Schriften der Gesellschaft für Wirtschafts- und Sozialwissenschaften des Landbaues e.V.

Britz, W.; Schmidhuber, J.: The Impacts of OECD Policy Reform on International Agricultural Commodity Markets: First Results of a Quantitative Assessment Based on the @2030 Model. In: Brockmeier, M.; Isermeyer, F.; von Cramon-Taubadel, S.: Liberalisierung des Weltagrarhandels – Strategien und Konsequenzen. Schriften der Gesellschaft für Wirtschafts- und Sozialwissenschaften des Landbaues e.V., Band 37, Münster-Hiltrup: Landwirtschaftsverlag (2001), S.95-104.

Schriften der Gesellschaft für Wirtschafts- und Sozialwissenschaften des Landbaues e. V., Bd. 37, 2001, S. 95-104

THE IMPACTS OF OECD POLICY REFORM ON INTERNATIONAL AGRICULTURAL COMMODITY MARKETS: FIRST RESULTS OF A QUANTITATIVE ASSESSMENT BASED ON THE @2030 MODEL

by

W. BRITZ and J. SCHMIDHUBER[1]

1 The structure of the @2030 model

1.1 Overview

The @2030 framework is a non-spatial, recursive-dynamic multi-commodity model for agricultural products solved on a yearly basis. Its parameterisation is primarily based on existing FAO models, notably the World Food Model (FAO 1998) and the Food Demand model (FDM). In addition to the FAO models, a number of „external" sources and/or „guestimates"[2] have been used to close the remaining gaps. All parameters have been calibrated to comply with micro-economic conditions and are adjusted dynamically over time so that they reflect appropriately the long-term dynamics in food and agriculture.

The model consists of identically structured *regional modules* in which supply (area, yield) and demand (food, feed and industrial use) for agricultural products are described with uniform double-log functions. The difference between domestic supply and demand generates a net trade flow for every country or region. Regional and world markets are cleared by adjusting *uniform world market prices*. Markets are treated as points, transport costs are excluded, and all commodities are assumed to be homogenous. Other important features include:

- The model aims to capture the peculiarities of *long-term developments*. This is reflected in a number of features, most importantly in the fact that all elasticities are dynamic. Income elasticities, for instance, are a function of the income levels and decline as income levels rise.
- The framework captures *all food commodities*, which allows to monitor changes in food consumption patterns, food consumption (calorie intake) levels and thus draw inferences on changes in food security.
- A *distinction* is made between *consumer and producer markets*. Consumer prices for food and fibre are, for instance, distinguished from producer prices for the agricultural commodities. Processing and distribution margins represent a variable wedge between the two. The margins are variable and dependent primarily on the level of economic development.

---

[1] University of Bonn and FAO, ESDG, respectively. All views expressed in this document are those of the authors not of their respective organisations.

[2] Such „guestimates" are typically based on cross-country comparisons and the specificities of agricultural production systems.

- Agricultural policies of OECD countries and selected transition economies[3] are represented by *Producer Support Estimates (PSEs)* as calculated by the OECD. Total PSEs are split into market price support and non-price related support elements.

Agricultural policies for non-PSE countries are not yet comprehensively covered. In general, the domestic-to-international price-wedge for developing countries distinguishes policy-related protection and „natural" protection.[4]

1.2 Country and commodity coverage

In its present form, the model distinguishes *seventeen countries or country groups* and *34 commodities and commodity groups* which cover the entire agricultural value added of the various countries and country groups. Specifically, these are wheat, rice (in milled equivalents), maize, barley, millet, sorghum and other cereals, vegetable oils, cassava, potatoes, sweet potatoes, yams, and other root crops, cocoa, coffee, and tea, plantains, sugar (in raw equivalents), pulses, vegetables, bananas, citrus, and other fruits, beef, pig meat, poultry meat, milk and milk products, eggs, sheep-goat-camel meat, and other food products (fish, etc.), as well as tobacco, cotton lint, other fibre plants, and rubber.

All *commodity data are expressed in primary product equivalent* unless stated otherwise. Historical commodity balances (Supply Utilisation Accounts - SUAs) are available for about 160 primary and 170 processed crop and livestock commodities. To reduce this vast amount of information to manageable proportions, all the SUA data have been converted to the commodity specification given above in the list of commodities, applying appropriate conversion factors (and ignoring joint products to avoid double counting: e. g. wheat flour is converted back into wheat while wheat bran is ignored). In this way, one supply-utilisation account in homogeneous units is derived for each commodity in the model. Meat production refers to indigenous meat production, i. e. production from slaughtered animals plus the meat equivalent of live animal exports minus the meat equivalent of all live animal imports. Cereal demand and trade data include the grain equivalent of beer consumption and trade.

1.3 Behavioural equations, identities, and model closure

1.3.1 Supply

A partial adjustment structure has been chosen to describe the dynamics of agricultural supply. The stylised representation of the desired, long-run activity level x_{ik}^{t*} (e. g. area harvested of product i in country/region r) is defined as:

$$(1) \qquad \ln x_{ir}^{*t} = sc_{ir}^{t} + sx_{ir}^{t} + \sum_{j} \varepsilon_{i,j}^{t} \ln(PI_{jr}^{*t})$$

where sc^{t}_{ir} denotes a vector of shift factors that is used to calibrate the model to the current set of projections to 2030. An additional vector of shift factors sx^{t}_{ir} has been included, whereby all vector elements are set to zero for the baseline projections. It was introduced to ease the implementation of alternative scenarios that represent shifts in supply, like higher or lower rates of technical progress. Both shift factors are specific to individual commodities i, countries/regions r and vary over time t.

---

[3] The model covers PSEs for all countries monitored by the OECD, i. e. all OECD countries plus Russia, Estonia, Lithuania, Latvia, Slovenia, Bulgaria, and Romania.

[4] This is often due to a lack of physical or market infrastructure and can cause significant (short-term) frictions in international-to-domestic price transmission. Natural protection is largely is a function of the level of development and is assumed to decrease as income and investments in infrastructure rise.

PI_{jr} are the producer incentive prices for commodity i in country/region r, assumed to equal the farm-gate price plus the sum of the non-price related policy incentives, as for example EU's compensatory payments.

Equation (1) assumes that changes in prices and other elements of the incentive system will induce farmers to adjust activities (area harvested, herd size) towards a desired long-run equilibrium level. In the short-term, however, a number of factors militate against a complete adjustment to the long-run equilibrium. These include, inter alia, long gestation periods, rigidities in the supply of inputs, or simply, a lack of market knowledge and production know-how. Taking account of the short-term dynamics renders the actual representation of the activity levels:

$$(2) \qquad \ln x^t_{ir} = \lambda_{ir} \ln x^{t-1}_{ir} + (1-\lambda_{ir})\left[sc^t_{ir} + sx^t_{ir} + \sum_j \varepsilon^t_{i,j} \log PI^{t-1}_{jr} \right]$$

Like the activity levels, the equations for *yields* are specified as double-log equations. The stylised form for the yield y of livestock/crop activity i in country/region r is represented as:

$$(3) \qquad \ln y^t_{ir} = sc^t_{ir} + sx^t_{ir} + \sum_j \varepsilon^t_{i,j} \ln(PI^t_{jr})$$

Production Q^t_{ir} (in tonnes) of commodity i in country/region r is written as the product of the respective activity level (acreage or herd size, in 1000 ha or heads) and the corresponding yield (defined in kg/ha or kg/carcass)

$$(4) \qquad Q^t_{ir} = Yield^t_{ir} \cdot ActivityLevel^t_{ir} / 1000$$

1.3.2 Demand

The stylised representation *food demand* equations can be written as:

$$(5) \qquad \ln x^t_{ir} = sc^t_{ir} + sx^t_{ir} + \sum_j \varepsilon^t_{ir,j} \ln(PC^t_{jr}) + \eta^{GDPt}_{ir} \ln\left(\frac{GDP^t_r}{POP^t_r} \right)$$

As for the activity equations, the formulation of the demand side includes two shift factors: sc^t_{ir} denotes a vector of shift factors that is used to calibrate demand to the existing AT2030 baseline, while sx^t_{ir} denotes an additional shift factor, set to zero for the baseline runs and introduced to ease the implementation of alternative scenarios. Such scenarios would represent shifts in the demand curves of countries or groups of countries.

η^{Yt}_{ir} are the elasticities of food demand with respect to changes in income. The superscript ^{GDPt} in η^{GDPt}_{ir} indicates that the income elasticities are variable over time and depend on the exogenously projected per caput GDP^t_r levels *(GDP is the Gross Domestic Product expressed in constant 1987 USD, POP^t_r is the population in 1000 persons)*. The elasticities are dynamically adjusted and decline with rising income levels (see Figure 1). PC^t_{jir} is the consumer price for the final good consumed, derived from the producer price by applying certain margins.

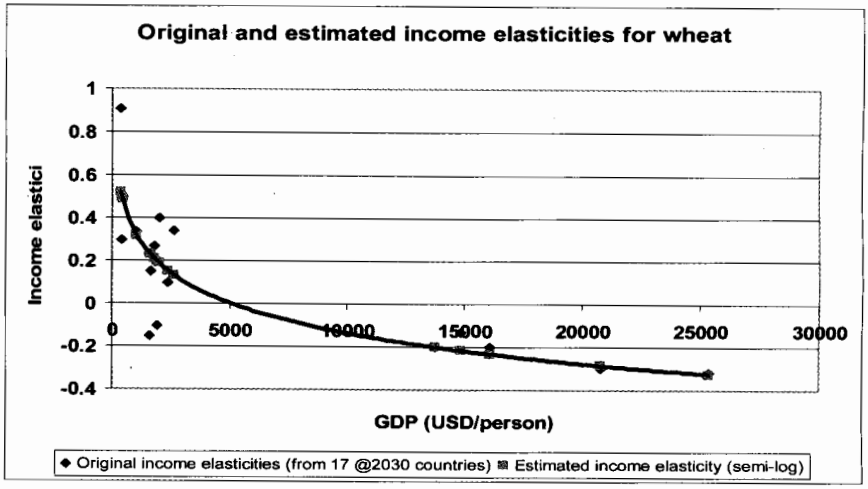
Income-dependent demand elasticities

Given the long-term nature of the outlook, the constant elasticity assumption applied in other short and medium-term models was dropped. Instead, all income elasticities were assumed to decline with rising incomes[5], which, according to the Slutsky equation, also

[5] Building upon a proposal by M. LAMPE (LAMPE 1999).

reduces the Marshallian elasticities even if the underlying utility structure remains intact. The relationship of income and income elasticities was estimated from a cross-sectional analysis (over the 17 countries or regions), exploiting changes in income responsiveness at different income levels. The resulting parameters generally decrease the absolute value of the elasticities, with especially strong effects in the case of basic food items, i. e. „Engel goods". Figure 1 compares the original income elasticities at regional level from the FAO World Food Model (WFM) with the results from the estimation process.

Figure 1: Income dependent demand elasticities for wheat



The demand for the individual *feedstuff* z is driven by (a) its grain or protein equivalents, *(b) the change of the total feed requirement (TRF), and* (c) a set of feed substitution elasticities θ. These assumptions allow the feed elasticities to be formulated as:

$$(6) \qquad \varepsilon^{f}_{i,j} = \theta_{i,j} + \sum_{k} \left(cont_{zk} \frac{\sum_{l} \varepsilon^{s}_{lj} Q_{l} \alpha_{kl}}{\sum_{l'} Q'_{l'} \alpha_{kl'}} \right)$$

where i,j denote the products and θ_{ij} the substitution elasticity of product i with respect to price changes of product j. The second term defines the change in total grain and protein needs resulting from a change in the herd size, which in turn is determined by a change in the price j and the corresponding supply elasticities.

The resulting feed demand elasticities are calibrated to the micro-economic properties of a consistent demand system (homogeneity, symmetry and curvature), and define the behavioural feed demand functions:

$$(7) \qquad \ln x^{t}_{ir} = sc^{t}_{ir} + sx^{t}_{ir} + \sum_{j} \varepsilon^{f,t}_{ir,j} \ln(PF^{t}_{jr})$$

Stocks levels (*ST*) are currently not included in the model, *stock changes* (ΔST) are simply set to zero. While this is unlikely to represent a major omission for the baseline exercise,

it circumscribes the options for, and the range of, possible scenario alternatives. The introduction of a stock equation is currently in preparation. It will be represented by one global stock demand equation per commodity. Country level stocks will be allocated to individual countries according to historical shares in production or consumption. *Seed and waste* are assumed to represent a fixed share *f* of production Q^t_{ir} at time *t*.

1.3.3 Market clearing and model closure

The model closure is based on the assumption that trade clears the world market for any given commodity i. The clearing condition is defined as:

$$(8) \qquad \sum_r NetTrade^t_{ir} = Err^t_i ,$$

where Err_i^t is equal to the world market imbalance as shown in the baseline.

The resulting framework of all equations and identities defines a square system of non-linear equations. The possibility of alternative solutions is excluded through the curvature conditions of the underlying behavioural functions.

1.4 Price linkage

The price linkage for all OECD countries and a selected number of transition economies is based on Producer Support Estimates (PSE) as calculated by the OECD. Based on information from the PSE database, the regional farm gate price PF^t_{ir} can be expressed as the world market prices PW plus a price wedge *PWedge* to the border plus per unit market price support PSE_M[6]:

$$(9) \qquad PF^t_{ir} = PW^t_i + PWedge^t_{ir} + PSE_{M\,ir}^{\ t}$$

The farm gate price PF^t_{ir} for country/region *r* and commodity *i* drives demand for feed and industrial use, whereas a producer incentive price PI^t_{ir} determines yields and activity levels (acreage response, herd sizes). The incentive price PI^t_{ir} is the sum of the farm gate price plus the entire non-price related support $PSE_{R\,ir}^{\ t}$:

$$(10) \qquad PI^t_{ir} = PF^t_{ir} + PSE_{R\,ir}^{\ t}$$

The PSE elements PSE_R and PSE_M are calculated on the basis of data compiled by the OECD. They are expressed in current US Dollars per unit (tonne) of output. The price wedge between uniform world market prices and the border price of each regional aggregate is derived from the reference price of the PSE calculations.

For countries where no PSE data are available, a double-log price transmission equation links the farm gate to the uniform world market price plus a price wedge:

$$(11) \qquad log(PF^t_{i,r}) = \varepsilon^{pt}_{i,r,t}\, log(PW^t_{i,r} + PWedge^t_{i,r})$$

---

[6] PSE denotes the Producer Support Estimate, as calculated by the OECD.

Consumer prices PC_{ir} differ from farm gate price PF_{ir} by a fixed margin $PC_{M,ir}$:[7]

$$(12) \quad PC^t_{ir} = PF^t_{ir} + PC^t_{M,ir}$$

2 Using the model to assess the impacts of comprehensive policy reform: A counterfactual to the baseline projections to 2030.

After numerous sensitivity tests and the creation of multiplier tables, a first major model application aimed at gauging the likely impact of agricultural policy reform relative to the baseline outlook to 2030. The assumptions for, and results of, this application are presented below.

2.1 The main assumptions

As explained above, the policy representation of the AT2030 model distinguishes two major sources of policy distortions. First, subsidies that introduce a direct price wedge between international markets and domestic farm gate prices, and second subsidies that provided direct payments based on output, or acreage, the number of animals, input subsidies, etc. (see left diagram of Figure 2).

Detailed estimates for the various subsidy categories are provided on an annual basis by the OECD secretariat. They are available for all OECD countries and a selected number of economies in transition. They are referred to as PSE-M to denote market price related subsidies and PSE-R for all other policy measures. For the year 2000, overall market price support (PSE-M) amounted to USD 158 billion for OECD countries and to about USD 1 billion for transition economies, respectively (OECD 2001a). Other subsidies to producers (PSE-R) accounted for a total of USD 87 billion in OECD countries and about USD 1 billion transition economies. In total, the producer support estimate for the year 2000 was USD 245 billion in OECD countries and USD 2 billion in transition economies. The General Services Support Estimate (GSSE) amounted to a total of USD 56 billion for all OECD countries in 2000.[8]

The two major categories of support also form the starting point for two different policy reform scenarios. In a first step, all market price support is phased-out in equal annual rates over a period of 30 years[9] (see diagram in the middle of figure 2). These price support measures are commonly regarded the most distorting kinds of subsidies and form a subset of the so-called amber box measures of the Uruguay Round. They stimulate production in a direct and immediate way, and promote production for exports or to substitute for imports.

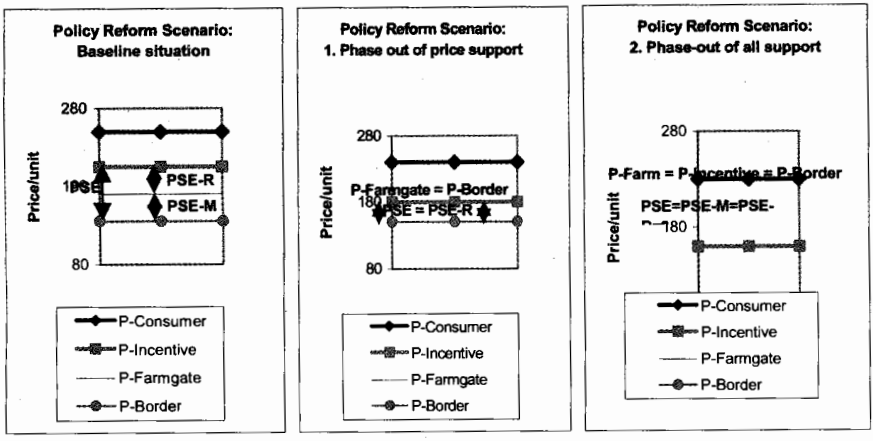
---

[7] Alternative approaches to modelling price linkage and incentive price structure have been considered. The most obvious alternative is to define the internal price as the world market prices plus tariffs, as is the case for instance in the WFM. While this may allow for more detailed and sophisticated trade liberalisation scenarios, it poses other problems like how to treat the water in the tariffs, i. e. the gap between bound and applied rates. Other problems relate to modelling tariff rate quotas, location specific trade preferences and the like. Additional problems for developing countries arise from the fact that differences between domestic and international prices are often caused by a lack of infrastructure rather than by policy wedges.

[8] GSSE payments include public expenditure for research and development, agricultural schools, inspection services, etc. They are not incorporated in the policy representation of the model. PSEs, GSSE and transfers from taxpayers to consumers amounted to a total support estimate (TSE) of 326 billion in 2000.

[9] It should be noted that this means that no allowance is made for possible de-minimis provisions, affording for developed and developing countries a subsidy limit of up to 5% and 10% of the value of production, respectively.

Figure 2: Price relations in the different scenario runs



In a second step, the gradual elimination of price support is accompanied by a complete phase-out of non-price related support (see diagram on the right hand side of figure 2). This second scenario reflects a comprehensive removal of agricultural policy interventions in all OECD and transition economies, i. e. a removal of subsidies to the tune of USD 266 billion for OECD countries and some USD 2 billion for economies in transition. Both the gradual elimination of market price support and the phase out of other subsidies are implemented at the level of individual commodity markets and countries or country groups.

For countries where PSE calculations are not available, i. e. non-OECD and non-transition economies, domestic and international prices are linked via simple price transmission equations that translate – at varying degrees - changes in international prices into changes in domestic prices. These varying degrees of price transmission are encapsulated in a price transmission elasticity, which represents both tariff-based protection and „natural" protection. The elasticity can range from 0 to 1, whereby a value of 0 represents full protection and thus complete insulation from the world market, while a value of 1 denotes full price transmission and thus no protection. These price transmission elasticities are being increased year by year in the scenario runs. In the first scenario, all price transmission elasticities are gradually increased to reach a value of 0.8 by 2030, wherever they are below this value in the baseline projections. In the second scenario, all price transmission elasticities are gradually being increased from 0.8 to a level of 1 by 2030, which together with a complete elimination of support policies in OECD and transition countries, creates a situation where agricultural markets would be free of policy distortions (OECD, 2001b).

2.2 The main results

As welfare measures are not yet implemented in the model, changes in prices and quantities produced or consumed are used as the main entry point for the impact analysis. As described above, policies affect prices at different stages in the production and consumption process and do so with different intensity. The various price categories of the model allow to look into the most important stages, notably incentive, farm gate, border, and consumer prices. Central to changes in these prices are the respective international clearing prices, which translate, though at varying degrees, into changes of all other prices. The respective price effects are summarised in Table 1.

Table 1: Impacts of partial and comprehensive policy reform on border, farm gate, producer incentive, and consumer prices
(Real prices in 1987 USD by the year 2030, world averages weighted by production quantities)

	1. Baseline scenario				2. Phase-out of market price support			3. Phase-out of all support	
Price indicator/ Commodity	Border price	Farm gate price	Producer Incentive price	Consumer price	Border = farm gate price	Producer Incentive price	Consumer price	Border = farm gate = farm incentive price	Consumer price
Cereals[10]	102	109	119	445	103	113	431	111	440
Wheat	96	101	119	623	95	114	609	110	625
Rice	117	135	138	212	122	121	194	123	197
Maize	106	107	115	694	104	104	690	111	697
Barley	106	121	148	835	115	115	813	127	827
Vegetable oils	1249	1249	1264	4654	1253	1267	4654	1256	4658
Meat[11]	1488	1544	1588	2602	1536	1549	2562	1581	2623
Beef	2189	2299	2408	3862	2329	2334	3806	2400	3915
Pig meat	1841	1894	1912	3209	1855	1872	3160	1910	3217
Poultry	755	781	792	1315	770	778	1295	799	1327
Milk	230	273	280	579	266	266	568	269	579

In general, the results suggest that even a comprehensive policy reform package would have only moderate impacts on the level of world prices. These moderate impacts can be explained by the following factors. First, supply for temperate-zone commodities in OECD countries is relatively responsive to price incentives. This holds particularly for countries with substantial production potential and where farmers have traditionally been producing at world market price levels (in North America and Oceania). As prices increase and volatility decreases, farmers in these countries will swiftly expand production. Higher prices and lower risks are also important incentives to farmers in a number of developing countries, particularly in Brazil, Argentina, Malaysia or Thailand. Moreover, there is also a considerable additional production potential in developed countries in which support is will decline (e. g. in Europe). In fact, many of these countries had put in place policy programmes (production quotas, extensification programmes, set-aside schemes) that offset the output-enhancing effects of support and hold production below „normal" output levels. Policy reforms are assumed not only remove subsidies, but also lift these production constraints. Second, a removal of subsidies for all commodities often results in mutually offsetting effects for inter-linked markets. The expected price changes for cereals are a case in point. While a removal of subsidies for cereals would put a brake on cereal production and underpin international cereal prices, the removal of support for livestock production would lower demand for feed grains and thus offset much of the international price boost from lower subsidies given to cereal producers. Third, there are also offsetting effects across countries so that the reported world averages (Table 1) mask more significant price effects in individual countries. The producer incentive price for rice in Japan, for instance, would be 85 % lower than in the baseline scenario. Fourth, the inc-

[10] Including millet & sorghum as well as cereals n.e.s.
[11] Including sheep & goat meat as well as meat n.e.s.

rease of price transmission elasticities in developing countries to unity means that price signals from the world market are fully transmitted into the domestic markets. This enlarges the size of the overall market significantly and makes supply responsive to price changes globally. This is particularly important to understand the moderate price increases for a market that is thus far characterised by small quantities and large price swings.[12] Finally, the starting year for the reform scenario is the year 2000, which is characterised by high USD exchange rates vis-à-vis essentially all other countries. The high dollar exchange rate reduces some of the starting levels of price policy distortions considerably, which in turn means that the effects of eliminating distortions can also be small.[13] More significant impacts on prices occur where distortions are particularly high and the responsiveness of producers to higher prices is generally low. This holds for particularly for milk production, where prices are expected to increase by about 17 %.

Another striking result is the very moderate impact on consumer prices, particularly in OECD countries and for staple food commodities like cereals. This is largely a reflection of the fact the price of the primary product (e. g. cereals) accounts for only a small share of the total costs for the final consumer good (e. g. bread, noodles). The effect of lower cereal prices on consumer prices for final cereal products is significantly diluted by substantial processing and distribution margins. In fact, consumers may hardly realise the effects of trade liberalisation that has taken place in the markets for primary products especially in OECD countries, where these margins can account for up to 90 % of the value of the final product. In developing countries, the processing and distribution margins are smaller and thus translate into more meaningful effects (increases) on consumer prices.

Not withstanding the small changes in international prices for most commodities, some international prices would be relatively strongly affected. Amongst the most significant price increases are expected in the dairy sector. After full liberalisation, the international milk price (weighted average of various dairy products) would increase by some 17 %. In general, the benefits of higher prices would accrue to the dominant milk exporting countries like New Zealand or Australia that currently produce at world market prices. Milk producers in protected markets, however, stand to lose, and their incentive prices will decline by 4 bis 5 % on average. Producers in developing countries stand to benefit from policy reform in milk and dairy markets but these gains are not expected to outweigh the adverse effects of higher prices for consumers so that developing countries as a whole will suffer a net welfare loss.

3 Summary and conclusions

The scenario presented in this paper captures the possible effects of a comprehensive agricultural policy reform package implemented over the next 30 years. The reform package is defined as a removal of agricultural support in OECD countries and a selected number of transition economies. The main results can be summarised as follows:

- OECD subsidies are primarily distorting markets for temperate-zone commodities, which are primarily produced in OECD countries and advanced developing countries like Argentina, Brazil, or Thailand. A removal of these subsidies would primarily translate in a swap in market shares within the OECD and some gains for the advanced developing countries.

---

[12] Moreover there is no distinction between Japanica and Indica rice, which enlarges the market even in the baseline scenario.

[13] For instance, the market price support for wheat in the European Union in 2000, traditionally a considerable measure, was reduced to an implicit tax of € -78 million due to the high USD rate in 2000.

- Overall, the impacts of policy reform, even if undertaken in a comprehensive way, are relatively small for the world as a whole. Notwithstanding the small effects for the world as a whole, the impacts can be more meaningful in individual countries, particularly where the current level of policy distortions is high.
- The limited effects on international price are also the reflection of mutually offsetting effects in inter-linked commodity markets. For example, a removal of grain subsidies lowers supply of grain which is, however, offset by lower feed grain demand.
- Consumers in hitherto protected markets (developed countries) stand to gain from lower food prices, but the benefits for the final consumer are relatively small as processing and marketing margins dilute the effect of lower raw material prices.
- Consumers in developing countries stand to lose from higher food prices. Unlike consumers in developed countries, they are more affected by the price rise for agricultural raw materials as processing and distribution margins are smaller and food expenditures account for a larger share of their total income.

References

FAO (1998): World Food Model, Technical Documentation, FAO Commodities and Trade Division, Rome.

FAO (2000): Agriculture: Towards 2015/30, Technical Interim Report.

JOHNSTON, J. and DINARDO, J. (1996): Econometric Methods, Fourth Edition, McGraw Hill.

OECD (2000): A Forward-Looking Analysis of Export Subsidies in Agriculture, COM/AGR/TD/WP(2000)90/FINAL, Paris.

OECD (2001a): Agricultural Policies in OECD Countries, Monitoring and Evaluation 2001.

OECD (2001b): Agricultural Policies in Transition and Emerging Economies, Monitoring and Evaluation 2001.

PINDYCK, R.S. and RUBINFELD, D. L. (1981): Econometric Models and Economic Forecasts, 2nd Edition, McGraw Hill.

VON LAMPE, M. (1999): A Modelling Concept for the long-term Projections and Simulations of Agricultural World Market Developments - World Agricultural Trade Simulation Model, WATSIM. Shaker, Aachen.