Asia-Pacific Research and Training Network on Trade

Working Paper Series, No. 86, November 2010

A comparative study of selected Asian countries on carbon emissions with respect to different trade and climate changes mitigation policy scenarios

By

Truong Phuoc Truong*

Truong P. Truong is Honorary Professor of Sustainable Transport Systems, The Institute of Transport and Logistics Studies, The University of Sydney, Australia and an advisor of ARTNeT for work on Trade and Climate Change Linkages. This paper was prepared as part of the Asia-Pacific Research and Training Network on Trade (ARTNeT) initiative on building research capacity in the area of Trade and Climate Change Linkages. The technical support of the United Nations Economic and Social Commission for Asia and the Pacific is gratefully acknowledged. The opinions are the responsibility of the author and should not be considered as reflecting the views or carrying the approval of the United Nations, ARTNeT, or the University of Sydney. Any errors are the responsibility of the author, who can be contacted at T.Truong@itls.usyd.edu.au

Table of Contents

List of Figures

List of Tables

Abstract

Trade, economic development, and climate change issues are closely linked and this has significant implications for the design of climate change policies especially for developing countries. Developing countries regard the objective of economic development and growth as being as important as the objective of climate change mitigation, and therefore prefer to use emission intensity reductions as targets for their climate change policies. In theory, this may seem to allow for both economic growth and climate change mitigation objectives to be achieved in a harmonious manner but on closer analysis, no simple choice of a policy target can help to resolve the fundamental issue of how to reconcile the objective of economic growth with the objective of climate change mitigation. In this study we look at the case of China, India, Bangladesh, Indonesia, Thailand, and Vietnam, and consider the following questions: (i) how to measure the impacts of trade and economic activities on the levels of CO_2 emissions, (ii) how to measure the impacts of current climate change policies on trade and economic activities, (iii) how to improve on existing policies to better achieve the targets of economic growth while also contributing to the objectives of climate change mitigation. A general equilibrium model is used to conduct some simulations of a business as usual (BaU) and also some climate change and policy scenarios.

Keywords: Climate change, CO_2 emissions, Energy intensity, Emission intensity, Mitigation policies, Economic growth, Trade, Computable general equilibrium model, Asian countries.

JEL Classification: Q41, Q43, Q54, Q56, Q58

Introduction

Trade, economic development, and climate change issues are closely linked and this has significant implications for the design of climate change policies especially for developing countries. While it is easily recognised that the main objective of climate change policies is to cut back on the level of greenhouse gases (GHGs) emissions, it is not so easily agreed between countries on how this objective is to be achieved. Developed countries, in particular those which ratified the Kyoto Protocol, believe that the most effective way of achieving this objective is to set specific targets for emissions reductions and then use economic instruments (such as emission trading and/or carbon taxes) to help achieve these objectives in the most efficient manner. Other countries (in particular developing countries) fearing the adverse impacts of direct emissions cuts on the level of economic development and growth prefer to keep the options open and therefore do not agree to direct emissions cuts. Instead, a preferred alternative in the case of developing countries such as China and India is emissions *intensities* reduction. In theory, this may seem to be a more reasonable approach because reducing emission intensities (but not necessarily reducing emissions) can 'accommodate' for both economic growth and climate change mitigation objectives to be achieved to some extent, but this cannot continue for very long without ultimately also changing the fundamental relationship between these two objectives. Shifting the focus of attention from one policy variable (emission level) towards the ratio of two related variables (emission level over production level) may help to 'mask' the underlying relationship in the short run, but in the long run, this may add to further confusion and introduce unintended inefficiencies into the system. In this paper, we look at this issue in more details. We examine the underlying relationship between emissions, production levels and trade patterns of some developing countries in the Asia-Pacific region (China, India, Bangladesh, Indonesia, Thailand, and Vietnam) by asking the following questions: (1) what are the potential impacts of the current and projected future patterns of trade and economic activities of these countries on their levels of GHG emissions; (2) what are the potential impacts of (current) climate change policies on the patterns of trade and economic production, and finally (3) what could be improved in terms of policies to achieve better co-ordination between climate change, economic, and trade policies. To assist in the answering of these questions, we use a computable general equilibrium (CGE) model called WIATEC (Truong and Kemfert, 2010) to carry out some simulations. The model is first used to estimate a 'Business-as-Usual' (BaU) or 'reference' scenario from which we can use to compare with other scenarios. In the BaU scenario, we assume the current patterns of production and consumption activities in the studied countries will continue into the future without modifications by any particular climate change policies. Next, we construct some hypothetical climate change policy scenarios. Here the impacts of specific climate change policies can be examined. A comparison of the results of the BaU and various policy scenarios can give us an indication of how climate change policies can be improved for the studied countries. The plan of the paper is as follows. Section 2 establishes the reference or BaU scenario. Section 3 considers some alternative climate change policy scenarios. Section 4 examines the linkage between trade and climate change policies, and Section 5 concludes with some policy recommendations.

Impacts of existing trade and production patterns on greenhouse gases emissions in the studied countries – Business-as-usual Scenario

In this section we establish a 'business-as-usual' (BaU) scenario to be used as a starting point for comparison with other climate change policy scenarios. In the construction of this BaU scenario, we assume that the current patterns of production and consumption activities in the studied countries will continue into the future without modifications by any specific climate change policies. We look at the impacts of the BaU patterns of production and trade on greenhouse gases emissions.[1]

1. Historical trend (2005-2007)

First, we examine the historical information. Unlike econometric or partial equilibrium analyses where we can usually look at a longer time series for some specific variables of interest in some sectors of an economy, in general equilibrium-based studies, it is difficult to construct a series of comprehensive and 'balanced' (input-output) databases for many consecutive years which can then be used as inputs into the model to look at a time 'trend'. Instead, we start with a particular base year (in this case, 2004, using the GTAP version 7 database, see Narayanan and Walmsley (2008)) and calibrate the model (WIATEC) to this specific base year. Next, we use historical information in subsequent years for some specific variables (such as population growth, GDP growth, and CO_2 emissions levels) as published by other sources of information such as the U.S. Energy Information Administration (EIA)[2], EUROSTAT and UNDP[3]) to 'project' the model from the base year to these later years. The projection is called 'historical simulation' in which the objective is to 'replicate' the historical data for these specific variables but also to let the model determine the values of other variables or parameters of interest, such as the rate of technological change during this historical period, and then use these historical estimations to project into the future.

In Table 1 we show the historical levels of GDP (at market exchange rate (MER) and purchasing power parity (PPP)) for the regions of this study[4] during historical period 2005-2007. Table 2 shows the rates of population growth and CO2 emissions levels. From these historical data, we can calculate the ratio of total energy used[5] or total emissions over GDP level (energy and emission intensities) for the regions and these are shown in Tables 3 and 4. In calculating these intensities, we use both the GDP valued at market exchange rate (MER) and at purchasing power parity (PPP) to show the differences in their initial levels. From Figures 1a-b, however, it can be seen that despite the differences in levels, the pattern[6] of the variation of rates of change of the emission intensities over different regions does not change very much if we switch from GDP-MER to GDP-PPP measures. Therefore for reasons of simplicity and data compatibility[7], henceforth we use only the emission intensities measured in terms of GDP at MER.

---

[1] For simplicity, we look only at CO_2 emissions from energy usage and will not consider CH_4, N_2O, nor CO_2 emissions from other non-energy uses such as land use, land use change and forestry (LULUCF), or from wastes.

[2] http://www.eia.doe.gov/

[3] http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database
http://unstats.un.org/unsd/snaama/dnlList.asp

[4] For a description of these countries/regions and the sectors, see Appendix A.

[5] GTAP v7 data base also contains information on energy usage but these are not shown here in Table 2 even though they are used for the calculation of energy intensities shown in Table 3.

[6] Since we are concerned mainly with the relativities of the rate of change over different regions, the shape of these patterns are more important than their absolute levels.

[7] The GTAP data base is available only at MER rather than PPP values.

Table 1: Historical levels of GDP using market exchange rate (MER) and purchasing power parities (PPP) for the period (2005-2007)

GDP using market exchange rate (MER) trillion 2005 US dollars				GDP using purchasing power parities (PPP) trillion 2005 US dollars			
Region (*)	2005	2006	2007	Region	2005	2006	2007
CHN	2.17	2.42	2.72	CHN	8.37	9.14	10.44
IND	0.75	0.83	0.90	IND	3.49	3.75	4.14
BGD	0.06	0.07	0.07	BGD	0.27	0.28	0.30
IDN	0.29	0.31	0.32	IDN	0.78	0.81	0.87
THA	0.18	0.19	0.20	THA	0.52	0.53	0.56
VNM	0.05	0.05	0.06	VNM	0.24	0.25	0.27
JPN	5.09	5.23	5.34	JPN	3.59	3.60	3.72
KOR	0.76	0.80	0.84	KOR	1.00	1.03	1.10
RAS	0.89	0.94	1.00	RAS	2.13	2.21	2.37
USA	12.89	13.27	13.56	USA	11.34	11.42	11.79
CAN	1.08	1.12	1.15	CAN	1.02	1.04	1.08
BRA	0.68	0.71	0.75	BRA	1.48	1.50	1.60
RAM	1.76	1.87	1.98	RAM	3.05	3.19	3.41
E15	13.34	13.75	14.14	E15	10.74	10.83	11.25
E12	0.76	0.82	0.87	E12	1.32	1.38	1.49
RUS	0.65	0.70	0.76	RUS	1.43	1.51	1.65
AUS	0.70	0.73	0.76	AUS	0.64	0.65	0.69
NZL	0.11	0.11	0.11	NZL	0.10	0.10	0.10
ROW	3.21	3.38	3.57	ROW	5.66	5.88	6.30
World	45.42	47.28	49.11	World	57.18	60.11	63.13

Source: U.S. Energy Information Administration and author's calculations.
(*) for details on country/regional definitions, see Appendix.