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## POSTER PAPER ABSTRACTS

### AFRICA

#### *Determinants of adoption of dairy cattle technology in the Kenyan highlands: a spatial and dynamic approach – I. Baltenweck and S.J. Staal*

Adoption of high-grade cows by smallholders is driven by the objective of increased milk production, for both home consumption and sale. Smallholders are believed to have a comparative advantage in rearing grade cows, but constraints to adoption are numerous: the cost of a grade cow is relatively high and dairying is risky. Risks include animal diseases and lack of reliable marketing outlets. Marketing risk is a common preoccupation for smallholders but it is particularly relevant for milk, which is bulky, highly perishable and sold daily. Using a dynamic and spatial framework, this study tests the hypothesis that access to credit facilitates adoption. Distances derived from GIS information are computed and introduced in a duration model in order to control for market access. Time is expected to play a key role in adoption and two time dimensions are introduced: an idiosyncratic time describing the conditions faced by the household at the beginning of the spell, and historical time accounting for the changes in the external conditions. Results show that access to credit cannot be excluded as a reason for delaying adoption of grade cows. Policy changes over time are also found to play a role in the adoption process, as the reduced availability of reliable market channels and veterinary services after liberalization in 1992 are shown to have shifted down the adoption function.

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#### *Factors affecting urban demand for live sheep in Addis Ababa, Ethiopia – Samuel E. Benin and Simeon K. Ehui*

In most of sub-Saharan Africa household consumption of 'small ruminant' meat is undertaken by first purchasing the live animal and then slaughtering at home. Thus, as the share of small ruminant meat, especially sheep, in the demand and consumption of meat in general grows, information about consumer expenditure behaviour and demand parameters for live sheep will be valuable for several interest groups. A survey conducted in Addis Ababa in 1992/93 shows that the share of expenditure on live animals in total sheep meat expenditure is about 87 per cent. Using the Heckman two-stage approach, the

study shows that price and household income as well as sociodemographic factors, including household size and composition, significantly affect the likelihood of purchasing live sheep and spending on them. Projections of demand in 2010 and 2020 show that live sheep demand will reach about 0.5 and 0.6 million animals, respectively. Assuming that live purchases will continue to dominate total sheep meat purchases, will current sheep production trends in Addis Ababa be able to meet the increasing demand? Sheep supply projections (offtake of private holdings for sale) show that producers in Addis Ababa alone will be able to meet only 5 to 27 per cent of the total demand in 2010 and 2020, respectively.

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*Agricultural policy evaluation at the local level through a regional social accounting matrix: an example from Morocco* – **Michel Benoit-Cattin**

In less developed countries policy evaluation methodology has to be reconsidered as the context has dramatically changed. For example, in Morocco, the main objective used to be self-sufficiency in basic commodities such as flour, sugar or milk. These objectives have justified heavy investments in large irrigation schemes. Nowadays, the problem is to evaluate the impacts of development alternatives on different kinds of economic agent: households, enterprises, public institutions and so on. For that, at national and local levels, the idea of using social accounting matrices is spreading. The methodology at the local/provincial level is illustrated by an example from Morocco where investments in irrigation are continuing but where there is also concern with poverty reduction in rainfed agriculture. During a research project on regional development, with a focus on agriculture and its upstream and downstream linkages, an SAM has been built for the province of El Djedida (on the Atlantic plain 90 km south-west of Casablanca) for the year 1997. This SAM, and the derived multipliers, is used to contribute to one aspect of the policy debate, namely whether it is better to invest in irrigated agriculture than in rainfed alternatives.

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*Achieving greater impact from integrated nutrient management technologies: strategies for intensification of inorganic fertilizer on smallholder farms in semi-arid areas of Kenya* – **H. Ade Freeman and John M. Omiti**

Application of inorganic fertilizer is a key component of integrated nutrient management (INM) strategies to address soil fertility maintenance and replenishment problems in Africa. Yet current levels of inorganic fertilizer applied on smallholder farms are lower than extension recommendations and there is a

lack of empirical studies that articulate clear strategies for achieving greater use. Using household data from eastern Kenya, this study uses Tobit analysis to explore the determinants of inorganic fertilizer use and predicts probabilities of adoption and use intensities for specific farm types. The results suggest that appropriate targets, experimentation that improves efficiency of use, diversification into cash crops and a shift in soil fertility research from production to a sub-system focus will enhance the probability of achieving impact from INM technologies.

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*Decentralized agricultural research priority setting (DARPS) under multiple objectives: an empirical experience of the Indian Punjab – D.K. Grover*

In view of growing scarcity of research resources and expanding needs, the present study on priorities deals with the undulating plain zone of the Indian Punjab. The main objectives were identification of researchable problems; formulation of agricultural research agenda/projects; suggesting research priorities based on multiple goals; resource-gap assessment for projects; and institutionalization of the DARPS process. The identification of problems was based on secondary data, discussion with scientists, interactions with farmers, feedback from extension workers and rapid rural appraisals (RRAs). These problems were then short-listed on the basis of relative profitability and sustainability. The Simple Variant Economic Surplus and Scoring Model was attempted for ranking the priorities. The impact on value of production (VOP) due to each research project was estimated on the basis of expected impact of research (EIR) and conditioned by expected probability of research success, spread of researchable problem, expected ceiling rate of adoption, adoption lag and adoption pattern. Using the information on costs/benefits, net present value was estimated and used to rank the projects. They were then separately ranked on sustainability, equity/employment, export orientation and spill-in possibility. These ranks were combined using the weights derived from the expert panel. The intended priorities were matched with available resources and gaps identified. The institutionalization of the DARPS exercise helped in redeployment of resources to address the needs of the farming community.

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*Smallholder irrigation in transformation: a case study from South Africa – Bettina Hedden-Dunkhorst and Tlou Magdeline Mathonzi*

Smallholder irrigation farming in South Africa and elsewhere is in a stage of transformation. With government withdrawal from irrigation, new challenges

and risks evolve. This study discusses the applicability of two 'modern' economic theories ('induced innovation' and 'new institutional economics') to smallholder irrigation. It then offers a theoretically based conceptual framework indicating determinants of smallholder irrigation performance, related to policy, institutions and infrastructure. Finally, the study describes these determinants in the South African context and assesses their impact on smallholder irrigation performance. The assessment points to a number of critical issues, which are primarily related to institutional arrangements. In particular, lack of appropriate extension, access to financial markets, scheme management and farmer organization limit performance. A simultaneous equation model supports the assessment of limited impact of the existing institutional set-up, but also indicates the potential of irrigation to contribute to smallholder welfare. To realize this potential, it is now important to get the institutional framework right. In this context new interventions are required. They could be based on a well-designed system of incentives, but, most of all, farmers' involvement, particularly that of women farmers, is essential to attain equity, employment and income generation through irrigation farming.

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*A methodology for the economic valuation of communal savannas: a study in the Eastern Cape Province of South Africa* – **L. Mabusela, G.C.G. Fraser and G. Antrobus**

This presentation outlines a proposed methodology to be used in the economic evaluation of communal savannas in the Eastern Cape Province. It is hoped to expose the proposal to constructive discussions that will help to refine it prior to commencement of the study. This type of approach has not been attempted in the communally owned grazing areas of the province and it is anticipated that the local situation may result in unique analytic problems. The main objective is to estimate the annual direct use values of an average hectare of communal savannas in the area. Use and non-use resource values will be considered using both the demand and non-demand approaches. The demand approach will include the contingency valuation technique to estimate non-use values and the travel cost method. A non-demand curve approach will include the substitution cost method to estimate the use values. Non-use values considered are option values and community integrity benefits. The use values will include the current uses, namely livestock production, plant gathering and hunting. The survey results will be used to determine the impact of changes to the average use value using sensitivity analysis. Other variables of interest include total land productivity, composition of use values, trade-offs between value components, differences between private and social use values and their spatial variation.

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*Seasonal food insecurity and household coping strategies in rural Tanzania –*  
**Ntengua Mdoe, Abdul Mhinte and Gasper Ashimogo**

The study was carried out to investigate seasonal food insecurity and coping strategies used by rural households in semi-arid areas in central Tanzania. A total of 270 randomly selected households were interviewed using a structured questionnaire, seeking information on household food supply, existence of seasonal food shortages and strategies employed to cope with the shortages. Descriptive statistics were obtained and a multiple regression model was used to determine factors influencing food available for household consumption. The results show that rural households in central Tanzania experience seasonal shortages. Own farm food production was generally inadequate and was readily available only for a short period after harvest. Post-harvest seasons are normally characterized by food insecurity. Most households consumed less than 80 per cent of the minimum of 2780 kcal per adult equivalent, per day. Poor households formed the most vulnerable group. Strategies used to cope with food insecurity include, in the following order, food buying, borrowing, and exchange of food for livestock or labour. The use of these strategies differs between poor and well-off households. Labour selling appears to be a common strategy among the poor. The results suggest that diversification of sources of rural livelihood rather than being entirely dependent on rain-fed agriculture would enable rural households to cope with food insecurity.

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*Gender and transaction cost: a conjoint analysis of choice of livestock health service among smallholder dairy farmers in Kenya –*  
**Leah Ndung'u and Thomas F. Randolph**

Poor adoption of livestock disease control technologies in developing countries is often attributed to the high transaction costs faced by livestock keepers in gaining access to livestock health services. These costs, though often described qualitatively, have rarely been analysed quantitatively. We report an approach for evaluation as reflected in the attributes that farmers consider when choosing a service provider. This technique is used to address the question of whether decision making about livestock disease control in Kenyan smallholder dairy farms is influenced by gender-based differences in perceptions of transaction costs. In addition to price, we identify five attributes of livestock health service provision that represent various aspects of search, negotiation and enforcement-related transaction costs: distance to service provider, degree of professionalism, familiarity with reputation, timeliness of

service and availability of interlocked services. A conjoint analysis experiment was administered to 297 farmers in which they were asked to rank 20 different combinations of selected levels for these attributes based on a fractional factorial design with four holdouts. Farms within the sample were categorized by gender of the respondent and gender roles in managing the farm and their dairy animal health. Average part-worths of the levels for each attribute of service provision, as well as the relative importance of each of the six attributes, were compared across the various subgroups. The results highlight the minor importance of price relative to the other attributes, representing non-pecuniary transaction costs, in farmer decision making and potential opportunities for improving women's access to livestock health services.

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*Improving resource allocation for sustainable development through participatory farming systems analysis* – **Arshford Njenga, Manfred Van Eckert and Justus Wesseler**

Information asymmetries between researcher and farmer create incentives not to disclose or to disclose biased information, thus resulting in inefficient design of development projects and government policies. The problem has long been recognized and several participatory approaches have been developed to overcome it by creating incentives for the disclosure of unbiased information. One approach, of Participatory Farming Systems Analysis (PFSA), which has been applied on many occasions, is presented here. The basic step is to organize a workshop where farmers and extension workers are trained in simple methods of farming systems analysis. Part of the workshop is the application of standard tools, including the analysis of the collected information. At the end of the workshop, information about the farming system is available, entered into the computer, and participants are trained in farming system analysis. Depending on the information needs, additional farms can be added to the data set. The approach does not make use of questionnaires or other forms of survey materials, so it requires a well-trained interviewing team. Another constraint is the relatively high amount of time needed per farm, with visits usually taking half a day or longer. Nevertheless, the approach has been successfully applied to provide information about farming systems for project planning, project pre-feasibility studies, monitoring and evaluation of project activities, and land use planning in countries such as India, Kenya, Malawi, Tanzania and the Philippines.

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*Institutions and delivery of services to smallholder coffee farmers in Kenya under liberalized market policies* – **Hezron Omare Nyangito**

A major challenge to agricultural development is how to ensure competitive provision of production and marketing services to farmers. Delivery of services was previously monopolized by public institutions, but, with liberalized market policies, farmers have perceived the reduced role of governments as a failure on the part of the government rather than a step in the right direction. This is because of poor delivery of services by the emerging former-controlled institutions and the private sector, and the accompanying low returns from agricultural output. An analysis of the delivery of services to coffee farmers in Kenya indicates that liberalized market policy reforms have yet to benefit smallholder farmers. Coffee production has declined since implementation of the policies. A major reason is that private organizations to take over functions previously undertaken by public institutions have yet to develop adequately. Instead, the public organizations, which were transformed to be brought under the control of farmers, are associated with poor management. They also play dual roles as regulators and providers of services leading to conflicts of interests. All these developments have led to poor coordination and control of service delivery, resulting in high transaction costs, which reduce returns to farmers. It is apparent that effective delivery of services in a liberalized market policy environment requires clear definition of roles among the various stakeholders and well functioning government institutions to enforce rules that govern transactions among various groups in the system.

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*Assessment of increasing cattle prices on crop/livestock integration among Sahelian livestock farmers* – **Amadou Sidibe**

In view of land scarcity and demographic pressure, agricultural intensification through crop and livestock integration could overcome low productivity, natural resource degradation and social conflict between farmers and herders in Sahelian countries. This paper examines how a rise in farm cattle prices can reinforce crop and livestock integration through forage production. A linear programming model is used to show the effects. Data were collected before currency devaluation, with prices after devaluation being used to represent the increase in the model. Two groups of livestock farmers were identified. Group II produce more cereals and have higher family labour than Group I. The optimal solution of the model indicates that the groups have the same strategy in selling animals, based on the sale of male cattle and old cows. Both groups produce insufficient quantities of forage and use it mainly to feed calves. Solving the model shows that land is not the constraint, hence cropping a large area seems to be less profitable. The increase of cattle prices would allow farmers to sell more cattle (from 10 to 21 per cent of the herd for Group I and



from 15 to 21 per cent for Group II). The analysis of land and labour use shows that land is still available but not labour, with the latter now being insufficient to produce enough forage for all productive cattle.

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*Crop–livestock production paths: an economic analysis of alternative futures in semi-arid West Africa* – **T.J. Wyatt and T.O. Williams**

In semi-arid West Africa, livestock and crop production are closely linked. Animals rely on crop residues as a major feed resource in the dry season, while draught power supplied by animals and nutrients deposited in the form of manure on croplands are indispensable to soil fertility maintenance and crop yields. The climatic, demographic and economic changes that have taken place in the region over the last three decades have, however, put enormous pressure on the complementary interactions between the two activities. These changes are occurring at a time when demand for livestock products is increasing and more effective measures are needed to maintain soil fertility. Improvement of livestock and crop production under this situation demands, amongst other things, new management practices and productivity-enhancing technologies that are biologically effective and economically viable. The data used come from studies conducted by the International Livestock Research Institute (ILRI) and the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) based in Niger. A bioeconomic, non-linear programming model of the whole farm is developed and used to consider potential development pathways for crop–livestock systems in the Sahel in the face of social, economic and policy changes. Various scenarios depicting improvements in crop and livestock productivity and economic incentives were analysed to determine the likely impact of potential technical and policy interventions on the livelihoods of smallholder farmers and the sustainability of crop–livestock production in semi-arid West Africa. Model results suggest that improvements in whole farm productivity and rural livelihoods can be achieved through better packaging of existing technologies and implementation of appropriate economic incentives and policies.

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## ASIA

*Challenges of agricultural economy in Kyrgyzstan* – **Jamin Akimaliew**

Agriculture is the leading sector of the Kyrgyz economy, contributing 50 per cent of GDP, with about 65 per cent of the population living in the rural areas. Almost three-quarters of them live below the poverty level. The republic faces

a number of tasks. The principal ones are speeding up agricultural production and combating poverty. Shortages and high prices of fuel, fertilizers, pesticides, herbicides and machinery and spares are restraining agricultural growth. Prices of agricultural products are low in relation to those of industrial goods. The result of implementing agricultural reform should be to bring about drastic change in the management of agricultural markets in a transition economy. Successful functioning of the market requires independence and economic responsibility of commodity producers, flexible pricing, competition, financial institutions and structural balancing of the economy. In the transition to market relations a broad-based programme of privatization of state property is being carried out.

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*Comparative economic analysis of conventional and organic hazelnut farming in Turkey* – **Mehmet Bülbül and Harun Tanrivermiş**

Hazelnut is cultivated on 420 000 hectares land and engages 362 405 producers on small family farms in the Black Sea region. Turkey has a share of 62–77 per cent in world hazelnut production, and the largest volume of output. As the increases in production exceed demand growth, the amount of stock had increased to 220 000 tonnes by 1998. In these circumstances, there is need for new regulations to govern hazelnut production and marketing. One of the great advantages of growing hazelnuts is that cultivation can be organic, which has marketing advantages overseas. In the study, organic hazelnut production was shown to be more profitable than conventional methods. Organic farming could be increased and would succeed if demand could be stimulated.

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*Are expenditures on a government food distribution system justified in developing countries? Perspectives from a comparative study of India and China* – **Vasant P. Gandhi and Zhang-Yue Zhou**

Government food distribution systems are commonly found in developing countries but are frequently challenged because of the costs. A comparison of the systems in India and China reveals many similarities, differences and lessons. Both systems evolved out of repeated experiences of severe food price fluctuations and threats to food security when there was exclusive dependence on private markets. The Chinese system sought government control of the whole market and was much bigger, whereas that of India covered less than 10 per cent of grain output and let the market function with the rest. Pressures against the subsidy expenditure led to the reduction and near dismantling of the Chinese system, but immediate subsequent experience of sharp price insta-

bility forced the government to revive the system in a different form. The Indian system has withstood these pressures and the Chinese experience provides some lessons. Analysis also reveals that, as a percentage of total government expenditure, the food security subsidy in both countries is much lower (3–4 per cent) than the comparable social security expenditure in developed countries (22–34 per cent). It appears to be a small enough figure to be justifiable in both cases.

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*A partial equilibrium analysis on the effects of trade liberalization in the APEC food sector – Shih-Hsun Hsu and Ching-Cheng Chang*

This paper considers the implications of trade liberalization for expanded trade in agriculture and food between the APEC group in Asia and the Pacific and non-APEC economies. The Global Trade Analysis Project (GTAP) Database Version 4 is used to calculate the revealed comparative advantage to explore the nature of agricultural and food trade. Using a Verdoorn-type partial equilibrium approach, the ex ante trade creation effects of an across-the-board tariff reduction are examined. Our results suggest that the exports within the APEC region are mostly complementary and a free trade scheme could make APEC an expanding market for cereal crops, with the best prospects in Japan, NIEs and ASEAN. It would also expand the markets for meat, dairy and other consumer-ready products, with additional prospects in China and Russia. The overall effects from free trade would amount to one-quarter of the current import level for agricultural and food products. The possibility of expanded imports from non-APEC economies is also strong for dairy, beverages, tobacco and processed products.

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*A study of new Japanese farmers: their development and future perspectives – Hiroki Inaizumi*

Last year Japan's Basic Law on Agriculture was revised. The law has encouraged the establishment of new farming enterprises (the New Farmers), not only by traditional farm successors but also by those outside farm communities. Some 15 years ago, Japan enjoyed a record-breaking economic boom, associated with extremely high levels of real estate pricing, partly including farmland. This situation caused pressure on Japanese agriculture, especially in terms of labour. However, following the economic crash around 1990, Japanese opinion has been gradually changing, particularly in regard to agriculture. There has

been a marked increase in interest in farming and environmental issues. This demand has resulted in the re-establishment of educational institutions in agriculture and the opening of new ones such as the Agricultural Pre-Academy. This is designed for New Farmers from outside farming communities, to provide basic knowledge of general agriculture and specific subjects, focusing on individual needs. It works at weekends and during holidays. The students include civil servants, engineers, retired persons, and so on. The results show that New Farmers obviously have less skill with farming techniques, but there is great potential for development because some of them already have modern management skills, which has been one of the weakest points among traditional farmers in Japan.

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*Development of Japanese Black calf production by use of embryo transfer: situations and a regional case study in Japan – Hirotake Miyaji*

Following the deregulation of Japanese beef imports, pressure from imported beef has affected dairy farmers who sell Holstein steers as by-products of milk production. As a result, the steer price declined from more than \$1000/head in 1989 to about \$160/head in 1998. On the other hand, the price of the Japanese Black calf, known to provide high-grade beef, has been relatively high. Thus, almost all dairy farms started to produce crossbred calves of Japanese Black/Holstein for fattening to produce higher-grade beef, which is difficult with the pure Holstein. However, the price of crossbred calves has also declined. Given this economic situation, the recent advances in techniques of embryo transfer (ET) have attracted attention. Japanese Black calf production using ET has benefited dairy farms by enabling them to produce animals from famous bloodlines, which command a higher price. ET is not yet extensively used in Japan but it is evident that it could trigger changes at the farm level.

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*Impact of rural small and medium enterprises on agriculture: a sectoral approach – Anit N. Mukherjee and Yoshimi Kuroda*

In the light of the recent debate on decentralization of industries away from urban areas, the benefits of the development of rural small and medium enterprises (SMEs) have come under scrutiny. Apart from generating employment, which helps to generate income for rural households, our hypothesis is that SMEs also contribute either directly or indirectly to increasing productivity in

agriculture through backward linkages. We analyse the rural sector of a developing economy comprising agriculture, traditional industries and modern SMEs. The latter supply goods, as well as services, which are local and non-substitutable by the urban sector. In a typical developing economy, such SME goods and services are constrained owing to various factors such as the government policy environment, poor quality of the infrastructure or low levels of education. We show theoretically, by means of a simple demand–supply model of the rural sector, that an increase in the availability of SME goods and services in the rural sector would positively affect the output in agriculture. Thereafter, we estimate a Cobb–Douglas type of production function in agriculture using time series data for India between 1980 and 1995 to confirm that the effect of SMEs on agricultural productivity is positive and statistically significant.

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*Analysis of agricultural commodity systems in developing countries through econometric simulation models: the case of Indian cotton* – **Gopal Naik and Sudhir Kumar Jain**

Though market structure analysis models can provide a sound base for econometric forecasts and policy analysis, their use in developing countries has been limited due to complexities involved in specification as well as difficulties in obtaining data. However, growing inter-linkages and complexities of agricultural commodity markets require use of econometric models for clearer understanding of their structure and economic behaviour. An econometric simulation model consisting of 24 equations has been developed to explain inter-linkages among major variables of the Indian cotton farming, spinning and weaving sectors considering various qualities of cotton, yarn and fabrics. The model has been estimated through three stage least squares. Forecasts have been made for the period 1995–96 to 2000–01. The results indicate that cotton farming and spinning sectors will have reasonable growth. However, there will be pressure on the weaving sector from increasing yarn prices and near stagnant fabric prices. This study shows that an econometric model can provide a sound base for understanding the structure of commodity markets and therefore help in addressing various policy related questions.

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*Estimation of stochastic frontier production functions using panel data from villages of Iran* – **Bahaeddin Najafi and Mansour Zibaei**

A stochastic frontier production function with time-varying technical efficiencies is estimated using panel data from eight Iranian villages. A sample of 40 wheat

producers was selected for study, over four years. The results revealed that technical efficiency of farms increased from 68.6 to 79.7 per cent during the period of study. It is suggested that improvement programmes, such as positive price policy and integrated extension services, have helped farmers' technical efficiency to increase considerably. It is also concluded that the gap between pioneer and lagging groups of farmers has been declining, but there is still a considerable difference between them. This implies that, by increasing the efficiency of extension, the present level of wheat production could be increased by around 20 per cent.

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*Irrigation efficiency in small-scale irrigation systems: a GIS approach in Nepal* – **Takumi Kondo, Fumio Osanami, Anita Manandahr and Tokihisa Doi**

Irrigation investment is necessary to increase food production, especially in the dry season, in South Asia. Efficient use of irrigation water has the highest priority and more analysis is needed to solve allocation problems. The difficulty comes not only from various institutional structures, but also from the many geographical locations of irrigation systems. General views become impossible. This paper demonstrates how to utilize GIS information combined with farm surveys. The field survey used was conducted in the Sali Nadi natural gravity irrigation system in Sankhu village, Nepal. Net income per hectare in the head and middle canals is five to seven times higher than that in the tail because there is Pareto-inefficiency of water allocation during the dry season.

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*A new approach to estimating consumer needs for farmers' markets in Japan: a choice-based conjoint analysis* – **Yuji Oura, Kazunori Sato, Katsuya Takahashi and Izumi Yamada**

The paper examines the validity of a new approach, using conjoint analysis, to understand consumer needs for farmers' markets in Japan. Data came from a survey of 3000 persons in Ueda City, Nagano Prefecture. The questionnaire forms were sent by mail in the summer of 1998, and 1052 valid answers were obtained. Five attributes (parking lot, assortment, local products, culture, sales prices) were studied to determine their relative importance. It was concluded that a new approach using conjoint analysis is available as the way of understanding consumer needs.

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*Agricultural commercialization and land use intensification: a microeconomic analysis of the northern uplands of Vietnam* – **Sushil Pandey and Nguyen Tri Khiem**

Low food security, high rates of population growth and environmental degradation are some of the major problems of agricultural development in the uplands of Vietnam. Although Vietnam has now become a major rice exporter, food production in these remote upland environments is insufficient to meet the needs of the region's growing population. To increase farmers' incomes and their access to food, the government of Vietnam has encouraged production of cash crops in uplands through institutional reforms and investments in marketing infrastructures. Using survey data for 980 farmers in six upland provinces of northern Vietnam, this study examines the effect of improved access to markets and increase in the productivity of lowlands on land use intensity, labour productivity and food security in the uplands. Land and labour productivity was found to be substantially higher in areas with better access to markets, although the total rice production per household was similar. Intensity of land use in the uplands was found to be lower in communes which have a higher proportion of lowland fields. This indicates that further improvements in the productivity of lowland areas can be an important way of reducing the pressure for intensification of uplands for food production. Food security in communes that do not have access to lowland fields depends critically on the productivity of upland fields. As such areas are mostly remote, with very limited access to markets, market-based mechanisms for improving their food security are unlikely to be successful. Agricultural research in these areas should be focused on improving the in situ productivity of food grains.

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*Analysis of the market integration of the corn futures market in Japan* – **Jun Sasaki and Katsuhiko Demura**

The purpose of this study was to investigate price relationships in the corn futures markets in Japan and to examine the structure of price discovery. A cointegration analysis was performed using the corn futures prices and the exchange rate using daily data arranged for each contract month for the period from 1993 to 1997. The study shows that the various corn futures markets in Japan are integrated, with one leading market. The fact that the corn futures markets are integrated suggests that the price discovery process is dominated by the leading market.

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*Revealing Japanese consumers' preference for safety food: an empirical study of choice experiments* – **Kazuo Sato, Hiroyuki Iwamoto and Katsuhiko Demura**

Recently, Japanese consumers have become very anxious about food safety, including that of rice, their staple food. There is a potential demand for rice produced with reduced amounts of chemical pesticides and fertilizers, though unfortunately supplies are scarce. In Hokkaido, the northernmost island of Japan, rice can be produced with fewer chemicals because insect pests are not as prevalent in the cooler temperatures. Rice producers are trying to make the name 'Hokkaido' a selling point. We conducted a 'choice experiment', using a multi-attribute preference-elicitation technique, to see whether this would be worthwhile. The main results are as follows: (1) Japanese consumers strongly preferred the rice produced with reduced chemicals or with no chemicals; (2) from the results of the simulation, 'Hokkaido rice' could be sold for higher prices, if produced with a smaller amount of chemicals or with no chemicals at all. All things being equal, the price of Hokkaido brand Kirara397 could be increased by 56.8 per cent if it were produced with a reduced amount of chemicals, and by 81.8 per cent if it were produced with no chemicals.

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*Vertical integration of agribusiness in China: a case study on Shangdong Province* – **Minjun Shi**

This paper examines the policy concept, effects and prospects of vertical integration of agribusiness in China. Following the disintegration of the People's Communes, the shipping of agricultural products and the purchasing of raw materials is conducted by individual producers. To supplement the marketing efforts of individual producers, vertical integration of agribusiness has been extensively promoted. Two examples are provided from Shangdong Province. The first involves vertical integration of the production, processing and distribution of broilers on contract in Zhuchen County. The second involves vertical integration of the production, processing and distribution of vegetables on contract by the Heya vegetable production cooperative in Gaomi County. Vertical integration of agribusiness has the following four results in terms of the farm management: (1) by using agribusiness sales routes, producers can reduce transaction costs in shipment of produce; (2) the prices are consistent, alleviating market risk involved in farm management; (3) producers receive technical assistance from the agribusiness companies, removing technical



entrance barriers; (4) the agribusiness company helps with credit sales of inputs, so reducing entrance barriers.

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*Aquaculture and environment: an alternative approach to the measurement of the impact of technologies applied in India* – **R.S.S. Shrivastava, A. Janaiah and A. Shrivastava**

This paper provides a conceptual framework to measure the impact of different technologies on sustainability by estimating a sustainable technology model. It defines the input–output relationships in a sustainable production system. The methodology could prove to be a superior alternative as it decomposes the overall economic efficiency loss into components of technical and allocative efficiency, between which there are trade-offs. The causes of the failure of intensive aquaculture because of the adverse impact on ecological environment of the pond ecosystem were examined. The demonstration of the application of the methodology was carried out by using panel data of progressive aquaculturists of the Punjab State of India. The extensive and semi-intensive systems were modelled. The estimated coefficients of the sustainable technology model are higher than in the other production systems. There were losses in technological and economic efficiency with the increasing intensification of aquaculture.

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*The behaviour of the cost and efficiency of transportation of vegetables distributed in the wholesale markets in Japan* – **Taichi Takahashi**

In Japan, since vegetables are often eaten fresh and consumers attach importance to freshness, they have to be treated as highly perishable foodstuffs. The design of distribution systems in the wholesale markets has been one of the important subjects of policy making and research activities in this field. In this paper the cost and the efficiency of transportation in the wholesale markets in Japan were analysed using transportation data for 14 kinds of main vegetables in the period from 1978 to 1995. Linear programming for transportation problems was used. The findings are as follows: (1) the distances over which vegetables were transported had risen, (2) this expansion is attributable to the changes in product-gathering activities rather than to changes in the location of production, (3) the efficiency of the transportation of the vegetables distributed in the wholesale market has declined over the period.

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*Agricultural trade liberalization and market integration: a study of Taiwan's livestock markets* – **Rhung-Jeih Woo, Yung-Chi Chen and Pai-Lung Chou**

The main objective of this study was to explore the relevance of trade liberalization and market integration to the linkages between domestic and international livestock markets. We adopted unit roots tests and cointegration methods to analyse the long-run relationships between markets of Taiwan and the rest of the world. The empirical analysis revealed that, although all of the livestock markets showed short-run relationships between domestic and international markets (international prices led the domestic), a long-run cointegrating relationship existed only between the domestic and the international beef markets. Since the beef market is the only livestock market which has no non-tariff trade barriers in Taiwan, the results imply that trade liberalization could help in improving the degree of market integration.

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## AUSTRALIA & OCEANIA

*How well do microfinance institutions perform? Comparing the Philippines and the rest of the world* – **Emmanuel F. Esguerra and Ma. Lucila A. Lapar**

This study is an inquiry into the effectiveness and efficiency of four types of microfinance institutions (MFIs): rural banks (RBs), cooperative rural banks (CRBs), credit cooperatives (COOPs), and credit-granting non-governmental organizations (NGOs) that operate in the Philippines. Effectiveness is measured in terms of an MFI's outreach and growth, while efficiency is measured in terms of a number of indicators of financial performance that include profitability, operational and financial self-sufficiency, financial productivity and leverage, and portfolio management performance, among others. The purpose is to identify the strengths and weaknesses of the different MFI types in relation to the policy objective of making microfinance services accessible to low-income households and small entrepreneurs in a manner that is cost-effective and financially sustainable. Analysis of available financial data and other related information indicates the following: formal MFIs (RBs and CRBs) have the potential to expand outreach, given their larger resource base and wider geographical network if only they can be induced to direct their activities increasingly towards low-income clients. Semi-formal MFIs (COOPs and NGOs), on the other hand, must reduce their costs and attain financial sustainability while continuing to serve their low-income clients.

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*Hybrid rice for shifting the yield frontier in the tropics: an evaluation of farm-level experiences in irrigated systems in India* – **A. Janaiah and Mahabub Hossain**

Policy makers and research managers considered hybrid rice, an innovative technology, in tropical Asia in the late 1980s as an available option to shift upwards the yield frontier under irrigated environments. However, certain quarters have raised the issue of whether hybrid rice would reverse the present declining yield trend in view of its slower adoption in the target environments. This paper aims to elucidate these issues, on the basis of empirical evidence obtained from sample farmers, seed growers, traders and millers of hybrid rice in irrigated rice systems in India during the 1997–8 crop year. On average, the yield gain of hybrid rice over that of popular inbred varieties was 16 per cent, with additional input cost of 19 per cent. But hybrid rice seed production was about 65 per cent more profitable than inbred rice production. The grain of hybrid rice was priced 11 per cent lower compared with inbred varieties because of lack of consumer demand for it, largely on account of inferior grain quality, poor cooking and eating quality and lower head rice recovery. Therefore the net return to hybrid rice production was 5 per cent lower than that of inbred rice. Higher seed cost, lower output price and inadequate yield gain (lower heterosis) brought about the lower profitability of hybrid rice production. Hybrid rice was also more cost-intensive and susceptible to major pests and diseases. For further development of hybrid rice, breeding for value addition, risk reduction and increase in farmer-realizable heterosis was identified as the top priority.

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*Effectiveness of border control strategies in minimising biosecurity risks to New Zealand agriculture* – **Ganesh P. Rauniyar**

The study aimed to identify factors influencing behaviour of international passengers, assess the impact of current border strategies and identify additional border strategies for influencing passenger behaviour. A four-step procedure was employed and included a comprehensive review of current New Zealand literature, a behavioural study at the three major international airports, face-to-face interviews with 853 arriving passengers and interviews with key stakeholders. The study suggests that passenger profiling at the airport remains an effective tool for selecting the highest risk passengers for searches. While deterrence is difficult to quantify, detector dogs and x-ray machines both play a significant role in this endeavour. The first-time travellers from non-English-speaking countries, and people from continental areas (Europe, Asia) where quarantine is of relatively little importance are least likely to be aware of New Zealand's quarantine regulations. The most effective strategies in influencing passenger behaviour have been the x-ray machines, quarantine detection dogs

and the Quarantine/Customs Declaration Forms. The impact of the in-flight quarantine video and loudspeaker announcements in the aircraft and at the airports, amnesty bins, display cabinets, multilingual signs and warnings posted in the baggage claim area have been relatively less effective. The requirement that every passenger arriving in New Zealand goes through the biosecurity area has no major discomfort for passengers. The biosecurity risk could be minimized further by adopting a combination of strategies directed at detection, deterrence and awareness. This will require a concerted effort from all stakeholders.

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*Ethnicity and gender roles in rural household decisions* – **G.P. Rauniyar and D. Devkota**

Gender disparity in household decision making is common in developing countries. Ethnicity, culture and geographical location also influence decision-making processes in rural communities. Household decision-making processes in central rural Nepal were examined with a primary focus on gender roles and involvement of men and women in the context of three distinct ethnic communities: Brahmin/Chhetri, Gurung and Tharu. Three Village Development Committees (VDCs) of the Chitwan district of Nepal were purposively selected for the study. A combination of participatory rural appraisal ( $n = 6$ ), gender analysis ( $n = 6$ ), key informant interviews ( $n = 14$ ) and household socioeconomic surveys ( $n = 123$ ) was used to gather information and data for the study. At the household level, men and women were interviewed separately. The results indicated that both men and women consistently carried out certain crop production activities. Ethnic variation had an impact on gender roles and involvement of household members. Males dominated crop marketing in the Brahmin/Chhetri and Gurung communities, but this was a joint activity of the Tharus. Livestock-related work was primarily within the domain of women, but variation existed in gender roles across the ethnic groups. Women were more involved than men in household management in all three ethnic groups, with the highest level of participation amongst the Tharu women. Household decision making also depended on the level and source of income. The Gurung women exercised control over crop income. For all ethnic groups, men overwhelmingly dominated the access to agricultural and veterinary services, community activities and off-farm employment opportunities.

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*The role of off-farm income in sustaining rural households in Nepal* – **G.P. Rauniyar and P. Kayastha**

Stagnant agricultural productivity and low returns in farming have led rural residents to look for opportunities to earn income from off-farm sources. This research dealt with eastern Nepal. Village Development Committee (VDC) areas were used from two ecologically distinct districts (Dhankuta in the Hill and Morang in the Terai). Six participatory rural appraisal (PRA) workshops, a household survey ( $n = 150$ ) and six key informant interviews provided data for research. The average annual household income was Rs33 963 (approximately US\$500 in 1999). The main sources of income were agriculture in the Hill households, and off-farm activities in the Terai households. Off-farm income, especially wages, was a major source of household income for the poor households in both zones. Income from business/enterprises in the Terai, and remittances in the Hill, were the primary sources of off-farm income for the non-poor households. Off-farm income also contributed nearly half of the household expenditure but it decreased as its area of landholding increased. Landholding, household size, ethnicity and the agroecological position of the households were the key determinants of household off-farm income. Characteristics of individuals such as gender, education level and ethnicity affected the type of employment taken up. The more educated males and those belonging to the Chhetri/Brahmin/Newar ethnic group dominated off-farm employment. Lack of adequate off-farm income opportunities was more prevalent in the Hill compared to Terai and reflected proximity to major market and employment centres.

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*Is the Green Revolution sustainable? Long-term productivity trends in a sample of Philippine rice farms* – **Marites Tiongco and David Dawe**

The long-term sustainability and productivity of intensive rice production is a key issue affecting the future food security of Asia. We investigate long-term productivity trends in this important cropping system using periodic farm level survey data spanning more than 20 years of the Green Revolution in two rice bowls of the Philippines. Estimation of production functions with year dummy variables shows substantial declines in productivity from the early 1980s to the mid-1990s. However, examination of secondary data shows that the survey years were unrepresentative of long-term trends and were unduly influenced by exogenous yield shocks. Correction for these effects removes the productivity decline. Farmers in these areas are operating close to the technical efficiency frontier, implying that future increases in yield will need to come from new technologies that shift the function outward.

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*East Asian approaches to food security and implications for the next WTO round* – **Ray Trewin and Yiping Huang**

East Asia is made up of a diverse group of economies of various sizes and stages of development, yet food security is a policy priority in most countries because of their high population density. While some nations address the issue by applying an open trade and investment approach based on comparative advantage, many others follow a strong self-sufficiency approach. Some economies are self-sufficient in raw commodities whilst others import these but are net exporters of broader foods, building on their comparative advantage in labour-intensive food processing activities. The choices of food policy approaches by some East Asian countries have significant impacts on their own economies but also have implications for world markets. This paper first presents a broad picture of different approaches amongst East Asian economies and explores their determinants and implications. Alternative approaches to food security are analysed by comparing China and Japan, two large economies at different stages of development. Political economy perspectives are included in this analysis. Also included are applications of global trade modelling to quantify the implications of more open versus closed trade policies, as well as increased farm support. The possibility of regional arrangements on food security is also discussed in light of the forthcoming WTO round negotiations.

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*Institutions and incentives for wetland conservation on private lands in Australia* – **Stuart Whitten and Jeff Bennett**

Wetlands on private land generate both private and social values. The nature and extent of these values are dependent on the biophysical status of the wetlands. In turn, biophysical status is dependent on the land management strategies pursued. However, land management strategies are made primarily on the basis of the values received by wetland owners. Since these strategies also affect the wider community, via the social values of wetlands, the wider community may wish to influence the decisions of wetland owners. Altering the institutional and incentive framework within which wetland owners develop their land management strategies can alter the private and social values generated. In particular, altering the ownership balance of property rights can help society influence wetland management decisions via market mechanisms.

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## EUROPE

### *Price policies and agricultural supply: the responses of producers in Haryana (India) – Véronique Alary and Daniel Deybe*

India is undertaking a process of liberalization of the agricultural sector as part of a structural adjustment programme. But several questions arise. Can farmers react positively to a change in price policies which implies higher price fluctuations? Will these policies increase structural problems? Will they have a positive or negative impact on food security? A mathematical model is used to simulate farmers' reactions to some agricultural policy scenarios. Three objectives are pursued with the model: (1) to reproduce farmers' individual economic decision-making processes based on a seasonal and pluriannual optimization procedure subject to individual and regional constraints; (2) to mirror the exchanges between farmers (manure, draught power, land, labour); and (3) to consider different technologies or opportunities for crop and livestock systems in order to test various alternatives under different scenarios. Liberalizing the agricultural sector in the northern part of India could have a limited impact since farmers might have to face higher price risk. The rural population could also suffer lower nutritional damage, even if milk intake compensated for part of the adverse effect. The policy could also deepen the gap between better endowed regions where revenue could be increased (even if the internal distributive aspects might not be socially equitable) and the less endowed regions, which have greater agronomic difficulties.

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### *Food consumption assumptions and their implications in Romania – Cecilia Alexandri*

In Romania, the prolonged transition has resulted in a significant decline in incomes. Food consumption has fallen for most products, except for dairy products, potatoes, cereals and alcoholic beverages. The present paper looks at the way food consumption might alter given four assumptions about future incomes compared with the 1998 level. The changes are 20 per cent decrease, 20 per cent increase, 50 per cent increase and 100 per cent increase. The results are based on regression equations, having total income per person as an independent variable. The information used comes from the Integrated Household Survey, which includes 36 000 dwellings located in urban and rural zones. The main results reveal that a drop in income would affect animal products (meat, cheese) and fruits. That would also apply, but as increases, for small and medium improvements in income. Under the hypothesis of income doubling,

the food consumption level is expected to reach 3050 kcal. Comparisons between demand and domestic supply, at that level of income growth, reveal the potential occurrence of significant deficits for meat and meat-based products, sugar and fats (edible oils).

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***Measuring the value of farm animal welfare legislation – Johan Andersson and Peter Frykblom***

Non-market valuation has already been used to evaluate legislation dealing with farm animal welfare. This paper improves on the previous methods in several ways. First, by recognizing that markets already exist for many features associated with any suggested legislation, the market failures in modern animal welfare arrangements can be pinpointed. In those circumstances it is the marginal change which matters. Second, by using a methodology found in the experimental economics literature, it is possible to control for a number of biases that have been regarded as serious sources of error in the valuation literature. An applied contingent valuation survey suggests that there are no significant market failures in egg production.

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***Animal welfare and profitability: a contradiction? – Ruth Badertscher Fawaz and Stephan Pfefferli***

Animal-friendly housing usually causes higher investment costs, higher labour requirements and/or higher running expenses. Often these are not compensated by higher prices. Farmers, therefore, choose conventional housing systems. However, there is some evidence that animal health is better under animal-friendly conditions. Many studies show better udder health and better fertility of dairy cows in loose housing compared with stanchion barns. In our study we want to show the effect of including animal health, product quality, working conditions and environmental aspects in an economic comparison of conventional and animal-friendly housing systems. The interest is in two housing systems for dairy cows (stanchion barns/loose housing with litter and an outdoor run) and fattening pigs (slatted floors/systems with straw bedding and an outdoor run). We mainly use results of other studies in the case of dairy cows. There are very few data available relating to pigs, so a survey is being made of 90 farms to look at housing, management, animal health, performance and meat quality. The project started in 1998 and will be completed in 2003.



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*Parametric measurement of scale efficiency: evidence from Iranian dairy farming* – **M. Bakhshoodeh and K.J. Thomson**

Many previous studies have applied a data envelopment approach to calculate farm-specific indices of scale efficiency. This paper focuses on a parametric measurement of such indices. The level of scale efficiency for individual farms is measured as the ratio of constant returns to scale technical efficiency (CRS TE) to variable returns to scale technical efficiency (VRS TE). Applying a transcendental frontier production function to 1995–6 data on 1626 Iranian dairy farms, the SE index was found to be about 0.80 on average, ranging from 0.25 to 0.95 and with more than one-third of the farms below the mean value. The index value was affected by farm size and by the proportion of pure-bred animals, but not by the use of modern farming techniques. In order to improve scale efficiency, expanding farms and increasing the number of pure-bred animals is recommended.

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*Methodological aspects of a linear programming model for evaluation of soil tillage technologies* – **Maria De Belém Martins, Carlos Marques and Maria Raquel Ventura-Lucas**

The introduction of new methods of soil tillage, such as direct seeding and reduced cultivation, raises critical questions that should be taken into account in economic appraisal. These are: (1) the need to carry out cultivation operations during the precise number of days available, which depends on the different cultivation operations involved, precipitation and soil type; (2) the number of hours and horsepower necessary, in each of the technologies, for establishing the cereal crop. Analysis of the results demonstrates that a linear programming model can be developed which should be useful in further analysis of new techniques.

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*Approaching the level of losses caused by a lack of finance: the case of Russian farms* – **Irina V. Bezlepkina and Nikolai M. Svetlov**

In Russia, weak financial discipline and an inefficient credit system result in insufficient financing of agricultural production. This study investigates whether a lack of finance causes losses for Russian agricultural producers. A modified Bayesian formulation allows us to employ scarce data to approximate losses. This formulation is incorporated in the objective function of an optimization model expressing the dependence of profit on cash flow and debts. Empirical application employs data from 60 quarterly reports of six agricultural enterprises from the Moscow Region in 1995–8. The losses are estimated at 42.6 per cent of total farm expenses.

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*On the efficient boundaries of the state: a transaction cost economics approach to the analysis of decentralization and devolution in natural resource management* – **Regina Birner and Heidi Wittmer**

Decentralization of authority in natural resource management and the devolution of management functions to local user groups have gained increasing importance in developing countries. While there is an increasing number of empirical case studies, development of theoretical concepts for systematic analysis of the efficiency of the newly created institutional arrangements is remarkably scarce. Likewise, questions of institutional design, such as the optimal level of decentralization and devolution, have hardly been analysed from a theoretical perspective. The poster demonstrates how this gap can be filled by applying transaction cost economics, especially Williamson's recent approach on governance structures involving public bureaucracies. Use is made of the case of decentralization and devolution in biodiversity conservation to show (1) how to determine the relevant transactions and identify their key attributes, (2) how to derive the trade-offs among these transactions, and (3) how to assess alternative modes of governance on the basis of their structural attributes. The poster extends Williamson's framework in two ways: (1) by including additional types of transactions and attributes and (2) by enlarging the set of possible governance structures by including, in addition to Williamson's markets and hierarchies, cooperative governance. By analogy with Williamson's efficient boundaries of the firm, this approach makes possible the derivation of hypotheses about the efficient boundaries of the state. Thailand's community forestry bill is used to show how the theoretical framework can be applied empirically.

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*Vertical and horizontal intra-industry trade: analysis of the agricultural and food trade for Slovenia* – **Štefan Bojnec**

This paper analyses Slovenian agricultural trade structures. Following the literature on intra-industry trade (IIT) a distinction is made between IIT and inter-industry trade, and IIT is separated into vertical IIT and horizontal IIT. More than one-quarter of Slovenian agricultural and food exports is directed to the European Union (EU) and more than half to the traditional former Yugoslav markets, particularly to Croatia. More than half of Slovenian agricultural and food imports is from the EU, followed by the former Yugoslav republics and the Central European Free Trade Agreement (CEFTA) members (about 10 per cent from Hungary). The paper gives explanations for the trade patterns, the two components of IIT and their implications. The Slovenian trade in agricultural and food products with Hungary, Poland, the EU, Romania and Bulgaria is largely of the inter-industry type. Yet, for several products, there is no trade with certain countries, such as the CEFTA members. In trade with the EU there is a high percentage of one-way, import flows. The statistical analysis revealed that more than two-thirds of IIT is vertical IIT with either very high or very low export to import price ratios. The price, and hence the quality, differences in traded goods are important factors contributing to diversification of supply for consumers and creating pressures for restructuring and reallocation of production sectors.

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*Age, entrepreneurship and commercialization in transition agriculture: evidence from Hungarian dairy farmers* – **Štefan Bojnec, Erik Mathijs and Liesbet Vranken**

This paper uses survey data on Hungarian dairy farmers to investigate their entrepreneurial behaviour and identify its constraints. The analysis reveals that most producers are commercial and that both entrepreneurial ability and marketing constraints play a bigger role than capital constraints in the off-farm commercialization of dairy farm products. Successful dairy farmers are young, use external advice and live close to local consumption centres. In addition, they either use cooperatives or integrate with processors to market their products effectively. These results suggest that a prime role for policy support should be directed to improving human capital, extension services and marketing infrastructure, rather than to providing cheap credit.

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*Why are most Europeans opposed to GMOs? Explanatory factors underlying the rejection movement – Sylvie Bonny*

A strong opposition movement to GMOs (genetically modified organisms) arose in European countries at the end of the 1990s and spread to some other non-European countries. With many people considering biotechnology and genetic engineering as major sources of progress, one might ask what the origins of this opposition are. Some underlying explanatory factors motivating public concern about genetic engineering are presented. First, there are doubts about institutions and companies, which amounts to a loss of confidence in them. The contaminated blood and BSE affairs led to the belief that the goal of safeguarding economic interests had been allowed to override health concerns. The same fear surrounds GMOs. Second, there is now a general context of concern about the effects of highly industrialized agriculture. Biotechnology has been seen as an ultimate reinforcement of intensive farming. Third, the role of environmentalist associations and the media in dramatizing the potential risks of GMOs has been important since consumers often have more confidence in them as sources of information. There is a growing view that the expected benefits are assessed by the public as being very small, or non-existent. GMOs are seen as profitable only to some large companies.

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*Reorganization of agriculture in the Czech Republic: the transaction cost problem in restructuring socialist large-scale agriculture – Markus Brem*

Institutional change in transition countries has to face the problem of restructuring large-scale farm organizations by reorganizing farm boundaries and ownership structures. The new property rights structure affecting the assets of socialist large-scale farms provides incentives for the individual owner to redeploy assets in a more efficient way. The poster looks at four partial models which deal with (1) reinforcing a similar governance structure due to the existence of increasing returns; (2) the break-up of state farms caused by opportunistic behaviour of individuals among the farm's stakeholder group; (3) the trade-off between increased costs in oversized socialist farms versus leaving the organizations; and (4) the coexistence of cooperative and hired-labour farms caused by different levels of opportunity costs and moral hazards. Using data from a 1999 farm survey conducted in two Czech regions, it is suggested that (1) structural change in agricultural transition occurs slowly and is dependent on organizational history; (2) structural change also gives opportunities for stakeholders with informational advantages to grab large shares of the assets; (3) the level of exit costs from the socialist deployment of assets leads to there being various possible reorganization paths.

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*Consumer attitudes towards organic food in Germany 1984–99: an application of cohort analysis* – **Maike Bruhn and Reimar von Alvensleben**

The poster presents the first results of the fourth phase of a long-term research project dealing with the change of consumer attitudes and behaviour in the organic food market in Germany. The data base is taken from the results of four consumer surveys ( $n = 2000$ ) conducted in five-years intervals (1984, 1989, 1994, 1999) using the same questionnaire. This material is a unique data base for the application of cohort analysis to answer the following questions.

- 1 Are changes of attitudes and demand caused by:
  - a change of behaviour of the total consumer population (= period effect), or
  - a cohort succession, a replacement of old consumers by young consumers with different behaviour in a generational change (= cohort effect)?
- 2 Are differences of attitudes and demand between age groups caused by:
  - the ageing of consumers with age-specific attitude/behaviour patterns (= age or life cycle effect), or
  - by the specific conditions of socialization of the age groups (= cohort effects)?

The analysis based on the survey results of 1984, 1989 and 1994 showed that the changes of attitudes and behaviour are due to both period and cohort effects. However, declining cohort effects within the younger cohorts suggest that there will be declining growth rates of demand in the future.

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*The horticultural sector in Romania: incentives necessary for recovery* – **Gabriela Burghilea**

Because of its economic, social and ecological functions, the horticultural sector is of great importance to Romania. Almost 4.5 per cent of arable area is covered by vegetables, orchards and vineyards. Under new legislation, private ownership of land has become dominant, representing 71 per cent in tree growing, 76 per cent in viticulture and 94 per cent in vegetables. They each occupy an area in excess of 200 000 hectares. Romania is a traditional wine producer, with an average output close to that of Portugal and Germany. In 1998, the viticultural area was up by 20 per cent on 1989, with much of the growth being in hybrid plantings, the area of which doubled between 1989 and 1998. The main objective of the reform in this sector is that of obtaining additional quality production to meet the needs of the internal market and ensure the development of exports. The latter may require technical, financial and legal incentives.

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*Economic impact of agenda 2000 on representative farms in Wallonia (southern Belgium)* – **Ph. Burny**

Based on several hypotheses, including the reduction of selling prices of 15 per cent for cereals, 20 per cent for bovine meat and 15 per cent for milk, this paper illustrates the economic impact of Agenda 2000 on farms representative of Wallonian agriculture. It appears that Agenda 2000 will have an adverse impact on dairy farms, though it will have more favourable effects on the income of beef producers. It is expected that direct payments will play a significant role for all types of farm.

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*A simulation of the effects of agricultural subsidies on irrigation water demand and nitrogen pollution in Spain* – **Javier Calatrava and Alberto Garrido**

Irrigation water demand is largely dependent on the state of the market and on the income support mechanisms delivered by agricultural policies. Three processes of reform are currently going on in Spain that will have large effects in the pattern of water use in the agricultural sector. First, there is a change in market and income support which Agenda 2000 will bring about for the period 2000–2006. Second, the European Union Water Framework Directive, which is imminent, will change the whole philosophy about water charges for all European water users. Third, there is to be reform of the Spanish Water Law, which will liberalize allocation systems. To investigate the likely effects of these three major changes, a non-linear mathematical programming model has been developed and calibrated for a number of areas in Southern Spain. The results show that the combined effects are ambiguous from the point of view of water management but may be beneficial in reducing farmers' chemical pollution. There is some concern that initial water allowances are based on technical parameters, rather than on efficiency or equity grounds.

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*Implications of EU enlargement for Slovak farms* – **Pavel Ciaian, Zlata Sojkova, Ladislav Kabat and Artan Qineti**

The objective of the paper is to determine likely future implications of EU enlargement for farms in the Slovak Republic. The following policy scenarios

were modelled for five farms, each situated in different regions for two distinct years, 2002 and 2007: (1) the continuation of existing policies in Slovakia, (2) reformed Common Agricultural Policy (Agenda 2000), (3) the complete liberalization of European agricultural policy. A linear programming technique was used to analyse effects on the financial indicators and production structure of the farms. The results show that the Agenda 2000 scenario led to increasing levels of farm profitability in both periods. The liberalization scenario led to a profitable structure only for farms situated in regions with better climatic conditions. From the results it is clear that current Slovak agricultural policy gives strong support to farms situated in regions with worse production conditions.

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*Institutional configuration of agricultural extension in south-eastern Europe –*  
**Lefter Daku, George W. Norton and George McDowell**

Effective extension is an important accelerator of development. It plays a key role as a support system, as a policy instrument and as a major component of the agricultural knowledge and information system helping farmers make informed decisions. Following economic reforms in the early 1990s, most of the south-eastern European (SEE) countries made efforts to establish extension services. However, a number of factors, including tight governmental budgets, lack of experience and the existence of vested interests, constrained the development. This poster examines the rationale for public funding of extension programmes and evaluates the incentive structure for private and public sector participation in providing a service. It sets out a medium- and long-term approach with a primary focus on institutional dimensions. Two groups of factors that affect the private sector supply of extension are analysed: (1) demand and supply-side factors that affect profitability, and (2) factors arising from the public good nature of extension output, externalities, moral hazards and economies of scale, that affect the appropriability of the returns from the service. The conclusion is that the SEE countries should try to achieve a public-private extension balance by following a more gradual approach towards privatization. However, there should be a phased withdrawal of the public sector from providing extension in areas best served by the private sector, while recognizing a continued important role for the public sector in correcting for undesirable effects of private extension.

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*Spatial and varietal aspects of agri-food prices –* **Karine Daniel**

The paper investigates the contributions of spatial and variety dimensions to agri-food prices. It presents a stylized model of multiple producers, supplying

differentiated products to consumers in different regions. Production is characterized by aspects that give rise to both increasing and decreasing returns. Marginal cost pricing is inappropriate in this context. The long-run equilibrium price received will reflect the premium paid by consumers who value variety. Differences between varieties can be due to differences in outputs (Appellation d'Origine Contrôlée). The open question is whether price premia could ever sustain the current farm structure without subsidies.

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*Training for integrated pest management: rice farmers in Indonesia* – **Daniel Deybe and Maurice Vaissayre**

In Indonesia, pest outbreaks affecting rice led to the implementation of the Integrated Pest Management Training Project (IPM/TP), with the technical assistance of FAO and funded by the World Bank. Farmers' Field Schools (FFS) were founded to train farmers in IPM practices and disseminate IPM principles in the community. The participatory process and the social dynamics involved enable farmers to develop collaborative efforts to ensure IPM implementation. At the request of the World Bank, Cirad carried out a pilot study in two provinces of Java to evaluate the qualitative and quantitative impacts on trained and untrained farmers. Through qualitative interviews and structured surveys it was possible to compare the practices and economic results. It appears that trained farmers are younger and better educated. They are better equipped, participate more in group activities, are more aware of environmental problems and employ safer techniques. Trained farmers' pesticide costs are lower with a higher gross margin/hectare.

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*An empirical study of the causes of agricultural labour adjustments during transition* – **Liesbeth Dries, Karen Macours and Johan F.M. Swinnen**

Reforms have strongly affected agricultural employment in transition countries, but in remarkably different ways. In countries such as Hungary and Estonia, labour use in agriculture has declined dramatically. In others (such as Poland and Slovenia) it has decreased to a lesser extent and in some (for example, Romania and Russia) agricultural employment increased during transition. We show that the differences in labour adjustment during transition are due to a combination of variations in initial conditions and differences in reform policies and effects. Reform policies that had a strong influence on labour adjustment were price and trade liberalization, privatization of produc-



tion factors, farm transformation policies and the set of general reform policies which liberalized factor markets and removed obstacles for improved allocation and mobility throughout the whole economy. Surplus labour outflow from agriculture is stimulated by liberalization and by the privatization of farm assets, since they improve incentives and remove constraints for optimal factor allocation and structural adjustment. The shift to individual farms, which was especially strong in labour-intensive production systems with low labour productivity, has reduced the outflow of labour from agriculture by improving farm governance and labour efficiency, although this effect was mitigated by losses in scale economies due to disruptions and market imperfections in transition. In general, labour outflow was considerably lower on individual farms than on corporate farms, owing to a combination of factors related to human capital, access to finance and physical capital, and social capital.

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#### *Thermometers for unhealthy Russian enterprises* – **David Epstein**

The majority of Russian agricultural enterprises have been unprofitable since 1994, and have accumulated large liabilities. Reorganization and restructuring of debt are necessary. However, the differences in financial standing of enterprises should be identified and taken into consideration. A method is needed which enables relevant indices to be constructed as a basis for classifying enterprises into qualitatively different groups, depending upon their financial and economic standing. This is a complex and still unsolved task, since the reported accounting figures for unprofitable enterprises inaccurately reflect their costs (particularly in respect of depreciation deductions). Financial ratio analysis is a potential tool. Experimental checking of the scheme developed was performed with the figures of agricultural enterprises of the Leningrad region for 1997.

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#### *Rural policy and regional governance: a neural network approach* – **Roberto Esposti and Franco Sotte**

The paper analyses the enforcement and effect of EU rural and agricultural policies at the local level. The different kinds of policy provide a complex system of incentives, constraints and opportunities interacting within the specific territorial context. The interaction between policies and the strategies of farmers and other local actors explains the spontaneous formation of emerging

institutions, which provide the actual governance of the territory. An Artificial Neural Network model can well represent and simulate the functioning of this complex local system. It emphasizes the main features of the functioning of local rural systems. Heterogeneous agents strongly interact in a weakly hierarchic ordering, while remoteness and small scale imply a limited contextual knowledge with consequent bounded-rationality behaviour. However, the interaction between agents makes the local system capable of 'learning' to adapt to changing external conditions and policy provision. A simulation illustrates how such a modelled system can generate spontaneous local institutions.

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*The impact of plant varieties rights on research: the case of Spain* – **M. Carmen Fernández Díez**

The impact of plant variety rights on the public and private research sectors in Spain has been to provide positive incentives, especially for the private sector, which increased its market share as a result of higher appropriability conditions. The plant-breeding sector consists of both international and small domestic firms. Many foreign breeders focus their research efforts on hybrid varieties, which provide 'natural' property rights. Finally, as a result of an increase in the innovative activities of foreign breeders, Spain has expanded seed imports and reinforced technological dependence.

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*Impact of market intervention on integration of Polish and world wheat prices* – **Szczepan Figiel**

Market reforms implemented in Poland, especially greater openness to international trade, should result in increasing price integration between Polish and world markets for internationally traded commodities such as wheat. However, in a period of economic transformation, Polish agricultural prices have been very volatile and there has been resultant government intervention in the market. As a result, Polish monthly wheat prices were found, by regression and cointegration analysis, to be generally unrelated to selected world prices over the period of 1990/91 to 1996/97. The intervention also caused market distortions such as deviations from the normally expected seasonal pattern. The Polish experience provides two important lessons. First, inefficiencies caused by underdeveloped agricultural market infrastructure and insufficient market information resulted in strong political pressure under which the government of Poland decided to implement some market intervention programmes. Un-

fortunately, the established government agency became a dominant player in the grain and other agricultural markets. Such a situation hampers the broader participation of private businesses in procurement and larger-scale market transactions. Second, excessive market intervention programmes not only failed to help stabilize agricultural markets, but also led to serious distortions and a political temptation to urge the government to make even more intensive interventions. Therefore a successful market transformation requires establishing, as soon as possible, necessary market institutions and regulations. Otherwise, a lot of resources that could possibly be spent on further development of the market infrastructure could be wasted on costly and ineffective market intervention.

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*Combined and changing effects of market incentives, technical innovations and support on maize production in southern Mali* – **Michel Fok, Mama Koné and Hamady Djouara**

The paper analyses the evolution of maize production during the last two decades in southern Mali, a region known mainly for its cotton. Maize production actually took off during the first half of the 1980s as a result of a voluntary programme bringing together technical support, effective input provision and a guaranteed price under compulsory state-controlled cereal trading. In 1986, while adoption of intensive maize cropping was in progress, the implementation of structural adjustment policy, through cereal market liberalization and abolition of input subsidies, at first led farmers to return to traditional intercropping with decreased fertilizer use. Maize has again been providing an increased contribution to food security, from the beginning of the 1990s and in particular after the 1994 currency devaluation. Farmers are adopting more intensive maize single cropping at the expense of millet and sorghum. Our case study emphasizes the need for long-term assessment of the impact of technical innovations, along with changes in market incentives. State market control has helped introduce technical innovations which farmers readopt after market liberalization, provided input provision remains effective.

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*Primary demand for red meats in the UK* – **Panos Fousekis and Brian J. Revell**

Flexible differential inverse systems are employed in this paper to analyse the farm-level demand for red meats (beef, pigmeat and lamb) in the UK for the period 1989:1 to 1998:12. A statistical selection process indicates that an

inverse CBS model with variable scale effects but constant quantity effects (CBSIDS) performs better than the alternative systems of inverse Rotterdam (RIDS), the inverse Neves (NBRIDS) and the inverse AIDS (AIIDS). The CBSIDS is then used for hypothesis testing and computation of price flexibilities. The differential inverse demand models were specified in terms of weighted cost/revenue shares and did not display any significant effect due to BSE. The empirical results suggest that preferences over red meats are homothetic and separable in the partition ((pork, lamb), beef). They also suggest that beef and pork are closer substitutes, as compared with beef and lamb and pork and lamb. Finally, all own price uncompensated price flexibilities are less than unity in absolute values.

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*Economic rationality and farmers' adjustment strategies under the CAP's reforms: the case of Andalusia (Spain)* – **Rosa Gallardo, Fernando Ramos and Eduardo Ramos**

The reforms brought about by the Common Agricultural Policy (CAP) aim to provide different support schemes for continental and Mediterranean crops. These different approaches have led to different adjustment strategies. However, there are farmers whose activities are located in areas sharing both continental and Mediterranean features. This, in fact, implies two opposing 'economic rationales' with which farmers have to deal. Work is focused on the study of the effects of CAP reforms on different farming systems: COP crops (cereal, oilseeds and proteins) in one of the main producing areas in Spain (Andalusia). Results obtained are from personal interviews with experts and from a survey carried out at the farm level in the study area. The observed adjustment strategy seems to indicate that most farmers do not follow a strict economic rationale.

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*The Romanian agri-food economy on the road towards globalization* – **Dinu Gavrilesu and Camelia Serbanescu**

With an agricultural area of 14.8 million hectares, over 36 per cent agricultural employment, a share of 19 per cent in overall GDP and almost 60 per cent of the family budget spent on agri-food products, Romania is the second agricultural producer in Central and Eastern Europe, having excessive available labour and low productivity. The state of the transition is such that the first seven years of the process could be described as groping in a labyrinth, trying to solve severe short-term problems, rather than taking sequential steps in a

longer-term approach. Over the last three years, the decision makers have enforced a more coherent reform programme including price and foreign trade liberalization, setting up a reasonable import tariff regime and joining CEFTA. Romania's presence at negotiations for joining the European Union raises more problems for the agri-food economy. There is still an urgent need to build appropriate market institutions and provide a much-needed legal framework.

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*The competitiveness of the Romanian agri-food sector in CEFTA* – **Daniela Giurca and Camelia Serbanescu**

The major political orientation in Romania is directed towards making the necessary adjustments to the economy in order to be able to join the European Union as soon as possible. The CEFTA agreement can be considered as solid field training both for Romania and for other member states, to test their ability to evolve in a free trade framework, especially in relation to sensitive agri-food products. The initial objective of introducing complete free trade from the very beginning proved to be unrealistic and the member states have agreed to reach this objective by gradually reducing existing trade barriers. Just a few months after the initial enthusiasm, Romania realised that its agri-food sector faced strong competition. Until 1996, the trade balance with the five member states was positive; but immediately after Romania signed the agreement the balance reversed and the deficit increased even more in the next two years. The paper assesses the competitiveness of Romanian agri-food products in 1997–9, pointing out those having a comparative advantage.

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*The application of agrienviromental policies in Portugal* – **Maria de Lurdes Ferro Godinho**

Recently, agricultural policies have been concerned with both the impact of intensive agricultural practices on environment and the problem of land abandonment in areas in which agriculture is no longer competitive. Major improving measures have been proposed and implemented. The so-called 'accompanying measures' of the 1992 Common Agricultural Policy reform (EC regulation 2078/92) are examples. Even though the overall objectives of these agrienviromental measures are identical for every European Union country, different schemes have been defined and applied in each specific case. Farmers' acceptance of the measures and their effectiveness in changing farming systems and incomes are studied using multivariate analysis applied to regional data. The results show the major attributes that distinguish the

non-participating farms from others and indicate the extent to which there have been reductions in the adverse effects of farming.

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*Identifying needs of tomorrow's agriculture: lessons from the use of a participatory approach in South Africa* – **Marijke D'Haese, L. D'Haese, J. Van Rooyen, W. Anseeuw, H. Verschueren and A.M. De Winter**

During the last decade the logical framework approach (or one of many similar techniques) was often used in the project planning. The object is to provide an overview of field experience of the use of 'logframe' analysis as a participatory approach for identifying constraints and needs in three case studies in South Africa. Studies included are (1) analysis of on-farm problems related to restricted access to resources, support services and rights of progressive small-scale mango farmers; (2) analysis of the problems causing the low competitive power of the informal cut flower sellers of Pretoria; and (3) examination of the food security problems of women with small children in Soshanguve, a suburb of Pretoria. Through intensive group discussions with farmers and sellers and by prioritization of problems and constraints, the farming and marketing systems are described and analysed in a problem tree. The development of the problem tree is the first step of logframe analysis. The next step is to convert to an objective tree in order to identify alternative strategies to alleviate constraints and problems. These are then summarized in the logframe matrix. The methodology can be applied to a diversity of problems and target groups. The positive experience is mostly enhanced by the interactivity of the process and the involvement and concern of the target group and extension services.

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*Price adoption resulting from extending the CAP to the east: prospects of competitiveness* – **Péter Halmai and Andrea Elekes**

Agriculture has a great macroeconomic significance in the economy of the CEECs as regards both their GDP contribution and their trade balance. Receiving higher prices will certainly have favourable effects on the income situation of producers, but it may threaten the (price) competitiveness of agriculture. There are two basic threats: first, higher producer prices can directly reduce competitiveness and, second, higher producer prices may increase consumer prices, causing problems on the demand side. The analysis concentrates mainly on Hungary. It is possible, because of the proposed reduction in institutional prices in the European Union and an expected rise in Hungarian real agricultural prices, that the difference between agricultural price levels may be reduced.

At the same time, obtaining direct payments (or at least part of them) and the special rural development grants will improve competitiveness and help the adoption process. It will be important to focus these additional resources on the restructuring of less effective enterprises and further improvement of export competitiveness.

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*Explaining institutional change: agricultural land reforms in Bulgaria and Poland* – **Markus Hanisch and Dominika Milczarek**

The poster presents a framework for the analysis of agricultural land reforms in Bulgaria and Poland as it emerges from contemporary theories of institutional change. It discusses to what extent the theories can contribute to an explanation of the policy design (formal rules) and the effective outcomes (formal plus informal rules) of land reform and agricultural privatization in both countries. The authors argue that the privatization processes took place without functioning markets in land, services, human and financial capital and physical agricultural assets. In this situation it is possible to model the process of land and asset reallocation as a bargaining game between managers, workers and land and asset owners. The recognition of differences between these actors in terms of specific resources crucial for bargaining success allows us to explain the pace of reforms in a different manner than pure public choice or transaction cost theories would suggest. The authors conclude that, in countries as different as Poland and Bulgaria, the analysis of the conflict about the potential gains from land and asset distribution, and the different ways in which the actors tried to influence the outcome of this conflict, can contribute much to the explanation of the whole process and its observable outcomes.

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*How do the labour markets react to structural change in agriculture?* – **Johannes Harsche**

Owing to general economic development, the agricultural transformation process in many European regions affects the farming household's decisions concerning on-farm and off-farm work. These decisions depend on various parameters, including specifically agricultural as well as general economic and sociodemographic variables. Using a panel data econometric model we establish in this study that several variables of this kind affect the agricultural labour markets. We use six years' panel data from 26 administrative districts (*Landkreise*) of the central German state of Hesse which has a very diverse agricultural structure and a long tradition of part-time farming. The economet-

ric analysis produces significant results on the way various agricultural as well as non-agricultural parameters affect the labour market decisions of farmers. Variables concerning local economic structure indicate different influences on the magnitude of farming on the labour markets. Thus a growth in wages results in an increase in the proportion of part-time farms in relation to all farms and in a reduction in the number of all farms in comparison to all employees. Additionally, an increase in wages involves a decrease in the share of agricultural employees in relation to all employees. Consequently, attractive wages in other sectors may give an incentive to switch into them or to practise a combination of on-farm and off-farm work. In addition to this, the results show that agricultural labour markets are significantly influenced by natural conditions in the regions.

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*Government intervention in central and eastern European agricultural markets: an empirical analysis* – **Jason G. Hartell, Štefan Bojnec and Johan F.M. Swinnen**

The development of agricultural protection in central and eastern European countries (CEECs) has been closely watched because of the potentially substantial and costly adjustments that may be required at the time of accession to the EU and the adoption of the Common Agricultural Policy. Convergence, of both policy and protection level has therefore been considered a factor in reducing these costs. Using data for six CEECs from 1992 to 1998, we find, however, that despite some similarities in agricultural protection instruments, the actual level of aggregate protection (PSE per cent) does not convincingly demonstrate convergence either among the CEECs or with the EU. Subsequently, we empirically investigate the reasons for the variation in agricultural protection levels among CEECs within a political economy framework. To understand the distribution of costs and benefits of supplying agricultural protection, political economy models commonly focus on the relative size of groups and lobbying efficiency, the degree of entrenched vested interests, relative income developments and various structural characteristics of the economy. Pooled OLS regression analysis generally confirms that the determinants of agricultural protection found important in other countries are applicable to the CEECs and that differences in these factors across countries help to explain the lack of convergence. To further identify policy effects, future work will incorporate greater dynamic elements and interaction effects in the empirical model specification.

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*Assessment of land use in marginal regions* – **A. Heissenhuber, J. Kantelhardt and E. Osinski**

There is a conflict between the maintenance of land in use in less favoured areas in Germany and its abandonment. From the economist's point of view, any existing type of land use depends on natural and economic conditions. In a broader sense it is a matter of the capability of natural sites for agricultural purposes, the infrastructure, the agricultural market and the resulting farm perspective. Because of changing economic conditions, intensive agriculture, in the long term, will probably lose attractiveness and extensive agriculture and woodland (even fallow land) will gain in importance. This is especially likely in the less favoured areas, which are often characterized by high ecological and landscape values. In a country with high population density (Germany) both the economic and ecological/tourism aspects of land have to be remembered when policy attempts to influence land use are made. An example of a grass-land area is used to show the relative merits of cattle farming against non-farming uses.

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*Strategies for survival: a modelling approach* – **Ludger Hinners-Tobrägel**

In this study the question is whether strategies other than profit maximization can lead to a higher probability of farm survival. Monte-Carlo simulations were carried out with a very stylized model farm, producing plant and animal products with uncertain prices and polypolistic markets. The model is characterized by rolling planning with a horizon of one period, linear programming and rational expectations. The steps in business planning are forming expectations, actual planning, realization, surprise and new planning. Three strategies are compared. Unrestricted profit maximization is used as a reference. The diversification strategy is marked by the fact that investment in plant and animal production is fixed, although animal production is more profitable. A farmer following the risk discount strategy calculates optimal investment using lower prices than actually expected. In other simulation studies the success of a strategy depends on the activities of its competitors. To avoid this, each strategy is simulated in an identical environment. The results show that, in the special formulation of the model, the simple strategies such as diversification or risk discounts on both product prices reduce the risk of failure compared with unrestricted profit maximization.

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*An integrated economic and environmental farm simulation model (FASSET) –*  
**Brian H. Jacobsen, Jørgen E. Olesen, Bjørn M. Petersen and Jørgen Berntsen**

The model presented here – FASSET – can be used to assess the economic and environmental consequences of different policies at the farm level. The model is a result of interdisciplinary research aimed at making the concept of sustainability operational at the farm level. The current prototype consists of a planning module and a simulation module where climatic conditions also affect the result. FASSET gives a detailed description of the entire nitrogen flow in order to assess the nitrogen loss. The effect of different types of taxation of nitrogen inputs in one farm example is presented and the cost of reducing leaching is calculated.

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*Spatial equilibrium modelling for policy analysis: effects of WTO agreements on agriculture in Costa Rica –*  
**Hans G.P. Jansen, Peter C. Roebeling, Aad Van Tilburg and Robert A. Schipper**

A spatial equilibrium model (SEM) is developed for the agricultural sector in Costa Rica to analyse spatial patterns of supply, demand, trade flows and prices for 17 major agricultural commodities in six planning regions and the rest of the world. Producer and consumer behaviour is modelled, while simultaneously taking transaction costs and government policies into account. The model is validated with 1995 data and used to assess the effects of a number of trade liberalization measures on spatial patterns of land use, trade flows and consumer and producer welfare. While raising aggregate welfare, especially for consumers and less so for producers, trade liberalization results in significant changes in patterns of agricultural production and trade. The main contributions of this research are (1) development of a well-established database on regional agricultural land use, production and prices for Costa Rica, (2) sound econometric estimates of regional demand and supply elasticities which were previously unavailable, and (3) an agricultural sector model that can be used by both policy makers and research institutions to evaluate alternative agricultural policy measures, also previously unavailable.

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*Motivations and influence of FDI in the Hungarian food sector – Csaba Jansik*

Hungary has been a popular target for foreign investments since the beginning of political and economic reforms. The country has received one-quarter of the total FDI inflow into the Central and Eastern European region. Food processing was one of the first sectors to be privatized in Hungary. Foreign investors have participated very actively in the process since 1990. The share of foreign ownership in the Hungarian sector exceeded 60 per cent by 1997. The objective of this study is to analyse the major determinants that caused an uneven distribution of FDI among the 17 food processing subsectors. The factors that attracted large amounts of foreign investments into certain food industries are sought, using a regression model and cluster analysis. The study reviews the fears previously associated with foreign ownership in the food sector and weighs them against the results achieved up to 1999. The assessment provides the Hungarian agri-food sector, foreign investors and Central and Eastern European countries with valuable future reference material.

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*Viable insurance schemes for the rural poor in developing countries: lessons from a women's association in India – Johannes Jutting*

The concept of mutual insurance is increasingly seen as a means of improving the access of poor people to efficient risk-sharing institutions. In this paper we analyse the mutual insurance scheme of an Indian self-help organization in order to identify criteria which help to explain why in some cases mutual insurance schemes are stable while in others they break down. The identified criteria for a viable scheme are (1) a careful selection of the risks covered, (2) experience in management and financial operations, (3) education and training of the staff and members, and (4) a low-cost incentive and enforcement structure which should contribute to the social capital stock of the community. As local mutual insurance schemes rarely insure against covariant risks, and participation is often biased against the poorer strata of the population, public institutions have to play a key role. In this respect, the case study of the Self Employed Women's Association (SEWA) in India shows that there are promising means of cooperation between state authorities and local self-help groups. In future this partnership should be enlarged to include private business, which could contribute to enlarging the risk pool and reducing unit transaction costs for contracts.

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*Induced changes in land use and property rights under the influence of market access and demographic change: the Borana pastoralists in southern Ethiopia*  
– **Abdul Kamara and Michael Kirk**

The study assesses the dynamics of land use and property rights in the Borana rangelands of southern Ethiopia, and evaluates their causes and consequences for livestock development. The driving forces are related to a complex set of endogenous and exogenous factors, among them rainfall variability, market variables and demographic forces. Theoretical considerations revolve around the theories of agricultural intensification and induced innovation, viewed from the perspective of collective action and interest group theories of institutional change. The dynamics of land use are an outcome of both exogenous processes related to changes in prices, technology, demographic and market variables, as well as endogenous processes initiated by the activities of interest groups. Local level responses may depend on endowments of natural resources, human capital and social capital. The study utilizes community-level data to test these hypotheses, using regression methods. The results indicate a general increase in crop cultivation and land allocation to private grazing. This process is largely related to rainfall variability, market variables, demographic change, and heterogeneity and social capital variables. The semi-arid nature of the area creates concern about its potential capacity to support a fully privatized system on a sustainable basis.

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*Modelling the rural economy: an interregional general equilibrium approach in Latvia* – **Artis Kancs**

A rural–urban interregional computable general equilibrium model (CGE) is constructed to simulate the effects of agricultural policies on household incomes, employment rates, farm and non-farm sectoral activity, allocation of factors across regions and sectors, regional costs of living and other economic indicators. Regions are characterized as open activity models with given endowments of natural resources and labour. Prices of differentiated commodities as well as of production factors are endogenous. The analysis is applied to Latvian economy using the 1996 input–output tables. The study provides a useful indication of conceptual and empirical issues that must be considered in further regional modelling efforts, issues which do not arise in static models. The application breaks new ground in interregional general equilibrium modelling of a transition economy and in disaggregating national economic data to the regional level.

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*Explaining EU-member states' positions towards Agenda 2000 and CAP reform* – **Stelios D. Katranidis and Alexandra Vakrou**

Member states' positions towards the reform of the common agricultural policy (CAP), as they were presented during the discussions for the Agenda 2000 proposals, form the basis for this study. The work is underpinned by a New Political Economy framework in exploring the creation of inter-state groups and coalitions at EU supranational level. The empirical part is based on cluster analysis. The results indicate that the significance of pressure group activities and the importance of collective action as proposed by the lobbying model (interest group approach) cannot satisfactorily explain the discrepancy between national positions. The political importance of this conclusion is that, even in the presence of measures capable of relieving the pressures exerted by the lobbying groups, the impact of these measures on the final outcome would be marginal. The results obtained are more easily explained by using some elements of the politician-voter approach. Most of the countries, which are supporters of a protectionist agricultural policy, have been faced with a great agricultural adjustment problem. Measures supported by the Structural Funds, particularly those aimed at the lagging countries and regions of the European periphery, could contribute significantly to the adjustment, subsequently leading to an alignment of the political priorities of national governments. The main consequence of this process may well be a further advancement in liberalizing the CAP and international trade of agricultural products in general.

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*Multiple job holding: off-farm employment, labour demand and labour supply of Irish farm households* – **Mary Keeney and Alan Matthews**

The supply of off-farm labour by farm families has received increased attention in recent years. Given the importance of off-farm income to Irish farm families, the attention is certainly justified. External employment by one or more family members is not only prevalent in Ireland but appears to be a permanent phenomenon. This study focuses on efforts to explain multiple job holding and its effect on the supply of agricultural labour. Contrary to assertions that it is essential to distinguish the firm from the household, it appears that such a distinction is not appropriate in the Irish context of predominantly family farming. Incomes earned elsewhere enable families to spread farm income risks, while capital tends to be directed into agriculture from external income sources. A number of factors hamper the adoption of off-farm employment as an adjustment strategy. The effects of these factors, some of which are market, and others institutionally, determined, may be accentuated for poorer farmers. For instance, the provision of subsidies serves to increase the off-farm reservation wage, thereby inhibiting participation in external labour markets. Also, when the labour market is depressed, some household members may not

be able to obtain work. In regions with few off-farm jobs and a high proportion of the labour force in agriculture, the 'discouraged worker effect' is shown to be important.

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*Structural changes in the Russian food market: an institutional analysis –*  
**Natalia Kireeva, Lyudmila Aleksandrova and Natalia Fisenko**

The object is to investigate the structure of the Russian food market. The basis of the analysis is the study of institutional changes in the agri-food sector and their influence in defining the economic behaviour of producers. For estimation of market and non-market institutional efficiency, the use of transaction cost economics is suggested. The issues analysed, with reference to the grain market, are formal rules, the non-formal limitations and characteristics of various constraints, alternative models of behaviour and new perceptions of privileges and costs.

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*Spatial integration during transition? The Russian wheat flour market, 1994 to 1996 –*  
**Michael Kopsidis and Guenter Peter**

According to the literature, agri-food markets in Russia are only poorly integrated. However, many important questions remain unanswered. In the case of spatial integration, different patterns in the relations between deficit and surplus regions have never been analysed for Russia. Our study closes this gap by analysing weekly wheat flour prices of seven Russian regional capitals, using cointegration analysis. We investigate whether integrated staple food markets have emerged during transition and which types of regions are part of a Russian domestic market and which are isolated from it. On the basis of our results, spatial integration of Russian wheat flour markets exists only to a very limited extent. Neither the two political and economic centres of Moscow and Saint Petersburg nor the poorly developed rural grain deficit regions at the southern border are integrated into a common Russian market. The only deficit regions which show a relatively high degree of domestic market integration are parts of the Russian hinterland, which earn large revenues from oil and gas and depend on domestic supplies owing to their location far away from any seaport.

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*Development trends in the Ukrainian agricultural market and its regulation –*  
**Sergiy M. Kvasha**

The transition to market relations in agriculture is one possible choice for Ukraine. Analysis of the openness level by countries shows that Ukraine is a country with high external trade activity, but also one which makes poor use of its internal economic potential. There are three commodity groups in the Agro-Industrial Complex (AIC) of Ukraine: (1) agricultural products produced by farms, (2) processed food and (3) industrial (manufactured) goods for agricultural use. The gross grain output in 1999 was about 24.3 million tons, which is the lowest since 1946. Only oilseeds output is still at the average level of the 1986–90 period. Main export agricultural products in 1998 were grain (20 per cent), oil seeds (13 per cent) and meat and meat products (10 per cent).

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*Private incentives to invest in the agricultural firm during transition: with illustrations from Sweden and Estonia –*  
**Carl Johan Lagerkvist**

In restructuring the agricultural sector in Central and Eastern Europe, the operation of asset markets and financial institutions, technology improvements and increased competitiveness are in focus. This paper analyses the incentives to invest, as reflected in the user cost of capital, in the agricultural firm in the presence of adjustment costs, information asymmetries and financial constraints, all typical characteristics of transition economies. It is shown that the user cost of capital is dependent on which financial regime is active in the firm. It is also found that, the more inefficient the technology used and the less efficient the monitoring which financial institutions can provide, the higher is the user cost of capital when used for new investments. In addition, if the farm operator lacks collateral, owing, for example, to poorly functioning land markets, essential cost reductions are forgone. An empirical illustration is presented for farms in Sweden and Estonia during 1986–97.

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*Modelling income effects on long-term developments of agricultural world markets: WATSIM simulation results –*  
**Martin von Lampe**

Income growth is one of the major driving forces for the growing food demand in developing countries. The recent Asian economic crisis has shown that changes in income prospects significantly affect agricultural markets. Given

the increasing importance of international trade due to increased import reliance of many developing countries, and gradually reduced protection in many industrialized regions, market projections are becoming more relevant. The proper modelling of income developments is therefore considered to be crucial for both projections and impact analyses on changed income prospects. Using the WATSIM model developed at Bonn University, the use of constant income elasticities of food demand is replaced by log-quadratic demand functions with respect to real per capita income. This poster presents a cross-section analysis across the model regions used to estimate the impact of rising incomes on income elasticities. It is argued that this systematic adjustment of model parameters to economic growth can significantly improve both projection results and sensitivity of trade models. Comparing the baseline projections for the cereal and meat markets with a high-income scenario for three Asian regions, the results suggest that economic prospects have significant impacts on world market price development. The principal trend of decreasing real world market prices for agricultural commodities should slow down considerably in the future.

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*Opportunity costs and enforcement costs of groundwater protection under different institutional conditions* – **Christian Lippert, Michael Köbler and Alois Heißenhuber**

Opportunity and enforcement costs of reducing the nitrate content of groundwater are estimated for the conditions prevailing in Southern Germany under four different assumptions concerning the necessary changes in farming practices. Starting from the assumption that the property rights related to groundwater attributes belong to farmers, two institutional arrangements are compared: (a) result related payments and (b) payments for defined actions (farming practices). Case (a) means that the state pays a bounty for the observance of a limiting nitrate content in soil, which entails costs of measuring, whereas case (b) is characterized by monitoring costs incurred when supervising the specific (nitrate-lowering) farming practices paid for. To make them comparable, 'monitoring costs' comprise not only the actual costs for monitoring measures but also the proportionate (lost) compensation payment for undetected contract breaches minus the proportionate fine from detected ones. They are calculated (minimized) using a small model including interdependent variables such as the probability of being caught in case of contract breach, the number of monitoring measures taken and the corresponding share of contract breaches. The results show that which of the two institutional arrangements is preferable from the budgetary point of view depends on the respective farming practice as well as on morality. Finally, some possible modifications of the model and some further characteristics of the two kinds of institutional arrangements are discussed.



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*Analysing financial health with artificial neural networks and fuzzy systems –*  
**H. Loebbe**

The assessment of financial health and the prediction of business failure are major problems of financial management. In this research an Artificial Neural Network (ANN) is used to analyse the financial health of farms in Germany. A multi-layer perceptron (MLP) is developed and applied to a data set of 10 012 farms in the years 1992 to 1997. The input variables originate from the financial statements. They can be subdivided into the areas of cash flow, risk, profitability and growth. This network classifies the farms in the two categories of healthy and unhealthy financial situations, respectively. Unfortunately, a classification criterion such as bankruptcy/non-bankruptcy exists only for a few German farms. An available event is 'financial distress'. But this event is subjective, not a fact and not directly available from the data analysis. Therefore the ANN is combined with fuzzy systems. In this research the event 'financial distress' is described by three ratios and these are merged by fuzzy logic. First, one ANN is developed for each of the three ratios. Then these three outputs are combined by fuzzy logic to form one event. The data sets of the output ratios are fuzzy sets. Thereby the ANN can 'learn' more accurately than traditional statistical instruments. The ANN is compared with a multiple discriminant analysis (MDA). The results show that the MLP performs better than the MDA.

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*Reshaping service provision in rural Russia: what role for private providers? –*  
**Daniela Lohlein and Peter Wehrheim**

Service provision in rural areas of the Russian Federation has been affected by two forces during the transition: agricultural reforms and decentralization of policy making. Large agricultural enterprises were the sole providers of rural services during the Soviet era. At the same time that these received the right to transfer their social assets to municipalities, the federal government shifted responsibility for service provision to the local level. The result in many regions has been a deterioration in both the quality and quantity of services. As some of the previously publicly provided goods are in fact merit and private goods, the potential role of the private sector is quite large. However, to this day there are few, if any, private service providers operating in rural Russia. Possible reasons for this are addressed. The discussion also covers the issue of why private providers should play a role in service

provision. The poster concludes by giving policy recommendations for remedying this situation.

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*The impact of farm credit programmes on technical efficiency: a case study for northern Germany* – **Jens-Peter Loy and Bernhard Brümmer**

The technical efficiency of dairy farms in Schleswig-Holstein included in the European Farm Credit Programme over the period 1987 to 1994 is analysed. The main objective of the programme is to increase the productivity of farms. Therefore participating farms should attain a higher level of technical efficiency, at least in the long run. However, several aspects of the implementation of the programme might obscure the realization of efficiency gains. This is the underlying hypothesis, which is tested by applying a stochastic frontier model. The approach is applied to explain differences in technical efficiency in terms of programme participation. Furthermore, the basic model is extended to allow for heteroscedasticity in the systematic error term. Statistical tests indicate the dominance of this model over alternative specifications. The results indicate a high average level of performance. However, participation in the programme appears to have resulted in a slight decrease of technical efficiency and the programme seems to have failed. This might stem from the institutional setting of the programme and the restrictions set by the Common Agricultural Policy. Both factors could explain the phenomenon that loans at a subsidized interest rate have not brought an increase in technical efficiency.

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*Market power of the German beer industry in export markets: an empirical study* – **Jens-Peter Loy and Thomas Glauben**

The existence and magnitude of market power of the German beer industry on selected international markets (France, United Kingdom, Canada, United States) is estimated and tested. Two theoretical approaches to model imperfect (monopolistic) competition on export markets are employed, the 'pricing to market' (PTM) model and the 'residual demand elasticity' (RDE) approach. Both models allow testing for the existence of market power, but its extent can only be quantified by the RDE approach. Monthly data of German beer exports over the period from April 1991 to May 1998 are used. The number of observations allows analysis of the time series properties of the data-generating processes. While significant market power of German beer exporters on the US and Canadian markets is indicated by the PTM model, the RDE specification indicates that there is market power of German exporters only on the French

market. Since the two approaches lead to different results, it is concluded that the underlying theoretical models have to be extended to match the observed situation. The explicit consideration of competitors' behaviour in international markets could enhance the understanding of pricing processes.

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*Supply constraints, export opportunities and agriculture in the Western Cape of South Africa* – **Scott McDonald and Cecilia Berning**

The benefits of trade and policy liberalization depend upon the ability of industries to respond to new opportunities. In the case of agriculture in the Western Cape, the availability of land imposes tight constraints on the ability of farming to respond to opportunities that may accompany trade and policy liberalization, and hence limit the benefits that may be realized. Recent years have seen a virtually complete liberalization of the agricultural policy environment in South Africa and this has led to a substantial increase in deciduous fruit and wine exports from the Western Cape. Results come from SAM-Leontief analyses, using a mixed multiplier model, of the impact of liberalization in the Western Cape when agriculture is supply-constrained. They indicate that increases in exports following liberalization should have benefited rural communities, especially farmworkers, but the benefits are supply-constrained. Relaxing the constraints, through raised productivity, would increase the benefits for agricultural and food processing industries. It was shown that higher levels of productivity in all agricultural sectors will greatly benefit farm households, and that there will be substantial benefits also to non-farm households, since limits on other activities consequent upon agricultural capacity constraints are relaxed.

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*Modelling land use dynamics with special respect to farm interactions in typical Bavarian landscapes* – **A. Meyer-Aurich, J. Kantelhardt, H. Schemm and A. Heißenhuber**

This study concentrates on the dynamics of land use in three typical Bavarian landscapes exhibiting different agricultural production conditions and farm structures. The selected regions (Feldkirchen, Haibach and Scheyern) represent favourable, marginal and medium production conditions. Owing to changes in prices and subsidies, a structural change is expected within the next decade. However, a high percentage of part-time farmers could have an influence on this process. The aim of the study is to analyse the driving and retarding forces of change in the selected regions with a modelling approach to predict future land use under different frame conditions with respect to the attitudes of the

land users. Therefore a farm-based modelling approach, with a land market, was chosen to reflect the individual behaviour of different farmers. The model shows that the output of future land use is highly dependent on the economic frame conditions and specific farmers' attitudes. For example, it can be shown that in Haibach milk productions systems would almost disappear if the farmers laid a claim for a higher labour income for their on-farm activities. In that case land use systems with less labour input, such as suckle cow systems, would displace dairying. It can also be shown that this attitude has a marginal impact in other regions, such as Feldkirchen.

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*Tapping the potential of African universities for national agricultural research*  
– **Heike Michelsen**

In order to improve the impact of agricultural research on development, it is important to evaluate the performance of those organizations conducting agricultural research. In the sub-Saharan African context, where national agricultural research systems (NARS) have been particularly criticized for lacking efficiency, effectiveness and sustainability, research performance evaluation is particularly important. This argument also applies to African universities more generally. Although considered part of the NARS, and having considerable human resources, they have often not contributed to development-oriented agricultural research. This paper describes the results from a comparative research performance evaluation study comparing universities and the public national agricultural research organizations (NAROs) in Benin, Burkina Faso, Côte d'Ivoire, Nigeria, Uganda and Zimbabwe. It shows that most university research is done independently of national priorities and plans and that, in many cases, universities have no specific budget for research. Universities are often not mandated to conduct research contributing to development. Thus they rarely systematically plan, coordinate, monitor and evaluate their work. The results also indicate that very limited collaboration exists between them and national research organizations. This is mainly due to the lack of specific policies to promote linkages of university research with other institutions. Contacts between universities and farmers, for example, are even less strong than those between NAROs and farmers. Finally, there is little information about research activities and resources available in nearly all research organizations, and there are no incentives to work jointly with other researchers. As an action research project, the study systematically provides several strategies to increase university contributions to national agricultural research.

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*Prospects for international trade and marketing in Spain's olive oil sector –*  
**Samir Mili and Manuel Rodriguez Zuñiga**

The purpose of this study is to forecast main trends and likely developments affecting the Spanish olive oil export business over the next decade. A Delphi survey was conducted in 1999 with a qualified panel of experts in the olive oil sector who, over two rounds of mailings, have contributed their judgments about future export perspectives. Issues discussed include the expected evolution of world olive oil supply and demand, the likely implications of the major impending changes in the institutional setting, the competitive conditions of the Spanish olive oil export industry and the key international marketing variables for the future. In general, experts seem to draw a future scenario with increases in world supply above those in demand, lower requirements for regulation and intervention, and a greater focus on quality and marketing-mix functions as key factors of competitiveness.

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*Modelling regional trade offs using a true position land use prognosis approach: economic output versus landscape aesthetics versus groundwater recharge –*  
**Detlev Möller, Bernd Weinmann, M. Kirschner and F. Kuhlmann**

Landscape functions are strongly connected to type and intensity of land use, forming a pattern which is a result of a complex network of economic, social, biotic and abiotic interactions. The main focus is to investigate the effects of variable field sizes on production costs and other regional key indicators, as well as looking at the trade-offs between economic, aesthetic and hydrological objectives. To investigate the potential allocation of land use systems, a GIS-based bioeconomic computer model of agricultural and forestry production named ProLand was employed. ProLand combines spatial explicit land use prognoses and the generation of key indicators representing a certain region considering a varying framework of land use decisions. The model uses the spatial distribution of achievable land rent as a decision criterion. Examining two example study areas, it was found that the spatial distribution of land use in the less favoured Aartal region of Germany shows a significant reaction to changing production cost due to a variation of field size from forestry to grassland systems. In the favoured region the effect is less significant; the arable farming area is quite stable. The less favoured region has advantages in providing groundwater and landscape aesthetics, while the favoured Amöneburg region has advantages in employing people and gaining income from agriculture and forestry.

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*Strategy for integrated development of agriculture and rural areas in CEEC countries: the necessity for a comprehensive approach* – **Tanja Möllmann and Kai Bauer**

The aim of the IDARA project (Strategy for Integrated Development of Agriculture and Rural Areas in CEE countries) is to identify key problems and discuss strategies for an integrated development of agriculture and rural areas in the first group of CEEC entering the EU. Such work must not restrict itself to a particular research field, however. At present, most countries lack integrated rural development policies and the supporting institutional structures. Most rural areas will undergo substantial agricultural adjustment and this will inevitably set labour free. Agricultural diversification can play a key role in stimulating local economic development. Finally, both the labour outflow and the income situation of households, central to a rural development strategy, will depend directly on agricultural production and price developments. In the light of these major interdependencies, the project has embraced a comprehensive approach to improve the understanding of three interdependent fields that have not yet been sufficiently addressed. These are the identification of adequate policy measures and institutional structures for the introduction of an integrated rural development policy in the CEEC, a thorough analysis of agricultural diversification patterns and their potential roles in rural development, and finally the development of a simulation model that allows a comprehensive estimation of the impact of different policy measures on agricultural production and income, on the EU budget and, in turn, its consequences for rural development strategies in the CEEC.

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*Investigation of the production type and the size of private farms in the conditions of Bulgarian agricultural reform* – **Nikolay Naydenov**

The results of a farm management investigation showed that 77 per cent of farmers prefer mixed farming with arable and livestock production, versus 20 per cent favouring arable specialization and 3 per cent opting for livestock farming. The findings can be explained by the trend towards diversification, as well as being an attempt to make better use of family labour. Most of the private farms are relatively small in size: 34.45 ha. on average for the mixed-type farms and 53.33 ha. for arable farms. However, the average size of a group of large rented farms is 391 ha. As private farmers own a relatively small amount of land (7 ha. on average), the proportion of rented land is very large. The preferred size of a sole private farm is 91.5 ha. on average, that is, two to three times larger than at present. The results obtained can help in designing the process of harmonization of farm businesses according to EU policy, as well as in restructuring and further development of the service units in agriculture.

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*Contribution to climate stability via afforestation of marginal agricultural and waste lands in the Ukraine – Maria Nijnik*

Afforestation of marginal agricultural lands and reforestation of previously wooded areas in the Ukraine are an attractive economic alternative to reducing carbon emissions. The paper explores the potential of afforestation of marginal agricultural waste, and unwooded lands within the State Forest Fund as an option for meeting the Kyoto commitments. The ultimate objective is to assess the Ukraine's potential to contribute to climate stability through the afforestation programme, to estimate costs of practical implementation of such a measure and to be able to compare the costs of various emission reduction options. The first step, a storage option presented in the paper, is to examine the impact of trees being grown for a period of 40 years. The option, in some cases, showed very poor returns because of the discounted opportunity costs of maintaining forests on agricultural land. The results also showed that it is important to define what use to make of trees after the 40-year time period. Considering the scarcity of oil in the Ukraine, the unreasonably high costs of coal extraction and all the problems connected with nuclear power plants, the energy option (wood burning to generate electricity) is likely to be the most attractive.

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*Trends in the development of agriculture in Yugoslavia – Nebojsa Novkovic, Natalija Bogdanov, Slobodan Ceranic and Vesna Rodic*

Agriculture plays an important role in the Yugoslav economy since the country has substantial resources for agricultural development at its disposal. However, their qualitative attributes are known to be unfavourable, lagging behind the highly developed countries. Since the beginning of the 1990s, the production and economic indicators of Yugoslav agriculture have consistently been unfavourable. Production variability was high; labour productivity was poor; inputs were minimized; processing was monopolistic compared with farming; investment in agriculture was low; transition processes were slow; and the agricultural sector was used as a means of solving social problems, against its own interests. The reasons were partly outside the control of farm policy. There was war in the area and the sanctions imposed by the UN limited and hindered external trade; the disintegration of former Yugoslavia caused further trade problems; and the economic collapse decreased the purchasing power and the living standard of the population. But the lesson for the future is that there were other underlying problems which will have to be addressed. The state had shifted the

social and economic aspects of the long-standing crisis to agriculture, maintaining social peace by insisting on low food prices. The disparity in agricultural product and intermediate goods prices had been at the expense of agriculture and there had been very inefficient distribution of agricultural products through 'grey' channels.

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***Impacts of agrienviromental programmes in Germany – Bernhard Osterburg and Hiltrud Nieberg***

Agrienviromental schemes according to Regulation (EEC) 2078/92 were introduced with the 1992 reform of the European Union agricultural policy. The regional implementation of the regulation resulted in a diversity of measures, conditions and hectare payments in the EU member states. Because of the regional variations in Germany, an experimental case study is carried out in order to assess the impacts of this new policy on land use and environment, farm structures, factor markets, competition and farm incomes. Since 1996, about 30 per cent of Germany's agricultural area is managed under Regulation (EEC) 2078/92 measures. Very few EU member states have higher rates of participation. An analysis of regional and farm accounting data came to the following conclusions. Flat rate payments for agrienviromental measures, calculated on the basis of average production conditions, lead to regional concentration of participation in areas with lower land use intensity. Thus only limited environmental benefits can be expected. Farms participating in agrienviromental schemes reduced land use intensity, starting from a comparatively lower level. For example, they reduced fertilizer input and increased permanent grassland. Positive income effects could be shown, as well as a high competitiveness of programme participants in land and milk quota markets.

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***Moral hazard in agrienviromental policy: risk aversion, monitoring costs and standard fixed payment contracts – Adam Ozanne and Tim Hogan***

Principal-agent theory is used to analyse economic inefficiencies arising from moral hazard in agrienviromental schemes employing compensation payments to farmers to secure environmental public goods. The model represents advances on the existing literature in three main respects; first, agrienviromental policy is modelled as a social welfare maximization problem which recognizes both the importance of the social cost to taxpayers of implementing such public initiatives and the potential trade-off between increased environmental



benefit and increased cost of monitoring compliance; second, farmer risk aversion is allowed for; and third, since it is an extension of an earlier adverse selection model, the theoretical framework developed covers both types of information asymmetry in agrienvironmental policy. It is shown that, if monitoring costs are negligible or fixed, or farmers are highly risk-averse, the moral hazard problem can be eliminated. However, if monitoring costs depend on monitoring effort and the degree of risk aversion is low, only a second-best solution can be obtained. Numerical simulations based on plausible representations of production technology, farmers' risk preferences and monitoring costs are used to further illustrate the results.

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*Ex-Soviet cropland expansion revisited: can Kazakh farms survive liberalization? Findings of a study on whole-farm risk – Martin Petrick*

Against the background of increased risks due to liberalized markets, hard budget constraints and dwindling government protection of farms in north-western Kazakhstan, the following questions are raised. How do these risks affect the performance of agricultural producers? Can the existing large-scale farms survive in spite of unfavourable natural conditions? To deal with these issues, use is made of the results of a quadratic risk programming model that depicts a typical farm in the Aktyubinsk region. Risk is considered as annual gross margin variation for the period 1993–8. The model solutions are (a) the ES frontier of a typical farm, and (b) a selection of efficient production programmes that reflect different return–risk combinations. Though the farm is profitable, the model exhibits a high profit variation which, in the presence of hard budget constraints, may well jeopardize its existence. Risk could be reduced by abandoning grain and shifting to lucerne and/or grassland hay production. To focus more on the cultivation of extensive fodder plants and the accompanying livestock is therefore regarded as a strategy to reduce risk and secure farm survival. The overall risk exposition of agriculture in north-western Kazakhstan is basically a result of the political decisions made during the Soviet era, which are briefly outlined. Nowadays, production structures inevitably have to adapt to natural and economic constraints. In most cases, a redundant labour force will then pose a major problem for government policy.

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*Impact of exchange rate policy on agriculture and food industry in CEECs –*  
**Witold-Roger Pogonietz**

As a consequence of the breakdown of the socialist system at the beginning of the 1990s, the protection of agriculture and the food industry diminished. At the same time, when the economies 'opened', exchange rate policy grew in importance. In view of the characteristics of the agri-food sector and the situation in Central and Eastern European countries (CEECs) the question arose whether exchange rate policy is relevant for the sector. This question was considered in two studies. The objective of the first was to test the impact of exchange rate policy on agri-food trade. On the basis of data for five CEECs for the period 1992–96, a cross-country time-series OLS estimation was made. There was no significant influence of exchange rate policy on import and export in volume terms, but exchange rate policy had some impact on agri-food exports in value terms. In the second study, the effects of Russia's crisis in summer 1998 on the agri-food sector were analysed. Owing to a drastic devaluation of the rouble, demand for foreign foodstuff by Russian households dropped while they shifted to staple food. The change of consumption patterns should have provided the Russian food industry with a chance to expand production, though in fact it declined. Further analysis of this paradox is needed.

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*Farmers' clubs for preserving wildlife and landscape: the importance of institutional environment –*  
**Nico B.P. Polman and Louis H.G. Slangen**

This paper analyses the influence of institutional environment on farmers organizing themselves with the aim of preserving wildlife and landscape. The organizations formed can be characterized as clubs producing activities and services for the members. The relevant theoretical background is club theory and the new institutional economics. The approach differs from the traditional approaches to clubs in the sense that it is assumed that any comparative advantage of a club is caused by its own 'internal institutions' or 'rules'. The (external) institutional environment of a club, together with other economic factors (for example, technology, rural amenities in an area, income and preferences), determines the development of clubs in the agricultural sector. A survey was conducted among farmers' clubs formed for the preservation of wildlife and landscape in The Netherlands. The survey is one of the first and most intensive to have been carried out among this kind of organization. One conclusion is that internal rules are important to clubs. The opportunities for shaping their internal organization in the way farmers wish and deciding on the activities they want to undertake are fundamental.

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*Farm modelling for regional policy analysis in Costa Rica* – **P.C. Roebeling, H.G.P. Jansen, R.A. Schipper and F. Sáenz**

Agricultural policy analysis can be performed at the regional level using agricultural sector models that maximize welfare, or at the farm level with models for representative farm types. While the former approach fails to model farm characteristics and behaviour, any aggregation of farm types to the regional level ignores their interaction in product and factor markets. Using data for Costa Rica, a regional equilibrium modelling approach is presented to incorporate farm types as well as product market equilibrium conditions. Compared with simple aggregation of partial results obtained with exogenous output prices, results of the regional model with endogenous product prices shows less specialization in production and lower incomes, profits and labour use. Therefore results obtained with a regional model including endogenous prices better reflect reality. Different policy scenarios are analysed, including a 20 per cent decrease in transaction costs, a 20 per cent increase in credit availability and a 40 per cent tax on chemical input prices. The former two lead to increased cash crop production and rising agricultural income, while taxing agrochemicals leads to less intensive production.

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*Technological innovation in agriculture: the contribution of agricultural input industries* – **Johannes Roseboom**

This paper proposes a new analytical framework to measure and analyse the spill-ins of technology into primary agriculture and in particular those through purchased inputs. The paper first sketches a structural transformation path for primary agriculture in terms of its integration with the rest of the economy. In its transition from a low-income to a high-income economy, a country's primary agriculture moves from weak to strong forward and backward linkages. The intensity of input use by primary agriculture in Colombia, Brazil and The Netherlands roughly matches that of a low-, middle- and high-income country. However, their input use also differs in terms of composition, origin (local/imported) and the technology embodied in the inputs. As a result, major differences were found in the amount and composition of acquired R&D through purchased inputs among the three countries. This reflects different levels and forms of technological interdependency between primary agriculture and the rest of the (world) economy. Colombia leans heavily on imported inputs and the (private) technology embodied in them. Its own capacity to

produce high-tech agricultural inputs is very limited. Brazil's position in this regard is considerably better, although still notably weaker than that of The Netherlands. In addition, the Dutch agricultural sector imports substantial amounts of high-tech agricultural inputs. The technology intensity estimates also shed new light on the relative importance of private and public sources of technological innovation: agriculture in Colombia (and not The Netherlands) depends most heavily on privately generated technology.

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*Rural households in Romania: between restructuring and resistance to change*  
– **Marioara Rusu and Violeta Florian**

Structural changes at the microeconomic and macroeconomic level have drawn the attention of the Romanian scientific community to the rural household. There is a contrast, from the economic and social points of view, between the existence of an autarchic rural society and the metamorphosis of this rural world into a market economy. Transformation at the rather conservative rural household level, with many associated behavioural changes, takes place with difficulty as a response to external stimuli emerges. The problems of the transition period are so important that understanding rural processes is a key element in framing restructuring strategies.

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*Valuing agrarian landscape: an application of conjoint analysis to sensitive mountain areas in south-eastern Spain* – **S. Sayadi, M.C. Gonzalez Roa and J. Calatrava Requena**

Among the externalities produced by agriculture, one must consider its contribution to the shaping of the landscape, an aesthetic externality value of agrosystems. Recognizing and appraising this contribution is becoming more and more important. In this study, conjoint analysis is applied to the appraisal of the landscapes of Alpujarras (Granada, Spain) in order to estimate the level of preference of visitors for agrarian components, as opposed to other landscape features, coexisting in the area. Three main landscape components have been considered: type of vegetation, density of rural building and level of incline. Results show that the nature of the vegetation is the most relevant attribute in forming preferences for landscapes. Within this feature, the agrarian component is highly valued aesthetically, though irrigated lands rank above dry farming.

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*Crop residue management for erosion control: an optimal control approach –*  
**Guenther Schamel and Daniel Mueller**

An optimal control model of soil conservation is developed to analyse the optimal private and social path for erosion treatment over an infinite time horizon. To offset soil losses, crop residue management is used as an erosion control strategy and incorporated into the dynamic optimization model. Choice variables for the farmer are variable input use and the crop residue cover left on the soil surface to counteract topsoil loss. The universal soil loss equation (USLE) as an empirical measurement of water-induced soil losses is employed to model the change in the topsoil stock and to provide the possibility of an empirical application for different localities and conditions. The corresponding Hamiltonian is formulated to analyse the optimal private path of soil conservation. Integrating off-site costs leads to the socially optimal path of soil erosion. Including off-site damage increases the value of the soil resource (the shadow price) by the amount of damage per unit, thus making conservation efforts more attractive for farmers and inducing a higher surface residue cover. Because of the close correlation of on- and off-site damage, a mitigation of off-site effects resulting in a reduction of soil erosion can potentially yield on-farm benefits in the form of increased future production capacity. However, more active and widespread public intervention to counteract market failure and market imperfections is best justified by the existence of the adverse environmental impact resulting from the non-point source pollution of soil erosion.

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*Macroeconomic shocks and trade responsiveness in Argentina: a 'VAR' analysis –*  
**Michael Schmitz and Michaela Kuhl**

A vector autoregressive system including macroeconomic and trade variables for Argentina is estimated for the period 1976 to 1997 and analysed using impulse response functions and variance decomposition methods. The analysis shows marked reactions of the path of imports and exports to shocks in Argentine macroeconomic variables. Important differences exist in the reaction of trade flows to certain macroeconomic shocks when they are expressed in real pesos or in US dollars. While in both cases exports and imports increase in reaction to a monetary shock, imports in dollars do not react significantly to an inflationary shock, so no large quantitative changes can be expected to follow from the shock. While exports in real pesos increase after a real devaluation shock, the reaction in dollars also is not significant. For imports, a positive short-term reaction is changed to a negative one if imports are expressed in dollars instead of (real) pesos. Over time, imports decrease enough to more than compensate for the rise in their prices expressed in domestic currency.

The analysis shows less pronounced reactions of trade flows in dollars than in pesos. However, for profitability of exports and opportunity costs of import expenditures, the reactions in domestic currency might be better indicators. For investment decisions in the tradeables sectors, the relatively high influence of the real exchange rate, money growth and inflation shocks, which affect Argentina over the relevant time horizon, add to the uncertainty about general developments in world markets and in important partner countries.

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*Comparison of the development of land markets in European transition countries* – **Eberhard Schulze and Peter Tillack**

The poster first discusses institutional requirements for the development of land and land lease markets and the impact of the economic environment. A further development of institutions must include a continuation of the privatization of land and the realization of land use rights. The ban on purchases of land by legal entities should be lifted in those countries where it currently applies. In addition, it would be appropriate to lift all restrictions on the sale and lease of land to non-nationals, provided they can present a convincing agricultural business plan. The agricultural sector in the transition countries would thus acquire foreign capital and expertise, which would ultimately benefit the entire economy. The second part aims to investigate what impact changes in the institutional and economic environments since the beginning of the transformation process have had. The recorded sales and lease prices for land are available for the various countries and are linked to performance criteria (agricultural GDP/ha.) and other income indicators. For nine of the ten EU associate countries, a correlation exists between sales prices for land and wheat prices, agricultural gross domestic product per hectare and monthly earnings per employee.

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*Risk management on Hungarian farms* – **Diána Sidlovits, András Bálint, Csaba Kovács and Katalin Szép**

To better understand the nature of agricultural risk, research was conducted into the behaviour of agricultural producers. We demonstrate the basic concept of risk perception and two potential types of risk management strategies. Farms in the transition period are characteristically undersized and insolvent; they are also exposed to financial leverage effects. To counter the relatively

low income level and inflexible cost structure of agriculture, the launch of marketing initiatives and operations through price policies are possibly the most effective tools for limiting risk. The Commodity Exchange in Budapest enables producers to contract the sale of their output and avoid price fluctuations and counterpart risk with hedge transactions. Farmers participate very little on account of their small scale and because many of them do not even know of the opportunities provided by the Exchange. More marketing channels make farmers' lives easier. Direct marketing is an option which allows farmers to reduce marketing risks. The ability to adapt innovations is generally improved by close contact and direct exchange of information. Hazards are reduced by quick feedback.

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*A framework for analysing institutions of sustainable agriculture and rural areas* – **Louis H.G. Slangen and Nico B.P. Polman**

Institutions are very important to the economic, environmental and social dimensions of sustainable agriculture and rural areas (SARA). This paper develops a conceptual framework for analysing the state of institutions and for designing new or better ones for realizing SARA. A distinction is made between formal and informal rules. The framework takes determinants or proxy variables into account on five different levels that may account for good performance in realizing SARA. The first level looks at government performance, the second at the agricultural sector and rural areas, the third at the formal rules of the institutional environment regarding SARA, and the fourth level at the informal rules of the institutional environment and of competencies (there is overlap between them and they can be taken together). The final level focuses on institutional arrangements. The question of what kind of institutional arrangements and design principles would be most suitable for realizing SARA is answered in relation to the level of competencies and the institutional environment performance.

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*New approaches for the integration of consumer needs in the product innovation process* – **Bernhard Stockmeyer**

Needs and requirements of today's consumers for food products are subject to continuous change. Food processors must be able to translate such changing requirements into new or improved products, otherwise their existence is at risk. Nevertheless, many new products do not meet these requirements and fail in the market place. In order to avoid the failure of new products, one key

factor for new product development (NPD) is to be able to gather and to understand consumer requirements and to translate them into new food products. Traditionally, final consumers are not directly involved in NPD until market testing of new products. On the other hand, findings from various studies suggest that close interaction with consumers can be helpful in defining and developing new products and leads to more success in innovation. In the research project, approaches for involvement of customers in NPD have been developed. On the basis of findings from other industrial areas, two successful approaches for interaction have been analysed and adopted for the food industry. These are the lead user approach and quality function deployment. Both concepts have been tested in cooperation with food processors and proved to be a successful means for NPD. Development results have been improved and costs and time reduced.

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*Optimal identification and composition of investment projects in Russian agriculture* – **Nikolai M. Svetlov**

The aim of the presentation is to discuss the agricultural application of a method that helps to identify and prepare investment projects. The general project cycle concentrates on project selection. In the case of Russian agriculture, most projects are usually rejected. Hence project identification and preparation processes need to be improved. To describe the problem of project composition, a formalization is suggested based on the following problem statement: given (a) the quantities of resources required for each goal, (b) opportunities to share resources between goals and to upgrade with superior resources, (c) effects of goals and costs of resources, (d) available financing and (e) incompatible goals, find the set of goals that maximizes the project's worth. The problem is an integer programming problem. A well-known ARIS project implemented in Russia is used for illustrative purposes. The project is spread over five territories and consists of four base components: marketing, consulting, seed processing and training, plus one supplementary component, the development of informational infrastructure. Different funding opportunities are considered. Even under complete financing, the best project worth is achieved if one rejects training, consulting and informational components in the South Urals, and seed processing plants in the northwest and Siberia.

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*Economic welfare effects of Romanian agricultural accession to the European Union* – **Kenneth J. Thomson and Maria C. Firici**

The paper estimates the economic effects (costs and benefits) on Romanian farmers, food consumers and taxpayers which would occur as a result of the adoption of the EU's Common Agricultural Policy and Agenda 2000 proposals, in the assumed 'accession' year 2006. The results are based on the construction and use of a conceptually simple model (multi-market, partial-equilibrium, comparative-static), which covers 15 major Romanian agricultural products (65.2 per cent of total output in 1997). Assumptions are embodied within two scenarios for the year 2006: (a) non-accession and (b) accession, in particular trends after the base year of 1997, and longer-term supply and demand elasticities. Four model simulations (calculations for sets of accession assumptions) are reported. For each of these the effects of EU agricultural accession are estimated by comparing the market situation for each product, the public expenditure situation and the differences in the real income (economic welfare) positions of Romanian producers, consumers and taxpayers. Taken together, 'standard' economic and policy assumptions result in a small net welfare gain of about 0.5 per cent in 1997 Romanian GDP. This falls to about 0.4 per cent in the year 2006, given economic growth in the intervening period. Farm producers suffer net losses, and consumers are net gainers, especially in terms of livestock products. The budgetary implications (taxpayer effects) of agricultural accession under the standard assumptions are almost budget-neutral, given the current EU 15 budget pattern.

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*Profitability in Hungarian private agriculture* – **József Tóth and Masahiko Gemma**

The study is a review of the performance of private farms in Hungary. Examination of the private sector could produce useful pointers for the future development of agricultural policy. In Hungary, many in the rural population own very small plots of agricultural land, typically of 0.1 to 2.0 ha. The analysis was carried out using survey data from 1580 agricultural producers. The determining factors of profitability in farming activities were identified using regression analysis. The study found that land area as well as quality, education, investment in machinery and buildings, certain factor endowments in vegetable and fruit production, and the share of own farm income in total income are the critical factors for the determination of profitability in individual farming. Policy should concentrate much more on the land issue than on that of income because that would provide more activity options without infringing upon the interests of certain groups of farmers.

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*Agrarian production organization under transition to a market economy in Bulgaria* – **Christian Tritten and Alexander Sarris**

The paper has two objectives. The first is to show that the Eswaran–Kotwal (1996) model provides an adequate description of the behaviour of agricultural producers in Bulgaria. In brief, the model shows that, in the presence of credit constraints, production behaviour is conditioned by asset holdings (in land and machinery), family size and availability of credit. Subsequently, this model is used to identify which markets work competitively and which do not. The observed behaviour of producers in Bulgaria is compatible with a version of the model where the land market is imperfect and the machinery market is competitive.

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*Agricultural policy in Ukraine and Poland: towards free agricultural trade in eastern and central Europe* – **Olga V. Trofimtseva**

International marketing is one of the key elements for agricultural business. Agricultural policy and state regulation in agriculture need to take account of the potential feasibility of increasing trade relations between countries. The Ukraine and Poland, as adjacent countries, have comparative advantages for developing profitable trade relations in food products. Agricultural policy should provide some measure of protection for domestic producers but at the same time it should not discriminate heavily against either importing or exporting. The Ukraine could avoid many mistakes by learning from Polish experience. For instance, the practice of preferential credits for agriculture has resulted in a waste of funds, misallocation of resources and significant losses in efficiency.

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*Technical efficiency and competitiveness of Czech production in late transition* – **Jarmila Ulmanová**

For the central and east European countries which applied trade and price liberalizations in the early 1990s, an important policy question is the impact of the newly established markets on the efficiency and competitiveness of agricultural production. The analysis presented in this poster seeks to address these

issues in the case of the Czech Republic by (a) evaluating the level of technical and economic efficiency among agricultural enterprises, using parametric stochastic frontier production methods on panel data from the farm accounting data network operated by the Research Institute of Agricultural Economics, using a policy analysis matrix, and (b) providing a framework for measuring farm-level competitiveness. The poster compares the results of both techniques and explores the relationships between technical efficiency and indicators for competitiveness. Finally, the determinants of technical inefficiency and competitiveness of Czech agricultural enterprises are assessed.

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*Factors influencing farmers' participation in agrienvironmental measures: a Belgian case study – I. Vanslebrouck, G. Van Huylenbroeck and G. Verbeke*

The role of agriculture in providing environmental quality, or the farmer's role as a guardian of the countryside, is now generally acknowledged. The challenge is, however, to develop measures that reward farmers for the services they provide while meeting the expectations of society. This research explores farmers' willingness to accept (WTA) changes in their agricultural methods in order to preserve the agricultural landscape. The contingent valuation approach is used as the context in which to explore farmers' hypothetical decision making. In a questionnaire, two countryside stewardship policies have been proposed to farmers, who are asked to state their WTA for every single measure. A conceptual model, taking into account both decision subject and decision maker characteristics, is formulated to deal with the different factors influencing farmers' contingent behaviour. Empirical testing is based on the specification and estimation of a probit model. From the results, conclusions for agricultural policy are drawn concerning farmers' decision making in relation to countryside stewardship policies.

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*The effects of transaction costs on production decisions and land use patterns: evidence from large-scale agriculture in Spain – Consuelo Varela-Ortega*

Diversity in cropping choice and production patterns has been explained by the fact that market failures and transaction costs play a major role in shaping agricultural production decisions. The objective of this paper is to analyse the causes of the different patterns of production decisions that farmers follow when transaction costs are considered (defined as an asymmetric access to input and product markets) in a region of large-scale commercial agriculture in

Spain. To analyse the farmers' behaviour, a mathematical programming model has been built incorporating transaction costs that characterize different forms of institutional arrangements (direct and indirect management and farming operations). Results of the model show that the type of institutional arrangement under which a farmer operates his farm is a determinant factor for explaining cropping choice, land use and farm income in different policy scenarios. Cropping patterns remain stable across farm sizes, and virtually no economies of scale are found. Institutional arrangements of lower transaction costs are perceived by the farmers as a surer environment and a more efficient risk shelter. Thus policy programmes can be expected to be more efficiently implemented when farmers engage in contractual agreements that will substantially reduce transaction costs.

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*Integrating irrigation modernization programmes and water pricing policies: empirical evidence and water policy implications* – **Consuelo Varela-Ortega, María Blanco and José M. Sumpsi**

As water becomes increasingly scarce worldwide, a preoccupation of public authorities is the enacting and implementation of water policies aimed at securing conservation and more efficient water management. An alternative to increasing costs and environmental damage of new public-funded irrigation networks will be to invest in the rehabilitation of existing systems that will enhance water conveyance efficiency. In Spain, irrigation agriculture is the largest consumer of water; hence the need to increase efficiency of allocation for irrigation is crucial for water policies. The objective is to investigate the combined effects of irrigation modernization policies and water pricing on conservation, farmer incomes and the government budget. An empirical dynamic model simulating farmers' behaviour has been developed and applied to different water districts in Spain. Results show that farmers' decisions are determined by technical, institutional and economic parameters, while the payments from irrigators to the water users' associations are insufficient to ensure network maintenance. In the absence of subsidies, irrigators will not invest in the modernization of their systems, even when water charges are high. No water conservation improvements are foreseen in the absence of price incentives, thus policies will attain their objectives only if subsidies for rehabilitation are granted in conjunction with the establishment of water prices. However, as the effects of these policies may vary across districts, supply-side and demand-side policies have to be carefully designed for attaining conservation objectives.

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*The Flemish greenhouse industry following increased pressure from competition and the environment* – **Poi Verwilt, Erik Mathijs and Bart Minten**

The poster outlines the preliminary results of an attempt to formulate policy measures to enhance sustainable development in the Flemish greenhouse industry. The poster shows, first, how the industry could develop in the coming years with respect to firm size and location within the conditions of the market and the environment, when additional policy measures are absent. It is a reference scenario based on historical trends. The poster outlines the optimal structure (firm size and location) that is economically and ecologically optimal, calculated using programming techniques. Finally, the policy measures that best realize conditions for sustainable development of the sector are derived by comparing 'reference' and 'optimal' structures.

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*Modelling agricultural policy impacts for EU accession candidates from central and eastern Europe* – **Gerald Weber**

The partial equilibrium 'Central and Eastern European Countries Agricultural Simulation Model' (CEEC-ASIM) is designed for agricultural policy analysis. It fulfils all theoretical conditions implied by the assumptions that producers maximize profits using a multi-input–multi-output technology and consumers maximize utility. The supply and demand systems are derived from flexible functional forms of the producer profit and consumer expenditure functions. CEEC-ASIM depicts a wide range of agricultural policy instruments. One of the issues analysed with the model is EU accession. It is assumed that the Common Agricultural Policy's market regulations, as reformed by Agenda 2000, will be applied in ten Central and Eastern European countries (CEEC-10). This scenario is compared with a scenario of unchanged national agricultural policies as observed for 1997. The main results for the aggregate of the CEEC-10 with respect to the welfare effects are the following (all in prices of 1999). First, higher protection by the CAP raises revenues from agricultural activity (measured as net revenue minus labour costs) by Euro6.9 billion. The main sources for the producer welfare gains are area payments and the beef and milk premiums. Second, low value shares of agricultural products in retail prices and the further reorientation of the CAP from market price towards direct income support result in very small welfare impacts on the consumer side (measured as the equivalent variation). The financial burden for the EU budget in the form of area payments, animal premiums and export subsidies is estimated at Euro7.5 billion.

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*Interregional and/or international integration of Russia's agri-food sector? An analysis based on two computable general equilibrium models* – **Peter Wehrheim and Arnim Kuhn**

At present, various integration strategies for Russia's agri-food sector are matters of intensive domestic debate. First, Russia is applying for WTO membership. The expected effects of an international integration strategy on the sector are controversial, especially within Russia. Second, Vladimir Putin's reforms to counteract decentralization of policy making have again stimulated the debate on interregional integration strategies. Two stylized approaches towards economy-wide modelling are used to show the impact of various trade policies on the agri-food sector. The first model is a single-country CGE model; its strength is a fairly high disaggregation of the agri-food sector. It reveals that anti-liberal integration strategies would, overall, be detrimental for the Russian economy. In contrast, the second CGE model is designed to capture the effects of improved interregional integration of agri-food markets. In a stylized way, the influence of trade barriers is addressed, which are composed of transport and transaction costs plus external tariffs. The second model suggests that the decrease of transaction costs is superior in achieving internal and external trade integration and economic growth in contrast to lowered transport tariffs. The reason is that lower transaction costs set productive resources free. Their beneficial impact for the economy is comparable to an equivalent lowering of external tariffs. We conclude that, in order to fully materialize the benefits of interregional and international integration, not only a reduction of custom tariffs is necessary, but also the elimination of non-tariff barriers and institutional deficiencies.

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*Demystifying women's participation: an analysis in rural Chad* – **Katinka Weinberger**

Participation is understood as taking part in a process, which strengthens abilities and possibilities of poor people. It is considered as crucial for the success of development projects. But studies indicate that women's participation seems to be hampered by several factors. This research analyses the determinants of women's participation in local development organizations using data collected in a region in the south of Chad. A major result of the analysis is the identification of a 'middle class effect' of participation. Additionally it can be shown that an existing social network within communities is a precondition for participation. In terms of costs and benefits that arise from participation, it can be shown that a complex process is involved. Many factors, such as incomplete information, cultural, ethnic and economic restrictions, influence the decision-making process of women and costs and benefits vary according to specific community, group and household as well as individual

characteristics. Factors that influence the creation of social capital are considered very important benefits of group membership. This suggests that interpersonal relations matter a great deal when physical and human capital is missing. Low transaction costs are important for members to join the group. The question remains, though, of how to reach the poorest and most disadvantaged of society, while at the same time not making transaction costs too high for wealthier participants. Certainly, no standard recipe can be applied when supporting rural women's groups. Instead, it is important to listen carefully when women talk about their needs and opportunities.

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*Farm and off-farm income linkages at household level: the case of the Tigray region, northern Ethiopia – Tassew Woldehanna*

A farm household model is developed that explicitly includes capital market imperfections so that farm households face binding liquidity (and borrowing) constraints. The model predicts that farm and off-farm income can be complementary, which is quite contrary to the predictions of a standard farm household model without liquidity constraints. Econometric models are developed and estimated to test the new formulation on Tigryan farm households (northern Ethiopia). The results reveal that the supply of labour for off-farm work (and hence off-farm income) is largely determined by farm characteristics, market wage rates and household composition. Farm households have an upward-sloping off-farm labour supply curve. External employment is complementary to farming activities in that off-farm income increases productivity and helps farmers to release liquidity constraints in the financing of agriculture. Farmers involved in better paying supplementary activities such as masonry and carpentry are in a better position to purchase farm capital inputs and hire farm labour. Therefore government policies simultaneously to increase agricultural productivity and provide alternative income-earning opportunities for the rural areas of the Tigray region seem complementary.

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*Biodiversity and drinking water quality: an analysis of values and determinants of willingness to pay – Tobias C. Wronka*

The danger posed to ecosystem services including biodiversity, drinking water quality and landscape aesthetics is that their scarcity is not reflected in prices and therefore not taken account of by the individual land user. This often

results in a limited supply and an overconsumption of those services due to their public good features. The 'pricing' of services is seen as a possible solution to this market failure. In this study, the economic value of biodiversity and drinking water quality has been measured using a modern contingent valuation design. A multiple bound choice format was used and intensive measurement of environmental attitudes was done. Annual willingness to pay for biodiversity was Euro68 per household and Euro72 for safe drinking water quality as regards nitrogen pollution. These results have important policy implications for the development of sustainable agriculture in Europe: if these values of ecosystem services are not taken into consideration, the consequence may be an inefficient allocation of resources. Two regression models show that 34.4 per cent of the variation in WTP for biodiversity and 24.4 per cent for drinking water quality can be explained by the dependent variables. The newly constructed index of environmental attitude is significant in both models and the most important dependent variable after the income of the household. Most of the explanation variables are plausible and significant in both models. The contingent valuation method, therefore, seems to be able to place values on complex environmental goods. However, this study also shows that additional research is needed in the construction of scientific, sophisticated indicators of biodiversity and the refinement of the scenario for drinking water quality.

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## NORTH AMERICA

*The WTO and Indian agriculture* – **David G. Abler, Latika Bharadwaj and Vasant A. Sukhatme**

Developing countries, among them India, are expected to play an increasingly proactive role in future world trade negotiations. This paper provides an overview of agricultural trade issues of probable importance to India in future WTO negotiations. We review recent policies in India toward agricultural trade, procurement, the public distribution system (PDS), stockholding and agricultural input subsidies. India's economic reforms since 1991 have reduced government intervention in the economy and promoted India's integration in world markets. The reforms in the trade and foreign exchange regime have eliminated a great deal of the bias against agricultural trade. Nonetheless, many elements of India's agricultural trade continue to be inward looking and high tariff and non-tariff barriers remain on many agricultural imports. Many agricultural products also continue to face numerous export restrictions. The paper then discusses opportunities and drawbacks from India's perspective of more liberalized agricultural trade. Further liberalization in developed country market access and domestic support could potentially necessitate major changes in Indian agricultural policy. There are several elements to India's food security policies, among them the system of domestic grain procurement and



public distribution, agricultural input subsidies on fertilizer, water and electricity, and the need to maintain domestic agricultural output price stability. A future trade agreement that opened up agricultural markets in the developed countries could reduce world price instability and obviate the need for India to maintain policies to insulate domestic prices from the fluctuations in world prices. Evidence indicates that exports of rice, wheat, cotton, and even dairy products could increase rapidly as a consequence of a more liberal world trading environment.

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*Technology adoption and agricultural sustainability: implications for groundwater conservation – Talah S. Arabiyat and Eduardo Segarra*

The state of groundwater utilization in the Texas High Plains (THP) is a reflection of the combined result of current economic, social and political factors. The main reason why groundwater resources in the THP are being used at a rate higher than the natural rate of recharge is that the revenues stemming from their current use are greater than the associated cost of extraction. This study evaluates the trade-off between technology adoption (advanced irrigation technologies and anticipated biotechnological advances) and the sustainability of agricultural activities in the THP. Specifically, a county-wide dynamic optimization model is used to determine optimal groundwater use levels and cropping patterns, and evaluate the impacts of irrigation technology and biotechnology adoption on groundwater use under four scenarios. The results indicate that the current crop acreage allocation and levels of advanced irrigation technology adoption are not close to optimal. Approaching the issue of sustainability, the results show that the return trade-off to achieve groundwater conservation, in terms of what producers would have to give up in terms of net present value of returns to achieve groundwater supply stability, would be small.

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*The impacts of project-food aid on nutrition in rural Kenya – Mesfin Bezuneh, Meheret Asfaw and Segu Zuhair*

As the total food aid available to distribution is declining, the role of effective targeting in selection, designing and implementing project-food aid programmes in recipient countries is becoming increasingly important. The purpose of this study is to assess 'directly' the impacts of project-food aid, Food For Work (FFW) in particular, on the nutritional status of children of FFW participant households. Since human capital formation, through improved nutrition, was

one of the arguments for FFW projects, it is imperative that we assess its nutritional impacts on the most vulnerable group of the household, children. Anthropometric analysis is carried out on both FFW participant and non-FFW participant households in order to assess the changes in nutritional status arising from participation in FFW projects. It is based on primary data collected from 133 randomly selected farm households in Baringo District, Kenya. Results indicate that the nutritional status of children of the participant households is not significantly different from that of non-participants. The findings of this study are expected to contribute to designing more effective and well targeted food aid-supported projects (project-food aid).

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*How many paths to the market? The organization of Polish hog transactions during transition* – **Silke Boger, Jill E. Hobbs and William A. Kerr**

New institutional economics suggests that the evolution of market institutions and their influence on transaction costs can be of crucial importance for the speed and success of transition. The paper studies the development of hog marketing channels in Poland during transition, using data from a survey of farmers. A number of transaction cost-related variables were used to distinguish a producer's marketing behaviour. These include contractual arrangement, grading system, final weight, speed of payment, prices, bargaining power, investment and total sales. Cluster and discriminant analyses could identify groups of producers homogeneous in their marketing behaviour. Given the diversified structure of market transactions and hog production, different transition paths can be identified. Currently, there is a low level of cooperation between farmers and processors in the marketing chain and many farmers cannot safeguard their investments in production by contracting. Closer vertical relations, with formal contracting and advanced grading, have developed in only one group. Supply chain relationships, such as contracting, that encourage improved quality and stimulate further investment by providing sufficient security in the business relationship are likely to exhibit long-run transaction cost advantages.

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*Foreign direct investment and product characteristics of the processed food industry in a North-South framework* – **Christine Bolling and Agapi Somwaru**

The importance of foreign direct investment (FDI) in the processed food industry is evidenced by its rapid growth during the late 1980s and 1990s. Most

studies of US investment in the food trades concentrate on the characteristics which motivate FDI and trade in the host countries. FDI is more prevalent in some subsectors than others. A Tobit model relates countries' state of economic development to characteristics such as trade and tariff levels, industry size and concentration for evaluating the food processing industry in relation to foreign direct investment.

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*The economic integration of Central European countries into world agricultural economies: the case of Poland and USA integration – Milton Boyd and Raquel Christie*

For Central European countries, the transition from planned economies to more market-oriented systems has involved a number of price realignments for agriculture. This study focuses on price transmission and market integration in Poland in relation to price alignments to world levels. The USA is used as a benchmark with which price behaviour in Poland's agricultural sector for grain and livestock, both at the farm and retail levels, is compared. The transition process for grain and livestock in Poland appears to be under way. This is evidenced by commodity prices converging at the farm and at the retail levels across the two countries, and also for the farm to retail spread within Poland. Farm to retail price transmission was higher for Poland than for the USA, though this may be because Poland has a lower value added component making up retail price.

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*Government v anarchy: modelling the evolution of institutions – David S. Bullock and Klaus Mittenzwei*

In the economics literature, institutions are usually viewed as 'the rules of the game'. Little agreement exists, however, on the precise meaning of the term 'rules'. Contrary to most of the literature, we refuse to accept that institutions constrain choices. Instead, we argue that institutions determine the (expected) consequences of choices made by economic agents. Together with the imperfect enforcement of institutions, and their highly complex and hierarchical structure, this leads us to advocate that institutions should be formally modelled as 'correspondences'. We sketch a general formal framework for institutional analysis in which institutions are incorporated as correspondences that map elements of the combined information set and choice set into the outcome set. We illustrate the framework using a two-stage non-cooperative

coordination game in which property rights over a natural resource emerge from an anarchy-like state of Nature. Two players have two strategies: to cooperate or to defect. Cooperation implies giving up some fraction of one's own personal resource to set up an enforcement mechanism that punishes a defecting player. A defecting player uses all of his/her personal resources to acquire the natural resource. We show that some institution will always emerge. Giving up own personal resources reduces the overall pay-off for the players, but can under certain conditions enable a Pareto improvement from anarchy (that is, unilateral defection) to government (that is, bilateral cooperation). One such condition is a sufficiently high enforcement technology. Another conclusion is that risk-averse behaviour makes the evolution of government more likely.

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*Hydroponic combines: site and technical choice under risk among Quebec shrimp fishermen* – **Peter Calkins, Patrice Dionne, Robert Romain and Rémy Lambert**

A fishing captain seeking mobile shrimp is like a farmer who chooses to buy a combine and sell custom harvesting services to other, dispersed, farmers. Economic analysis of this situation must consider both the human ability to choose the correct site and the technical characteristics of the boat. A logit model of two sites in Quebec showed that shrimp fishermen are averse to risk, as measured by the variance in average individual yields observed the day before going out to sea. Therefore their choice of fishing site is not random. The number of boats having exploited a site the day before revealed that, at least in 1993, fishermen adopted a follow-the-leader strategy. The availability of quota also affected site choice. As to the choice of technical characteristics of the boat, only engine power significantly explained tonnage caught in four different sites under both transcendental and Cobb–Douglas forms. This result is important to shrimp captains desirous of optimizing the allocation of their investments in fishing vessels. The other consistently significant technical factor was hours spent fishing per day. Crew size is only significant when the capture process is represented by a Cobb–Douglas form.

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*How does gender affect the adoption of agricultural innovations? The case of improved maize technology in Ghana* – **Cheryl R. Doss and Michael L. Morris**

Why do men and women adopt agricultural innovations at different rates? A national survey of maize farmers carried out in Ghana during 1997/98 revealed that improved maize production technologies promoted through the Ghana Grains Development Project have been adopted less extensively by women than by men. Only 39 per cent of female farmers reported planting modern varieties of maize, compared with 59 per cent of male farmers. Similarly, fewer female farmers (16 per cent) reported using chemical fertilizer than male farmers (23 per cent). When the adoption decision was modelled using a simultaneous probit approach, it was found, contrary to expectations, that gender per se is not significantly associated with adoption. Instead, the model results indicated that differences in adoption behaviour are associated with gender-linked differences in access to complementary production inputs, including land, male labour and extension services. This finding has important policy implications, not only in Ghana but also in other countries where women and men have been observed to adopt agricultural innovations at different rates. It suggests that ensuring more widespread and equitable adoption of improved technologies may not require changes in the research system. Rather, often what may be needed are policy measures to ensure that women farmers have better access to complementary inputs, especially land, labour and extension services.

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*'Separate spheres' agricultural household production within the humid forest benchmark* – **Renata L. Elad, Jack E. Houston and Doyle Baker**

Resource allocation within households often constrains their ability to respond to new opportunities and incentives. We develop and evaluate a 'separate spheres' household production model incorporating the benchmark concept. Our model posits a gender-differentiated production system within Humid Forest Zone households of sub-Saharan Africa. This hypothesis of separate agricultural production processes is supported by the lack of significance of cross-prices in own output supply estimations. Imputed prices portray significant influences on female output, but less so on male output. Given the production technology of the benchmark zone, we find that the total outlay of female labour exacts a higher estimated shadow wage than does male labour. The benchmark hypothesis is verified in this analysis and provides useful information on farmer responses to their environment. Gender roles are found to be an integral part of the production systems and must be accounted for explicitly in national policies and programmes.

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*Forecasting global crop yields* – **John N. (Jake) Ferris**

Important as forecasting crop yields from year to year has been for planning by farmers and agribusinesses, for developing farm policies and for administering food security programmes, analysts continue to assume normal weather and project yields as an extension of past trends. With improvements in long-range weather forecasting over the past decade, particularly with the information gleaned from El Niño/Southern Oscillation (ENSO), new approaches to crop yield forecasting are becoming feasible. In an analysis of global crop yields, ENSO variables were statistically significant in eight out of the 12 yield equations for coarse grain, wheat and oilseeds, and indirectly affected three of the other four. The incorporation of ENSO variables not only reduced the error terms but also converted the most highly skewed distributions to a more normal structure. Even so, yield equations with ENSO variables could not explain much more than 15 to 35 per cent of yield variation over the past 40 years. With or without ENSO considerations, analysts can provide more useful information by generating probability distributions of yields. This procedure was demonstrated by running AGMOD (econometric/simulation model of US agriculture) 500 times in forecasting distributions of yields and other agricultural variables for 2000 and 2001.

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*The market for spreads in an emerging market economy of Bulgaria* – **W.J. Florkowski, W. Moon, L.R. Beuchat, M. Chinnan, P. Paraskova and J. Jordanov**

The objective of this paper is to identify socioeconomic and demographic factors influencing the consumption of selected spreads in Bulgaria. Knowledge from this study enables food manufacturers, distributors and retailers to improve marketing strategies and concentrate market development efforts on most promising products. Data for this study was collected in 1997 among members of the Bulgarian household panel. A total of 2133 respondents (85 per cent of the panel members) completed questionnaires providing insights into food consumption habits, economic and demographic background of the respondent and his or her household, and a measure of household income. Spread consumption information was recorded by respondents for four types of meals: breakfast, snack, dinner and supper. The choices of offered spreads included jam/jellies, mayonnaise, honey, processed cheese, margarine and butter. Because spreads were most likely to be eaten at breakfast or as a snack, the empirical model of the consumption decision was specified for these two

cases. Household income and education of a consumer, which tend to be positively correlated, influenced the consumption of mayonnaise and processed cheese, two spreads consumed least frequently. With increasing incomes and improving education, the consumption of these spreads will probably increase. Currently, residents in southern and coastal regions are more likely to eat mayonnaise and processed cheese than are residents in the metropolitan area. Residents in northern Bulgaria are particularly unlikely to eat processed cheese. The regional differences occur after controlling for difference in income or educational attainment level and suggest distinct preferences for taste.

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*The household as a source of growth with increasing returns* – **Beatriz Gaitan**

In the present work we explain how in the process of development countries move from household to market production and why some countries are unable to take advantages of economies of scale. Our model extends the neoclassical growth model by introducing household production and imperfect competition. We justify the simultaneous production of firms and households by the consumer's desire for variety. The proportion of household production to market production will depend on how cost-efficient the household is when compared to the market production, the level of technological change in each of them, and to the degree to which market and home-produced goods are good substitutes for each other. In addition, the larger the number of households a firm can sell to, the more the economy can take advantage of economies of scale, shifting household production to market production as population grows. Effectively, the economy becomes more competitive at producing a larger number of varieties relative to the household. We simulate the impact of alternative policies such as improving infrastructure or promoting investment and technological spillovers from abroad for some developing countries.

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*Ten institutional perspectives on agriculture and rural development: a conceptual framework for policy makers, managers and analysts* – **Christopher D. Gerrard**

For developing and transition countries, macroeconomic stabilization, liberalizing foreign exchange markets and international trade, and removing price controls on agricultural commodities have not been sufficient. They must also address a set of 'second-generation' issues, which are primarily institutional, in

order to achieve their desired rates of agricultural and rural development. Based upon work done at the World Bank Institute over the last five years, this paper presents ten institutional perspectives on the substance and the process of institutional reform which together comprise a conceptual framework and practical steps for addressing these second-generation issues in agricultural and rural development. Drawing heavily upon the new institutional economics, the paper clarifies terms like 'public' and 'private' goods in order to address in a logical fashion the roles of the central government, local governments, the private sector and civil society in agricultural and rural development. It also works through the complexity of agricultural and rural development in order to understand which institutional reform strategies are more likely to succeed in different subsectors, from agricultural marketing and agricultural extension on the one hand to rural infrastructure and natural resource management on the other. The paper concludes by stressing the importance of involving the participation of all legitimate stakeholder groups in the process of implementing and sustaining institutional reforms.

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*Factors affecting obesity among school children in the United States – Chung L. Huang, Jonq-Ying Lee, Biing-Hwan Lin and Nancy L. Canolty*

Despite increasing health consciousness and awareness, obesity has reached epidemic proportions in the United States, affecting demographic groups, with as many as 20 per cent to 25 per cent of the nation's youth being overweight or obese. The objectives of this study are to examine and determine the prevalence of obesity among school children, aged six to 17 years. Furthermore, the study will estimate and quantify the effects of selected socioeconomic factors, dietary patterns such as intakes of fat and cholesterol, and diet quality on body mass index (BMI) measures. The U.S. Department of Agriculture's 1994–6 Continuing Survey of Food Intakes by Individuals (CSFII) is the source of data. Regression results suggest that increases in BMI were associated with various socioeconomic and environmental factors. As expected, the study found a positive and significant relationship between fatness and the amount of time spent watching TV. A child's dietary quality, as measured by the healthy eating index, was also found to have a negative and significant effect on BMI. With respect to socioeconomic characteristics, results suggest that African-American and Hispanic school children are more likely to become obese than their counterparts. In addition, the result suggests that school children from higher income households were less likely to become overweight or obese than others.

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*Marginal value of improved maize seeds and inorganic fertilizer under stochastic yield distribution* – **Aloyce R.M. Kaliba, Wilfred Mwangi and David Norman**

This study's objectives were to determine the marginal value of adopting improved maize seeds and inorganic fertilizer by farmers in the intermediate altitude and lowland zones in Tanzania. Stochastic dominance analysis and Bayes' theorem were used to compare yields of local maize varieties and improved seeds with and without inorganic fertilizer application. Rainfall distribution was considered as the major source of production risk. The stochastic dominance results suggest that, in the intermediate zone, growing improved maize seeds with and without fertilizer application was equally superior. In the lowlands, growing improved maize seeds with fertilizer application dominated both growing local varieties and improved maize seeds without inorganic fertilizer application. The Bayes' theorem results, which take rainfall distribution into account, indicate that a farmer moving from growing local varieties to improved seeds without fertilizer application stands to gain about 7948 Tanzania shillings per acre in the intermediate zone and 3695 shillings per acre in the lowland zone. However, by moving from growing improved seeds alone to fertilizer application, the farmer potentially loses money (about 9305 and 1733 shillings per acre in the intermediate and lowlands zones, respectively). Promotion of inorganic fertilizer in both zones should go hand in hand with technologies that increase the efficient use of available moisture to minimize field loss.

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*Efficiency and economies of scale and scope of Polish cooperative banks* – **Tamar Khitarishvili**

Agriculture is an important sector of the Polish economy, employing about 28 per cent of the labour force and constituting 5.6 per cent of GDP in 1997. There is a serious problem of low productivity. With accession of Poland into the European Union, the pressures to improve the competitiveness of the sector will increase significantly. Rural financial institutions can assist the agricultural sector in this transition. However, these institutions are themselves undergoing changes, as they improve the efficiency of operations and economies of scale and scope. The current study analyses the efficiency of cooperative banks in Poland in 1997, using bank-level financial data. It identifies some of the determinants of profit inefficiencies and economies of scale and scope. Two approaches to measuring inefficiencies are employed: the stochastic frontier approach (SFA) and the thick frontier approach (TFA). The majority of studies that use the SFA assume the half-normal or the exponential distribution of the inefficiency term. These distributions imply that the density of the

inefficiencies is concentrated near zero. In this study, that would mean that most cooperative banks are close to being fully efficient. This is not expected to be the case owing to the early stage of transformation attained among cooperative banks. To address this issue, the current study uses a more flexible gamma distribution of the inefficiency terms, and compares the results with those of the SFA half-normally distributed inefficiencies and with the TFA measures. Tests are conducted for the presence of the economies of scale and scope.

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*Welfare impacts of economic reform: Poland in transition* – **Sonya Kostova Huffman and Stanley R. Johnson**

This is a study of the welfare impacts of the economic reform in Poland. The costs of shortages/rationing are not captured by standard consumer price indices. Thus real GDP per capita is an overestimate of welfare losses of Poland and other transition economies. The analysis uses quarterly household expenditure data and a complete demand system. Virtual prices (at which consumers would voluntarily choose the rationed level of goods) provide a more precise and useful way to measure a welfare change if comparing periods in which there has been rationing of goods. Virtual prices are used to calculate the cost of living indices, making it possible to construct more accurate pre- and post-reform welfare comparisons. The cost of living index was increasing at a similar rate for all groups, but it increased the most for families with three children. The results for Poland show a roughly 75 per cent decline in welfare for households over the transition, with the most affected group being large families. Using virtual prices rather than actual prices for the rationed goods greatly reduces (by a factor of three) the estimated welfare loss during the transition. Specifically, incorporating the effects of consumer rationing can improve understanding of transition processes and provide an improved basis for targeting compensation packages that are a part of welfare policy formulation.

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*Food demand elasticities for the Hispanic community* – **Bruno A. Lanfranco, Glenn W.C. Ames and Chung L. Huang**

Hispanics are the fastest growing ethnic community in the United States; by 2010, they will comprise 15.5 per cent of the population. Moreover, their buying power, estimated at \$350 billion, grew at a compound annual rate of 7.5 per cent between 1990 and 1997. The primary reasons for the Hispanic market

being the leading growth sector for food in the USA are income growth and high birth and immigration rates. Income and household size elasticities for nine main food groups – grains, vegetables, fruits, milk, meat, legumes, fats, sugars and beverages – were estimated from Engel curves for Hispanic households in the USA. Income demand elasticities were very low, with point elasticity estimates smaller than +0.5 in absolute value. Household size elasticities were higher. As the size of the household increased, the demand for meats – beef, pork and chicken – increased substantially. The educational level of the household head appeared to be one of the most important variables explaining the demand for food among Hispanic consumers, particularly for grains, fruits and legumes. Other socioeconomic characteristics such as home-tenure status, age and national origin, were also significant in explaining food demand. Consistent with programme goals, government income subsidies (Food Stamps or Women, Infants and Children (WIC) Certificates) received by low-income Hispanic households increased the demand for specific food groups, such as milk and fruits. Processors and retailers now perceive the emergent Hispanic communities as a primary sector of the food economy.

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*Tomorrow's agriculture: an example of effects of proper diets on agriculture in Taiwan and China* – **Kang E. Liu and Wen S. Chern**

Food consumption analysis is a mainstream of agricultural economics. Increasing concerns about proper diets not only affect food consumption patterns but also influence agricultural producers. A linear programming model of least cost minimization is applied to study the changes in food consumption needed to achieve the desired nutrient intakes in Taiwan and China. The results show that the desired dietary changes would have an impact on consumers and producers in the two countries domestically but also affect trade opportunities with other countries such as the United States. It will be a big challenge to world agriculture if all the people in the world achieve a proper diet. The resulting welfare changes among consumers and agricultural producers could be enormous.

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*Agribusiness as an engine of growth in developing countries* – **Shirley Pryor and Tyler Holt**

The role of agriculture in the development process is often underemphasized. Simple, quantitative measures make it seem as if agriculture loses impor-

tance as economies grow, so most people conclude that the role of agriculture diminishes as development progresses. In most countries, however, the typical pattern is for agriculture to continue to grow in size and to modernize along with the entire economy, even as it declines as a share of total GNP. More importantly, as the entire economy develops, agriculture and related industries become more complex and increasingly integrated with the other sectors in the economy. In fact, a significant portion of the growth that occurs in other sectors of the economy can be attributed to concurrent development and modernization in agriculture. Agribusiness is the combination of all the inputs and outputs of agriculture. Combined, they represent much bigger shares of the economy than just agriculture alone. In the development process, both agriculture and agribusiness decline relative to other sectors of the economy, but, more importantly, the linkages between agribusiness and other sectors of the economy continue to grow and become increasingly complex. Based on the analysis of 11 input–output tables representing ten low- and middle-income countries, and the United States, this paper presents some important findings on the linkages between agriculture and other sectors of the economy that make up agribusiness.

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*Testing, imperfect competition in agricultural markets: an alternative index measure* – **Kwamena Quagrainie, James Unterschultz, Scott Jeffery and Michele Veeman**

Structural changes in the food processing industry arouse interest in the market power that may exist in the output markets associated with agriculture. A common approach to measuring such power involves the use of conjectural elasticity measures. Typically, this assumes that conjectural elasticities are identical across firms, represented by an index that, in essence, measures the wedge between the marginal value of a commodity and its price. This study presents an alternative index to measure market power. The procedure expresses the conjectural marginal input cost as a cost–output index and explicitly incorporates this into a translog profit function, building on the basic notion in modelling the production structure of the food industry that economic performance involves profitability and unit costs. If unit cost drops owing to technological or other factors, the associated increase in cost efficiency implies the use of fewer resources as well as potentially lower prices for consumers. If market power is exerted, ‘mark-downs’ of producer prices are expected. Industry conduct can be assessed over time with this approach and this may provide insights into pricing strategies in oligopsonistic market structures. The procedure is applied to assess ‘price mark-down parameters’ based on data for four food processing industries in Canada (meat and meat products excluding poultry, cereal grain flour, livestock feed, vegetable oil processing). The results do

not suggest application of food industry market power in these Canadian markets.

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*Infrastructure investment, transactions costs and rural poverty alleviation –*  
**Mitch Renkow and Daniel G. Hallstrom**

A conceptual framework for understanding the impact of publicly funded infrastructure investment on the welfare of semi-subsistence households is developed. It is suggested that such investments narrow the price bands facing households by lowering transaction costs associated with market exchange. If these are higher for poor households – as is commonly supposed – then public investments that lower unit transaction costs equally for all households are likely to increase the welfare of (richer) households (already participating in agricultural commodity and input markets) by more than they will benefit poorer households (many of whom will initially be autarkic). The success of infrastructure investment as a mechanism for enhancing the agricultural incomes of the poor therefore may well depend on the degree to which such investment can be aimed towards autarkic households (for whom transaction costs are highest). However, it is also argued that significant potential exists for infrastructure investment to reduce rural poverty via general equilibrium effects transmitted through both agricultural and non-agricultural sectors.

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*Foreign direct investment by US firms in processed foods: a comparison of developed and developing countries –*  
**Agapi Somwaru, Chris Bolling, John Dunmore and Shiva Makki**

US firms' foreign direct investment (FDI) for processed foods totalled \$33.8 billion in 1998. US FDI quadrupled to developing countries and more than doubled to developed countries in the years 1990–98. The increase in FDI sales of processed foods and the shift in trade shares from developed to developing countries has significant implications. We study sales for both US foreign affiliates and US exports in four developed and four developing countries and highlight the different results for both sets. Our study addresses the role of FDI as a complement to, or substitute for, US exports and hypothesizes that a nation's stage of development explains the differences in US FDI–trade relationships in food processing industries. We estimated a four-panel equation system separately for developed and developing countries using time-series, cross-section procedures for the two panel models. Our empirical results indi-

cate that US exports of processed foods compete with US foreign affiliate sales in developed countries, but complement foreign affiliate sales in developing countries. Exports to developed countries are mostly consumer-ready products while those to developing countries are more likely to be intermediate inputs, which these countries are likely to process and then export. That is, developing countries often act as 'export platforms'. There is evidence that US firms' FDI in processed food industries varies according to the stage of economic development of host countries.

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*Knowledge creation in tomorrow's agriculture – S.T. Sonka and Donna Fisher*

This paper highlights key economic and strategic concepts that can serve as a framework for the evaluation of information technologies. These concepts are employed as a strategic lens to examine the future evolution of precision agriculture, with special attention directed to potential effects upon the broader agricultural and food sector. Managerial implications are identified.

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*Income elasticity of rice demand in Japan and its implications: cross-sectional data analysis – Kiyoshi Taniguchi and Wen S. Chern*

Researchers believe that in developed countries such as Japan rice became an inferior good a few decades ago. This study employs the flexible complete demand system for analysis of recent cross-sectional data. Contrary to other studies, the results clearly show that rice in Japan is a normal good. We use the monthly cross-sectional household data, *Annual Report on the Family Income and Expenditure Survey (FIES)* for 1997. Food items are non-glutinous rice, bread, noodles, fresh fish and shellfish, fresh meat, milk, eggs, fresh vegetables, fresh fruits, fats and oil, and food away from home. Single equation models used include the Working-Leser model estimated by OLS, Heckman's two-step estimator and the Tobit estimator. All coefficients have correct signs and are statistically significant. For the complete demand system analysis the technique was the linearly approximated almost ideal demand system (LA/AIDS). In order to overcome measurement error problems, the LA/AIDS model with the Stone index and the Laspeyres index are compared. Results from the model show that the expenditure elasticity of rice is positive and close to one. Marshallian and Hicksian own-price elasticities for rice are highly elastic for all models. Fresh meats and rice are mild complements in all models; however, fresh fish and rice show mixed results.

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*CAP reform, wheat price instability and producer welfare* – **Stanley R. Thompson and Wolfgang Gohout**

A simple nonlinear commodity market model was used to illustrate the impact of recent reform of the common agricultural policy (CAP) on the stability of European Union and world wheat prices. Second, within an expected utility framework estimates were made of the transfer and risk effects on producer welfare due to market-liberalizing reforms. It was found that wheat producers were overcompensated for losses due to lower prices following the 1992 reforms. The transfer effect clearly dominated while the risk component was effectively zero. Over the post-1992 reform period there was no significant increase in income instability, a major pre-reform fear.

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*Using food management and agribusiness education to understand the barriers to trade between the major trading blocs: the international food and agribusiness Masters experience* – **Eric P. Thor, Jonathan Turner, Deevon Bailey, Olga Panteleeva and Tim Moruzzi**

The Phoenix Project, named after the Greek bird that arose from the ashes, is the symbolic character of student experiences gained from a new international degree scheme begun in 1997. It has evolved from the traditional Agricultural Economics curriculum in the early 1990s. This poster highlights the innovations, courses and curriculum. Students and faculty from 14 universities in nine countries have participated in the first three years. The events at the Seattle trade meetings highlighted the serious challenges in agribusiness trade and education issues. The International Food and Agribusiness Masters and the Phoenix Project have helped universities, countries, students and faculty to understand food management and trade 'wars', which cost hundreds of millions of dollars. A total of 23 disputes have been identified. The students from South America, nine European countries and three US universities have studied under the programme.

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*Household motivations for in situ conservation of crop genetic resources: empirical results for the Mexican milpa agroecosystem – M. Eric Van Dusen*

Results are presented from a new and unique household level data set to measure the motivations for in situ conservation of crop genetic resources in the Mexican milpa agroecosystem. Previous studies have focused on the conservation of varietal diversity within the principal crop. This study improves on previous work by explicitly incorporating the diversity of multiple varieties of multiple crops. A household–farm model is used to incorporate household characteristics concerning consumption, production and market integration. A nested model is used to test for the separability of the production and consumption decisions. Household participation in a given activity is controlled for in order to look at genetic erosion at the activity level, as well as to control for selection bias in the general model. Results from a single, aggregated Poisson regression and a system of three Poisson regressions by crop species are presented. Important findings are that ethnicity positively affects the level of household diversity, and the level of infrastructure negatively affects levels of household diversity. Policy implications are discussed for the targeting of in situ conservation programmes and for facing apparent contradictions between conservation and development.

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*Market share analysis of the world wheat market – Michelle Veeman, Terrence Veeman and Shiferaw Adilu*

Using two alternative models, the multinomial logit (MNL) model and the multiplicative competitive interaction (MCI) model, this study reports on an attempt to identify and evaluate the effects of market and non-market variables on time-series cross-sectional variation in market shares of major wheat-exporting countries of the world wheat market. The explanatory factors include FOB prices, distance from source to market, credit provisions, non-commercial shipments, long-term agreements (LTAs) and a measure of trade relations in other products. All variables but the FOB price and non-commercial shipments were significant in the MNL model, while all variables but the FOB price were significant in the MCI model at the 5 per cent level. Two major implications for policy of the results are (1) that non-market variables or export strategies, such as credit provisions and LTAs, are important determinants of international wheat market shares; and (2) that, although insignificant, the inverse relationship between prices (which were weighted by wheat types, thereby incorporating quality effects) and market shares suggests that prices are more important than quality in affecting market shares. Finally, although the MCI model gives slightly better statistical results, the principles of consumer choice underlying the MNL model provide this model with a stronger theoretical basis.



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## SOUTH AMERICA

*Spatial determinants of labour productivity at the national level: the case of Honduras* – **Bruno Barbier, Orlando Mejía and Grégoire Leclerc**

The study establishes the link between agricultural labour productivity and natural resources at the national level in Honduras. Using ordinary least square regression and GIS, we identified why some villages enjoy higher labour productivity than others. For every village in Honduras, we constructed 44 natural resources and socioeconomic variables that could have an impact on productivity. Soil variables were obtained by interpolating, within geological regions, the results of the analysis of 4000 soil samples. Climate variables were obtained by interpolating long-term averages of monthly data from 400 meteorological stations. The 25 socioeconomic variables, most of them derived from unit-level census data, were chosen to describe the main farm characteristics and their access to markets. We show that the impact of natural resource conditions on agricultural productivity is not as direct as could be imagined. Soil and terrain slope and altitude had little impact because the valuable coffee production, which is located in the hillsides, compensates for the supposed handicap of hillside areas. The length of the rainy season, however, showed the strongest correlation with labour productivity. Socioeconomic factors such as population density, adoption of new germ plasm, technical assistance and education were found to be strong determinants of labour productivity. The conclusion is that rainfall is the main factor. Thus migrations that are currently occurring from the dry, highly populated areas towards the rainy, less populated ones will improve the situation. There is also great scope to improve labour productivity through proper public investment.

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*Fostering agricultural development in Peru in the nineties, with special attention to innovation processes* – **José Alfonso Heredia**

During the 1990s, attempts to foster sustainable innovation in the agricultural sector in developing countries took place against the background of significant tendencies towards deregulation and structural reform. In the case of Peru, the studies that have been done and the knowledge that has been gathered have produced data for assessment in order to modify the basic concepts of the actual reform process and to draw certain lessons from it. In this way, some information has been made available about concrete cases in the Peruvian

agricultural sector and about the specific factors that brought about the start and influenced the development of those innovation processes.

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*Identifying wheat germ plasm flows in Brazil: lessons for agricultural policies*  
– **Daniela Horna and Javier Ekboir**

Brazil has strong public and private wheat breeding programmes, which have heavily relied on germ plasm developed locally and by CIMMYT. The aims of this paper are to identify germ plasm flows in Brazilian wheat-breeding programmes, and to estimate the impact of these flows. First, we recorded the origin of the parents of each variety and the institution responsible for crossing or selecting it. Then the contribution of each source of germ plasm to wheat production was estimated as a combination of the breeding work, the origin of the parents and the acceptability of each variety among farmers, expressed as a percentage of cultivated area occupied. The results showed that Brazilian institutions have been active in crossing, selecting and releasing new varieties for the two main production areas: Paraná (PA) and Rio Grande do Sul (RGdS). Brazilian contributions were concentrated in RGdS (an area with acid soil limitations) while CIMMYT contributions were concentrated in Paraná. The analysis of the contributions to wheat-breeding work in Brazil showed that (1) the impact of breeding programmes can be enhanced through active participation in international germ plasm exchange programmes, and (2) local work is important, especially in areas with particular ecologies. These two factors should be considered in the definition of agricultural research policies.

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*Threats, risks and benefits of the commercial release of transgenic crops in Argentina* – **Walter A. Pengue and J.E. Morello**

Argentina is the only country of South America that allowed the commercial release of transgenic crops. Indeed, it is the second in the world (following the United States) in transgenic crop planting and first in technology adoption. Transgenic crops used are soybean and maize, with traits such as tolerance to glyphosate or Lepidoptera. The rate of adoption of the new herbicide-resistant crop is higher than in the USA. But this fast adoption of biotechnology has not been a smooth one. In Europe, Japan and Brazil, consumers, environmentalists, policy makers, researchers, the popular press and other social groups have forced governments to review their regulatory systems. Concern of consumer

groups about human health involves the problem of labelling the foods derived from transgenic crops. In a global context, while the USA is changing part of its position and segregating crops, and Brazil has not allowed transgenics, Argentina is alone in supporting their use. Given concerns about human health and environmental issues, where long-run studies are needed, Argentina is facing a market problem. This situation could affect the commercialization of soybean and maize in the near future. A change of policy and strategy is needed if Argentine production is to reach the high-income markets that the country could lose.

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*Food consumption and income distribution in Argentina* – **Elsa Rodríguez, Miriam Berges and Karina Casellas**

The debate over ‘food security’ has recently moved from concentration on production problems towards considering the entitlements to access to enough food to achieve a productive and healthy life. The gap in the income distribution worldwide indicates a growing inequality of access to nutrition levels which guarantee adequate individual welfare. Recent studies in Argentina reveal an increase in the concentration of wealth and in inequality between rich and poor. The aim of our research is to analyse food consumption behaviour for the country as a whole and for its regions. Income elasticities are calculated for different food groups by estimating Engel curves. Finally, through the application of Principal Components techniques, different classes of households with similar socioeconomic characteristics are studied. Preliminary results indicate a marked difference in the income and kinds of food consumed by households according to their geographical location.

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*An integrated framework to analyse the impact of agricultural research* – **Luis Romano**

The internal rate of return is the most frequently used indicator for economic efficiency in evaluation of the effects of agricultural research. While this indicator is useful in that context, it may be appropriate to find out more about distributional effects, technological consequences and overall economic effects (employment, household income, value added). The purpose of this paper is to work towards a more holistic framework for evaluating the impact of agricultural research.

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*Maize seed markets and institutional structure in Central America and the Caribbean* – **Gustavo Sain and Greg Traxler**

Information is presented on the current structure of the maize improvement research and seed technology delivery system in CAC, using a general model of incentives for public–private cooperation in small markets. Research investments are meagre, with only 29 maize specialists being employed in national research systems of the whole region. There has been a high level of collaborative research between national efforts and CIMMYT. The contribution of regional collaboration is demonstrated by the fact that 90 per cent of the maize area cropped with improved varieties contained CIMMYT germ plasm. In 1996, only 21 per cent of the total maize area was sown with first-generation improved varieties. Nine private companies were active in Central America in 1997, but less than \$500 000 was invested in private sector maize research. Weak economic incentives owing to the small market size and lack of infrastructure limit private sector interest. There has been a movement to improve the policy environment; most importantly, intellectual property rights legislation is being enacted in several countries, and discussion on harmonizing regional seed certification laws is under way. The low overall level of adoption of improved varieties remains an important concern.

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*Analysing the adoption of productivity-enhancing, resource-conserving (PERC) technologies in Central America using a logit and a structural equation model* – **Monika Zurek, Gustavo Sain and Ernst-August Nuppenau**

Despite many efforts to foster the use of soil-conserving technologies by small farmers in Central America, overall adoption is low. This seems to result mainly from a technology and policy design process that does not account sufficiently for the differences between commercial and environmental innovations. Consequently, many promoted practices do not fit small farmers' circumstances in the region. A case study was conducted in the Polochic Valley in northeastern Guatemala on the adoption of the herbaceous legume Velvetbean (*Mucuna spec.*) as a cover crop in maize cropping systems. A logit model is used to identify factors that influence the adoption of this productivity-enhancing, resource-conserving (PERC) technology. A structural equation model (SEM) is also built to model links between food security needs of farmers, institutional factors, the intentions of farmers behind their choice of technologies and the adoption of soil conservation technologies. Results show that soil-conserving technologies that do not have additional substantial short-term effects in

increasing productivity will always need strong external incentives for their adoption, while technologies combining both effects seem to be better suited for a rapid diffusion among small farmers in Central America.

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## COMPUTER DEMONSTRATIONS

## AMERICAS

***Measurement of technological change in the European Union – Carlos Arnade, Susan E. Leetmaa and David Kelch***

This study calculates Malmquist productivity indices for all 15 EU countries from 1963 to 1997 and breaks them into efficiency and technical change components. It also demonstrates the performance of one country's technology variable, calculated using data envelopment analysis, when used as an explanatory variable in a country-specific supply response model. France is used for illustration. The commodities modelled were (1) wheat, barley, maize, rapeseed and other grains; (2) pulses and sugar beets; (3) aggregated vegetables and aggregated fruits; and (4) aggregated livestock products.

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***Exploring the dynamics of future global protein consumption – Donna Fisher, Steve Sonka and Randall Westgren***

Public policy decision making is particularly difficult in the case of research investments, where the uncertainty inherent in research and lengthy time lags require investments to be made long before outcomes are known. The Protein Consumption Dynamics (PCD) system is a tool created to assist managers to improve their perspective of future protein needs. This research effort was funded by the Illinois Soybean Checkoff Board to aid them in strategic allocation of research funds. The PCD system includes a system dynamics model, the output of which is displayed using a three-dimensional visualization tool, In3D. The system dynamics model component relates population and income growth to regional protein needs and malnutrition. The model tracks estimated consumption annually (for the years 2001 to 2025) of six agricultural commodities that serve as sources of protein for humans in eight regions that cover the world. The system dynamics model is designed so that alternative scenarios of the future can be examined using population and income projections of the World Bank and the UN's Food and Agriculture Organization. The visualization component was developed in collaboration with design experts from the National Center for Supercomputing Applications at the University of

Illinois. Through formal experiments with actual managers in the soybean sector, the effects of use of the PCD system are being formally evaluated. This evaluation documents the effects of scenario modelling and visualization on individual and group decision-making processes.

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*Communicating a vision of the future with optimization models and virtual landscapes: an application to community management of the Jalapa watershed in Honduras* – **Grégoire Leclerc, Alexander Hernandez and Bruno Barbier**

The demonstration presents the results of exploratory work on the communication of possible scenario outcomes to the population of a small watershed. This is done by combining optimization models with computer-generated images of future landscapes. Five scenarios (rapid population increase, sustainable forest management, an increase in agricultural productivity, a new credit programme and a payment for environmental services) were introduced into a linear programming (LP) model which maximizes the total income of the watershed while finding the most profitable land use condition. The results of the model were fed into a virtual reality (VR) landscape rendering software that simulates the aspect of the watershed under given scenarios. The population were presented with realistic 'pictures' of the watershed based on the assumptions about the future. This included present and future roads, buildings, land use patterns and eroded hillsides. Animations were also generated which correspond to what an observer travelling through or flying over the landscape would see. Surprisingly, farmers have no problem grasping the profit maximization principle, and understand perfectly what would be the impact on the landscape. In fact, we found that VR helps to lower the level of abstraction typically associated with LP and GIS. VR animations reinforced the perceived realism of the simulated landscapes. This decision support tool will help communities forecast the impact of different collective actions such as new rules, new roads or adoption of new techniques on both their incomes and their landscapes.

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*A computer program to evaluate competitive advantage in agricultural production* – **Sinezio Fernandes Maia and Ricardo Chaves Lima**

This computer program evaluates the impact of the organization of economic blocks in the agricultural sector in each member nation, through the use of instruments of international market assessment. The method aims to identify

market costs in agricultural production within and amongst each country in the region, to estimate opportunity cost and to determine comparative and competitive advantage amongst regions. The analytical model is based on the determination of effective production coefficients (EPC) and the cost of domestic resources (CDR). Both represent a way of using David Ricardo's classical approach of comparative advantage, adapted to modern situations. The program was developed in MS Excel spreadsheets, using Visual Basic. The spreadsheets are interlinked, requiring prices and technical coefficients from each region as input. The output identifies each country's (or each economic region's) competitive advantage in agricultural production. One of the spreadsheets refers to the total production cost, including fixed and variable costs. This spreadsheet is linked to another showing the break-even point for the economic activities, as well as the minimum competitive quantity and price.

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## EUROPE

*A decision support system for the economic–environmental assessment of crop production* – **Guido Maria Bazzani, Paolo Caggiati and Carlo Pirazzoli**

The 'Crop Economic Analyzer Model' (CEAM) is a decision support system (DSS) for the economic–environmental assessment of agricultural crops, designed to answer both public and private needs. The software attempts to reconcile the demand for an eco-compatible agriculture with the farmers' need to obtain an adequate return on investment. CEAM operates at crop level, taking into account all the activities required by the production cycle; this permits it to quantify analytically the utilization of raw materials, labour and machinery and their cost. The program, which operates as a Windows application, consists of three main modules: problem definition, calculation and report generation. The user interface is user-friendly. The system supports the creation and storage of personalized archives pertaining to specific farm conditions and the scenario analysed. CEAM can be used at the farm level as a decision support tool for technicians and farmers, to estimate ex ante profitability and conformity to regulations, and to evaluate ex post compliance with standards, consumption of resources and economic return on the basis of real data. It should be emphasized that, for some practices, such as fertilization, it performs as an expert system, through the internal database on agricultural technologies and regulatory constraints, organized into a comprehensive evaluation process. At the public level, if adopted for the extension service, it permits the collection of homogeneous data on agricultural practices. Flexibility, coupled with simplicity of use, makes CEAM a powerful tool for guiding and monitoring agricultural activities.



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*Agent-based modelling in agricultural economics* – **Kathrin Happe**

With the rapid advance of computer technology, multi-agent system (MAS) approaches have become more and more suitable for modelling and understanding dynamic processes. They are computer models consisting of artificial entities, which can communicate with each other and act in an environment. In agricultural economics, MAS appears to be very suitable for studying endogenous structural change, intrasectoral distribution effects, possible adoption paths of new technologies and path dependence. The presentation consists of (a) a short introduction to multi-agent modelling in agricultural economics, to present the structure of an agent-based model for studying structural change and its implementation through computer simulation, and (b) an exemplary policy simulation, to give an idea about the simulation software and the way in which a simple policy measure effects the agents in the model. The simulation studies the impact of a simple direct income transfer policy on the system.

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*TRANS-FARM: a farm model to assess development strategies and predict effects of policy changes for agricultural enterprises, especially in Central and Eastern European countries* – **Volker Mothes, Ludger Hinners-Tobraegel and Peter Tillack**

Farm reconstruction in Central and Eastern European countries (CEEC) has led to a great variety of farms and farm types. It can be assumed that these farms will follow very specific development paths. Farm models have to fulfil various demands to assess development strategies and to predict the effects of political instruments for agricultural enterprises. Firstly, they have to include the current situation on farms, such as factor availability, current use of factors and aims of farm managers. Secondly, they have to mirror the farm environment. Important factors for Central and Eastern Europe are high costs of capital, the availability of arable land, low labour cost and rapid changes of the terms of trade. Thirdly, they should consider the decision-making processes of farm managers. TRANS-FARM has been developed to plan growth and development strategies of agricultural enterprises. This LP model is able to show cost-saving effects of investments, the advantages of cooperation and the feasibility of growth strategies in relation to factor availability, the current use of factors and political programmes. TRANS-FARM is applied to assess farm growth strategies in Poland.

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*Is the CAP promoting viable technical change? The case of olive oil in Andalusia (Spain)* – **Dionisio Ortiz, Felisa Ceña and Fernando Andrada**

The olive production system in Andalusia (Spain) has undergone a rapid and massive technical change, through irrigation, in the 1990s. The main reason has been the availability of incentives from CAP subsidies. The main aim of this paper is to analyse whether the strategy of introducing irrigation systems can guarantee farmers a lower dependence on subsidies in the future. A net income index has been built to measure the ability of olive farms to earn adequate returns on inputs. This 'competitiveness' index has been estimated for a group of standard farms (small = 5 hectares, medium = 30 hectares and large = 100 hectares), with and without irrigation, and with and without subsidies. The scenarios have been projected to the year 2002. According to the results, introduction of irrigation is not justified in all cases. This could be due to the high sensitivity of the index to yields. In any case, dependence on subsidies is widespread. Therefore the next reform of the regime should adopt mechanisms to guarantee the economic viability of the olive oil farming system, as its abandonment would have clear adverse effects on the region as a whole.

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*The experience of the Czech Republic with the implementation of its WTO commitments in agriculture and the assessment policy option for the pre-accession period* – **Tomáš Rättinger and Jiřina Šlaisová**

It seemed at the time of signing the Agreement on Agriculture in Marrakesh that the relatively liberal Czech schedule would provide enough 'water' for supporting farming to the full extent that the economy would be able to bear during transition. This appeared to remain true (except for sugar) until 1999. However, the commitment may become a serious constraint for pre-accession policy and to some extent for accession itself. At the request of the Ministry of Agriculture, VÚZE has started to provide an assessment of policy options for gradually adopting the CAP, but if possible staying within the limits of the Czech WTO commitments. At the same time, VÚZE was asked to provide an analysis for a further specification of the Czech position for the new round of WTO/GATT negotiations. Since quick responses are needed, VÚZE has adopted a modular approach with an easily manageable computer solution. Two EXCEL templates (CSAD and AMS modules) were developed: (1) generating scenarios of price convergence in the pre-accession period (2000–2003); (2) showing bottlenecks of current commitments in the light of pre-accession

processes; (3) showing the effect of some negotiation options; (4) illustrating the effect of adopting EU agricultural policy on the Czech commitment. The analysis to date has indicated that a gradual convergence of price levels is not feasible under the current Czech WTO commitments unless very restrictive production control is introduced.

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