

**GTAP Board Report**  
**International Food Policy Research Institute**  
**July 2010 – June 2011**

Most of the GTAP-related work realized within IFPRI has been done at MTID (Markets, Trade and Institutions Division)-GRP2.

The GRP2 theme studies the policies and institutions needed to manage the globalization of the food system in a pro-poor fashion. The research emphasizes global agricultural trade negotiations, linkages between domestic policies and globalization, the impact of developed-country policies on developing-country food security, and pro-poor policies along the entire food chain, given the growing importance of consumers and retail industries as food system drivers.

The globalization and markets team is currently composed of: Valdete Berisha, Antoine Bouet, Betina Dimaranan, Carmen Estrades, Fabienne Femenia, David Laborde, Solomon Lemma, Sam Morley, David Orden, Devesh Roy, and Marcelle Thomas.

### **Selected Trade-Related Projects in 2009-2010**

The work realized at MTID-GRP2 and based on the GTAP database addresses in particular four issues: biofuels, poverty, gender, the potential impact of a DDA on LDCs.

#### **1) The potential impact of programs supporting biofuels development in rich countries on trade and food security in developing countries and on CO<sub>2</sub> emissions.**

The primary objective of this study is to analyze the impact of possible changes in EU and US biofuels policies, including trade policies on global agricultural markets and land use (environmental) markets. This research pays particular attention to the effects of food prices and the Land Use Changes (LUC), and the associated emissions, of the main feedstock used for first-generation biofuels production.

The research introduces new methodological developments to adapt the MIRAGE model to the biofuels sector. Among major methodological innovations introduced in the model is the new modeling of energy demand which allows for substitutability between different sources of energy, including biofuels. The underlying Global Trade Analysis Project (GTAP) database has been greatly modified to separately identify ethanol (with four subsectors), biodiesel, five additional feedstock crops sectors, four vegetable oils sectors, fertilizers, and the transport fuel sectors. This extension has been introduced using innovative tools to ensure the consistency in both value and volume for the sectors of interests. The model was also modified to account for the co-products generated in the ethanol and biodiesel production processes and their role as inputs to the livestock sector. Fertilizer modeling was also introduced to allow for substitution with land under intensive or extensive crop production methods. Finally, another major innovation is the introduction of a land use module which allows for substitutability between land classes, classified according to agro-ecological zones (AEZs), and land extension possibilities. We assess the greenhouse gas emissions (focusing on CO<sub>2</sub>) associated with direct and indirect land use changes as generated by the model for the year 2020, and separately quantify the marginal ILUC for each feedstock crop.

This is the only study, out of the four launched by the Commission, that uses a global computable general equilibrium model (CGE) to estimate the impact of EU biofuels policies, in this case an extensively modified version of the existing MIRAGE model.

The central policy scenario translates the 5.6% first-generation biofuels mix in road transport fuels in 2020 into an increase in biofuels consumption in the EU to 17.8 Mtoe. The required increase in biodiesel production is mostly domestic in the EU while the increase in bioethanol

production is mostly concentrated in Brazil. World cropland increases by 0.07%, showing that there is indeed indirect land use change associated with the EU biofuels mandate. Direct emission savings from biofuels are estimated at 18 Mt CO<sub>2</sub>, additional emissions from ILUC at 5.3 Mt CO<sub>2</sub> (mostly in Brazil), resulting in a global net balance of nearly 13 Mt CO<sub>2</sub> savings in a 20 years horizon.

The model simulations show that the effect of EU biofuels policies on food prices will remain very limited, with a maximum price change on the food bundle of +0.5% in Brazil and +0.14% in Europe. The EU biofuels policy also has no significant real income consequences for the EU, though some countries may experience a slight decline in real income: -0.11% to -0.18% by 2020 among oil exporters, and -0.12% for Sub-Saharan Africa, due to a decline in fossil oil prices and a rise in food prices, respectively.

Analysis of ILUC effects by crop indicates that ethanol, and particularly sugar-based ethanol, will generate the highest potential gains in terms of net emission savings. For biodiesel, palm oil remains as efficient as rapeseed oil, even if peatland emissions are taken into account. The model also indicates that the ILUC emission coefficients could increase with the size of the EU mandate. Simulations for EU biofuels consumption above 5.6% of road transport fuels show that ILUC emissions can rapidly increase and erode the environmental sustainability of biofuels.

While the research work has delivered specific outputs in 2010, work on this important topic will continue through various other projects in the future.

## **2) The evaluation of the impact of trade liberalization or other shocks on the world markets on poverty with a new version of MIRAGE that includes households' heterogeneity.**

Various international shocks are expected to have a substantial impact on poverty levels and inequality in developing countries (either positive or negative). In particular, major trade agreements, new massive domestic support programs in rich countries (agricultural policies, biofuels support programs for example) and increased volatility of world food prices could have substantial distributional effects in these countries. Therefore, it is important to develop a consistent and detailed modeling instrument that allows understanding how poverty between and within developing countries reacts to various shocks at the world level. This instrument has to be economically consistent, it has to tackle the economic mechanisms that lead to international transmission of major shocks and it has to provide a detailed representation of the characteristics of poverty within developing countries. Until now, multi-country multi-sector Computable General Equilibrium Models are not well adapted to study distributional impacts of this kind of shocks as they only tackle how remunerations of primary factors are affected at the macroeconomic level, without taking into account the diversity of sources of revenues and consumption structure across individuals and households in developing countries. This project seeks to close this gap. Its objective is to develop a module of the MIRAGE model of the world economy with household heterogeneity.

A new version of the MIRAGE model has been developed and enriched with disaggregation of households in three countries: Uruguay, Pakistan, and Tanzania. In these countries, the model disaggregate the representative household into approximately 100 households by country, characterized by exogenous criteria like geographic place of residence, qualification and gender of the household's head, (private vs. public or agriculture vs. industry vs. services) and sector of activity so to represent the income distribution within the country. The sources of income and consumption structure reflect disaggregated statistical information coming from household surveys. Moreover, the new model better captures the behavior of the public agent in terms of revenues collected and in terms of expenditures.

This new version of MIRAGE will allow studying the impact of various policy shocks and identifying which households are expected to win, which households are expected to lose and why, while taking into account the reaction of households to these shocks. This will represent a considerable improvement of the MIRAGE model and in general to the existing world models.

First results show that: (i) behind the average impact of a trade shock at the national level, there is much diversity in terms of impact at the individual level; (ii) divergences in gains and losses come mainly from the factor prices' channel and less from the consumption structure channel; (iii) how transfers of households are indexed is of great importance.

This version of MIRAGE is dynamic and models the long term evolution of the various strata of households. The work in 2011 will focus on introducing endogenous changes in the composition of strata, like rural/urban migration thanks to an augmentation of the non agricultural/agricultural unskilled labor of endogenous modification of the split of active population between skilled and unskilled labor. We will also implement endogenous inter-household transfers in order to understand to what extent these transfers may mitigate external shocks for certain categories of households.

### **3) A database and a new version of MIRAGE that accounts for gender issues is being developed and relies partly on the GTAP database**

As part of the Globalization and Markets (GRP2) research program to help countries to better evaluate the implications of different trade liberalization scenarios, we have launched a project to quantitatively assess the gender-differentiated impacts of multilateral and regional trade reforms. As a first step, the study aims to develop a gendered global database where male and female employment are incorporated by sector and country. This activity will build on the most recent GTAP database and will rely on sectoral employment data from the International Labor Organization, augmented by data and/or shares coefficients estimated from household surveys and social accounting matrices (SAMs). The current MIRAGE model will be modified to enable, the assessment of the gendered impacts of trade liberalization. This important development will constitute a cornerstone in analyzing the gender dimensions of trade agreements and can be used in subsequent research on the gendered impacts of other global shocks. A future application is in analyzing the linkages between gender, trade and poverty, using the MIRAGE poverty model with disaggregated households.

### **4) Finally a study on the trade characteristics of LDCs and the potential implications of a Doha Development Agenda on LDCs.**

In this study we examine whether LDCs' interests are favored by the Doha Development Agenda (DDA) proposals currently on the table. First we characterize LDCs' trade and market access situations. More specifically, we examine if LDCs benefit today from significant trade preferences as compared to other groups of countries, and evaluate the implications of potential preference erosion from multilateral liberalization. Moreover, an existing concern is that LDCs could be hurt by the removal of distortions prevailing in the agricultural sector. Trade reform under the Doha Round could entail a rise in world agricultural prices: as evidenced by the current food crisis, net food importing countries and poor people within these countries may be hurt by higher agricultural prices. Furthermore, increased competition in the textile and apparel sector implied by the DDA could also inflict deterioration in the terms of trade for LDCs.

The December 2008 modalities provide a fairly complete outline of a potential agreement and make it possible to carry out a detailed simulation of a realistic DDA. We undertake this modelling exercise using the MIRAGE model of the world economy with detailed assessments of this trade reform on market access and economic variables concerning LDCs. In order to understand which elements of the global package are important for LDCs, we proceed with a sensitivity analysis.

In this paper we show that the benefits that LDCs can draw from the trade reforms outlined in the December 2008 Modalities, are negligible, if not negative. This arises because: (i) LDCs could be hurt by erosion of preferences . (ii) most LDCs are net-food importing countries that would

likely be negatively affected by rising food prices, and resulting from removal of agricultural distortions. (iii) they are not committed to any reform of their own trade policies.

### **Other selected Trade-Related and/or GTAP-related Projects in 2009-2010 realized outside MTID**

Guyslain Ngeleza's contribution (DSG – IFPRI Accra):

Contribution with the D.R. Congo I-O table to the GTAP data base: So mainly an updating of the existing D.R. Congo I-O table, reorganized it by including new sectors and splitting some existing sectors in order to have all the D.R. Congo's economy relevant sectors in it, then mapped to the GTAP sectors. This new I-O table was then added to the GTAP data base (this project was funded by the World Bank through GTAP).

Guyslain Ngeleza wrote a research paper on Free Trade Agreements under the EPA between EU and CEMAC using this new GTAP database. The paper is under review.

### **Contributions to the GTAP Database in 2009-2010**

- David Laborde contributed the following:
  - Continued development of the TASTE software,
  - quality checks (agricultural production, IO coefficients, trade) on the pre-release and final candidate databases, and

### **Potential contributions to the GTAP Database for 2011-2012**

- David Laborde's contribution on export taxes

The limited analysis of export taxation under a global and multi-sectoral framework is largely due to the lack of data. Indeed, in the recent years, detailed information on applied tariffs has been made accessible for researchers and practitioners with the MAcMapHS6 database (See Boumelassa, Laborde and Mitaritonna, 2009, for the latest version) and included in the GTAP database. Unfortunately, such information, i.e. applied policies at a bilateral level at the HS6 level, does not exist yet for export taxes. International institutions do not provide systematic datasets on this issue, and WTO notifications remain scarce.

Looking at existing data in the GTAP dataset, we see that export tax coverage is pretty limited: only 21 sectors over 42 (trade in merchandises) have observations with export taxes and on average, 17 percent of the exporters of these sectors use export taxes. Overall, the average export tax on global trade in goods is estimated at 0.5 percent. However, these data have to be taken carefully and have several flaws. First, they are not based on data collection at the HS level but are the result of the processing of macro data coming from the Social Accounting Matrices. They can be outdated and the export taxes are mixed with other price distortions between domestic and export prices, or defined at a higher level of aggregation and then applied to several GTAP sectors during the GTAP database construction process. Second, the GTAP treatment on agricultural products leads to only a net distortion at the border: net export taxes from export subsidies. Since the focus has been on export subsidies in agricultural negotiations,, the GTAP database simply discards the information on export taxes for agricultural products. This result is clearly illustrated by a study undertaken by IFPRI for the European Commission, where no export taxes are applied on agricultural trade. Only the "raw milk" sector (rmk) is affected, but in reality, there is nearly no international trade of this commodity. Third, it is obvious that some important countries, e.g. China, are missing from the list of export tax users. Fourth, the GTAP database has a specific module to address the energy sectors (coal: coa, natural gas: gas, oil, p\_c: petroleum, and coal processed/refined). We clearly see that this different treatment and the additional information available on these sectors lead to a high concentration of export taxes in

this sector. Due to these limitations, we had to update the existing dataset before conducting a policy simulation under the MIRAGE model.

This updating of the export taxes data was done for a confidential study for the European Commission; the database may be shared with the GTAP community if an agreement is reached with the donor.

## **GTAP- and trade-related publications**

### ARTICLES IN PEER-REVIEWED JOURNALS

Bouet, A., and G., Gruere, 2011, A refined estimate of the opportunity cost of non-adoption of Bt cotton in five countries of West Africa, *Applied Economic Perspectives and Policy*, forthcoming.

Bouet, A., and D. Laborde, 2011, Food Crisis and Export Taxation: the Cost of Non-Cooperative Trade Policies, *Review of World Economics*, forthcoming.

Bouet, A., and D. Laborde, 2010, Why is the Doha Development Agenda Failing? And What Can be Done? A Computable General Equilibrium-Game Theoretical Approach, *The World Economy*, (11), 1486-1516.

Bouet, A., and D. Laborde, 2010, Assessing the Potential Cost of a Failed Doha, with D. Laborde, *World Trade Review*, 9: 319-351.

Bouet, A., B. Dimaranan and H. Valin, 2010, Evaluating the environmental cost of biofuels policy: an illustration with bioethanol, *International Economics*, 122: 57-88.

Bouet, A., and D. Laborde, 2010, Eight Years of Doha Trade Talks: Where Do We Stand?, with D. Laborde, 2010, *Estey Centre Journal of International Law and Trade Policy*, 11(2): 349-70.

### BOOKS, MONOGRAPHS AND RESEARCH REPORTS

Bouet, A., G. Gruere and S. Mevel, 2011, International Trade and Global Welfare of Genetically Modified Crops, with in C.A. Carter, I.M. Sheldon and G. Moschini, eds., *Genetically Modified Food and Global Welfare*, Elsevier, forthcoming.

Bouet, A., V. Berisha-Krasniqi, C. Estrades and D. Laborde, 2011, Trade and Investment in Latin America and Asia: Lessons from the Past and Potential Perspectives from Further Integration, in S. Fan and M. Torero, ed., 2011, *Fostering Growth and Reducing Poverty and Hunger in Asia and Latin America: Opportunities for Mutual Learning*, IFPRI, forthcoming.

Bouet, A., and D. Laborde, 2010, The economics of export taxes in a context of food security, in OECD, *The Economic Impact of Export Restrictions on Raw Materials*, Paris, OECD Trade Policy Studies, Trade and Agriculture Division, 59-78.

### IFPRI AND OTHER DISCUSSION PAPERS

Bouet, A., E. Dienesch, K. Elliott and D. Laborde, 2010, The Costs and Benefits of Duty-Free, Quota-Free Market Access for Poor Countries: Who and What Matters, 2010, Center for Global Development Working Paper 206, March.

*And* The Costs and Benefits of Duty-Free, Quota-Free Market Access for Poor Countries: Who and What Matters, with Elisa Dienesch, Kim Elliott and David Laborde, 2010, CATT, March, *CATT Working Paper*, No.11.

Bouet,A., B. Dimaranan, and H. Valin, 2010. "Modeling the Global Trade and Environmental Impacts of Biofuel Policies," IFPRI Discussion Paper 1018, August.

Bouet, A., S. Mevel and M. Thomas, 2010, Is SAFTA trade creating or trade diverting? : A computable general equilibrium assessment with a focus on Sri Lanka, IFPRI Discussion Paper No. 950.

Al-Riffai, P., B. Dimaranan, and D. Laborde, 2010. *European Union and United States Biofuel Mandates: Impacts on World Markets*. Inter-American Development Bank, Technical Notes No. IDB-TN-191, December.

Al-Riffai,P. B. Dimaranan, and D. Laborde, 2010. *Global Trade and Environmental Impact of the EU Biofuels Mandate*. Final report submitted to the Directorate General for Trade, European Commission, March.