

The GTAP Advisory Board Meeting, April 2000
Australian Bureau of Agricultural and Resource Economics (ABARE)

GTAP activities of ABARE

ABARE currently uses the Global Trade and Environment Model (GTEM), the successor to MEGABARE. GTEM based activities fall into three groups: model development, applications and documentation. Some GTAP based activity, mainly on the database, has also been undertaken over the past year. These activities are summarised below.

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 international climate change policies on a range of developed and developing economies. Major model development activities undertaken over the year include the introduction of capacities in GTEM to assess the impacts of supplementarity rules, which restrict the quantity of permits a country can buy or sell, in emissions trading, investments in sinks and clean development mechanisms (CDM). Investments in sinks and CDMs have been modelled in a simplistic way in which inter-temporal nature of the decision making process has been suppressed. Further complications into the sinks and CDM related activities would be introduced gradually over the year. Introduction of forward-looking behaviour in the model has come naturally into the next phase of model development.

In addition to these developments, nominal exchange rate has been modelled explicitly. Decomposition of changes in GDP and GNPs into standard conceptual units, such as changes in factor employment, changes in factor productivity, changes in terms of trade and changes in dead-weight losses, has been incorporated into the GTEM equation system and are routinely used to check and analyse GTEM results.

GTEM and GTAP model applications

(a) Climate change

Over the past year, ABARE has continued its program of research into the economic impacts of the Kyoto Protocol. The standard version of GTEM now accounts for methane, nitrous oxide and noncombustion carbon dioxide.

The program has had two major focuses: impacts of the Kyoto Protocol on developing country and impacts on European Union member countries. These focuses have been underpinned by regional disaggregations in GTEM that extend the GTAP disaggregation by adding population and emissions data, and data on the cost structure of electricity generation. All the analysis includes projections of meeting the protocol targets both with and without international emissions trading.

(i) Developing country impacts

The study focuses on examining the impacts of Annex B emission abatement on non-Annex B countries, which, despite having no abatement targets, will be affected through trade and investment links with Annex B countries. Overall welfare impacts are examined, together with detailed sectoral implications. The study also includes an illustrative example of the potential impact of the clean development mechanism, which focuses on the thermal electricity generation sector. The report is expected to be released by May 2000.

(ii) European Union impacts

This study focuses on the economic impacts within the European Union of meeting Annex B abatement targets under the Kyoto Protocol, with a particular emphasis on the fossil fuel industries. Baseline emission projections are examined carefully and the sensitivity of simulation results to them is considered. This study is in progress and is expected to be released mid-year.

(iii) Suplementarity and a double bubble

The European Union has proposed formulas that would restrict the extent to which Annex B parties could use the three Kyoto mechanisms - international emissions trading, joint implementation and the clean development mechanism - toward meeting their Kyoto targets. This project examines the impact on costs of meeting Kyoto targets if the EU formulas were to be applied to international emissions trading.

(iv) Coverage of abatement policy

The Kyoto Protocol is comprehensive in its coverage of greenhouse gases. However, governments will determine the coverage of abatement programs within countries. In this study GTEM is used to examine the impacts of differing gas and source coverage in a domestic abatement programs. Three scenarios are examined: full coverage, that is, carbon dioxide, methane and nitrous oxide from all sources are taxed; emissions from the agricultural sector, other than combustion carbon dioxide emissions, are untaxed; and combustion carbon dioxide only is taxed.

(iv) Sinks

The use of forest sinks to help countries meet their Kyoto Protocol commitments at least cost is an important provision of the Kyoto Protocol. The provision has the potential to affect investment, output, management regimes and returns to the forestry, agriculture and land use sectors. Work has recently commenced on representation of forest sinks in GTEM that will enable analysis of these impacts as well as analysis of the broader implications for the overall costs of meeting Kyoto commitments. Another component of the analysis will be to examine the implications of sink projects under the clean development mechanism.

(v) Calibration of supply elasticities for fossil fuels

In GTAP, the presence of a fixed factor (natural resource) in the fossil fuel production structure acts to dampen the supply response of producers (supply elasticity). The greater the share of resource rent in the production cost of coal, oil and gas, the lower the supply elasticity. In GTEM, the global average supply elasticity for coal, oil and gas is equal to 0.5 (the GTAP default parameters), with supply elasticities varying across regions according to their marginal extraction and distribution costs. Fossil fuel producers with low marginal extraction and distribution costs are assumed to receive more rent and hence have lower supply elasticity.

For oil and gas, it is assumed that extraction and distribution costs depend on the ratio of recoverable reserves to production. As the available recoverable resource is diminished, the extraction and distribution costs are assumed to rise. In GTEM, this means that regions with a relatively high recoverable reserve to production ratio (such as oil in the Middle East), have relatively low production and extraction costs and have relatively low supply elasticities. However, unlike oil and gas, coal is not a scarce resource, so that the ratio of recoverable reserves to production can not be used as a measure of relative extraction and distribution costs. Instead, this information is derived from IEA estimates.

In order to implement these supply elasticities in GTEM, the required natural resource (resource rents) cost share in coal, oil and gas production costs in each region is determined. To reach the required natural resource cost share, labour and capital in coal, oil and gas production is reclassified as natural resources. If there is insufficient labour or capital to meet the target elasticity (which only occurs in a few regions), all labour and capital is reclassified as natural resources, and the target is not reached.

(b) *Trade Analysis*

Another major stream of work undertaken using GTEM is analysis of trade issues, particularly relating to energy markets in the Asian region. Five projects are currently being conducted or have recently been completed under this program:

(i) Coal fired power generation in south east China

This study was published in November 1999 in collaboration with the Energy research Institute of the Peoples' Republic of China. It 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 highlights the potential for increased imports of coal by China if assistance to the domestic industry were removed.

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.

(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 also analyses the impact of the Asian financial crisis on medium term economic growth in the region and on the demand for domestic and traded coal.

(iii) Trade and investment liberalisation in APEC: economic and energy sector impacts

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 economic growth and structure as well as on energy markets in APEC economies, including the impacts on energy production, consumption and trade. It includes an assessment of the trade liberalisation timetable established under the Bogor Declaration as well as the impacts of accelerating or delaying the implementation of liberalisation commitments. The study also uses a case study of Japan to compare the macroeconomic impacts of trade liberalisation with the impacts of deregulation in the electricity sector – another key element of the APEC energy agenda. The report of this study will be published in May 2000 and presented to the APEC Energy Ministers' Meeting.

(iv) Japan's Energy Future

The objective in this study is to examine some of the key long run economic and structural changes that are occurring in the Japanese economy and energy sector and to consider the implications of these for the level and structure of energy demand in Japan. The key changes that the study is examining are long run sustainable growth rates, including the impacts of deregulation throughout the economy and changing demographics; energy sector deregulation; and climate change response policies. On the basis of analysis of these changes and of alternative policy responses to them, the study will develop a likely outlook for the economy and energy sector in 2015 or 2020. It will examine the implications of this outlook for national, regional and global fuel markets.

(v) Removing Energy Subsidies

Using data on energy subsidies from the World Bank and the International Energy Agency, this study will use GTEM to analyse the implications when subsidies are removed. This will include an assessment of the macroeconomic impacts, the impacts on energy production, consumption and trade and on greenhouse gas emissions.

(c) *Agricultural trade reform*

Study of agricultural trade reform is another area in which GTEM has been employed to assess the economic impacts of the proposed reform. It is contained in three different projects.

(i) Agricultural trade reform

Since the previous Board meeting in 1999 ABARE has focused on undertaking agricultural trade reform analysis in a dynamic framework using GTEM with the version 4e GTAP database. Several counter-intuitive movements in output, prices and welfare obtained from the ag lib simulation finally led us to discover some anomalies in the protection data, trade flows and input-output tables, which we fixed in our own way. In addition to this we decomposed land into three types - crops, livestock and speciality land such as that used in horticulture, sugarcane and fibre productions. We have also inserted small quantities of rice imports into Japan and Korea to enable the model to generate significant imports of rice in response to relative price change as the import restrictions were partially lifted in 1996. We would like to set up a formal channel of communication with the GTAP team to report and discuss such changes regularly.

(ii) Impact of trade liberalisation on developing countries

ABARE is currently conducting a project aimed at providing an enhanced appreciation by Australian and other negotiators of the importance of issues of concern to developing countries and to increase developing countries' support for further trade liberalisation.

The objectives of the project are: to examine the key patterns of agricultural policies in developing countries; to provide an appreciation of the concerns about agricultural trade liberalisation being raised by developing countries; to analyse the potential economic impacts of agricultural trade liberalisation on developing countries, considering the important differences among these countries; to identify the particular domestic factors that have implications for the benefits of agricultural trade liberalisation and to identify policies that may be required to allow developing countries to fully realise the benefits of trade liberalisation.

As part of its analysis, ABARE is using its general equilibrium model GTEM to analyse the economic impacts of alternative trade liberalisation scenarios in selected developing countries and country groupings, focussing not only on agricultural trade but also on multi-sector liberalisation.

The project is scheduled for completion by June 2000.

(iii) Other Outputs:

This includes a conference paper to the Australian Agricultural and Resource Economics Society on ag trade liberalisation called 'Increasing benefits to Australia from WTO agricultural trade liberalisation', and an ABARE Outlook2000 conference paper entitled 'WTO trade reform: maintaining the momentum for liberalisation'. In both cases we measured the impacts of partial liberalisation of agricultural to 2010 on output, trade and welfare. We have also attempted comprehensive liberalisation scenarios resulting in real GNP losses in several countries, although real GDP improves in all countries. In the process of this work, for example, we ran a scenario on liberalisation for manufacturing alone in developed countries only, and attained what appears to be a counter intuitive result indicating real GNP losses in all liberalising countries. This may indicate that liberalisation of manufacturing alone might reduce tariffs below optimal levels implicit in the model. This reflects the Armington assumptions. Also, the generally low levels of manufacturing support relative to agriculture could mean that reductions in manufacturing support might increase the internal distortions between manufacturing and agriculture. Nonetheless, we intend to incorporate such comprehensive results in a study on the developing countries and trade reform.

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 recently transferred a PC version of GTEM to the Tsing Hua National University in Taiwan and provided an in-house training course.

Constant development of the model is superseding any attempt to document it. To resolve this problem ABARE has released the Tablo code of the core version of the GTEM at its web site. A companion documentation of the Tablo code will be made available at the web site by the middle of the year. A full documentation of the model is being written now. It is hoped that it will be possible to release the document by the end of the year 2000.

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

Recent publications

- Brown, S., Kennedy, D., Polidano, C., Woffenden, K., Jakeman, G., Graham, B., Jotzo, F., and Fisher, B.S. 1999, *Economic impacts of the Kyoto Protocol: Accounting for the three major greenhouse gases*, Research Report 99.6.
- Brown, S. et al. 1999, Modeling the economic impacts of the Kyoto Protocol: Accounting for the three major greenhouse gases, paper presented at 1999 Energy Modeling Forum Seminar Workshop, Snowmass, 26 July – 5 August
- Brown, S., Jotzo, F., Fisher, B.S. 1999, Assessing the impacts of the Kyoto Protocol: Implications for the Australian aluminium industry, paper presented at the Australasian Aluminium and Alumina Summit in Sydney, 21–22 April.
- Brown, S., Jotzo, F., and Fisher, B.S. 1999, The economic impacts of the Kyoto Protocol: Accounting for the three major greenhouse gases, presented to the UNFCCC Technical Workshop on Mechanisms in Bonn, 9-15 April.
- Fisher, B.S. 1999, The economic impacts of the Kyoto Protocol: Accounting for the three major greenhouse gases, presented at UNFCCC Technical Workshop on Mechanisms in Bonn, 9–15 April.
- Freeman, F. and Roberts, I. 1999, 'Multifunctionality: a pretext for protection?', *Current Issues* 99.3, August.
- Graham, P. and Curtotti, R., 2000. South Africa in the world coal market: implications for Australia, presented at the 44th Annual conference of the Australian Agricultural and Resource Economics Society at the University of Sydney, 23-25 January 2000.
- Jotzo, F., Heyhoe, E., Woffenden, K., Brown, S., Fisher, B.S., and Tulpule, V. 2000, *Impacts of the Kyoto Protocol on Developing Countries*. Preliminary report.
- Jotzo, F., Heyhoe, E., Woffenden, K., Brown, S. and Fisher, B.S. 2000, Kyoto Protocol: Impact on developing countries and some implications for the design of the Kyoto mechanisms, presented at the ABARE Outlook 2000 conference, Canberra, 29 February – 2 March.
- Millstead, C., Schneider, K. and Tulpulé, V, 1999, Energy outlook into the new millenium: Key trends and determinants, paper presented at AIE National Conference – 1999: 'Energy for the New Millennium', Melbourne, 24-25 November.
- Polidano, C., Brown, S., Woffenden, K., Beil, S. and Fisher, B.S. 1999, The Kyoto Protocol: Economic impacts on Annex B economies and key Australian industries, paper presented at the ABARE Outlook 99 conference, Canberra, 17–18 March.
- Stuart, R., Schneider, K. and Saunders, M., 2000, Impacts of international policies on APEC coal markets: Trade liberalisation and climate change, presented at The Sixth APEC Coal Flow Seminar 'Coal in the New Millenium' at Kyongju, Korea, 14-15 March.

Podbury, T., Roberts, I., Vanzetti, D. and Fisher, B.S., 2000, Increasing benefits to Australia from Wto agricultural trade liberalisation, paper presented at the 44th Annual conference of the Australian Agricultural and Resource Economics Society at the University of Sydney, 23-25 January 2000.

Roberts, I. et al 1999, *Reforming World Agricultural Trade Policies*, ABARE Research Report 99.12, RIRDC Publication 99/96, Canberra.

Schneider, K., Phamduc, T., Zhonghu, W., Xiaoli, L., Lin, S., Lin, D. and Yuezhong, Z. 1999, *Supplying Coal to South East China: Impacts of China's Market Liberalisation*, Research Report 99.13.

Horticultural Research and Development Corporation (HRDC), Australian Horticultural Corporation (AHC) and Australian Bureau of Resource and Agricultural Economics (ABARE) 1999, *Australian Horticulture in the Global Environment*.

Roberts, I. And

Tulpule, V., 1999, 'Multilateral Agricultural Policy Reform', Current Issues 99.4, September.