IDRC Award Recipients Technical Report.

An Economic Analysis of the Impacts of Trade Liberalization on Kenya's Maize Sector

Jonathan Nzuma

Department of Food, Agriculture and Resource Economics,

University of Guelph.

November 2006

Introduction.

This study evaluates the market and welfare impacts of trade liberalization in Kenya's maize sector. The objectives pursued include the examination of producer and consumer responses and an analysis of the market and welfare effects of trade reforms. These will be achieved by combining the results of a spatial equilibrium model with household survey data. The trade model will be constructed from the estimated demand and supply parameters and used to simulate the market and welfare effects of trade liberalization on maize producers, processors and consumers. This is a static, deterministic, reduced-form, supply-demand (SD) trade model.

The household survey data will be used to estimate the impacts of the simulated market changes on real incomes of different groups of farmers. This study will be beneficial to Kenya's policy makers as they can have meaningful policy and trade dialogues based on its findings. The findings will also be of interest to maize producers, consumers, policy makers and researchers in the field of agricultural trade economics and development policy in Kenya. Finally, it is hoped that the findings will be relevant to other countries in Sub-Saharan Africa (SSA) where maize is a major staple food and an occasional cash crop that had previously been strictly regulated.

Field work towards this research was undertaken in Kenya between June and September 2006. It involved the compilation of time series data from secondary sources on cereal production, consumption, processing, prices and tariffs from 1963 to 2005. In addition, a survey was conducted to collect additional information from 280 maize producers covering five agricultural districts in Kenya (Figure 1). This study will result in a high quality PhD thesis and at least two referred journal articles.

Study Design

A number of activities related to the collection of primary and secondary data were undertaken during the grant period (April-September, 2006). Table 1 shows the breakdown of these activities and the period during which each of the tasks was accomplished. The months of April and May were spent designing a questionnaire and making arrangements to begin data collection. These arrangements included identifying four research assistants with the help of the University of Nairobi (the local institution of affiliation in Kenya) and purchasing research equipment.

Table 1. Scope and Timeframe of Fieldwork Activities

Timeframe	Activity	Status
September 2006	Travelled back to Guelph from Nairobi, Kenya and undertook data entry	Done
July to September 2006	Primary data collection (questionnaire administration) in five agricultural districts (Machakos, Makueni, Nakuru, Tranzoia and Uasin Gishu	Done
12-18, August, 2006	Presented a contributed paper at the 26th International Association of Agricultural Economics (IAAE) conference at the Gold Coast, Australia.	Done
June 2006	Secondary data collection in Nairobi (national aggregates) and six other provincial headquarters (regional data)	Done
May 2006	Travelled to Nairobi, Kenya from Guelph, Canada and trained four research assistants	Done
April to May 2006	Preparation of data collection manuals and the questionnaire	Done

I travelled to Kenya in May and spent the last week of May selecting and training the research assistants on how to collect the relevant data from secondary sources and on how to administer the questionnaire. The month of June was spent collecting time series data from secondary sources in Nairobi and the seven provincial headquarters (Eastern, Central, Western, Nyanza, Rift Valley, North Eastern and Coast). Nairobi is not considered as an agricultural province but houses the departmental headquarters.

3

The survey of 280 farmers was undertaken between July and September in five maize growing districts in Kenya (Figure 1). In August, I presented a contributed paper at a 26th IAAE conference held in Australia. Data collection was completed in early September and I travelled back to Guelph for primary data entry and consultation with my advisory committee. Data entry was undertaken in the last two weeks of September and early October. Currently, am revising my draft Chapters 1 to 5 of the thesis and sorting out the data for analysis. I will be meeting my thesis advisory committee before the end of November, 2006 for their comments on how to improve my analytical framework and how to proceed with the empirical work.

Data collection and Survey Methods

The study will used both primary and secondary data sources. Annual time series data for the period 1963 to 2005 from public institutions in Kenya and international sources such as the FAO and the World Bank have been collected. The sources of government statistics included publications from Kenya's Central Bureau of Statistics, (CBS) in the form of yearly Statistical Abstracts and Economic Surveys and annual reports from the Ministry of Agriculture (MOA). Household expenditure data were also compiled from the CBS household surveys conducted in 1984, 1992 and 1997.

Time series data on farm inputs such as cropped acreage (land), seed, fertilizer and labour, and domestic production was compiled from the MOA while their prices were compiled from the CBS. CBS publications also provided data on intermediate processing costs and maize meal output. The intermediate inputs considered in this study include labour, capital, material (grain), and energy while the cereals targeted included maize, wheat, rice, millet and sorghum.

Data on cereal consumption, consumer prices and incomes were generated from CBS publications while cereal imports and import tariffs were collected from the Customs Department of the Kenya Revenue Authority. In conformity with the production data, consumer information was collected on the main cereals consumed in Kenya (maize, wheat, rice, sorghum and millet). The consumer price index data to be used in this study were also derived from the CBS. Finally, NCPB publications provided data on NCPB inventories, purchase and sale prices.

Figure 1. Study Sites in Kenya.
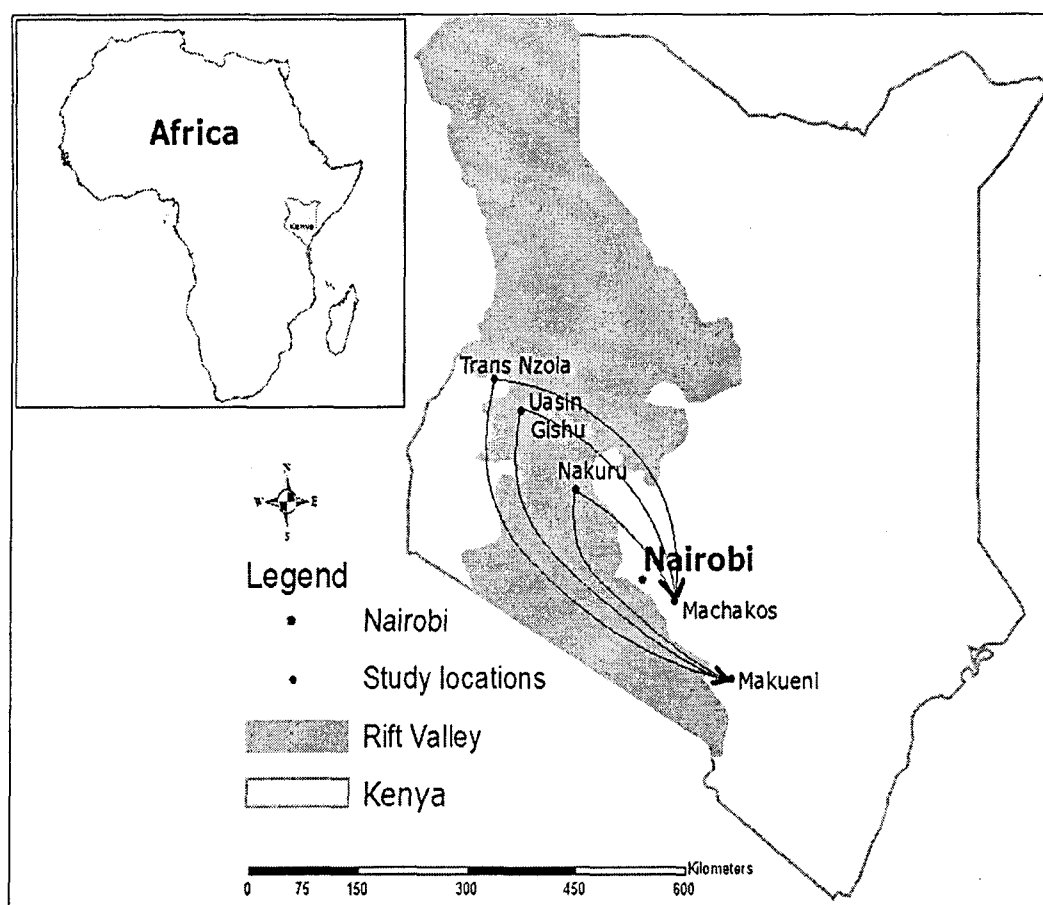
* Maize flows from the surplus producing zones in the Rift Valley to the deficit zones in Eastern Kenya as indicated by the arrows.

A multi-stage sampling procedure was used to identify 280 farmers who were finally interviewed. In the first stage, five districts were purposively chosen to represent the major agro-ecological zones and food production systems in Kenya. The districts selected included Machakos and Makueni in the low potential zones while Nakuru, Uasin Gishu and Tranzoia were chosen to represent the high potential zones (Figure 1). The low potential zones are mainly occupied by semi-subsistence farmers while the high potential zones are dominated by large scale commercial maize farmers.

In the second stage, three divisions were randomly selected in each district. These formed the broad framework for identifying clusters. In the third stage, cluster sampling was used to identify villages and households within the selected villages after consulting the extension officers from the Ministry of Agriculture. Finally, systematic sampling was used to select every fourth farm from the starting point in each village until that particular cluster was fully covered. The households were interviewed for a period ranging from about an hour to two hours using a semi-structured questionnaire (Annex 1).

The objective of the primary survey was to characterize farmer's production patterns and identify their sources of incomes. The survey also assessed the sources of production risk in maize farming, attitude towards risk and the extent of risk that each household was willing to take (Annex 1). On the consumption side, the survey data will be used to estimate the share of home consumption as a ratio of household production. The survey compiled household data on cereal acreage, output, input use, and their prices. Moreover, data were compiled on food consumption in Kilograms (KG) and their respective expenditure in Kenya Shillings (KES).

Logistics

The survey was with generous support from the University of Nairobi and the Ministry of Agriculture in Kenya. Four research assistants were recruited from the graduate students at the University of Nairobi to assist in the data collection exercise. In addition, the Ministry of Agriculture facilitated the identification of the clusters. Specifically, the Divisional Agricultural Extension Officer (DAO) and the Crops Officer in each sampled division were very helpful in identifying the clusters and introducing the research team to the farming communities.

A research permit was acquired from the Ministry of Education in Kenya in addition to an ethics approval secured from the University of Guelph (see attached approvals). In order to ensure that the farming communities developed trust in the research team, the extension service from the Ministry of Agriculture and community leaders were used as entry points. The households were interviewed within their homesteads to guarantee confidentiality and participation was voluntary. In cases where a household was not willing to participate, the research team moved to the next household.

The questionnaire was pre-tested in Kirinyanga district, Central Kenya (a medium potential zone) during the first week of July. The main objective of this piloting of the survey instrument was to gauge whether the questions were framed properly and estimate the amount of time required to complete one interview. Twelve farming households were interviewed during the pre-test phase and the responses generated were entered into a spread sheet for preliminary analysis. Subsequently, the questionnaire was revised to accommodate the issues identified in the pilot study and the revised questionnaire was used to collect data from 280 farmers.

A minimum of two weeks were spent in each district with a target of about 60 farmers per district. However, more time was spent in the districts that have large-scale farmers due to the larger distances, which implied that more time was spent in locating the fourth farm. The team's mobility was ensured through the use of a rented car while a laptop computer was used for ease of record keeping. On an average each of the five members of the research team (four research assistants and myself) interviewed a minimum of three households each day.

The next phase of the study will involve an analysis of the data to derive results for this study. At the initial phase, the secondary data will be tested for data stationarity before it is used in estimating demand and supply relationships. The parameter estimates will then be used to construct a spatial equilibrium model to simulate the trade effects. On the other hand, a measure of risk aversion will be estimated from the survey data that will also be used to estimate the effects of changes in trade policies on different producer groups. A number of statistical software's will be utilized in this analysis. These will include SPSS, EXCEL, SHAZAM and GAMS.

Annex 1

Department of Food Agriculture and Resource Economics

University of Guelph, Canada

Nzuma. M. J. - PhD. Student (0282799).

An Economic Analysis of the Impacts of Trade Liberalization on Kenya's Maize Sector

Good Morning/Afternoon/Evening,

I am a researcher from the University of Guelph in Canada, who is studying the impacts of trade liberalization on Kenya's maize sector. In this analysis, I am seeking to better understand the role of price risk in shaping the behaviour of maize producers in Kenya. This survey will lead to the formulation of desirable policy instruments for the development of maize sector in Kenya. I would like to ask if you would be willing to participate in this survey. If you do, I will ask you a few questions ranging from personal information to information on your farm production activities and consumption. Your help in answering these questions is very much appreciated.

Your participation is completely voluntary, and you do not need to answer any questions that you do not want to. If you choose to participate you may refuse to answer certain questions or you may stop participating at any time. Your responses will be **COMPLETELY CONFIDENTIAL** and your participation will not affect your current or future activities. The interview will last about half an hour. If you have any questions or comments about this survey, you may contact Jonathan Nzuma at 0722-686063 or P.O. Box 29053, Nairobi.

Farm level questionnaire.

Instructions.

- This questionnaire should be administered to obtain information from the household head or the Person managing farm operations.
- Circle or fill the appropriate response.

1.0. Identification.

1.1. Name of enumerator.....................Enterprise Number....................

1.2. Village................................. Location.............................

1.3. Division................................. District.............................

1.4. Date...................................Start Time...........................

2.0. Household Characteristics

2.1. Name of respondent (optional)...

2.2. Age...............................years

2.3. Gender (1) Female   (2) Male

2.4. Formal education level (years) ....

    (1) None ....   (6) Higher (A level) ....

    (2) Primary..................   (7) Certificate course ....

    (3) Secondary (O level)......... (8) Adult education...................

    (4) Bachelors degree..............(9) Postgraduate diploma..............

    (5) Masters degree...............(10) Doctorate Degree..................

2.5. Marital status of the household head

    (1) Single (2) Married (3) Widowed (4) Divorced

2.6. Main occupation of the head of the household

    (1) Farming (2) Trader (3) Formal employment (4) Informal employment

2.7. For how long have you been involved in farming?........................years.

3.0. Farm Production

3.1. What is the size of your farm?.....................acres.

3.2. Did you rent land in 2005? (1) No (2) Yes.

3.3.If yes what is the cost of renting an acre of land?.............................

3.4.Name the major cereals grown on your farm in 2005.

Crop	Acreage	Expected Output (bags)	Actual output	Expected price at planting	Actual Price at harvest (KES/bag)
1. Maize					
2. Wheat					
3. Rice					
4. Sorghum					
5. Millet					

3.5. Use of inputs in maize production.

Input	Maize		Total cost
	Quantity	Unit Cost	Kshs
1. Seed • Own • Purchased (local) • Certified			
2. Fertilizer • Manure • Inorganic			
3. Labour • Own • Hired			
4. Land • Own • Rented			
Total			

3.6. Does the household consume part of what they produce? (1) Yes (2) No

3.7. What proportion of cereal output is consumed at home?

Crop	Output (Bags)	Marketed (bags)	% sold	Consumed at home (Bags)	% consumed at home
Maize					
Wheat					
Rice					
Millet					

3.8. What is the main purpose of your production?

(1) Commercial (Consumes less that 50% of farm production)

(2) Subsistence (Consumes more than 50% of farm output)

(3) Both

3.9. Please indicate the sources of the household annual income?

Income source	Amount 2005	Amount 2004	Amount 2003	Share of total (Compute, do not ask)
Farm income • Maize • Wheat • Rice • Millet • Sorghum • Other (specify)				
Off- Farm (Specify)				
Remittances (Specify)				
Total				

3.10.   What is the contribution of maize production to household income.........%

3.11.   Rank the major constraints that you face in grain production.

(i). Low output price.........................Rank

(ii). High input prices.......................Rank

(iii). Poor weather..........................Rank

(iv). Lack of credit.........................Rank

(v). Pests and diseases......................Rank

4.0. Labor on maize.

4.1. What is the size of your family?...........Persons

4.2. What type of labor do you use in farming? (1) Family (2) Hired. (3) Both.

4.3. Family Composition

Description	Number	Male	Female	Days worked on farm/week	Days worked off-farm/week
Persons below 5 years					
Persons 6 - 12 years					
Persons 13 – 18 years					
Persons 19 – 60 years					
Persons above 60 years					
Total					

4.4. Total man days worked on-farm per week.....................

4.5. Total man days worked off-farm per week.....................

5.0. Attitude Towards Risk

5.1. Have you experienced any major commodity/revenue losses due to any of the following shocks in the past 5 to 10 years?

Cause	2005	2004	2003	Last 5 yrs	Last 10 yrs
Output price fluctuations					
Input price fluctuations					
Bad weather (floods, frost, draught)					
Pests and Diseases					
Theft					
Other					

5.2. Are you willing to grow a new food crop that could either double your income or give you a zero return with equal chance?

(1) Yes (2) No (3) Unsure

5.3. Suppose you could add a new food crop enterprise to your current production. This enterprise does not take labour away from your existing enterprises but would cost KES 15,000 per Ha/year and would generate a profit of KES 30,000 per Ha/year or zero with equal chance. What would be the highest amount of money you would be willing to invest in this new crop enterprise?.........................KES/acre/year.

6.0. Food Consumption.

6.1. Approximately how much income do you earn per month?

      (i). Less than KES 10,000

      (ii). KES 10,000 to 30,000.

      (iii). KES 30,000 to 50,000.

      (iv). Over KES 50,000.

6.2. Approximately how much of this income do you spend on food?

      (i). Less than KES 2,000

      (ii). KES 2,000 to 5,000.

      (iii). KES 5,000 to 10,000.

      (iv). Over KES 10,000.

6.3. What proportion of the income is spend on food...........% (compute)

6.4. What is your weekly expenditure on the consumption of the following foodstuffs?

Foodstuff	Quantity (Bags)	Price KES/bag	Expenditure	% of total income (compute)
Maize				
Wheat				
Rice				
Millet				
Meats				
Milk				
Fruits				
Vegetables				
Oils & fats				

Time at the end of interview............................... .

Thank you.

16

RESEARCH ETHICS BOARD
Certification of Ethical Acceptability of Research Involving Human Participants

UNIVERSITY ⸱ᵒᶠ GUELPH

APPROVAL PERIOD:	July 20, 2006 to September 30, 2006
REB NUMBER:	06Ju025
REPORTS REQUIRED:	Completion Report: September 30, 2006
TYPE OF REVIEW:	Delegated ☒ Full Board ☐
RESPONSIBLE FACULTY:	RAKHAL SARKER
DEPARTMENT:	FARE
SPONSOR:	INTERNATIONAL DEVELOPMENT RESEARCH CENTRE
TITLE OF PROJECT:	**An Economic Analysis of the Impacts of Trade Liberalization on Kenya's Maize Sector**

The members of the University of Guelph Research Ethics Board have examined the protocol which describes the participation of the human subjects in the above-named research project and considers the procedures, as described by the applicant, to conform to the University's ethical standards and the Tri-Council Policy Statement.
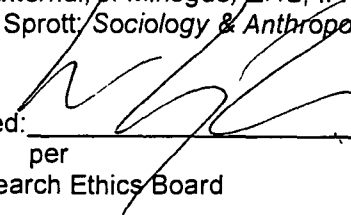
The REB requires that you adhere to the protocol as last reviewed and approved by the REB. The REB must approve any modifications before they can be implemented. If you wish to modify your research project, please complete the Change Request Form. If there is a change in your source of funding, or a previously unfunded project receives funding, you must report this as a change to the protocol.

Adverse or unexpected events must be reported to the REB as soon as possible with an indication of how these events affect, in the view of the Responsible Faculty, the safety of the participants, and the continuation of the protocol.

If research participants are in the care of a health facility, at a school, or other institution or community organization, it is the responsibility of the Principal Investigator to ensure that the ethical guidelines and approvals of those facilities or institutions are obtained and filed with the REB prior to the initiation of any research protocols.

The Tri-council Policy Statement requires that ongoing research be monitored by, at a minimum, a final report and, if the approval period is longer than one year, annual reports. Continued approval is contingent on timely submission of reports.

Membership of the Research Ethics Board: F. Caldwell, *Student Health Services*; A. Duncan, *HHNS*, Michelle Dwyer, *Legal Representative*; M. Fairburn, *Ethics and External*, B. Ferguson, *Economics*, C. Harvey-Smith, *N.D. and External*; J. Minogue, *EHS*; I. Newby-Clark. *Psychology*; J. Randall Simpson, *FRAN*; P. Salmon, *SETS*; J. Sprott, *Sociology & Anthropology*.

Approved:_____
per
Chair, Research Ethics Board

Date: _____OCT - 4 2006_____