

# IMPACT OF AGRICULTURAL PROTECTION IN OECD-COUNTRIES ON SOUTH AFRICAN AGRICULTURE

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## ABSTRACT

Agricultural protection in industrialized countries and price distortions in developing countries are accused to hamper economic and agricultural development and are partly responsible for poverty and hunger in the Third World. A multi-commodity multi-country comparative static trade model is used to simulate the impact of different policy scenarios in this typical second best world for the case of South Africa. Special emphasis is given to the disincentive effect of production and to endogenous policy responses in South Africa. In conclusion South Africa could benefit a lot by liberalizing trade and agricultural policies world wide, although it is an importer for most of the considered commodities.

**Keywords:** Agricultural protection, agricultural development, applied welfare economics, international trade, multi-commodity multi-country model

## INTRODUCTION

The Johannesburg Summit on Environment and Development this summer has once more stressed the importance of agricultural policies for the development process in many countries and in fighting poverty and hunger in the world. Industrialized countries are accused to protect their agricultural markets against imports from the developing world and at the same time to dump of their surpluses onto the world market using massive export subsidies. However, also developing countries are criticized too for their own agricultural policies, very often discriminating against agriculture by using export taxes and import subsidies. Both types of policies potentially harm agricultural development in the Third World and thus also contribute to poverty and environmental stress. Hence, the answer for improving the situation for agricultural development and the environment seems to be so easy: Liberalize agricultural policies and trade in industrialized and developing countries.

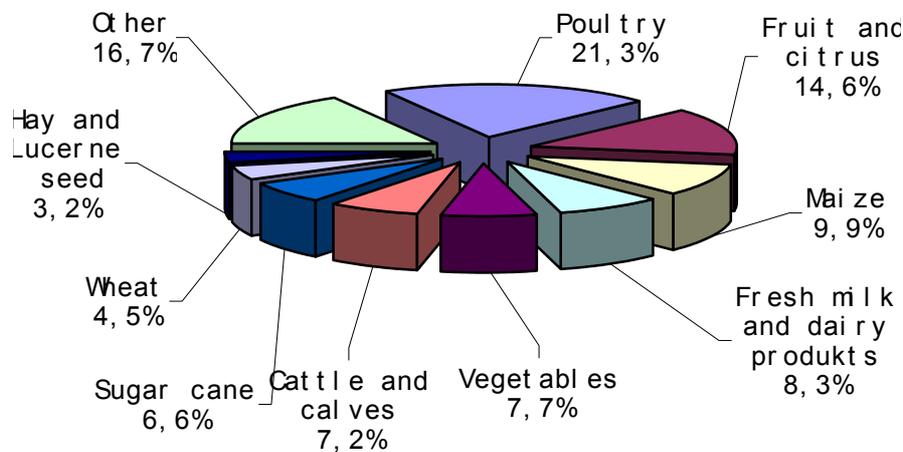
Looking in more detail at the problem, however, one discovers a complex structure of distributional and allocational effects of the current price distorting policies around the world. Some countries loose, some countries gain and even within the countries taxpayers, consumers and producers are differently affected. The net benefits or net costs for a country very much depend on the production pattern, the trade status, the structure of protection/discrimination in the own country and in other countries, on the degree of liberalization, the extent of price transmission as well as on induced supply responses at the farm level. This is a typical second best situation implying that only an empirical analysis of a special case gives quantitative reasonable results. With this background in mind the aim of the contribution is to quantify the impact of agricultural protection in OECD countries on South African agriculture, and the effects of South African's own agricultural and trade policies. A multi-commodity multi-country trade model is used to check the hypothesis whether agricultural policies harm agricultural development and welfare and are responsible for hunger and malnutrition in the Third World.

Section 2 gives an overview on South African agriculture. In section 3 the theoretical background is explained. Section 4 contains a brief description of the model and the simulation results. In section 5 some conclusions are drawn.

## AGRICULTURE IN SOUTH AFRICA

South Africa is a global player in the food and beverages industry and has received more than Rand 3.8 billion (US-Dollars 0.5 billion) in foreign investment since May 1994 - leading to a major restructuring and realignment of production techniques within the industry to ensure world standards.

South Africa has one of the most developed farming sectors in Africa and is a leader among emerging markets. Today, South Africa is a major producer of grain crops, vegetables, sugar, flowers, wood and various types of fruits. The farming industry encompasses almost every type of animal, crop, fruit and vegetable production suited to weather conditions ranging from temperate to subtropical climate (see figure 1). The share of agriculture in GDP is 3.2% (2000) and 9.7% of the working population is employed in the farming sector (2001).



Source: National department of agriculture

Figure 1. Structure of agriculture production, 1998 (in %).

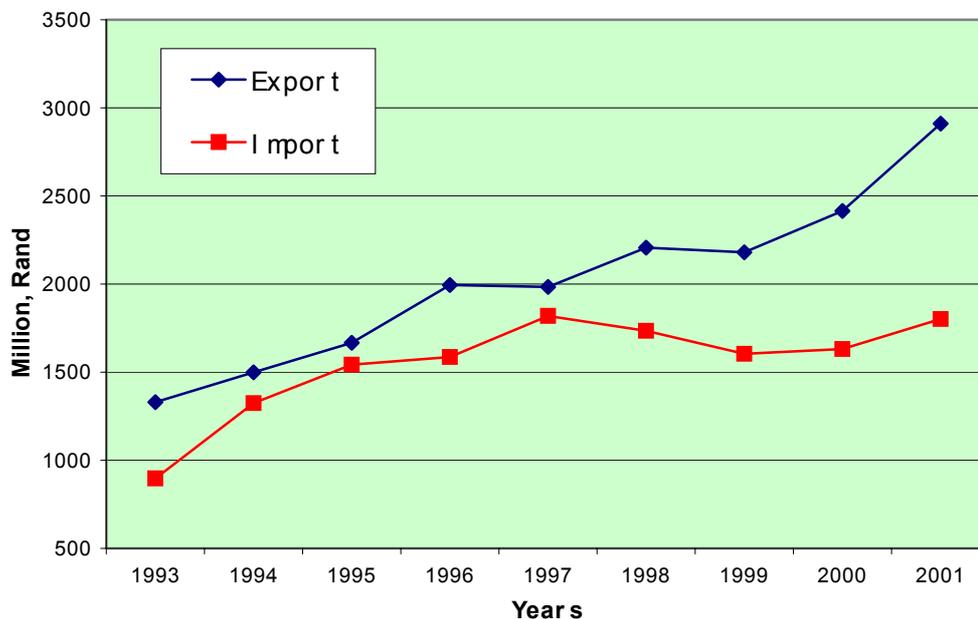
Food processing is also an important sector in the South African economy, accounting for 13% of the manufacturing employment and about 12% of the manufacturing value.

The sector consists of twelve downstream agricultural sub-sectors:

- Meat processing,
- Dairy products,
- Fruit and vegetable canning and preserving,
- Fish canning and preserving,
- Vegetable and animal oils and fat,
- Grain mill products,
- Bakery products,
- Sugar mills and refineries,
- Cocoa,
- Chocolate and sugar confectionery,
- Other food products,
- Processed animal feed.

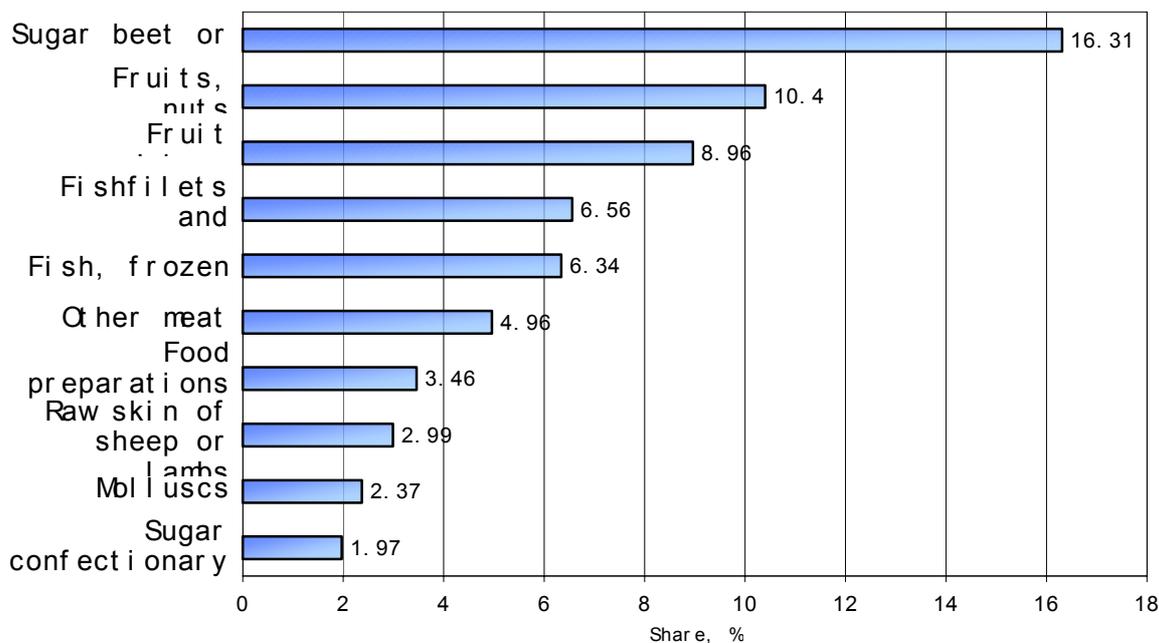
Meat processing is the single largest sub-sector, contributing 25% of total food production. Grain milling follows at 13%, then animal feeds at 10%. The other sub-sectors each contribute between 4% and 9% of overall food production.

The South African investment climate has improved markedly since the implementation of the new macroeconomic policy. Food exports have been bolstered by the deregulation of the local industry, the opening up of international markets to South Africa and the relatively low inflationary pressure on domestic cost structures. Exports are spread across the top export destinations, while Africa itself offers a fast growing and largely untapped market due to the high rate of urbanization. The development and structure of exports/imports are shown in figures 2-4.



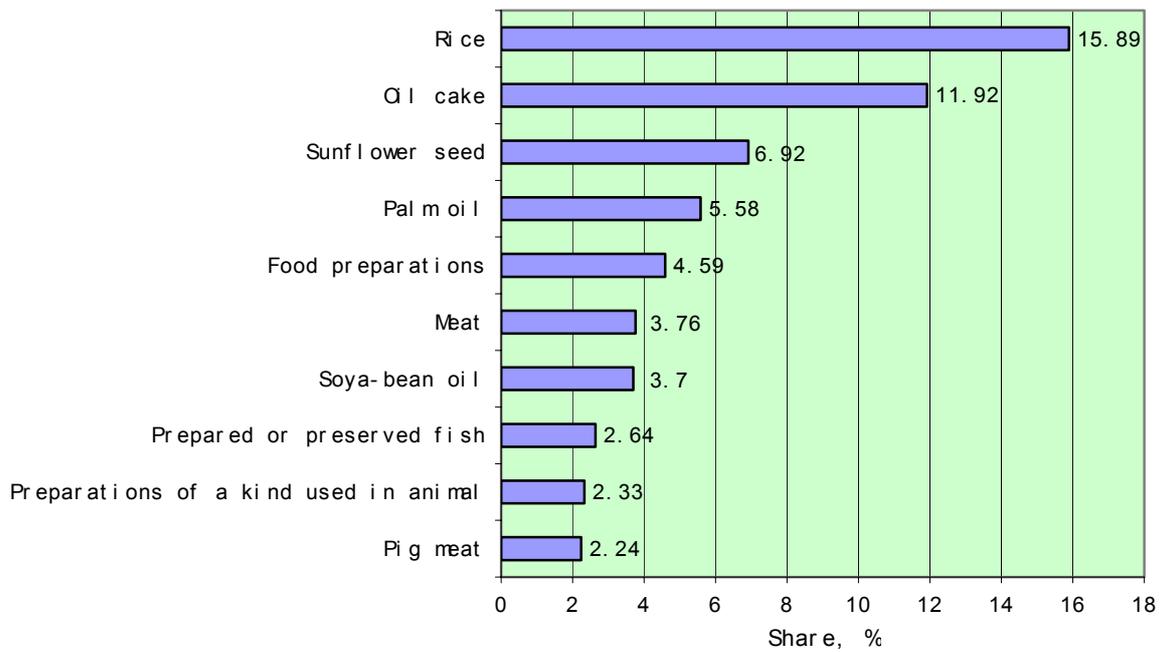
Source: Department of trade and industry

Figure 2. Foreign trade of food products, beverages and tobacco products (in Million Rand, constant 2000 prices).



Source: Department of trade and industry

Figure 3. Export of food and food products (in %).



Source: Department of trade and industry

Figure 4. Import of food and food products (in %).

### THEORETICAL BACKGROUND

Agricultural Protection in OECD countries raises supply and lowers demand and thus leads to a price pressure on international markets. The world market price decline is the higher, the more elastic OECD consumers and producers respond to protection, the less elastic reactions in other countries are and the higher the OECD-protection rate is. The resulting effects for developing countries are shown in figures 5 to 7. Without any own agricultural policy (figure 5) consumers gain from the price decline on world markets and producers lose. Depending on the trade status the overall welfare effect is negative in case of exports  $[+a-(a+b) = -b]$ , is positive in case of imports  $[+f+g-f = +g]$  and is positive or negative in case of trade reversal  $[+c+e-(c+d) = e-d]$ .

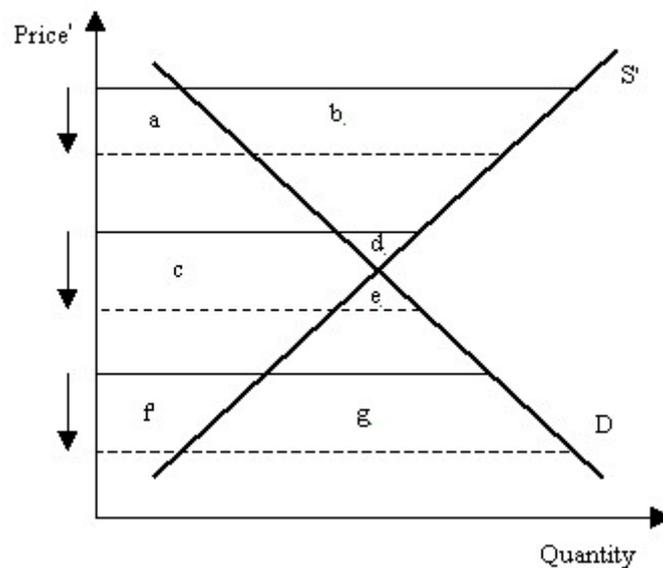


Figure 5. Welfare Effects of Agricultural Protection in OECD-Countries on South African Agriculture for different Trade Situations – Without Trade Interventions in South Africa.

In case of own agricultural policies the impact is more complex. Figures 6 and 7 show the world market driven effects under the policies of import duties and export taxes, respectively, and assuming different price transmission elasticities in both cases. The welfare gains (losses) in the import case (export case) increase with rising price transmission elasticity. With constant domestic prices the welfare effects are reduced to a budget gain or loss.

Summarizing these consideration, for a multi-commodity-situation the impact of agricultural protection in OECD countries on developing countries depends on:

- the degree of protection in OECD-countries,
- the trade status of the concerned developing country,
- the type, extent and structure of own trade policies (positive/negative protection),
- price transmission and own/cross price elasticities of supply and demand,
- production structure of the country.

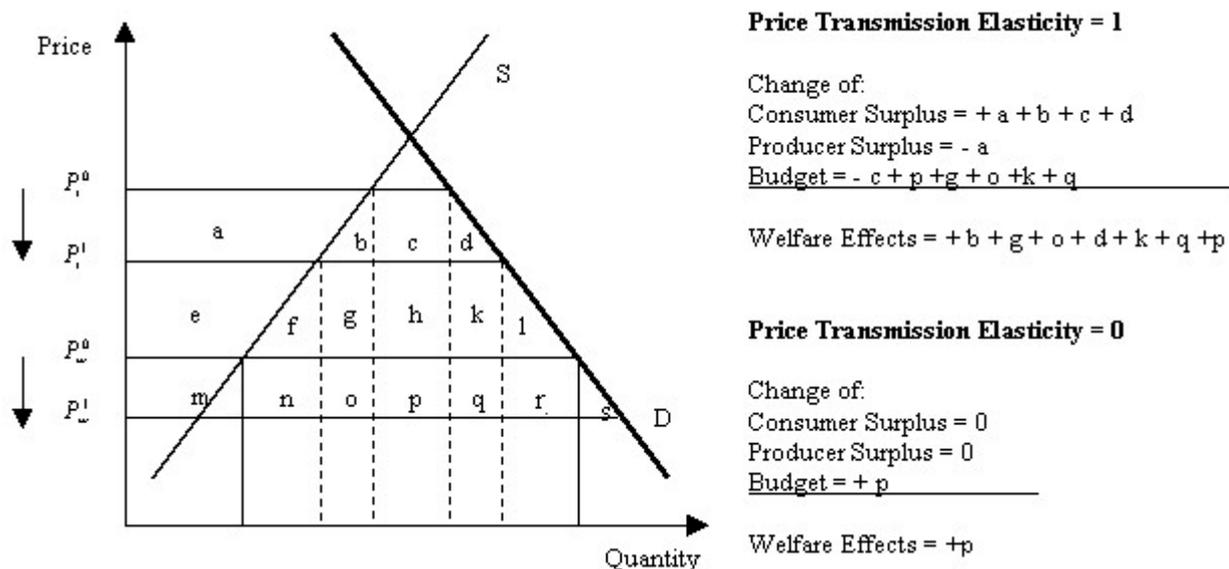


Figure 6. Welfare Effects of Agricultural Protection in OECD-Countries on South African Agriculture for different Trade Situations –With Import Duties in South Africa-

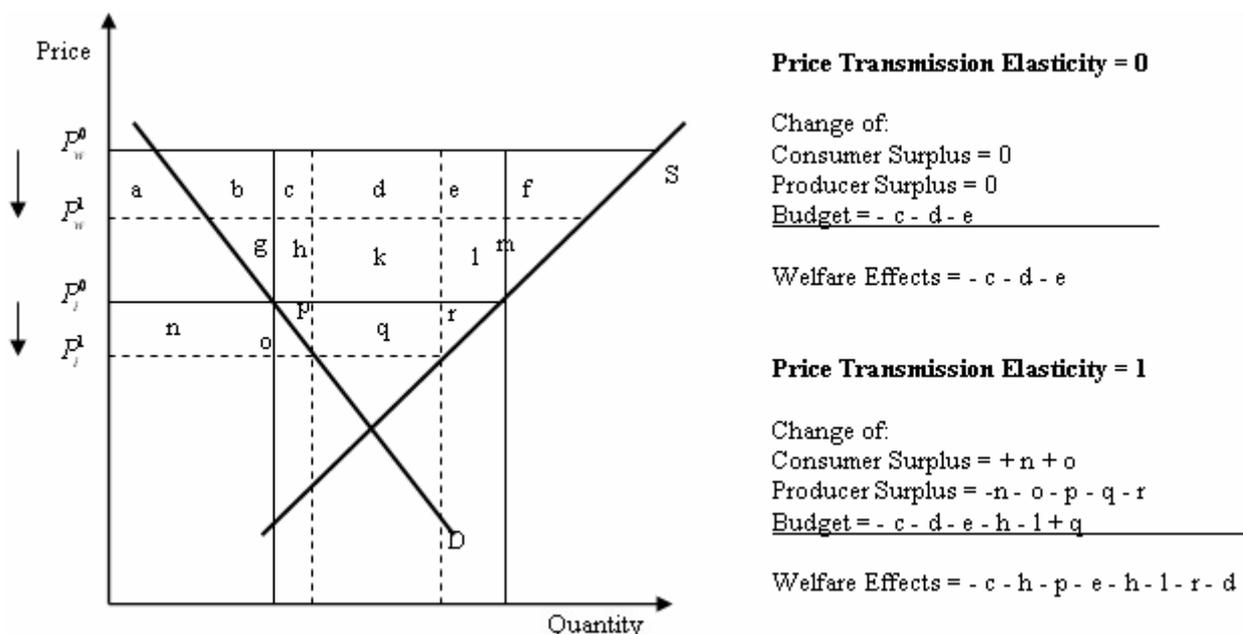


Figure 7. Welfare Effects of Agricultural Protection in OECD-Countries on South African Agriculture for different Trade Situations –With Export Taxes in South Africa -

## SIMULATION RESULTS

For simulating the effects of agricultural protection in OECD-countries a partial equilibrium multi-commodity multi-country model is used (see also Braverman and Hammer, 1986; Devadoss et al., 1993; English et al, 1993; Fackler and Goodwin, 2001; FAO, 1991; Gardner and Rausser, 2001; Hazell and Norton, 1986; de Janvry and Subbarao, 1986; McKarl and Spreen, 1980; Quizon and Binswanger, 1986; Robinson, 1989; Sadoulet and de Janvry, 1995; Takayama and Judge, 1971; Thorbecke and Hall, 1982; Taylor et al., 1993). The model is comparative static in nature and consists of nine agricultural commodities (wheat, coarse grain, rice, oilseeds, sugar, milk, beef, pork, poultry) and 16 countries/ regions covering the OECD countries, South Africa and further selected developing and transition countries. Demand and supply functions are non-linear with constant elasticities. Policy interventions are considered as changes of net protection rates, intervention prices, production quotas, direct payments to farmers, input subsidies and general subsidies (For more detailed informations about the equation system see appendix).

Various shift factors in supply and demand functions in addition allow for calculating the effects of:

- population and income growth;
- productivity (i.e. yield) increase;
- factor price changes.

For the purpose of this contribution the following scenarios are simulated:

- A complete liberalization of agricultural policies in all OECD-countries.
- The same as in I plus assuming an induced 1% yield increase per year over ten years in South Africa (removal of the disincentive effect).
- The same as in I plus assuming an induced 2% yield increase per year over ten years in South Africa (removal of the disincentive effect).
- The same as in I plus assuming an induced liberalization policy in South Africa.

In order to measure the impact of agricultural protection in OECD-countries on South Africa the results of these liberalization runs have to be reversed in sign. The outcome of the simulations is reported in tables 1 to 3 (see appendix).

Main findings are:

- The world market prices (border prices for South Africa) of the different commodities are depressed between 6.5% for wheat and 19.4% for milk (exception: rice where the border price remains constant).
- Assuming a price transmission elasticity of 1 these price decreases are directly transferred to the farm gate prices thus lowering production between 1.8% and 10.6%.
- Consumption is growing slightly for field crops and strongly for milk and meat products.
- For all animal products a trade reversal for South Africa is induced due to OECD-protection. Under liberal OECD policies South Africa would be a net-exporter of milk products, beef, pork and poultry whereas under protection South Africa imports those products. Imports of wheat and oilseeds are even increased under protection. Only coarse grain is and remains an export product and is even increasing in quantity.
- Agricultural income (producer surplus) in South Africa is depressed as well, especially if one assumes a disincentive effect on yields. In the worst case producers loose 1.7 bill. US-Dollar per year. Consumers and taxpayers gain from protection in OECD-countries. This gain overcompensates the producer losses, unless the disincentive effect is strong enough which is reasonable in most developing countries.
- So the general result is that exporting countries like Brazil and Ukraine loose welfare and that importing countries gain (see table 3 in the appendix). But in all countries one can observe significant losses of producer income which are progressively increased by considering the disincentive effect on yields.
- Finally, it is assumed that South Africa protects their own farmers against low world market prices by trade interventions. In that case producer surplus increases by 1.0 Bill. US-Dollar, but at the expense of consumer and taxpayers with an overall welfare loss of 0.2 Bill. US-Dollar. Thus, buffering the protectionist policies of OECD-countries is an expensive policy for South Africa.

- So, liberalizing both OECD-countries' policies and South African agricultural policies could be the best way of contributing to agricultural development and avoiding poverty and hunger. In addition, industrialized countries would save money (welfare gains) which could be spend directly as development aid. The gain in the EU-15 due to a complete liberalization sums up to 35 Bill. US-Dollar, for USA the gain is 11 Bill. US-Dollar.

## CONCLUSION

Reducing protection and getting prices right in international agriculture still seem to be a reasonable rule of thumb for improving efficiency and contributing to agricultural development in poor countries. Even importing countries could gain from liberalization of OECD countries' agricultural policies if the disincentive effects of production are taken into consideration and own policies are adjusted to more open markets (see also Anderson et al., 2001; Beghin et al., 2002; Diao et al., 2002; Hoekman and Anderson, 2000; Martin and Winters, 1996). In case of South Africa it can be shown that trade liberalization could even reserve the trade status for important products. Hence, South Africa seems to be not only a successful exporter of fruit and vegetables but also a potential exporter for northern agricultural products under liberal markets. South Africa can take as an example for many other developing countries. Rich countries in addition can support the agricultural development process in poor countries by abolishing all those trade interventions which generate tariff escalation and price destabilization (i.e. variable import levies in the EU) and by transferring at least some of the money they save from liberalization as direct development aid.

## REFERENCES

- Anderson, K., Dimaran, B., Francios, J., Hertel, T., Hoekman, B., Martin, W., 2001. The Cost of Rich (and Poor) Country Protection to Developing Countries. Discussion Paper No. 136, Center of International Economic Studies, Adelaide.
- Beghin, J. C., Roland-Holst, D., van der Mensbrugge, D., 2002. Global Agricultural Trade and the Doha Round: What Are the Implications for North and South? Working Paper 02-WP 308, Center for Agricultural and Rural Development, Iowa State University.
- Braverman, A., Hammer, J., 1986, Multimarket Analysis of Agricultural Pricing Policies in Senegal. In: Singh, I. et al. (Eds.). *Agricultural Household Models: Extensions, Applications, and Polics*. The Johns Hopkins University Press, Baltimore.
- Devadoss, S., Westhoff, P., Helmar, M., Grundmeier, E., Skold, K., Meyers, W., Johnson, S. R., 1993. The FAPRI Modeling System: A Documentation Summary. In: Taylor, C. R., Reichelderfer, K. H., Johnson, S. R. (Eds.), *Agricultural Sector Models for the United States. Description and Selected Policy Applications*. Iowa State University Press, Ames, pp. 129-150.
- Diao, X., Roe, T., Somwaru, A., 2002. Developing Country Interests in Agricultural Reforms under the World Trade Organization. TMD Discussion Paper No. 85, International Food Policy Research Institute, Washington D.C..
- English, B. C., Smith, E. G., Atwood, J. D., Johnson, S. R., Oamek, G. E., 1993, The CARD LP Model: A Documentation Summary. In: Taylor, C. R., Reichelderfer, K. H., Johnson, S. R. (Eds.), *Agricultural Sector Models for the United States. Description and Selected Policy Applications*. Iowa State University Press, Ames, pp. 80-107.
- Fackler, P. L., Goodwin, B. K., 2001. Spatial Price Analysis. In: Gardner, B. L., Rausser, G. C. (Eds.). *Handbook of Agricultural Economics. Volume 1b. Marketing, Distribution and Consumers*. Elsevier, Amsterdam, pp. 971-1024.
- FAO, 1991. Working with CAPP Series. Food and Agriculture Organization of the United Nations, Rome.
- Gardner, B. L., Rausser, G. C. (Eds.), 2001. *Handbook of Agricultural Economics. Volume 1b. Marketing, Distribution and Consumers*. Elsevier, Amsterdam.
- Hazell, P., Norton, R., 1986. *Mathematical Programming for Economic Analysis in Agriculture*. Macmillan, New York.
- Hoekman, B., Anderson, K., 2000. Developing Country Agriculture and the New Trade Agenda. *Economic Development and Cultural Change* 48 (3, April), pp. 171-80.
- de Janvry, A., Subbarao, K., 1986. *Agricultural Price Policy and Income Distribution in India*. Oxford University Press, Delhi.
- Martin, W., Winters, A. (Ed.), 1996. *The Uruguay Round and the Developing Countries*. Cambridge University Press, New York.

- McKarl, B., Spreen, T., 1980. Price Endogenous Mathematical Programming as a Tool for Sector Analysis. *American Journal of Agricultural Economics* 62, pp. 87-102.
- Quizon, J., Binswanger, H., 1986. Modeling the Impact of Agricultural Growth and Government Policy on Income Distribution in India. *World Bank Economic Review* 1, pp. 101-48.
- Robinson, S., 1989. Multisectoral Models. In: Chenery, H., Srinivasan, T. N. (Eds.): *Handbook of Development Economics*, vol. 2. Elsevier, Amsterdam.
- Sadoulet, E., de Janvry, A., 1995. *Quantitative Development Policy Analysis*. The Johns Hopkins University Press, Baltimore and London.
- Takayama, T., Judge, G., 1971. *Spatial and Temporal Price and Allocational Models*. North Holland, Amsterdam.
- Thorbecke, E., Hall, L., 1982. Nature and Scope of Agricultural Sector Analysis: An Overview. In: Thorbecke, E., Hall, L. (Eds.). *Agricultural Sector Analysis and Models in Developing Countries*. Food and Agriculture Organization of the United Nations, Policy Analysis Division, Rome.
- Taylor, C. R., Reichelderfer, K. H., Johnson, S. R. (Eds.), 1993. *Agricultural Sector Models for the United States. Description and Selected Policy Applications*. Iowa State University Press, Ames.

## APPENDIX

### Supply function

$$q_i^A = a_i [p_i - p_{Quo}^i]^{\varepsilon_i} \cdot [p_j - p_{Quo}^j]^{\varepsilon_j} \cdot S_i^A \quad (1)$$

- $q_i^A$  - Supply of commodity i
- $a_i$  - Coefficient
- $\varepsilon_i$  - Elasticity of supply of i
- $p_{i,j}$  - Producer incentive price of commodity i, j
- $\varepsilon_j$  - Cross price elasticity of supply of i with respect to j
- $p_{Quo}^{i,j}$  - Quota price of commodity i, j
- $S$  - Shift factor

### Yield function

$$Yield_i = e_i \cdot p_i^{\beta_i} \cdot E_i \quad (2)$$

- $e_i$  - Coefficient
- $\beta_i$  - Yield elasticity
- $E$  - Shift factor

### Area function

$$F_i = \frac{q_i^A}{Yield_i} \quad (3)$$

- $F_i$  - Area of commodity i

### Demand function

$$q_i^{N_k} = n_i \cdot p_i^{\eta_i} \cdot p_j^{\eta_j} \cdot y^{\theta_i} \cdot N_i \quad (4)$$

- $q_i^{N_k}$  - Per capita demand for commodity i
- $n_i$  - Coefficient
- $p_{i,j}$  - Producer incentive price of commodity i, j
- $\eta_i$  - Price elasticity of demand for commodity i
- $\eta_j$  - Cross price elasticity of demand for commodity i with respect to j
- $y$  - Per capita income
- $\theta_i$  - Income elasticity of demand
- $N$  - Shift factor

$$q_i^N = q_i^{N_k} \cdot B \quad (5)$$

- $q_i^N$  - Total demand
- $q_i^{N_k}$  - Per capita demand
- $B$  - Population

## Other Components of Demand

$$q_{seed_i}^N = \alpha_i \cdot q_i^A \cdot SS \quad (6)$$

$q_{seed_i}^N$  - Seed demand of commodity i

$\alpha_i$  - Relation between seed quantity and production quantity in the base year

$SS$  - Shift factor

$$q_{Fi}^N = f_i \cdot p_i^{\varepsilon_i} \cdot p_j^{\varepsilon_j} \cdot T \quad (7)$$

$q_{Fi}^N$  - Feed demand of commodity i

$f_i$  - Coefficient

$T$  - Relation between animal production in grain units in the terminal year and animal production in grain units in the base year

$$q_{Vi} = \delta_i \cdot q_i^A \cdot S_i \quad (8)$$

$q_{Vi}$  - Waste of commodity i

$\delta_i$  - Relation between waste and production in the base year

$S_i$  - Sift factor

$$q_{Li} = q_{LiB} \quad (9)$$

$q_{Li}$  - Stock of commodity i

$q_{LiB}$  - Stock of commodity i in the base year

## Price Transmission

$$p_i^P = t \cdot p_w^\gamma \quad (10)$$

$p_i^P$  - Producer Price

$t$  - Coefficient

$p_w^\gamma$  - World market price

$\gamma$  - Price transmission elasticity

$$p_i = p_i^E + 0,5S_D + 0,2S_A + S_I \quad (11)$$

$p_i$  - Producer incentive price

$S_D$  - Direct subsidies per metric ton

$S_A$  - General subsidies per metric ton

$S_I$  - Input subsidies per metric ton

## Equilibrium Conditions

$$q_{ij}^H = q_{ij}^A - [q_{ij}^N + q_{ij}^F + q_{ij}^S + q_{ij}^V + q_{ij}^L] \quad (12)$$

$i = 1, 2, \dots, 9$

$j = 1, 2, \dots, 16$

$$\sum q_{ij}^H = 0 \quad (13)$$

$i = 1, 2, \dots, 9$

$j = 1, 2, \dots, 16$

Table 1. Impact of Agricultural Protection in OECD-Countries on South African Agriculture assuming an independent and given agricultural policy in S.A. (in % change).

Commodities	Border Prices	Production	Consumption	Import(M)/ Export (X)
Wheat	-6.5	-1.8	0.1	12.7 (M)
Coarse Grain	-9.2	-3.0	0.1	782 (X)
Rice	0	0	0	0
Oilseeds	-7.7	-3.1	1.6	8.8 (M)
Sugar	-9.5	-4.7	3.1	-12.3 (X)
Milk	-19.4	-10.6	4.9	(a) (X/M)
Beef	-14.7	-8.4	30.3	(b) (X/M)
Pork	-11.7	-6.8	9.9	(c) (X/M)
Poultry	-7.7	-5.1	22.7	(d) (X/M)

(a) Change of trade status: From export situation 425,000 t to import situation due to OECD protection 63,000 t. (b) Change of trade status: From export situation 130,000 t to import situation 40,000 t. (c) Change of trade status: From export situation 15,000 t to import situation 5,000 t. (d) Change of trade status: From export situation 25,000 t to import situation 101,000 t

Source: Own Calculations assuming a price transmission elasticity of 1

Table 2. Impact of Agricultural Protection in OECD-Countries on South African Agriculture, Welfare Effects including the Disincentive Effect on Yields and considering the countervailing own protection policy (Bill. US-Dollar per year).

Scenarios	Producer Surplus	Consumer Surplus	Budget Effect	Total Welfare
Static Welfare Effects	-0.8	0.7	0.3	0.2
Welfare Effects assuming and induced 1% yield decrease p.a. over ten years	-1.2	0.7	0.5	0
Welfare Effects assuming an induced 2% yield decrease p.a. over ten years	-1.7	0.7	0.7	-0.3
Welfare Effects assuming an induced protectionist agricultural policy in South Africa	1.0	-1.1	-0.1	-0.2

Source: Own Calculations assuming a price transmission elasticity of 1

Table 3. Impact of Agricultural Protection in OECD-Countries on South African Agriculture and other selected Developing/ Transition Countries, Welfare Effects (Bill. US-Dollar per year).

Selected Countries	Producer Surplus (1)	Consumer Surplus (2)	Budget Effect (3)	Total Welfare (1+2+3)
South Africa	-0.8	0.7	0.3	0.2
Brazil	-5.8	4.4	1.1	-0.3
China	-13.4	11.3	3.4	1.3
India	-7.8	7.0	2.2	1.4
Thailand	-0.6	0.5	0.2	0.1
Russia/Belarus	-2.8	3.1	-0.1	0.2
Ukraine	-1.0	0.8	-0.3	-0.5

Source: Own Calculations assuming a price transmission elasticity of 1