act.

Domestic environmental regulations can be enforced with relative ease, compared to the more complex and comprehensive international agreements (IEAs and other multilateral provisions), which can raise a number of considerations since the (voluntary) participation many parties are often required in order to ensure effective implementation. In addition, multilateral agreements also subject to the concern that trade-related environmental provisions may potentially fall into the grey area between environmental action and protectionism, which is a debate that will most likely continue when the details of some IEA implementations in trade are discussed. Nevertheless, while the adverse effects of protectionism are to be avoided, as it may lead to inefficiency, lack of accountability and competition, and monopolistic tendencies that may deteriorate environmental outcomes, the ecological constraints of the global ecospheres should also be considered simultaneously.

Demand Side: Policy implications on the demand side can be more difficult to pinpoint, due to the qualitative nature of the issue. In a sense, it can be argued that trade-generated pollution caused by the production and consumption of "dirty" goods and/or transportation activities are in part contributed to by the consumption demand that facilitates them. While it is difficult and perhaps inappropriate to formally limit consumption demands via artificial measures, it cannot be denied that imbalances may occur when goods with significant environmental side-effects are demanded in high quantities. Negative environmental impacts will be reduced if production and post-consumption activities are made cleaner, coupled with reduced demand for goods that generate high degrees of harmful side-effects. This is not unlike the EKC-related argument that environmental qualities will improve as the people demands cleaner products and processes.

While the pollution issue can be satisfactorily addressed by improving the process, without much need to limit the products, the concern of resource usage is another issue. If there are no significant technological changes that reduce the required intake (and, correspondingly, the exhaustion) of natural resources used as inputs, then many categories of production will likely lead to the deterioration in the natural resource pool. While improvements in technology may be able to lower such

resource requirements, this can be notably difficult in practice. This is a separate issue that supply-side policies may not totally be effective, given that the artificial measures to limit production and consumption activities are impractical.

Again, agents' preferences are to be addressed if we were to deal with resource usage in economic activities. The decisions of agents are derived from their perception of "costs", but these costs are divided into public and private. Agents who maximize their own interests with respect to private costs will behave differently from agents who optimize between private and public interests with respect to total costs of an economic activity – Individuals who takes into account only the private costs are expected to engage in greater volumes of environmentally costly activities, while the individuals who incorporate social costs into their optimization problem will moderate their economic activities to balance between personal benefits and social consequences. Taxation of activities with negative side-effects is a frequently proposed solution, with both supporters who argue that they are amongst the more effective ways to introduce public costs to individual optimization problems, and skeptics who are worried about distortion, especially when trade is concerned.

At this point, it has also been suggested that, in order to satisfactorily deal with the environmental and social imbalances occurring due to human economic activities, the economic paradigm of agents will need to be improved. The term "mind development" has been proposed as a solution, and refers to (economic or psychological) processes that reduce the weight of self-interests and short-run myopic gains in agents' preference and utility patterns, and increase the relative weights of social costs and benefits, and long-run societal gains. If this can be accomplished, then economic activities will likely generate less negative environmental and social externalities.

Demand-side implications are that, while rules and regulations may not go as far as to limit the amount of activities that agents can engage in (i.e. consumption), it is partially up to each economic agent to take into account the social costs of activities. In this respect, it may be argued that policy implications are faced with

some difficulties, as public-mindedness in economic activities is a voluntary aspect. Policymakers wishing to avoid complicating, restrictive, or distortive regulations should instead seek to promote public-mindedness and the awareness of public costs of economic actions. A similar example is that, while household electricity consumption is not limited by law, energy conservation campaigns are often encouraged due the voluntary nature of consumption choices. While this shift in individual and collective behaviour may be associated with some reduction in economic activity, it is arguable that it can actually improve economic efficiency. This is because the volume of an activity is now chosen with respect to the actual costs associated with it, and not only the private costs derived mainly from self-interest, satisfaction or profit, which often fail to reflect the larger picture. Proper consideration of the costs of an activity will reduce wasteful and unnecessary depletion of valuable and often limited resources, which can be used for other productive activities. As a result, it can be argued that economic efficiency can improve when the volume of economic activities are optimized rather than maximized, as redundant activities and resource expenditures are reduced, leaving room and resources for other activities that can provide more benefits.

In terms of policymaking, states should, similar to how it would regulate its businesses and agents, consider the potential environmental or social impacts of their policies and projects. As some adverse effects may be subtle and difficult to foresee, policymakers should frequently seek counsel from technical experts, environmentalists, academics, stakeholders and local or affected population, so as to ensure commonly acceptable policy guidelines and limit undesirable or unexpected consequences. Policymakers and governments can contribute to sustainability by considering the environmental needs of the population, and by ensuring good governance in its practices and policies. States and governments that are committed to the well-being of its citizens as the primary objective will likely perform better in terms of sustainability, given that its policy implementations are efficient.

With regard to international environmental compliance, nations should place environmental concerns as an important goal, along with economic progress, and participate in environmental initiatives where they can provide improvements in the ecological outlook. As some environmental costs may not be fully captured in financial projections, but will pose significant effects on economic or social livelihood when a threshold (which is often invisible) is reached, nations must always be cautious in its environmental stances and give proper consideration to these possibilities as well, so as not to incur massive costs resulting from environmental imbalances or, in the worst case, local or large-scale ecosystem collapse.

In the long-run, public-mindedness can be promoted as desirable social values through education. Rules and regulations apply as a disincentive to outright damaging behaviour, process or conduct, but positive (and, in some instances, selfless) actions not motivated by self-interest will be present only through the voluntary participation of agents. Countries will ultimately benefit environmentally and socially from the presence of social-minded and environmentally conscious population. Opinions regarding the details may differ between individuals, but the main objective of this policy suggestion is to promote the inclusion of social costs, public-mindedness, and environmental considerations as socially desirable values, which will ultimately lead to efficient intertemporal and intergenerational consumption of resources, corresponding to sustainability. In this sense, social integrity (which is comprised of both regulatory measures dissuading damaging behaviour, and the promotion of voluntary desirable behaviour), while an aspect of the Social Dimension, will have considerable importance in bridging the relationship between international trade activities and the environment.

6.3.2 International Organizations

International environmental agreements (IEAs) are one of the most important instruments in securing cross-border environmental compliance, as nations design and implement their own policies and usually participate in multilateral initiatives only on a voluntary basis (although this can be affected by international pressures and

persuasion). IEAs are important since certain environmental hazards or issues have become a global or regional problem that individual action of a single nation cannot provide satisfactory results. At any rate, a concern is that, up to a certain point, some environmental and trade provisions may clash when environmental standards begin to go into details that may be considered protectionistic by free trade proponents. Environmental enforcements should be reviewed and discussed so that they are used genuinely for conservation, and not protectionistic, purposes. On the other hand, multilateral discussions on trade should include environmental considerations into the picture, yet whether all environmental proposals are accepted and adopted will depend on the details and the relative costs on the economy, environment and the society. Yet, while protectionism is a politically impractical approach to the environmental concerns, liberalization initiatives must also consider the environmental (and social) side-effects of economic development, and the limitations of the global resource pool and ecosphere.

Given the nature of voluntary participation of states, the role of international organizations are limited, but remains important nevertheless. Negotiation forums should facilitate discussion and compliance where possible, while international environmental organizations should take the responsibility of pointing out the potential environmental impacts of economic activities (both positive and negative) to raise awareness and consideration. Environmental organizations may potentially play the role of educators and commentators of national policies and international environmental initiatives. As was argued earlier, nations will benefit in terms of environmental quality if environmental awareness is present amongst the population, and international organizations and nongovernmental organizations can take up this role in educating the public.

6.3.3 Polluters

Profit-seeking as enterprises tend to be, they are also expected to comply with the rules and laws in existence. If their maximization problem is to obtain the greatest amount of profit with respect to a number of constraints, then rules, laws and

standards are to be employed to ensure that profits are sought in a manner that does not generate widespread environmental deterioration. The views on the environmental stance of producers and firms, and how (or whether at all) they should contribute to environmental protection and restoration would vary. At any rate, the decision of producers, as entrepreneurial bodies rather than persons, are based mainly on incentives and disincentives.

Naturally, environmental degradation occurring from production and business-related activities is arguably never a deliberate attempt to destroy the environment, but is rather a by-product of the maximization of self-interest where environmental, social, or long-run costs are left out of the maximization problem. Supply-side policies can set the incentives and allow industries and enterprises to proceed according to them. Of course, rules should not be so restrictive that they disrupt the livelihood of the business sector or forces clean and decent enterprises out of business, and should not incur unnecessary or unwanted complications that will harm entrepreneurs, but, at the same time, they should be effective enough, both in concept and implementation, to deter widespread environmental deterioration.

Polluting parties, after all, are ultimately comprised of human agents whose objective is to seek financial well-being for themselves and, possibly, their families and descendants. As human well-being is comprised of many factors, where material and monetary gains are important, but are merely one of the major aspects of the quality of life, profits and enjoyment of consumption can no longer be considered a sole component of happiness. Economic, environmental and social gains are to be enjoyed together; the absence of environmental and social quality will most likely render wealth and financial prosperity useless, even in excessive amounts. After all, if we were to compare the global ecosystem to a person, where the Economic Dimension is wealth, the Environmental Dimension is health, and the Social Dimension friends and family, then we see that a happier person is one who, along with a decent economic standing, is healthy and lives in a good society where only few social problems ever occur.

Despite their profit and wealth objectives, entrepreneurs, industrialists, and potential polluters, should, ideally, always be aware of the fact that they are also part of the global ecosphere, as much as they are an important part of the economy. With a larger scale of pollution comes a greater economic opportunity, but also the inadvertent potential to inflict greater harm on the environment. The global ecosphere is a unique asset that humans of the current and future generations must depend on. Consequently, as polluters are, like everyone else, agents seeking wealth, income prosperity, and happiness for their families and loved ones to enjoy even after they pass away, they must also make sure that their economic and industrial actions do not destroy this one-of-a-kind wonder that is the global ecosystem.

It is implored that industrialists, potential polluters, as well as individual agents take these issues into consideration, for the sake of the future generations, their children and theirs included.

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APPENDIX

VITA

Wasutadon Nakawiroj is a PhD candidate and teaching assistant at the Faculty of Economics, Chulalongkorn University, where he assisted in junior and senior courses on International Economics, Trade Theory, and Development Economics, as well as a Master's Degree course on Quantitative Analysis.

His academic interests include international trade, economic integration, monetary economics, sustainable development, development economics, behavioural economics and East Asian history. He is also a lecturer in economics (elective courses) for 10th – 12th grade students at the Chulalongkorn University Demonstration School, where he has been teaching for six consecutive years. He was born in Bangkok, Thailand, on 27/5/1987, and obtained his bachelor's degree with first class honours (Gold Medal) in Monetary Economics from Chulalongkorn University in 2009.

He completed his MA in International Economics and Finance in 2010, and attended the PhD Programme at Chulalongkorn University in the same year, acquiring straight As in both Programmes, and was nominated as one of the ASEAN representatives to participate in the Lindau Nobel Laureates Meeting in 2011.

One of his research articles, which is part of this dissertation, was accepted for publication in the International Journal of Economic Policy in Emerging Economies (IJEPEE), and another article was published in the ICADA 2013 proceedings.