Topics Available for Thesis Research

Agricultural Economics

Purdue University

2003
**Table of Contents**

*Philip C. Abbott  
Institutional innovation in the cocoa trade (with Prof. Masters)  
Preferential Trade Arrangements with the WTO

*Channing Arndt  
Poverty in Mozambique  
Economic Implications of AIDS in Southern Africa

Timothy Baker  
Risk Management  
Financing and Hog Contracting  
Stochastic Dominance  
Machinery Cost

Michael Boehlje  
Industrialization and Vertical Coordination in the Agricultural Sector  
Structural Change in Production Agriculture

*Otto Doering  
Resource Policy, Conservation Issues, Farmland Preservation

*Ken Foster  
Time Series Testing of Market Power  
Monte Carlo Valuation of Investment Options

Joan Fulton  
Economic Implications for Producer Investments in Value-Added Business  
Structural Change in Cooperatives and Agribusiness: Joint Ventures, Strategic Alliances and Mergers  
Organizational Structure of Agribusiness  
Effective Teaching and Learning Approaches

Thomas Hertel  
Harmonizing Livestock Productivity, Trade and Environmental Policies

*Jess Lowenberg-DeBoer  
Biotechnology and the Economics of the Seed Sector in West Africa  
Estimating Consumer Demand for Bt Cowpea in West Africa  
Economic Assessment of Precision Agriculture Technology  
Optimization of Pattern Drainage Systems using Yield Monitor Data
Table of Contents

*William Masters
  Identify preservation in cocoa trade
  Climate, agriculture and economic growth
  Demand for public innovation in agriculture

*Philip Paarlberg
  Risk Assessment of SPS Barriers
  Implementing Multifunctionality Rules

George Patrick
  Risk Management Strategies for Farmers
  Risk Attitudes of Producers and Economic Behavior

*Paul Preckel
  Competition’s Impact on the Supply Chain
  Fine-tuning Vertical Coordination in the Swine Industry

*Gerald Shively
  Agricultural Intensification and Deforestation in the Philippines
  Landscape Change in the Vietnamese Central Highlands
  Estimating Dynamic Time Series Models of Agricultural Price Formation

Wallace Tyner
  Agricultural Policy Impacts under Drought Conditions
  Agricultural Policy Issues in Developing Countries
  Impacts of Future Commodity Price Variability on Food Security
Institutional innovation in the cocoa trade (with Prof. Masters)

Chocolate manufacturers and cocoa producers argue that the world cocoa market has become “broken”, with a wide gap between farmers' incentives and consumer demand. One factor may be the elimination of state marketing agencies in West Africa, allowing the three major cocoa processors (ADM, Cargill and Barre Callebaut) to exercise market power against both farmers and chocolate manufacturers. Other factor may be changes in consumer information and preferences, yielding increased willingness to pay for the environmental or social attributes of production processes. An important issue related to cocoa trade and social attributes of production, driving the overall USAID effort now, is child labor. This study asks whether and how the introduction of identity preservation can help the world cocoa market become more competitive, aligning farmers’ incentives with consumers demand, and addressing social concerns related to cocoa production.

Preferential Trade Arrangements and the WTO

Developing country interests have emerged as important to future WTO negotiations, with many developing countries resisting opening a new round until implementation issues from the Uruguay Round outcome are addressed. Prominent among these issues are special and differential treatment of developing countries, most clearly evident in preferential trade arrangements. Moreover, the European Union in 2000 extended its Lome convention in the form of the Conotou Agreement, and gives special consideration to the least developed countries in it “Everything but Arms” proposal. The U.S. also expanded the Caribbean Basin Initiative to include Africa in the Trade and Development Act of 2000. Opponents of these agreements argue they are incompatible with WTO principles, and have been largely ineffective due in part to lack of capacity in development countries to respond to these tariff advantages. In this research project we are investigating the extent and effectiveness of preferential trade arrangements, focusing on investment strategy and policy in addition to trade policy as a necessary facilitating mechanism.
CHANNING ARNDT

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**Regional integration in Southern Africa**

A regional integration agreements is in the process of being negotiated in Southern Africa. The implications of this agreement is a current topic. Analysis could include gains from integration of maize markets, infrastructure improvements necessary to facilitate regional trade, and staging of regional agreements. Proposals to examine these issues are in process.

**AIDS in Southern Africa**

Recent demographic and epidemiological information from Southern Africa point to an alarmingly high AIDS infection rate. While early work on the macroeconomic implications of AIDS found mild impacts, the scope of the current AIDS epidemic may force one to rethink this conclusion. Current work in Southern Africa seeks to flesh out the economic implications of the AIDS epidemic and help design appropriate mitigation strategies. Recent focus has been on the implications of the pandemic for human capital accumulation.

Note: Dr. Arndt will be resident in Maputo, Mozambique from late 2002 to mid 2005. This complicates but does not necessarily preclude involvement with students as long as topics are consistent with his work program.
### TIMOTHY G. BAKER

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#### Risk Management

This project is to provide the background research for the department’s risk management extension work. Essentially risk management alternatives are to be identified (marketing alternatives, hedging, crop insurance, diversification, revenue insurance, etc.), then the probability distribution of returns under the various alternatives will be determined.

#### Financing and Hog Contracting

This is a joint project with the University of Illinois. A survey of lenders attitude toward lending for contract vs. independent production has been completed and a simulation model is being built. There is the possibility that a student could define a thesis topic that would complement the work under way.

#### Stochastic Dominance

The literature on stochastic dominance includes the work by Jack Meyer on stochastic dominance with respect to a range of risk aversion. Meyer’s procedure uses a range of coefficients of absolute risk aversion. There is little agreement in the literature on the relevant range of absolute risk aversion, and many times stochastic dominance is performed on returns per acre and returns per dollar invested. This research is to rework the method of Meyer to use relative risk aversion. There is much less controversy regarding the range of relative risk aversion, and some of the problems associated with multiplicative gambles are alleviated.

#### Machinery Cost

This project is to use the machinery repair and remaining value equations in the literature to determine the marginal cost of using machines. Such costs are very relevant in the partial budgeting situations that frequently arise. The current literature contains frequent reference to average costs, but the marginal cost is often inaccurately assumed to be equal to the current repair cost per unit of use (without considering future repairs, remaining value, and trading time).
Significant changes are occurring in the agricultural sector — changes often described as the industrialization of agriculture. One of these changes is increased use of alliances, contracts and negotiated coordination between the various stages of the food chain. As quality and other product attributes become more important and valuable to consumers, and technology for producing and measuring these attributes develops, the benefits of negotiated coordination are likely to increase. The objective of this project would be to evaluate the efficiency gains, transactions costs, and quality impacts of changing technology to measure quality and other product attributes, and changes in market coordination systems in the markets for corn or soybeans. Results will be useful in anticipating both structural changes in the industry and strategies that grain companies may adopt to increase efficiency and market share.

Financial Implications of Structural Change in Production Agriculture

A critical issue facing the agricultural lending community is the expected rapid structural change of production agriculture in the future and the implications these structural changes have for both the size, ownership and other characteristics of the customer base and the changing financial production/service needs of customers.

The potential financial implications of these structural changes are profound. With the movement to larger scale operations, the financing needs of individual businesses are likely to grow rapidly. At the same time, the risk involved in financing these businesses will likely change from those traditionally associated with price and productivity risk to relationship, market access, specialized asset, and other strategic risk. And the nature of the competition in the financial markets may well change at the same time. Integrators may become more predominant in providing financial services to the food supply chain, either in the form direct financing of production units, or recommendations of preferred suppliers of credit who understand their program and will provide attractive terms and rates including the potential of equity as well as debt financing. These potential structural changes have significant implications for traditional lenders who have expertise and delivery systems that focus on traditional debt financing of relatively independent farm and agribusiness firms. The focal point of work in this area would be to better understand the forces that are resulting in the structural changes in the agricultural and food distribution industries, to attempt to quantify those forces so that the future structure of various industries and sectors could be projected, and to develop the implications of these changes for those who are and will finance the farm and agribusiness sector.
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**Resource Policy**

Limited funding to work for the Natural Resources Conservation Service responding to their analysis needs on these issues. Much of the work is short term and specific, but has been expanded to MS thesis topics in the past.
Ken Foster

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### Time Series Testing of Market Power

First order conditions for profit maximization suggest that input prices and the value of marginal product should be cointegrated regardless of the degree of competition. However, the first order conditions for oligopolistic firms lead to very different hypotheses about the value of the cointegrating vector versus those of the perfectly competitive firm. While the methods for testing these hypotheses have been worked out, they are tedious to apply and the connection between market power and the cointegrating vector has not been previously addressed in the literature on market power. Furthermore, the traditional structural models used for testing market power suffer from multicollinearity and specification bias, and data driven time series specifications can alleviate these problems to some degree.

### Monte Carlo Valuation of Investment Options

Recent developments by Brody and Glasserman using monte carlo methods to value investment options make it easier to estimate option values where the stochastic process does not necessarily follow a Brownian Motion. Closed form solutions do exits for other classes of stochastic process, but these are also somewhat restrictive. This research would focus on using Linear System State Space models to estimate discrete approximations of the stochastic processes of interest and use Brody and Glasserman’s monte carlo approach to value important agricultural investment or policy options.
JOAN FULTON

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**Economic Implications for Producer Investments in Value-Added Business**

This research addresses one of the critical issues the industrialization of agriculture poses for producers. Part of the industrialization process involved forming more tightly aligned supply chains that extend from the producer through the first handler to the processor or potentially the retailer. Examples of these organizations include New Generation Cooperatives, limited liability companies, as well as joint ventures and strategic alliances. The purpose of this research is to identify the returns and risks for producers who take the initiative in the formation of food supply chains through investment in value-added first handling, processing or other downstream activities. The output from this research will identify those commodities as well as stage in the food system where producer investment is most attractive. The results will be useful for producers as they consider significant capital investment in value-added processing.

**Structural Change in Cooperatives and Agribusiness: Joint Ventures, Strategic Alliances and Mergers**

The structure of all sectors of agribusiness is currently undergoing rapid change, including increased consolidation due to mergers, acquisitions, joint ventures and strategic alliances. This research will explore the structural changes in agribusiness, related to mergers, acquisitions, joint ventures, and strategic alliances, and identify the driving forces behind the reorganizations as well as the factors that contribute to the success of the new structures. The objectives of the research are to (1) analyze theoretically and develop a model of the structural change that is currently occurring in cooperative and investor oriented agribusinesses with particular emphasis on mergers, acquisitions, joint ventures and strategic alliances, (2) continue with the database development of the mergers, acquisitions, joint ventures, and strategic alliances that have occurred in the United States among cooperative and investor oriented agribusinesses at the regional and national level during the 1990s. In addition to listing the partners involved in the restructuring the database will contain the driving forces behind the reorganization as well as the factors that contributed to the success and/or failure of the reorganization. (3) perform empirical analysis of the data, draw conclusions and identify implications for agribusiness decision makers and policy makers.

**Organizational Structure of Agribusiness**
In the changing, industrialized agriculture new organizational structures are emerging for agribusiness which impact efficiency, competitiveness, and profitability. In turn, the welfare of farmer producers, who may be the suppliers, the customers, and sometimes also the owners of the business is affected. The results of the research exploring the impact of organizational structure on efficiency, competitiveness, and profitability will be beneficial to decision makers as they respond to the changing industry and adapt their organizational structure. Thesis topics could explore a number of specific topics including: (1) the impact of centralized versus decentralized decision making authority on efficiency and profitability under different product environments; (2) the use of different ownership and organizational structures (including cooperative, partnership, and producer purchasing or marketing associations) to enable independent producer to achieve size economies and remain competitive; and (4) the opportunities for traditional cooperatives to adopt the characteristics of new generation cooperatives to deal with the long standing challenges of equity financing, member commitment, and efficient business operations.

**Effective Teaching and Learning Approaches**

University faculty are paying increased attention to teaching and learning within their respective institutions. In this context they are exploring new teaching methods and approaches as well as examining new ways to evaluate the effectiveness of teaching and learning. The development of capstone courses represents an example of the first issue while outcomes assessment is an example of the second issue. This project involves first reviewing the literature associated with capstone courses and outcomes assessment. The second component of the research will involve evaluating existing courses and evaluation methods followed by development of new courses and evaluation methods. The findings will be written up for submission to academic journals.
ALLAN W. GRAY

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<td>Costs of Production for Retail Agronomic Dealers</td>
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<td>3. MS</td>
<td>Changing Volatility of World Supplies: Policy Implications for U.S. Agriculture</td>
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**Evaluation of the Impact of Technological Advances on Retail Agronomic Firms**

Technological advances will have substantial affects on the agronomic industry over the next few years. For example, seed choice is becoming increasingly tied to the pest control program and in many cases the fertilization program. It is likely that the role of the traditional agronomic dealer will change dramatically over the next few years. Information on the impacts of these technological advances on the agribusiness firm's clientele base, market share, profitability, and risk exposure can help define the strategic alternatives available to these firms. A project in this area would evaluate the implications of technological advances for strategic alternatives that reduce risk and maintain or improve profitability in small to medium-size retail agronomic firms.

**Costs of Production for Retail Agronomic Dealers**

As manufacturers of agricultural products continue to look for new ways to distribute their products, the economic well being of retail suppliers is being called into question. A detailed analysis of the cost structure for retail agribusiness is needed to determine the possible alternative business-to-business relationships that could evolve between manufacturers and retailers. A study along these lines could include a survey of agricultural retailers and modeling of the economic activities for a retailer under alternative relationships with manufacturers.

**Changing Volatility of World Supplies: Policy Implications for U.S. Agriculture**

The constant improvement in seed hybrids and the increasing adoption of top producing seeds around the world calls into question the expected volatility in world wide production of grains. In today's environment of low commodity prices many argue that we need a weather disaster somewhere in the world to reduce supplies and boost prices. But, how big of a weather disaster do we need? Perhaps the increased tolerance of the world's seed hybrids has reduced the negative effects of weather and even worse disaster than we think maybe needed to correct oversupplies. To the extent that downside yield risk has been reduced worldwide, there are serious implications for agricultural policy and the amount of future income support that will be needed from the government. This study would entail gathering data on Worldwide crop production and conducting statistical tests of the variability over time to determine if downside yield variability has been reduced.
Harmonizing Livestock Productivity, Trade and Environmental Policies

In the past two decades there has been a marked shift in the composition of global food trade, away from grains and oilseeds and towards trade in meat products. This has been fueled by sharp increases in the demand for livestock products in the rapidly growing economies of Asia, and the developing world more generally. Meanwhile, livestock supplies in many of these countries have been constrained by low levels of productivity, sharp competition with the manufacturing sector for labor and capital, as well as environmental constraints. In addition, innovations in international transportation have lowered the cost of trade in meat products. But what of the future? Will livestock productivity levels in East and Southeast Asia converge on that of the United States, thereby eroding US competitiveness? If this occurs, will it translate into a slowdown in the growth of meats trade – perhaps boosting trade in grains and oilseeds instead? This proposal integrates innovative methods for the estimation of total factor productivity in the livestock industries with a simulation model of international trade in order to address these important questions.

The broad objective of this proposal is to estimate the degree of convergence in livestock productivity in the Asia-Pacific region, and analyze its implications for trade in general, and US exports in particular. Specific objectives are as follows:

1. To estimate indexes of Total Factor Productivity for livestock sectors in the Asia-Pacific region over the 1961-97 period.

2. To test for productivity convergence in the livestock sectors of the Asia-Pacific region.

3. To evaluate the implications of convergence for global trade volumes in livestock and feedstuffs.
In West Africa the formal seed sector is not well developed. Most of the public sector seed system built in the 1970s and 1980s have collapsed. Only a few countries have for-profit seed companies (e.g. Ghana, Nigeria) and those companies are struggling. The main off-farm source of seed is from non-governmental organizations (NGOs), but they are not perceived as the long term solution. Seed sector underdevelopment has always constrained the dissemination of improved varieties in the region, but it becomes particularly important when genetically modified (GM) seeds are considered. With biotechnology seed companies typically acquire the additional responsibility of implementing biosafety and resistance management (e.g. refuges, rotations) plans.

The key hypothesis is that in West Africa the seed sector has not developed because improved varieties were not sufficiently better than traditional varieties to justify the transactions cost involved in seed marketing. Bt cowpea varieties may change that situation with 200% to 300% yield increases over traditional no-insecticide production. The first step in this research would be focus groups and key informant interviews with seed sector participants throughout West Africa. Case studies would be done of both functioning and failed seed businesses. Simulation may help us understand how introduction of Bt cowpea may affect the seed sector. This work would be done as part of the Network for Genetic Improvement of Cowpea in Africa (NGICA) plan to create Bt cowpea.

Genetically modified (GM) crops have proven popular with producers in many parts of the world, but they have encountered resistance from some consumer groups. The reaction of West Africa consumers to GM products is largely untested, but information on consumer preferences is crucial to the plans of the Network for Genetic Improvement of Cowpea in Africa (NGICA) to develop pest resistant Bt cowpeas. Willingness to Pay (WTP) studies have been common in the attempt to assess ex-ante consumer response to GM foods in developed countries. The reliability of the WTP information is in question in developed countries because consumers are typically not well informed on genetic science. That reliability problem is likely to be even greater in West Africa because consumers there generally have
less information. A more reliable source of information is likely to be observing reaction to imported GM food products (e.g. soybean based foods). If such GM foods can be found in markets, a hedonic pricing analysis could be used to estimate the premium or discount. Consumer reaction to other imported foods products might provide an indication of their willingness to tolerate alternative production practices which could results in lower food prices (e.g. chicken leg quarters from the US or Brazil, beef from Europe that may have been fed on animal protein).

Economic Assessment of Precision Agriculture Technology

Global Positioning Systems (GPS), yield monitors, remote sensing and other precision farming technologies have greatly reduced the cost of crop production information. Variable rate applicators with GPS are making it technically feasible to apply inputs differentially according to recommendation maps. Manufacturers are rushing to the market with a wide variety of precision farming products and farmers are wondering which aspects of site specific management make economic sense. Potential research topics related to precision farming technology include:

- Potential profitability of automated steering technology
- Implications of applicator inaccuracy on variable rate lime profitability
- Potential economic benefits from integrated precision farming systems.
- Economics of on-farm robotics

Answering these questions will involve some mix of case studies, on-farm trials and simulation.

Optimization of Pattern Drainage using Yield Monitor Data

Yield monitoring has driven a new wave of interest in drainage. Yield maps quantify the losses to poor drainage and make it easier to convince landowners that drainage is a good investment. Pattern drainage involves systematic installation of drainage tile in parallel lines, in contrast to the traditional practice of installing drainage in the low areas of the landscape. Spacing the tiles too widely results in some area between lines that is poorly drained. Spacing them too closely is a waste of resources. Optimal spacing varies by soil type, rainfall pattern and other factors. Yield maps show how crop yields respond to the placement of a tile line. The spatial econometric methods allow estimation of a crop yield response to drainage from the yield monitor data. Methods for determining optimal spacing of soil conservation barriers (Zougmore et al., AJ 2000) can be adapted to drainage.
WILLIAM A. MASTERS

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Identity preservation in cocoa trade (joint with Phil Abbott)

The international trade in cocoa beans provides an unusual opportunity for consumers in high-income countries to influence the development of tropical forest areas. Through the “Sustainable Tree Crops Program” financed by USAID, we are helping to analyze how changes in trading arrangements could help eliminate child labor, preserve forest tree cover, and raise farmers’ income. We consider the costs of achieving these objectives, consumers’ willingness to pay, and the effects of alternative market structures on farmers’ choices.

Climate, agriculture and economic growth

There is a strong correlation between climatic conditions, agricultural productivity, and per-capita income. Tropical countries have consistently experienced lower growth rates and have lower output than temperate-zone countries. Using new data on climate differences across countries, we try to understand why this correlation has arisen, and what can be done about it.

Demand for public innovation in agriculture: A schedule-of-prizes approach

Many desirable agricultural innovations are public goods, that spread directly from farmer to farmer and end up helping consumers rather than farmers. When the high cost of excluding free-riders makes patent protection ineffectual, R&D for such innovations requires public funding. Almost all of that funding is now provided on a pre-paid basis, through allocations and grants to research agencies. An alternative would be to use research prizes, to be paid after successful innovations are discovered. Improvements in economic impact assessment make it possible to compute a schedule of prizes for various kinds of innovations, offering incentives for research that are roughly proportional to the payoffs for society as a whole. Such a “schedule-of-prizes” approach may be particularly useful now that genetic material and research techniques are increasingly held by private firms under patent protection – making prize payments necessary to have these inputs applied to non-marketable, “public good” kinds of innovations. The proposed research project articulates the methods and procedures that might be used to compute and implement a schedule of research prizes for African agriculture, with case studies of particular innovations that could be financed in this way.
PHILIP L. PAARLBERG

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Risk Assessment of SPS Barriers

Recent literature analyzing sanitary and phyto-sanitary (SPS) trade barriers has begun to demonstrate how trade barriers can be linked to the risk of importing a diseased product. A deficiency in this literature is the risk assessment component which has treated risk as discrete choices of a probability of importing a diseased good and the expected loss if an outbreak occurs. These parameters are not known with certainty and the expected losses are particularly suspect estimates. This research is intended to improve the risk assessment of models tying SPS trade barriers to the risk of importing a disease bearing product.

Implementing Multifunctionality Rules

Differing views of multifunctionality are a source of conflict in World Trade Organization (WTO) negotiations. Recent conceptual work proposes that production subsidies satisfying three conditions be considered WTO legal. Empirical work to date has developed subsidies that satisfy two of the rules, but no empirical example of a case meeting all three rules has been developed. The objective of this research is to provide empirical examples where the proposed WTO rules for multifunctionality set WTO legal production subsidies.
GEORGE F. PATRICK

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Risk Management Strategies for Farmers

Agricultural producers face many sources of variability which can affect the cash flow, net returns, and economic progress of the farm firm. The risks which producers face may have been significantly affected by the ‘96 farm bill. “Freedom to Farm” is also “Freedom to Fail.” Less than fully equity in the farm business creates financial risk which may compound the effects of the business risks which all farmers face. Farmers typically combine production, marketing, and financial responses to risk and practice risk balancing. Past research has often failed to consider the sequential nature of the decision-making and knowledge which becomes available during the production process. For example, grain storage investments are often analyzed assuming storage will be used each year without considering the effect of alternative market situations. This project will analyze the interactive effects of various risk responses in a whole farm situation. Emphasis will be given to the short and long run consequences of alternative risk management strategies on representative farm firms.

Risk Attitudes of Producers and Economic Behavior

Several surveys of producers attending the Purdue Top Farmer Crop Workshops have been conducted. Part of these surveys have dealt with measuring producers’ risk attitudes using alternative measurement procedures. In addition, some producers completed the Myers-Briggs personality type indicator test. Producers surveyed have also provided information on a variety of production, marketing, and financial decisions. Analysis will consider the efficiency and effectiveness of alternative measures of risk attitudes and prediction of observed economic behavior. Possibilities exist to test these measures with participants in future workshops or with other groups of producers.
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**Competition’s Impact on the Supply Chain**

One of the current industry “buzz phrases” is “supply chain management.” Supply chain management has become nearly synonymous with the sharing of information between supplier and consumer up and down the supply chain from raw materials to finished consumer goods. This has occurred largely due to the development of computer technology and protocols that have made the extremely rapid and nearly seamless transfer of information between supply chain agents. While there has always been concern over the sharing of information at the strategic level, recent work has begun to call into question whether information sharing is always a good thing at the tactical level. The answer appears to be “it depends.” In particular, when individual supply chain agents wield market power, information sharing can be a bad thing. The goal of this project is to learn more about the role of competition and market imperfections in determining the value of information sharing.

**Fine-tuning Vertical Coordination in the Swine Possible NRI Industry**

This project addresses how to coordinate a pork production supply chain that spans hog production through processing of consumer pork products. In particular, we will examine the design of producer/packer contracts that will increase the value added in the supply chain. In evaluating producer responses to contract incentives, we will include options for altering nutrition, marketing strategies, and the use of Paylean™.
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<tr>
<td>1. MS/PhD</td>
<td>Agricultural Intensification and Deforestation in the Philippines</td>
<td>Yes</td>
</tr>
<tr>
<td>2. MS/PhD</td>
<td>Landuse change in the Vietnamese Central Highlands</td>
<td>Pending</td>
</tr>
<tr>
<td>3. PhD</td>
<td>Dynamic Time Series Models of Agricultural Price Formation</td>
<td>None at present</td>
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**Agricultural Intensification and Deforestation in the Philippines**

I have an ongoing “microeconometric” research project focusing on the impacts of agricultural development near the forest margin in a remote part of Palawan, in the Philippines. I am using panel data to study the ways in which technological advances in agriculture (in this case irrigation development) have had spillover environmental effects. The research may provide an opportunity to conduct overseas fieldwork.

**Landscape Change in the Vietnamese Central Highlands**

I am starting new research focusing on changes in agricultural land use during the 1990s in Vietnam. The research will use econometric analysis of a large sample of panel data to examine factors related to crop choice, agricultural intensification, and poverty reduction.

**Estimating Dynamic Time Series Models of Agricultural Price Formation**

I have an ongoing interest in time series econometric work focusing on dynamic models of agricultural price formation and market integration, including models with structural breaks and changes in regime. I have very interesting sets of data from Ghana and the Philippines that would be ideal for a graduate student interested in advanced time series econometric work. The data are available for term paper and thesis writers.
## Agricultural Policy Reform in a Drought Prone Country like Morocco

In the past, Morocco has had in place a system of encouraging domestic production of import substitutes like wheat, sunflower, and sugar (irrigated) to the detriment of export crops. Wheat production under dryland conditions is not very drought tolerant, and under irrigation, it requires lots of water. Irrigated sugar is very intensive in water. In the decade of the 1990s, six of the nine years were drought years. Climatologists predict that variability and drought will be the norm in Morocco's future. One could characterize the current policy set as one which assumes the normal condition is one of adequate rainfall and plentiful irrigation water. Clearly, that is no longer the case in Morocco. If one changes from an assumption of adequate rainfall to a presumption of drought, then the policy set which emerges is quite different. The objective of this analysis is to simulate the impacts of alternative policy sets under variable rainfall conditions and to determine the impacts on water use efficiency, environmental factors, economic growth, etc.

## Agricultural Policy Issues in Developing Countries

There are a wide range of important policy issues in developing countries, analysis of which can make a nice M.S. thesis. We expect to have some funding for work on policy issues in Egypt. Possible topics would include evaluation of alternative food subsidy policies, examination of the impact on Egypt of European trade policies, and analyses of alternative price support and other domestic agricultural policies.

## Commodity Price Variability and Food Security

The United States has agreed with other world nations on a objective of cutting in half the number of mal-nourished people by 2015 (from 800 million to 400 million). At the same time, the U.S. is no longer supporting prices of agricultural commodities and bringing land into and out of production based on these prices. Several other changes also lead us to believe that commodity prices are likely to be more variable in the future than they have been in the past. The objective of this research would be to examine the impacts of increased price variability on low income consumers and on developing country farmers under some alternative policy scenarios.