

## **ABARE**

Purdue University

April 14-16, 1999

ABARE currently uses the Global Trade and Environment Model (GTEM), the successor to MEGABARE. Some GTAP based analysis has also been undertaken over the past year.

### 1. Model developments

The major focus of GTEM developments over the past year has been on building a specific capacity to analyse the impacts of the Kyoto Protocol. It is intended that GTEM be a detailed dynamic model of the world economy designed specifically to analyse the economic impacts of post COP-4 international climate change policies on a range of developed and developing economies. The major model developments have been the introduction of a capacity to model the impacts of emissions trading and the implementation of emission response functions for greenhouse gases other than carbon dioxide.

### 2. GTEM and GTAP model applications

#### a. Climate change

Over the last year, ABARE has undertaken analysis of the economic impacts of the Kyoto Protocol using GTEM. Analysis of the protocol centred on two key provisions: emissions trading and the comprehensive coverage of greenhouse gases. Initially, analysis of the protocol was undertaken with a version of GTEM that accounted for carbon dioxide from fossil fuel combustion. Results of this analysis were submitted to the Energy Modeling Forum's model comparison exercise, the results of which are to be published in a special edition of the Energy Journal. The GTEM policy scenarios that will appear in this paper include:

- No trading, where Annex B countries act independently to meet their Kyoto commitment in terms of emissions of carbon dioxide from fossil fuel combustion to levels agreed to at Kyoto;
- Annex B trading, where Annex B countries engage in emissions trading; and
- Double bubble, where two emissions trading bubbles are formed, one consisting of members of the umbrella group and another consisting of the European Union and eastern Europe. In this case countries within each bubble trade in emissions quotas, but there is no quota trade between bubbles.

A second stream of climate change analysis was undertaken using a version of GTEM that, in addition to carbon dioxide from fossil fuel combustion, accounted for noncombustion carbon dioxide, methane and nitrous oxide. To model these additional gases, ABARE developed emission response functions that allow reductions in methane, nitrous oxide and noncombustion carbon dioxide emissions per unit of output from the majority of emitting industries in GTEM. The magnitude of an emission reduction response is determined by the size of the carbon

equivalent emission penalty and in some cases, energy prices. Currently, no trading and Annex B trading simulations have been undertaken with this version of GTEM and will be published in an ABARE research report in April.

(b) Trade Analysis

A second major stream of work undertaken using GTEM is analysis of trade issues, particularly relating to energy markets in the Asian region. Three major projects are being conducted in this program:

i. Coal fired power generation in south east China

The study evaluates the real, economic costs of using domestic coal in electricity generating plants in south east China, taking into account subsidies on coal production and transport and coal import tariffs. It examines the implications of substituting greater quantities of imported coal for power generation in this region.

A key database development implemented in this study is the disaggregation of China into two regions – Eastern Coastal China and the Rest of China. The information used to disaggregate China was taken from the People’s Republic of China General Equilibrium Model (PRCGEM) developed by Australia’s Monash University and the Chinese Academy of Social Sciences. The PRCGEM model has a highly disaggregated commodity structure, identifying 118 commodity groups. These were aggregated to the same 17 commodities used in GTEM. The database also contains shares of output, investment, household consumption, government consumption and overseas exports for each of China’s 30 provinces. These were aggregated to reflect the two regions used as the basis of this study.

ii. Coal in ASEAN

The study provides a baseline assessment of current and prospective coal demand and supply in the ASEAN economies including production, consumption and trade patterns, tariff and subsidy regimes and trends in national energy policies. It includes an assessment of the impacts of relevant trade agreements, including the ASEAN Free Trade Agreement and APEC, on regional coal markets. It also analyses the impact of the Asian financial crisis on the demand for domestic and traded coal in the region.

The study represents the first occasion on which ABARE has implemented the version 4 database.

(iii) Assessing the impacts of APEC trade and investment liberalisation on the energy sector in member economies

This study is being undertaken for the APEC Energy Working Group. Its purpose is to evaluate the impacts of trade and investment liberalisation policies on energy markets in APEC economies, including the impacts on energy production, consumption and trade. It includes an assessment of the liberalisation timetable established under the Bogor Declaration as well as the impacts of accelerating or delaying the implementation of liberalisation commitments. The version 4 database is being used in this study.

c. Implications of further agricultural reform in the WTO negotiations

A standard version of GTAP with a 22x24 aggregation of the version 4 database was used to obtain preliminary estimates of trade and economic welfare effects from:

- i. further agricultural trade liberalisation; and
- ii. the economic implications of reinstrumentation from output subsidies to direct support.

As part of this process the standard GTAP database was modified to improve the data representation of agricultural support policies where necessary. For example, support to the Australian dairy industry is represented in the database as a small export subsidy. In fact, since the implementation of the Uruguay Round provisions this support is more accurately described as an output subsidy. Other policies that were modified in the database include EU compensatory payments, EU sugar and milk quotas and, more generally, tariffs and export subsidies. Numerous changes were made to the tariffs in the ASEAN countries in particular to make the data consistent with that contained in the UNCTAD TRAINS database, the APEC Tariff database and notifications to the WTO. For example, tariff rates were significantly reduced in Korea (wheat, rice and sugar), Malaysia (cereals, sugar, beef, milk and rice), the Philippines (wheat, sugar, beef, milk and rice) and Thailand (wheat, beef and milk). Tariff rates were significantly increased in Korea (beef), Philippines (sugar), China (sugar cane and beet and sugar) and Taiwan (beef). Average tariffs for the European Union were raised on beef from 27 to 120 per cent, on dairy products from 5 to 90 per cent, and on sugar from 27 to 147 per cent. This is because 1995 was an unrepresentative year for many products.

The only sizeable export subsidies in agriculture are in Canada, USA and the European Union. For countries other than those listed above, the export subsidies were revised and the previous method of using the notifications of subsidy expenditure to the WTO was employed. This applies particularly to Japan, and to many ASEAN countries. Export subsidies on coarse grain from Japan, Korea, Indonesia, Malaysia, Philippines and Thailand; on wheat from Japan and Thailand; on dairy products from Japan, Korea, Malaysia, Philippines and Thailand; and sugar from Malaysia and the Philippines were removed from the database.

Several changes were also made to output subsidies in the database. These include Australia (noted above), Malaysian paddy rice (zero to 132 per cent), Thai paddy rice and South Africa (sugar cane and beet). For the European Union, output subsidies on beef were increased from 5 to 18 per cent, and on dairy products from 1 to 8 per cent.

A further issue dealt with concerned intra-regional trade within the Europe Union. For the purposes of the analysis undertaken, intra- EU trade has been excluded from the measures of exports and imports.

Several issues remain outstanding on which further work is being undertaken. These include the handling of tariff quotas in a fashion that does not involve changing the closure and re-running the model, the development of a plausible post-UR baseline and a more rigorous handling of decoupling.

A list of recent ABARE publications of the above GTEM and GTAP applications is attached.

### 3. Public release and documentation

The public release and documentation of GTEM is aimed at assisting the community to analyse policy issues and to increase the awareness of GTEM and its capabilities. Making both documentation and a version of the model publicly available also increases the transparency of ABARE's modeling research.

ABARE will provide a version of the GTEM documentation to referees in May 1999. A PC version of the model will be available for initial testing in late April.

### Recent publications

Australian Bureau of Agricultural and Resource Economics (ABARE), Proceedings of the international conference on greenhouse gas emissions trading, June 1998.

Beil, S., Fisher, B.S. and Hinchy, M., 1998, The economics of international trading in greenhouse gas emissions — some post Kyoto issues, paper presented at the 'From Kyoto to Buenos Aires' International Conference on Greenhouse Gas Emissions Trading Sydney, 21-22 May.

Fisher, B.S., 1998, An economic assessment of the Kyoto Protocol using the Global Trade and Environment Model, paper presented at 27th Conference of Economists, 27th September – 1st October, Sydney.

Hinchy, M., Fisher, B.S. and Graham, B., 1998, 'Emissions trading in Australia: developing a framework', ABARE Research Report 98.1, Canberra.

Hinchy, M., Hanslow, K., Fisher, B. S. and Graham, B., 1998, 'International trading in greenhouse gas emissions: some fundamental principles', ABARE Research Report 98.3, Canberra.

Jotzo, F., Polidano, C., Brown, S. and Stuart, R., 1999, Global environmental measures and the Kyoto Protocol, paper presented at the Symposium on Pacific Energy Cooperation – SPEC '99, Dai-ichi Hotel, Tokyo, 16-17 February.

Kennedy, D., Brown, S., Graham, B. and Fisher, B.S., 1998, Assessing the economic impacts of the Kyoto Protocol, information paper prepared to coincide with the Fourth Conference of the Parties to the Framework Convention on Climate Change, Buenos Aires, 2–13 November.

Kennedy, D., Polidano, C., Lim, J. and Fisher, B.S., 1998, Climate change policy and the economic impact of the Kyoto Protocol, paper presented at the South Australian Office of Energy Policy 'Opportunities Out of Kyoto: A Conference on Greenhouse Targets and the South Australian Economy', Adelaide, 1 September.

Kennedy, D., Brown, S., Lim, J. and Fisher, B.S., 1998, Impacts of the Kyoto Protocol on the Australian mining and metallurgy industries, paper presented for the Australasian Institute of Mining and Metallurgy, Southern Queensland Branch, Julius Kruttschnitt Lecture, Brisbane 28 July.

Roberts, I., 1999, Agricultural trade: economic significance of multilateral reform, paper presented at the ABARE Outlook 99 conference, Canberra, 17–18 March.

Schneider, K., Millsted, C., Kennedy, D. and Stuart, R., 1999, Assessing the impacts of the Kyoto Protocol on APEC coal market, paper presented at The 5th APEC Coal Flow Seminar, 'Kyoto Targets and Asian Financial Turmoil: The Outlook for Coal' Yokohama, 3-5 February.

Tulpule, V., Brown, S., Lim, J., Polidano, C., Pant, H. and Fisher, B.S., 1998, An economic assessment of the Kyoto Protocol using the Global Trade and Environment Model, paper presented at OECD Workshop, 'The Economic Modelling of Climate Change: Background Analysis for the Kyoto Protocol', OECD Headquarters, Paris, 17-18 September.