85th Annual Conference of the Agricultural Economics Society
Warwick University

18 - 20 April 2011

ON THE ROLE OF THE BROKERAGE INSTITUTION IN THE DEVELOPMENT OF ETHIOPIAN AGRICULTURAL MARKETS

Maria Quattri, Adam Ozanne, Xioabing Wang, and Alastair Hall
The University of Manchester; Contact Information: Maria.Quattri@manchester.ac.uk

Abstract

The recognition that policies aimed at "getting prices right" in less developed countries were failing due to incomplete markets has spurred a new wave of reforms, directed instead at "getting markets and institutions right". Although previous studies have documented the potentially crucial role of the brokerage institution in crop commercialisation, few have investigated what determines wholesalers' decisions to use brokers.

Using data collected in 2006/07 by Gabre-Madhin, IFPRI and EDRI, we examine Ethiopian traders' decisions regarding whether or not they should use brokers, and how much. Independent variables are human, financial and social asset availability, implemented trading practices, access to infrastructure and institutions, location, travelled distance and traded crops. Results show that brokerage services are particularly valuable for wholesalers lacking social capital and storage capacity, who are based in areas with low population density, and who trade at a distance especially when roads are not asphalted. Buyers in drought-prone domains rely on brokers more for their long-distance purchases, while sellers in moisture-reliable domains employ brokers more for their long-distance sales. These results provide useful indications regarding where and how the recent formalisation of brokerage functions through the ECX could be most beneficial for the functioning of Ethiopian agricultural markets.

JEL codes: O12, O13, O18

ACKNOWLEDGEMENTS

We thank Dr. Eleni Gabre-Madhin (*Ethiopian Commodity Exchange, ECX*, Ethiopia) for arranging access to the "ECX Trader Survey 2007" and for much good advice, Seneshaw Tamiru Beyene (*International Food Policy Research Institute, IFPRI*, and the *Ethiopian Development Research Institute, EDRI*, Ethiopia) for collecting and compiling the data and many helpful suggestions, and Dr. Paul Dorosh, Dr. Shahidur Rashid and Dr. Asfaw Negassa (IFPRI) for their valuable comments. The views expressed are, however, those of the authors and do not necessarily reflect the views of ECX, IFPRI or EDRI. All remaining errors and shortcomings are the authors' responsibility.

1. INTRODUCTION

Major policy reforms were undertaken in Ethiopia in the early Nineties in order to substitute the centrally-planned and controlled socialist economy, in place since 1974, with a free-market system. These reforms were based on the idea that eliminating distortionary economic interventions by the state was a precondition for "getting prices right", which was itself necessary for spurring private investment and economic growth (TIMMER, 1986).

Studies conducted in the post-reform era have found that liberalisation succeeded in enhancing price transmission between the main regional markets (JAYNE et al., 1998; NEGASSA and JAYNE, 1997). Nevertheless, it has also been widely recognised that "The withdrawal of parastatals from core input marketing activities created a void that the private sector often failed to fill due to underdeveloped physical communications, power and transport infrastructure, credit constraints and continued bureaucratic impediments that increased transaction costs for input suppliers" (BARRETT and MUTAMBATSERE, 2005: 7). To address the challenges posed by failing and incomplete markets, the Ethiopian Government has implemented a number of post-structural market reforms focused instead on "getting institutions right" (BARRETT and MUTAMBATSERE, 2005) and "getting markets right" (THE WORLD BANK, 2004).

Of all the institutions that might contribute to such reforms and enhance the operation of markets, several studies have documented the crucial role played by brokers. These studies outline the benefits farmers and wholesalers alike derive from engaging the services of brokers. However, very few contributions have investigated the variables influencing economic agents' decisions to use brokers (see DESSALEGN et al., 1998; FAFCHAMPS and GABRE-MADHIN, 2001; GABRE-MADHIN, 2001; JABBAR et al., 2008) and, to our knowledge, only Gabre-Madhin (2001) has attempted to explain through econometric modelling the actual decision processes followed by traders in choosing whether or not to use brokers.

The aim of this paper is to shine light on wholesalers' use of brokers in Ethiopian grain markets, and contribute to the literature on the roles played by social capital, trading practices, institutions and infrastructure in the development of agricultural market. In particular, we ask two questions. Firstly, which of the variables significantly impact on wholesalers' decisions on whether and for how much to use brokers? Secondly, which traders would benefit most from the formalisation of brokerage activities?

These research questions are especially relevant to the current debate regarding the roles and importance of the Ethiopian Commodity Exchange (ECX). Launched in April 2008 as a national and multi-commodity exchange born out of a public-private partnership, the ECX formalised and strengthened the functions typically conducted by brokers.

We estimate traders' use of brokers in their main markets for buyers and sellers separately. The analysis benefits from the use of newly available data collected through the ECX Trader Survey 2007 (GABRE-MADHIN et al., 2007) conducted by Gabre-Madhin, the International Food Policy Research Institute (IFPRI) and the Ethiopian Development Research Institute (EDRI).

The paper is organized as follows. Section 2 reviews the literature on the relevance of the brokerage institution for agricultural markets and traders' attempts to minimise high transaction costs through the use of brokers; Section 3 introduces the details of the estimation procedure, data and summary statistics; Section 4 presents and discusses the main research findings; Section 5 concludes.

2. LITERATURE REVIEW

The Relevance of the Brokerage Institution for Agricultural Markets – The essential role of intermediaries in agricultural markets has been documented for a number of Sub-Saharan Africa countries. For example, it has been found that brokers compensate for the lack of networks of business partners at traders' disposal in Benin and Malawi (FAFCHAMPS and GABRE-MADHIN, 2001); they encourage impersonal exchange by acting as guarantors for the parties involved in trade in Tanzania (ESKOLA, 2005); they provide information, funding and technical assistance to wholesalers of fresh fruits and vegetables in Uganda (BEAR and GOLDMAN, 2005); and they represent the first alternative for farmers to other forms of collective action such as producer marketing groups in Kenya (SHIFERAW et al., 2009). Also, in the livestock sector brokers facilitate pig marketing in the Northern part of Nigeria (AJALA and ADESEHINWA, 2007) and livestock trade in Nairobi, which is a leading terminal market for livestock from throughout the Greater Horn of Africa. Given the cross-border nature of these trading networks, trust between brokers and traders is essential (BAILEY et al., 1999).

The important role played by brokers has also been reported outside Africa. In Brazil, for example, they support farmers by helping to minimise price risk in futures and derivatives agricultural markets (PESSÔA and JANK, 2002), while in Peru commission agents promote

long-distant trade (SCOTT, 1985). In India, in the traditional marketing system, small land-holding farmers depend on intermediaries for credit (LOKANATHAN and DE SILVA, 2010).

Gabre-Madhin (2001) Research Findings – A study that deserves particular attention for the purpose of this paper is that of Gabre-Madhin (2001), who depicted the benefits that the use of brokers could bring to wholesalers while explaining why traders use brokers in the first instance. Using primary data collected in Ethiopia in 1996, Gabre-Madhin (2001) demonstrated how the use of brokers by traders is positively related to transaction costs of search, defined as the shadow opportunity costs of search labour and of working capital kept in the form of grain stocks, and inversely related to social capital availability.

However, Gabre-Madhin (2001) based her analysis on strong hypotheses regarding the functional form specification of the trader's profit function, used for the instrumental variable derivation of opportunity costs, while the assumed endogeneity of search labour and working capital was not tested. Gabre-Madhin also assumed that the probability that wholesalers use brokers in their main markets and the expected share of brokered transactions are determined by the same set of variables (a consequence of the use of the Tobit model), which may not be the case. Furthermore, the approach she adopted assumes the impact of a given variable on both the likelihood to turn to brokers and the amount of brokerage use is in the same direction (BAUM, 2006).

Traders' Attempt to Minimise High Transaction Costs and The Use of Brokers – Gabre-Madhin (2001) and the aforementioned studies suggest that traders' use of brokers is closely related to traders' attempt to minimise prohibitively high transaction costs. Transaction cost economics essentially asserts that market institutions minimise transaction costs associated with market exchange and that markets evolve over time following changes in the nature and sources of transaction costs (KHERALLAH and KIRSTEN, 2001).

Jabbar et al. (2008) further argue that traders own different assets (such as physical, financial, human and social capital) and adopt various trading practices, including the use of brokers, in order to reduce transaction costs. Among trading assets, the existing literature has given particular relevance to social capital[1].

[1] In general terms, social capital refers to articulated networks linking human beings, based on mutual trust, reputation and reciprocity (GABRE-MADHIN, 2006; GABRE-MADHIN and HAGGBLADE, 2003). Fafchamps and Minten (1999b) distinguish between social capital collected unintentionally (through family connections, ethnicity or by belonging to a religion group) and social capital intentionally acquired through joining associations and actively looking for potential trading partners. Fafchamps and Minter (1998) provide evidence of the large and significant impact that social networks have on the performance of traders in

Traders' ability to minimise transaction costs is also challenged by the environment in which they operate. For example, Gabre-Madhin (2001) found that traders' use of brokers varies depending on whether they are located in a surplus or deficit production region. A geographic disaggregation of Ethiopia is therefore specified in this paper following Chamberlin et al. (2006) which allows the heterogeneity of production and marketing contexts prevailing in the country to be taken into account[2].

Staal et al. (1997) and Gabre-Madhin (2006) found that, apart from location, travelled distance and physical infrastructure availability also have an impact on traders' ability to minimise transaction costs. The inadequacy of physical infrastructure (such as road networks, telecommunications and storage facilities) pushes searching, screening and bargaining costs up. Moreover, the farther wholesalers are from their main markets the more these costs rise. Schmidt and Shiferaw (2009: 7) add that 'The shortest route in Kilometres may not always be the fastest route'. Hence, in order to investigate wholesalers' use of brokers aimed at minimising transaction costs, Euclidean distance between traders' base and main market centres is considered in connection with dummy variables assessing the quality of roads linking these markets.

Assets' ownership, implemented trading practices, location, travelled distance and infrastructure availability mean that some traders are more able to reduce transaction costs than others. But do these variables impact on wholesalers' decisions on whether and for how much to use brokers? We test the hypotheses that their impact is relevant and statistically significant. This will lead to the formulation of policy advice on where and how the activities of the ECX could be particularly beneficial for the functioning of agricultural markets.

3. ANALYTICAL FRAMEWORK

3.1 The Model under the Assumption of Sample Selection

We assume traders follow a sequential decision process, with a discrete choice on 'whether or not' to use brokers and a subsequent continuous decision on 'how much' to use brokers.

The selection equation describes whether a trader is using or not brokers,

$$T_i = 1 \ \{Z_i'\alpha + u_i > 0\}$$

Madagascar, while their research conducted in Benin, Madagascar and Malawi supports the beneficial impact of social capital on the productivity of agricultural traders (FAFCHAMPS and MINTEN, 2001).

[2] Chamberlin et al. (2006) analyse crop commercialisation by farmers in Ethiopia, and classify smallholder-relevant agricultural domains based on agricultural potential, access to market (measured by the average travel time to the nearest town of 5,000 or more inhabitants) and population density. They define domains as 'geographical locations sharing broadly similar rural development constraints and opportunities' (ibid.: vii).

$T_i = 0 \ \{Z_i'\alpha + u_i \leq 0\}$ (1)

T_i, a brokerage-use indicator, is a dummy variable and the realisation of a latent continuous variable $\{Z_i'\alpha + u_i\}$. When $T_i = 1$, the marginal benefits of using brokers exceed the marginal costs (or lost profit due to brokerage fees).

Only when the binary participation decision T_i equals unity is the 'brokerage-use intensity' B_i observed. B_i explains how much trader *i* uses brokers and represents the share of brokered transactions out of total transactions. Therefore,

$B_i = B_i^*, \quad if\ T_i = 1$

B_i not observed, $if\ T_i = 0$ (2)

where B_i^* (the potential share of brokered transactions, a latent variable) corresponds to

$B_i^* = X_i'\beta + \varepsilon_i$ (3)

Equations (1) to (3) are valid under the following assumptions (WOOLDRIDGE, 2002: 562):

(a) (X_i, Z_i, T_i) are always observed;

(b) (ε_i, u_i) is independent of (X_i, Z_i) with zero mean, which means (X_i, Z_i) are exogenous vectors of covariates for $i = 1, \dots, N$

(c) $u_i \sim N(0,1), \quad i = 1, \dots, N$

(d) $E(\varepsilon_i|u_i) = \sigma_{\varepsilon u}u_i = \rho_{\varepsilon u}\sigma_\varepsilon u_i$ With $\rho_{\varepsilon u} = corr(\varepsilon_i, u_i) = \frac{\sigma_{\varepsilon u}}{\sigma_u \sigma_\varepsilon}$

Therefore, once trader *i* decides to use brokers ($T_i = 1$), the observed B_i is positive. In other words, the participation decision dominates the intensity decision[3].

3.2 Testing for Independence

Before estimating the sample selection model, the presence of sample selection needs to be tested. Wooldridge (2002: 564) suggests performing a standard t-test on $\sigma_{\varepsilon u}$ for the null hypothesis of no selection bias:

$H_0: \sigma_{\varepsilon u} = 0$

$H_A: \sigma_{\varepsilon u} \neq 0$ (4)

corresponding to:

[3] This is the reason why the sample selection model à la Heckman is also known as first-hurdle dominance model (MADDEN, 2008: 301-302; MOON et al., 2004: 12-13). Whereas the Tobit model, used by Gabre-Madhin (2001) in her investigation, assumes that the participation decision is irrelevant and treats as zeros those observations for which the shares of brokered transactions are zeros (i.e. corner solutions or actual and fully-observed outcomes of a constraint optimization process), the Heckman model considers these observations as unobserved/missing. In the words of Dow and Norton (2003: 6), 'The non-zero values are assumed to be true observations of the potential outcome, but zero values indicate observations for which the potential outcome is missing (latent). The zeros do not represent zero values for the potential outcome'.

$$H_0: \rho_{\varepsilon u} = 0$$
$$H_A: \rho_{\varepsilon u} \neq 0 \quad (5)$$

Yamagata and Orme (2005: 479-480) highlight how this standard regression-based t-test procedure, originally proposed by Heckman (1979) and Melino (1982) and robust to nonnormality, is recommended when the multicollinearity between the regressors in the selection equation (1) and those in the outcome equation (3) is not severe. Otherwise, under the multicollinearity problem, 'the Likelihood Ratio test, based on Maximum Likelihood estimation under the assumption of normality, remains powerful and has reasonable size properties' (YAMAGATA and ORME, 2005: 479-480).

Additionally, in order to reduce multicollinearity, Wooldridge (ibid.) suggests making X_i a strict subset of Z_i. Thus, at least one variable called the exclusion restriction or selection instrument should explain a trader's decision to self-select him/herself into the group of wholesalers using brokers, but should have no partial effect on his/her chosen share of brokered transactions.

3.3 Estimation Methods

Sample Selection Detected – If sample selection was detected, we would proceed by estimating the model by Full Information Maximum Likelihood. The FIML approach strengthens asymptotic inference by estimating the selection (1) and the outcome equation (3) jointly (BOLWIG et al., 2009: 1098), and produces likelihood ratio statistics and standard errors which can be used directly (WOOLDRIDGE, 2002: 566). The FIML estimator is not only consistent, but also asymptotically efficient under the hypothesis that the error terms in the two regressions are distributed bivariate normal with mean zero. Assumptions (c) and (d) stated above are thus replaced with the stronger assumption that

$$\binom{\varepsilon_i}{u_i} | X_i, Z_i \sim N\left(\binom{0}{0}, \begin{pmatrix} \sigma_\varepsilon^2 & \sigma_{\varepsilon u} \\ \sigma_{\varepsilon u} & 1 \end{pmatrix}\right). \quad (6)$$

It can be shown that the log-likelihood function for the selection model à la Heckman is given by (WOOLDRIDGE, 2002: 566, IMBENS, 2004: 3)

$$L(\alpha, \beta, \sigma_\varepsilon^2, \rho_{\varepsilon u}) = \sum_{i=1}^{N} (1 - T_i) \ln\left(1 - \Phi(Z_i'\alpha)\right) + T_i \left(\ln \Phi \left(\frac{\left(Z_i'\alpha + \frac{\sigma_{\varepsilon u}}{\sigma_\varepsilon^2}(B_i - X_i'\beta)\right)}{\sqrt{\left(1 - \frac{\sigma_{\varepsilon u}^2}{\sigma_\varepsilon^2}\right)}} \right) + \ln \phi \left(\frac{B_i - X_i'\beta}{\sigma_\varepsilon} \right) - \ln \sigma_\varepsilon \right) \quad (7)$$

Parameters' estimates are obtained by maximising this function. As the coefficient estimates represent changes in the desired or potential quantities transacted, the variation in the observed and actual quantities can be derived through the decomposition (DOW and NORTON, 2003: 8)[4]

$$E[B_i|X_i, Z_i] = Pr[B_i > 0|X_i, Z_i] \times E[B_i|B_i > 0, X_i, Z_i]$$

Sample Selection Not Detected – If sample selection was not detected (i.e. the correlation $\rho_{\varepsilon u}$ between the error terms in the participation and outcome equations is not significantly different from zero), we would instead follow a hurdle or two-tiered estimation procedure (WOOLDRIDGE, 2002). First, the selection equation (1) would be estimated by Probit using the entire sample of N observations (see LEUNG and YU, 1996: 201-202),

$$P(T_i = 1|Z_i) = \Phi(Z_i'\alpha),\ i = 1, \dots, N, \quad (8)$$

where $\Phi(Z_i'\alpha)$ is the standard normal cumulative distribution function evaluated at $Z_i'\alpha$. Thereafter, the estimates of β would be derived by running an Ordinary Least Squares (OLS) regression on the model

$$B_i = X_i'\beta + v_i \quad (9)$$

With $E(v_i|X_i, T_i = 1) = 0$

The OLS estimation would use all observations for which $T_i = 1$, which means the subsample of traders using brokers. Marginal effects for the Probit and OLS coefficient estimates from the two-part estimation would thus be reported.

3.4 The Data and the Variables

The "ECX Trader Survey 2007" (GABRE-MADHIN et al., 2007) was conducted in May-July 2007 before the launch of the ECX in April 2008. In this survey, 457 wholesalers in 21 markets around Ethiopia were asked to recall their activities from the start of that production year (October/November 2006) until April/May 2007. Hence, the survey covered the main

[4] If x_{ki} is an arbitrary continuous *k*-th independent variable which enters both the selection and the outcome equations, the marginal effect of x_{ki} on the expected actual share of brokered transactions $E[B_i|X_i, Z_i]$ is (omitting the condition on X_i and Z_i for ease of notation):

$$\frac{\partial E[B_i]}{\partial x_{ki}} = \frac{\partial Pr[B_i>0] \times E[B_i|B_i>0]}{\partial x_{ki}} = \left(Pr[B_i > 0] \times \frac{\partial E[B_i|B_i>0]}{\partial x_{ki}}\right) + \left(E[B_i|B_i > 0] \times \frac{\partial Pr[B_i>0]}{\partial x_{ki}}\right)$$

where $Pr[B_i > 0] = \Phi(Z_i'\alpha)$ is the probability that trader *i* uses brokers in his/her main market;

$\frac{\partial Pr[B_i>0]}{\partial x_{ki}}$ is the marginal effect for the probability of using brokers;

$E[B_i|B_i > 0]$ is the expected share of brokered transaction for trader *i*, conditional on the fact that s/he is currently using brokers in his/her main market; and

$\frac{\partial E[B_i|B_i>0]}{\partial x_{ki}}$ is the conditional marginal effect.

harvest seasons for 2006/07 (the Meher and the Belg seasons) when crop commercialisation by farmers and trading opportunities for wholesalers were flourishing.

In the analysis, we consider buying and selling transactions separately and identify a "main market" regularly used for each trader's purchases and sales, which may be the market where the wholesaler is based or a long-distant market[5].

The variables used in the estimations for buyers and sellers, their specifications and units of measurement, are presented in Tables A. (exclusion restrictions, chosen based on economic reasoning and available evidence) and B. in the Appendix. The reasons underlying the choice of selection instruments are also reported in the Appendix.

3.5 Summary Statistics

Table 1 reports descriptive statistics computed after eliminating outliers, leverages, unusual and influential observations and, from the sample of sellers, exporters (the analysis focuses on transactions relevant for local markets only).

Table 1 Summary Statistics for Buyers and Sellers

	BUYERS		SELLERS	
	Mean	**SD**	**Mean**	**SD**
Gender of the owner of the trading business (=1 if female)	0.09	0.29	0.09	0.29
Main Traded Agricultural Product				
Cereals (=1 if the wholesaler buys/sells cereals)	0.67	0.47	0.72	0.45
Coffee (=1 if the wholesaler buys/sells coffee)	0.13	0.34	0.11	0.31
Oilseeds (=1 if the wholesaler buys/sells oilseeds)	0.11	0.31	0.09	0.29
Pulses (=1 if the wholesaler buys/sells pulses)	0.1	0.29	0.08	0.28
Trading Practices				
Trading Firm Ownership				
Sole-ownership of the trading business (=1 if sole-ownership; 0 otherwise)	0.96	0.2	0.99	0.12
Distance between the base and main markets (Kms)	289	271	364	223
Assets				
Human Capital				
Number of years of operation of the trading business (Years)	12	11	12	10
Number of people authorised to buy and/or sell for the trading business	1	2	1	2
Human Capital Used to Minimise Information Costs				
Employees engaged in price search (Number)	2	1	1	1
Social Capital Used to Minimise Information Costs				
Trading contacts in the main market (Number)	44	158	43	135
Social Capital Used to Minimise Negotiation Costs				
Regular suppliers/customers in the main market (Number)	13	73	30	202

[5] We define "regularity" according to the following criteria (the order in which they are mentioned dictates their priority):

1. The market in which the greatest percentage of the most purchased/sold agricultural product is traded (i.e. the crop for which the wholesaler purchased/sold the greatest quantities during the last harvest year).
2. The market in which the trader has a stall.
3. The market where the trader has the greatest number of trading contacts.
4. The number of business-related journeys made to that market from the start of the production year.

Financial Assets & Access to Credit				
Working Capital (National Currency Unit: 000 Ethiopian Birr)	1,478	10,600	250	611
Access to credit (=1 if the wholesaler had access to in/formal credit since the start of the production year; 0 otherwise)	0.44	0.5	0.42	0.49
Physical Capital/Access to Physical Infrastructure				
A storage facility is under the trader's exclusive control (=1 if yes; 0 otherwise)	0.97	0.17	0.97	0.17
Capacity of storage facility/ies under the trader's exclusive control (Quintals)	6,525	28,033	2,898	13,725
Contractual Performance				
Costs				
Annualised Physical Marketing Costs (000 Ethiopian Birr)	291	1,914	57	214
Fixed/Operational Costs (000 Ethiopian Birr)	67	351	27	93
Market where the trader is based				
Location: Agricultural Potential				
Drought-Prone Area (=1 if the trader is based in a drought-prone area)	0.28	0.45	0.27	0.44
Moisture-Reliable Area (=1 if the trader is based in a moisture-reliable area)	0.51	0.5	0.53	0.5
Pastoral Area (=1 if the trader is based in a pastoral area)	0.06	0.24	0.05	0.22
Central Market (=1 if the trader is based in Addis Ababa)	0.15	0.36	0.15	0.35
Location: Access to Market and Population Density				
(=1 the market where the trader is based has the following aspects)				
Low Market Access & Low Population Density	0.35	0.48	0.34	0.47
Low Market Access & High Population Density	0.18	0.38	0.19	0.39
High Market Access & High Population Density	0.47	0.5	0.47	0.5
Main Market				
Relevance & Competition				
Share of total purchases/sales in the trader's main market (%)	0.91	0.18	0.95	0.13
Availability of Infrastructure & Telecommunications				
Type of road linking the trader's main market to the market where s/he is based (=1 if road is as indicated; 0 otherwise)				
Asphalted Road	0.5	0.5	0.76	0.43
Dry-Weather Road	0.2	0.4	0.14	0.34
All-Weather Road	0.3	0.46		
Financial Institutions' Availability				
Availability of a Bank in the trader's main market (=1 if yes; 0 otherwise)	0.89	0.31	0.98	0.15
Number of Observations	449		414	

The overwhelming majority of traders are male sole-owners with an average of 12 years in the trading business, mostly located in moisture-reliable agricultural domains (more than 50 percent of them), in areas characterised by high market access and high population density (47 percent of them) and are mainly trading cereals (on average, 69.5 percent of them).

The size of trading businesses varies remarkably, as indicated by available working capital and the capacity (in quintals) of storage facilities under exclusive control. Survey results indicate that wholesalers of cereals and pulses (i.e. food crops) have an average working capital four times smaller than that of coffee and oil seed (i.e. cash crops) traders. Moreover, storage facilities exclusively controlled by cash-crop wholesalers can store, on average, 9 percent more produce than the facilities controlled by food-crop traders. Given the heterogeneity in the size of the trading firms, observations for working capital and storage

capacity are normalised through a logarithmic transformation to make them comparable (FAFCHAMPS et al., 2000: 16).

The number of regular customers for an average wholesaler is more than double the number of regular suppliers and, as expected, the number of trading contacts is greater than that of regular partners. Surveyed wholesalers conduct on average 93 percent of their total transactions in their main markets, where the number of trading contacts (i.e. social capital) is the greatest. This helps minimize the transaction costs of obtaining and processing market information. Considering infrastructure availability and access to credit, roads linking base to main market centres are mainly asphalted and only 43 percent of all traders can access in/formal credit.

Further data investigation shows that main markets are distant markets for a larger proportion of buyers than sellers (25 versus 20 percent), and that sellers tend to travel on average for longer distances (364km versus 289km for buyers). Moreover, buyers in drought-prone and pastoralist areas travel on average 157km more than buyers in moisture-reliable areas, and sellers in moisture-reliable domains travel on average 97km more than sellers in drought-prone domains. The mean distance covered by cash crop wholesalers is 185km greater than the distance covered by food crop wholesalers.

4. RESEARCH FINDINGS AND DISCUSSION

4.1 Preliminary Analysis

Before reporting estimation results, we conduct a series of tests to check for the exogeneity of potentially endogenous explanatory variables for human and working capital, the presence of sample selection and the validity of the introduced exclusion restrictions.

Test statistics show that working capital and human capital are exogenous explanatory variables[6], and that the introduced exclusion restrictions are valid selection instruments[7].

[6] In her analysis of traders' use of brokers in Ethiopia in 1996, Gabre-Madhin (2001: 55) noticed that the use of directly observed search labour and working capital to describe wholesalers' use of brokerage would cause endogeneity bias because the chosen levels of working capital and search labour depend on traders' choice of brokerage. Gabre-Madhin defined working capital as the "average amount of funds that the trader has at his or her disposal for the purpose of buying and marketing grain" and search labour as the "number of persons in the trading firm who are engaged in searching for buyers and sellers" (GABRE-MADHIN, 2001: 56). Accordingly, before estimating the models for buyers and sellers we test for the exogeneity of the variables search labour (i.e. the number of employees engaged in the search for market price information) and working capital. In order to test whether these variables are endogenous explanatory variables, we identify valid and relevant instruments and then run a two-step instrumental variable robust probit estimation for the probability of brokerage use, reporting a Wald test of endogeneity. This is done for both buyers and sellers. We derive potential instruments from the analysis of Fafchamps and Minten (2001). Valid, relevant and non-redundant instruments are identified through a testing procedure. Both variables for human and working capital are found to be exogenous

When it comes to sample selection, the Wald and LR tests for buyers (with test statistics of 5.49 and 3.58 and p-values of 0.0191 and 0.0586 respectively) reveal that the correlation coefficient $\rho_{\varepsilon u}$ between the error terms in the outcome and selection equation is significantly different from zero (condition (d) on page 7). For sellers, this is not the case: both the Wald test and the LR test show that there is not sample selection (test statistics of 1.12 and 1.72 and p-values of 0.2898 and 0.1893 respectively). For sellers we thus conduct a two-part estimation procedure.

4.2 The Results

Table 2 reports the marginal effects for the selection model for buyers in Columns 1 and 2. For sellers, marginal effects for the estimated probability of brokerage use are listed in Column 3, while OLS coefficients for the share of brokered transactions are given in Column 4. Results are discussed based on the categories for independent variables: assets' availability (i.e. availability of social, human and working capital), external environment (i.e. base market characteristics, in terms of market access, population density and agricultural potential), distance between base and main markets and quality of roads linking the two markets, contractual performance (in terms of physical marketing costs and fixed costs), access to credit and presence of banks in the main markets.

for both buyers and sellers; hence, they are introduced in the Heckman selection models directly. Exogeniety test results are not reported to save space.

[7] As reminded by Ettner (2004: 51), exclusion restrictions shall have 'only a negligible direct influence on the outcome after controlling for the covariates'. We find that selection instruments are uncorrelated with the error term in the outcome equation, and are thus orthogonal. Results are not shown here to save space.

Table 2 Estimation Results for the Probability of using Brokers and the Shares of Brokered Transactions for Buyers and Sellers

BUYERS *Sample Selection Model Estimation*	Unit	**1.** Marginal Effect[a] for $Pr(B > 0)$	**2.** Conditional Marginal Effects[a]
ASSETS			
Social Capital			
No. of Regular Suppliers	ln(x+1)	**0.036***	**-0.096*****
		(0.022)	(0.020)
No. of Trading Contacts in the Main Market	ln(x+1)	**-0.039***	
		(0.022)	
Human Capital			
No. of Employees Engaged in Search	ln(x+1)	**0.246*****	
		(0.057)	
No. of Trader's Substitutes	ln(x+1)	**0.144****	
		(0.066)	
Financial Assets & Access to Credit			
Working Capital	ln	-0.021	**0.048****
		(0.023)	(0.019)
Credit Access	yes=1	**-0.096***	-0.082
		(0.054)	(0.050)
CONTRACTURAL PERFORMANCE: Costs			
Annualised Physical Marketing Costs	ln	-0.006	
		(0.018)	
Fixed/Operational Costs	ln	**0.073*****	
		(0.023)	
TRADING PRACTICES			
Distance from the Base to the Main Market	ln(x+1)	0.042	**0.092****
		(0.056)	(0.045)
ACCESS TO PHYSICAL INFRASTRUCTURE			
Storage Capacity	ln(x+1)	**-0.049*****	-0.007
		(0.018)	(0.014)
Asphalted Roads	yes=1	-0.275	**-0.595****
		(0.178)	(0.278)
Dry-Weather Roads	yes=1	-0.016	**-0.602*****
		(0.303)	(0.229)
All-Weather Roads	yes=1	0.053	**-0.667*****
		(0.331)	(0.246)
ACCESS TO FINANCIAL INSTITUTIONS			
Bank	yes=1	**0.310*****	
		(0.059)	

SELLERS *Two-Part Model Estimation*	Unit	**3.** Marginal Effect[a] for $Pr(B > 0)$	**4.** OLS Estimation Coefficients
ASSETS			
Social Capital			
No. of Regular Customers	ln(x+1)	0.019	**-0.082****
		(0.013)	(0.032)
No. of Trading Contacts in the Main Market	ln(x+1)	0.002	
		(0.017)	
Human Capital			
No. of Employees Engaged in Search	ln(x+1)	**-0.067***	
		(0.037)	
No. of Trader's Substitutes	ln(x+1)	0.053	
		(0.046)	
Financial Assets & Access to Credit			
Working Capital	ln	0.021	0.015
		(0.018)	(0.041)
Credit Access	yes=1	**0.075***	0.000
		(0.040)	(0.087)
CONTRACTURAL PERFORMANCE: Costs & Trading Disputes			
Annualised Physical Marketing Costs	ln	0.018	
		(0.012)	
Fixed/Operational Costs	ln	**-0.030***	
		(0.017)	
TRADING PRACTICES			
Distance from the Base to the Main Market	ln(x+1)	-0.003	0.054
		(0.013)	(0.049)
ACCESS TO PHYSICAL INFRASTRUCTURE			
Storage Capacity	ln(x+1)	-0.013	0.028
		(0.011)	(0.020)
Asphalted Roads	yes=1	0.021	-0.056
		(0.088)	(0.271)
Dry- & All-Weather Roads	yes=1	0.022	-0.005
		(0.139)	(0.353)
ACCESS TO FINANCIAL INSTITUTIONS			
Bank	yes=1	**0.114*****	
		(0.033)	

Table 2 Estimation Results for the Probability of using Brokers and the Shares of Brokered Transactions for Buyers and Sellers (cont.)

BUYERS *Sample Selection Model Estimation*	Unit	**1.** **Marginal Effect[a] for $Pr(B > 0)$**	**2.** **Conditional Marginal Effects[a]**
MAIN CROP BOUGHT			
Cereals	yes=1	-0.114	**0.291*****
		(0.099)	(0.091)
Pulses	yes=1	-0.098	**0.222****
		(0.104)	(0.108)
Coffee	yes=1	**-0.207****	**0.198***
		(0.082)	(0.117)
LOCATION			
Moisture-Reliable Areas	yes=1	**0.291*****	**-0.222****
		(0.086)	(0.102)
Drought-Prone Areas	yes=1	**0.593*****	-0.055
		(0.079)	(0.100)
Pastoral Areas	yes=1	-0.012	-0.203
		(0.152)	(0.171)
Base Market: Low-Market Access & High-Population Density	yes=1	-0.037	**-0.168****
		(0.078)	(0.070)
Base Market: High-Market Access & High-Population Density	yes=1	-0.046	-0.016
		(0.074)	(0.060)
		Psel=0.323	Ycond=0.703
Number of observations		449	
Of which uncensored		162	
Log pseudolikelihood		-241.673	
LR test of indep. eqns. (rho = 0)/χ^2 (1)		3.58	
p-value for the LR test		0.0586	
/athrho		0.450**	
		(0.224)	
/lnsigma		-1.261***	
		(0.074)	
rho		0.422	
sigma		0.283	
lambda		0.120	

SELLERS *Two-Part Model Estimation*	Unit	**3.** **Marginal Effect[a] for $Pr(B > 0)$**	**4.** **OLS Estimation Coefficients**
MAIN CROP SOLD			
Cereals	yes=1	**-0.165****	0.109
		(0.084)	(0.124)
Pulses	yes=1	**-0.098****	0.093
		(0.043)	(0.201)
Coffee	yes=1	**-0.112*****	0.231
		(0.035)	(0.178)
LOCATION			
Moisture-Reliable Areas	yes=1	**0.170****	-0.223
		(0.085)	(0.331)
Drought-Prone Areas	yes=1	**0.298****	-0.300
		(0.136)	(0.333)
Pastoral Areas	yes=1	0.135	0.063
		(0.193)	(0.396)
Base Market: Low-Market Access & High-Population Density	yes=1	-0.013	**-0.216***
		(0.048)	(0.126)
Base Market: High-Market Access & High-Population Density	yes=1	-0.022	0.048
		(0.047)	(0.116)
Constant			0.424
			(0.469)
		Psel=0.167	Yhat=0.588
Number of observations		414	
Breusch-Pagan/Cook-Weisberg heteroskedasticity test, χ^2 (1)		0.78	
p-value for test for homoskedasticity		0.3767	
Z-statistics for Shapiro-Wilk W test for normality		0.771	
p-value for normality test		0.22038	

Standard errors in parentheses. Sample excludes missing observations, outliers, leverages and exporters.
Marginal effects for buyers computed from the Maximum Likelihood Estimations of the sample selection model.
a. For a binary variables, the conditional marginal effect (dy/dx) is for discrete change of the dummy from 0 to 1.
* p < 0.10, ** p < 0.05, *** p < 0.01
Unit: ln(x+1) means that the regressor is computed as ln(x+1) to avoid losing observations which original value is zero.
Ycond (Columns 2) stands for predicted conditional shares of brokered transactions; Yhat (Column 4) stands for predicted shares of brokered transactions; Psel (Columns 1 and 3) stands for predicted probability to use brokers.

4.2.1 Buyers

Assets' Availability – *SOCIAL CAPITAL* – Considering social capital availability, which helps traders reduce transaction costs of contract negotiation, we find a negative relationship between the number of regular suppliers and the share of brokered transactions for buyers currently using brokers (see the significant conditional marginal effects of -0.096 in Column 2). The more buyers have regular partners, the less they rely on brokers to conduct their trading business[8]. A similar negative relationship is shown for the number of trading contacts in the main market: a 1 percent increase in this number reduces the predicted probability that buyers turn to brokers by 0.039 percentage points (p.p.; Column 1).

HUMAN CAPITAL – For buyers, the number of employees that participate in collecting price information (i.e. search labour) represents an indicator of human capital availability as well as a proxy for the cost of search. In other words, the higher the number of employees engaged in search, the greater the cost of gathering information on market prices. A 1 percent surge in search labour increases the predicted probability that buyers use brokers by 0.246 p.p. (column 1). At the same time, a 1 percent increase in the number of people authorised to buy for the trading firm increases this probability by 0.144 p.p. (Column 1).

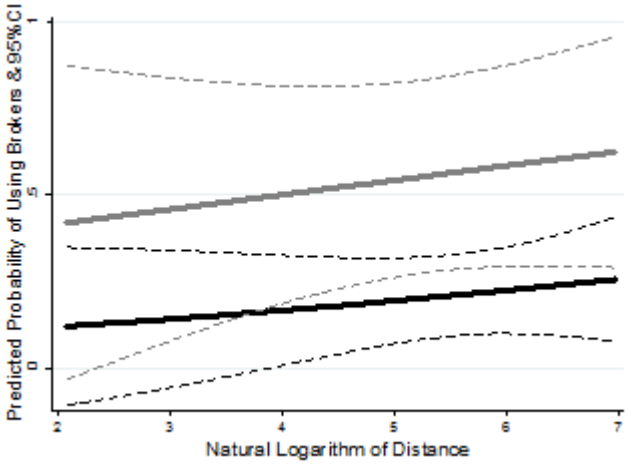
CAPACITY OF STORAGE FACILITIES UNDER EXCLUSIVE CONTROL – Together with negotiation and information costs, wholesalers bear the cost of storing stocks for the time needed to complete a transaction. Estimation results reveal that a 1 percent increase in the capacity of storage facilities (in quintals) under buyers' exclusive control reduces the predicted probability that they use brokers by 0.049 percentage points (Column 1).

External Environment & Traded Crops – *ROAD QUALITY* – Storage capacity is an indicator of the size of the trading business and of traders' access to physical infrastructure. Additionally, the quality of physical infrastructure is measured by the kind of roads (either asphalted, dry-weather or all-weather roads) linking base markets to main distant markets. As Figure 1 shows, as travelled distance increases, the predicted probability that buyers use brokers is more than double when roads are all-weather roads than when they are asphalted roads. The predicted probability for all-weather roads significantly exceeds that of asphalted

[8] Even though there seems to be a positive and significant (barely at 10 percent level) marginal effect equal to 0.036 for the probability that buyers use brokers in relation to the number of regular suppliers, this result should be considered cautiously. To check for results' robustness, the model for buyer was estimated by both FIML and Quasi Maximum Likelihood Estimation. All results were the same, but this one that is insignificant under the QMLE.

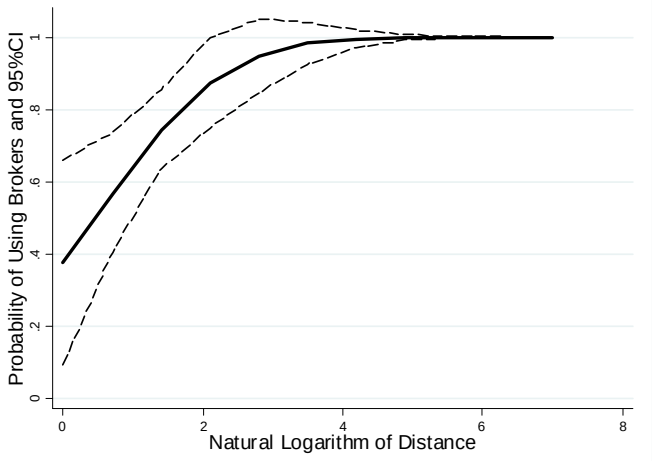
roads for values of distance between 80 and 660kilometers approximately, as shown by the non-overlapping 95 percent confidence intervals of the two predicted probability lines.

Figure 1 Predicted Probability of Brokerage Use as a function of Distance and 95% CI;
Traders accessing Asphalted versus All-Weather Roads



TRAVELLED DISTANCE BETWEEN BASE AND MAIN MARKETS AND TRADED CROPS – The conditional marginal effect of distance on brokered transaction is positive and significant (see the 0.092 value in Column 2), meaning that an increase in distance raises the share of brokered purchases for those buyers already using brokers. Distance seems to impact in particular on the decision process of buyers of cereals in drought-prone areas. As depicted by Figure 2, after the travelled distance reaches and overcomes 160km, all buyers of cereals based in these domains would be likely to ask brokers to manage (some or all of) their long-distant transactions.

Figure 2 Predicted Probability of Brokerage Use as a function of Distance and 95% CI;
Subset of Buyers of Cereals based in Drought-Prone Areas



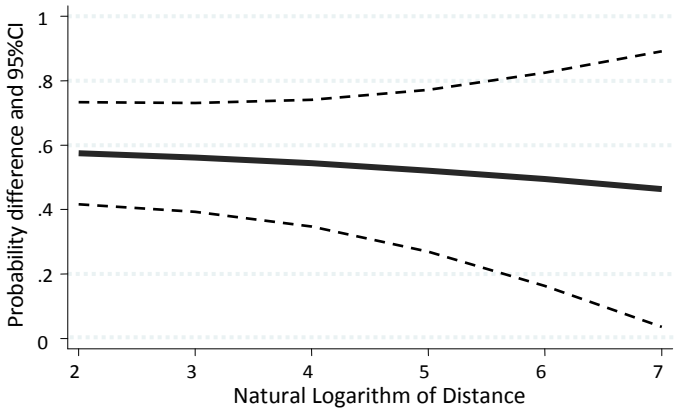
In general, and independently from distance, the greatest share of brokered purchases are found for buyers of cereals (see conditional marginal effect of 0.291 in Column 2),

whereas coffee buyers are less likely to use brokers for their transactions than oilseed buyers (see the negative marginal effects of 0.207 for buyers of coffee in Columns 1).

AGRICULTURAL DOMAINS – Agricultural domains where buyers are based affect their decision towards brokerage use. The predicted probability that buyers use brokers is 0.593 if they are based in drought-prone areas and 0.291 if they are located in moisture-reliable domains (Column 1).

By reintroducing travelled distance into the analysis, Figure 3 shows that, for the whole sample of buyers and as distance increases, the gap between the greater predicted probability that buyers based in drought-prone areas use brokers and the smaller predicted probability that buyers located in other areas (i.e. moisture-reliable and pastoralist areas, and the central market of Addis Ababa) use brokers decreases. Nonetheless, the confidence interval for the estimated probability difference becomes larger as the distance approaches 150 kilometres, which indicates greater uncertainty on the true value of the estimated gap in predicted probabilities.

Figure 3 Variation in the Gap between the Predicted Probabilities of Brokerage Use, as a function of Distance, for Buyers based in Drought-Prone Areas versus Buyers based in Other Areas and 95%CI



BASE MARKET ACCESS AND POPULATION DENSITY – The negative conditional marginal effect of -0.168 reported in Column 2 for buyers implies that an average buyer based in a market with low access and high population density has a share of brokered purchases smaller than a buyer located in a market with low access and low population density (the base category). Thus, high population density in the markets where buyers are located reduces their need to use brokers.

Presence of Banks in the Main Markets and Access to Credit – Apart from physical infrastructure, we assume that traders' choices regarding whether or not to employ brokers may depend on the availability of formal market institutions in their main markets. This presence induces buyers to use brokers with 0.310 predicted probability (Column 1).

Focusing on access to in/formal credit sources instead, which may help buyers face liquidity constraints, the marginal effect of -0.096 in Column 1 indicates that buyers that can access credit are less likely to turn to brokers.

Contractual Performance – Buyers' decisions whether to use brokers seem to depend not only on transaction costs, but also on contractual performance as measured by marketing and fixed costs. After a 1 percent surge in fixed costs, the probability that buyers use brokers increases by 0.073 p.p. (Column 1).

4.2.2 Sellers

As compared to buyers, fewer results are significant for sellers.

Assets' Availability – A 1 percent increase in the number of employees engaged in price search (human capital indicator) reduces the predicted probability that sellers use brokers by 0.067 p.p. (column 3). A 1 percent surge in the number of regular customers (indicator for social capital availability) reduces the share of brokered sales by 0.082 p.p. (Column 4).

External Environment & Traded Crops – *AGRICULTURAL DOMAINS* – Similarly to buyers, sellers based in drought-prone areas are the most likely to use brokers (marginal effect of 0.298 in Column 3, as compared to 0.170 for sellers based in moisture-reliable domains).

TRADED CROPS – In general, the predicted probability that sellers of either food or cash crops use brokers is negative, and this is particularly the case for sellers of cereals (marginal effect of -0.165 in Column 3, as compared to -0.112 for coffee sellers and -0.098 for sellers of pulses).

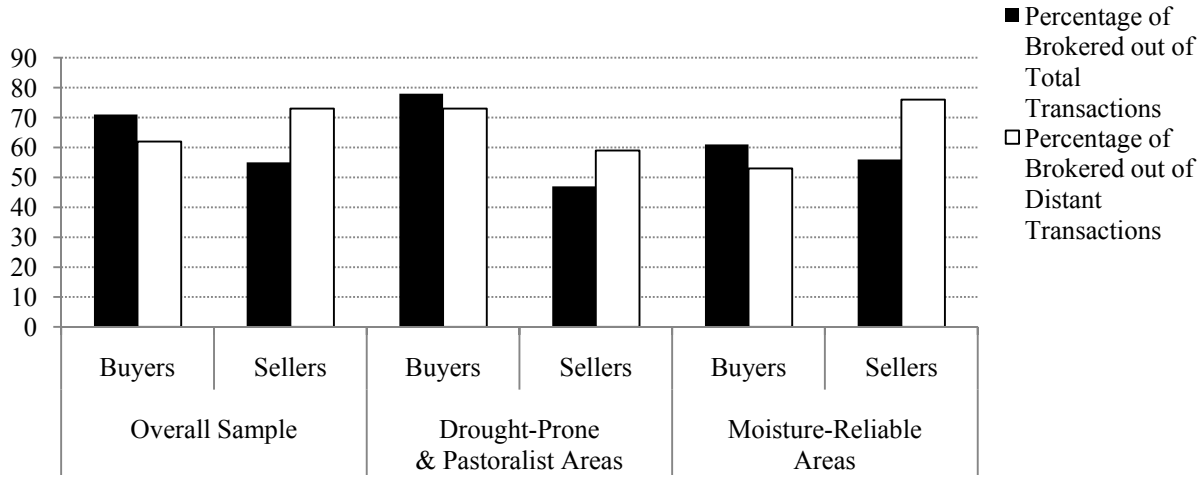
BASE MARKET ACCESS AND POPULATION DENSITY – As for buyers, the higher the population density in base markets the smaller the share of brokered sales (see the value of -0.216 for the estimated coefficient in Column 4).

Presence of Banks in the Main Markets and Access to Credit – If there is at least one bank in sellers' main markets, it is more likely that they use brokers (see the predicted probability of 0.114 in Column 3). Furthermore, the more sellers have access to credit the more they tend to engage the brokerage services (see the 0.075 value for the predicted probability in Column 3), which interestingly is the opposite of the result found above for buyers.

Contractual Performance – While buyers seem to more likely to turn to brokers when they face high fixed costs, sellers bearing expensive fixed costs are less prone to turn to intermediaries (probability of –0.030 in Column 3).

Finally, while travelled distance seems not to impact on sellers' choice to engage brokers, further analysis is conducted on the subsample of wholesalers whose main markets are distant markets. Figure 4 shows that brokered transactions, as a share of all distant transactions, were 73 percent for buyers and 59 percent for sellers based in drought-prone and pastoralist areas in 2006/07. For traders based in moisture-reliable domains, the shares of distant brokered transactions were 53 for buyers and 76 percent for sellers instead.

Figure 4 Percentage of Brokered Transactions out of Total/Distant Transactions and by Agricultural Domains in 2006/07



4.3 Discussion

We now discuss the relevance of the results reported above to the first of the research questions identified in the Introduction; namely, which of the variables impact on wholesalers' decisions on whether and for how much to use brokers?

Assets' Availability – Availability of social capital, human capital and working capital.

SOCIAL CAPITAL – The more wholesalers have regular partners and trading contacts, the less they turn to brokers to conduct their trading business. This is in line with the evidence found by Gabre-Madhin (2001) for Ethiopia, and by Fafchamps and Gabre-Madhin (2001) for Benin and Malawi. Agricultural traders rely on social relationships to get information on price trends and grain flows, to minimise the risk for contractual disputes and to maintain regularity in their trading activities (FAFCHAMPS and MINTEN, 1998). Brokers provide similar services and are a substitute for missing social networks.

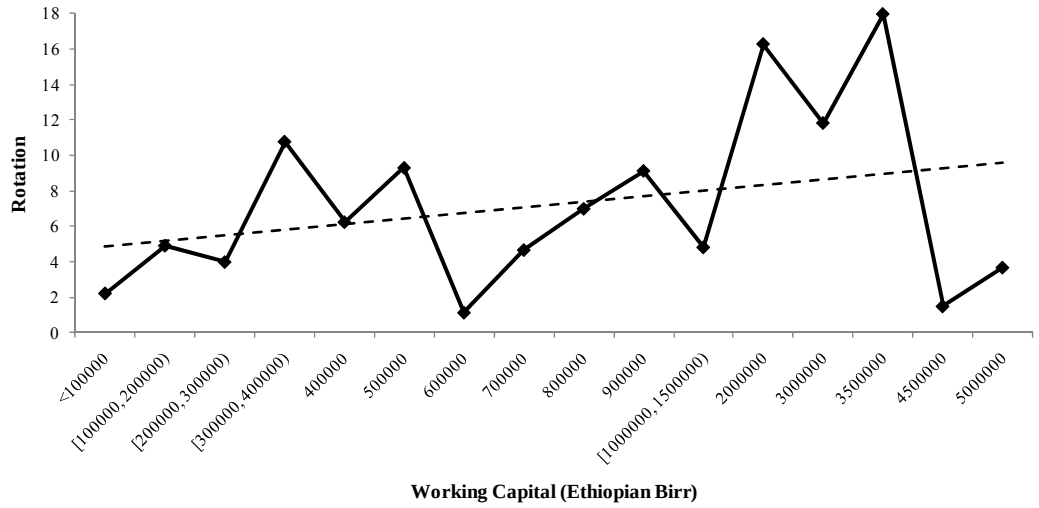
HUMAN CAPITAL – Seemingly counterintuitive results are obtained for the number of employees engaged in price search (search labour). The marginal change in the predicted probability to use brokers, after a change in search labour, is positive for buyers and negative

for sellers. This suggests that buyers view search labour as the cost of searching for market information, while sellers consider it as human capital.

WORKING CAPITAL – Working Capital is an indicator for the size of the trading business and is the amount of funds regularly used for trading purposes. Gabre-Madhin (2001) found an inverse relationship between working capital and brokerage use: the smaller the working capital, the higher the opportunity cost of tying it up in stocks, the higher the transaction costs, the more traders use brokers. Nonetheless, the evidence also shows that large Ethiopian traders do not rotate their working capital faster than smaller wholesalers, as happens for example with traders in Madagascar (FAFCHAMPS and MINTEN, 1999a: 7). In other words, the ratio between working capital and monthly sales (i.e. the rotation) does not fall as working capital and firm size increase, as indicated by Figure 5.

Figure 5 Rotation for All Sellers (except Exporters)

*Rotation: Ratio between Current Working Capital and Monthly Sales in May 2007**



* 'Current working capital' refers to funds used for trading purposes, and available while the ECX Traders' Survey (GABRE-MADHIN et al., 2007) was conducted (May – July 2007).

The rotation ratio is actually following an upward trend, which also suggests that big trading businesses may suffer from liquidity constraints and explains why the bigger the working capital, the greater the share of brokered purchases (see conditional marginal effect of 0.048 in Column 2, Table 2). Buyers who do not want to tie up their working capital in conspicuous stock to be sold may thus engage the services of brokers to minimise rotation time and the related transaction costs.

CAPACITY OF STORAGE FACILITIES UNDER EXCLUSIVE CONTROL – This is another indicator for the size of the trading business. The negative relationship between this capacity and the

probability that buyers use brokers outlines how a commodity exchange, formalising the activities of the brokerage institution and supported by warehouses, might benefit smaller wholesalers who cannot afford the costs of storage facilities with adequate capacity under their exclusive control.

External Environment – Traders' ability to minimise transaction costs is also challenged by the environment where they operate.

AGRICULTURAL DOMAINS – Wholesalers located in drought-prone domains relied on brokers more for their distant purchases than for their distant sales in 2006/07 harvest year, while those based in moisture-reliable domains turned to brokers mainly for their distant sales (Figure 4). These results suggest the relevant role of the brokerage institution in facilitating movement of crops in Ethiopia.

BASE MARKET ACCESS AND POPULATION DENSITY, AND TRADED CROPS – Estimation results indicate that traders use brokers most of all if they are based in markets with low population density and if they are buying cereals and pulses. Given that food crop commercialisation is generally higher in areas of medium to high population density (CHAMBERLIN et al., 2006: 33), we may infer that the more smallholders sell their surplus food crop production on the market the more buying opportunities arise, the less it is likely that traders buying those crops need to hire brokers. Moreover, coffee buyers and sellers are less likely to use brokers than oilseed wholesalers. This is most probably because coffee is marketed in Ethiopia through cooperatives that organise transportation from producers to city warehouses (CHAMBERLIN et al., 2006: 17), whereas oilseed commercialisation is mainly conducted in less densely populated domains (ibid.: 33, 34), where wholesalers are more prone to using brokers.

Institutions' Availability –Both buyers and sellers are more likely to hire brokers if at least one financial institution is operating in their main markets. This suggests that the functions of the informal brokerage institution are supported by the existence of formal market institutions.

Finally, similarly to what was found by Gabre-Madhin (2001: 69) with reference to distant purchases and sales, results are more robust for buyers than for sellers. Gabre-Madhin suggests this may be due to greater transaction costs involved in purchases than sales as "buyers must ensure that the quality and quantity of the contracted grain will conform to their expectations and that delivery will occur in the appropriate time frame", they tend to rely more on brokers. At the same time, "Transaction costs seem to matter less in the case of

sales, perhaps because traders are not concerned with being cheated as to the quality of the grain" (ibid.).

5. CONCLUSIONS AND POLICY RECOMMENDATIONS

"As the weaknesses of reformed agricultural markets in developing countries became evident, development agencies' and governments' focus began to shift from merely 'getting prices right' to 'getting institutions right' so as to address market failures arising from imperfect information, contract enforcement and property rights, and insufficient provision of public goods" (BARRETT and MUTAMBATSERE, 2005: 8).

This new generation of market reforms was introduced in Ethiopia in the late Nineties. Based on non-price policy measures, they have given particular emphasis to the ability of private and public market institutions to increase market efficiency and reduce high transaction costs and business risk (BARRETT and MUTAMBATSERE, 2005; REARDON and TIMMER, 2005). Of all these market institutions, it has been argued that the informal brokerage institution can play a pivotal role in getting agricultural markets right. However, although many studies especially of Sub-Saharan African countries have outlined the benefits that the use of brokers can bring to agricultural traders, very few studies have analysed the variables impacting on traders' decisions whether or not to turn to brokers. Moreover, to our knowledge, only one study (GABRE-MADHIN, 2001) has attempted to depict econometrically the decision processes followed by traders, and that analysis was based on restrictive assumptions regarding the traders' production function and excluded important regressors.

The purpose of the current study is to give an account of the reasons why Ethiopian agricultural wholesalers decide to hire brokers, building on a wide set of control variables suggested by the theoretical and empirical literature. After testing and rejecting the endogeneity of potentially-endogenous covariates, traders' decisions (regarding both whether to use brokers and for what share of their transactions to use them) were estimated using a sample selection approach or, when appropriate, two-part estimation. The analysis was conducted using original data collected in 2006/07 by Gabre-Madhin, EDRI and IFPRI.

The empirical results throw light on the variables that influence wholesalers' decisions regarding whether and for how much to use brokers. In particular, significant marginal effects are found for regressors indicating asset ownership, transacted crops and contractual performance, the external environment where wholesalers operate and the

availability of institutions other than brokers. These results are important as they indicate the types of trading and traders that would benefit most from the formalisation of the brokerage activities provided by the Ethiopian Commodity Exchange (ECX), and lead to the following policy recommendations.

The evidence suggests that ECX would benefit traders who lack social capital (in terms of number of regular partners and trading contacts). Hence, relatively young trading businesses, which are trying to build their own social network of trading partners (especially when the trading business was not inherited), could find in the ECX a way to minimise the risk associated with contractual disputes and maintain regularity in their activities.

Trading businesses suffering from liquidity constraints while their working capital is tied up in unsold stocks could minimize their rotation time through the ECX, and smaller trading businesses that cannot afford the cost of storage facilities under exclusive control would particularly benefit from ECX warehousing services.

The results indicate that wholesalers located in drought-prone domains rely on brokers more for their long-distance purchases, while wholesalers based in moisture-reliable domains turn to brokers more for their long-distance sales. This suggests that ECX could facilitate crop movement within and between agricultural domains in Ethiopia.

Infrastructure and institutions, together with incentives, represent the "3 I's of market development" and are essential for getting markets right (GABRE-MADHIN, 2006). Results show that, as distance increases, buyers are more likely to use brokers if road networks are not asphalted. Also, brokerage functions become more valuable if complemented by formal financial institutions in main market centres. By formalising these functions, the ECX could have a similar role of substitution for missing infrastructure and complementarity for existing institutions. This, in turn, would speed up the development of agricultural markets.

The findings of this study suggest a number of important policy implications for the directions of ECX's scope of action. Considering that buyers of cereals seem to be using brokers for a bigger share of transactions than all other wholesalers, the number of commodities traded by ECX could be enlarged to include teff, which is one of the most widely traded grains in Ethiopia. The provision of credit facilities to ECX buyer clients, through warehouse receipt financing, would also be beneficial, especially for buyers who lack collateral and therefore have difficulty accessing formal loans. At the same time, buyers based in agricultural domains less favourable for food crop commercialisation (i.e. drought-prone areas) and with low population density would find ECX activity especially valuable. Thus, ECX should consider further developing its warehouses throughout the country - in

Dessie (in the Amhara region) for example, which in recent years has become a key transit points from where traders redirect food to the drought-prone areas in the North (USAID and FEWS NET, 2009). Such warehouse spreading would facilitate crop movement from moisture-reliable to drought-prone areas; and this, we suggest, might substantially mitigate the effects of the recurrent droughts and famines that hit the country.

6. APPENDIX

Table A. Exclusion Restrictions

	VARIABLE	DESCRIPTION	UNIT
ASSETS	**No. of Trading Contacts in the Trader's Main Market** (SOCIAL CAPITAL)	The trader engages with trading contacts in conversations regarding market conditions. Trading contacts could be local officials, the Ethiopia Grain Trade Enterprise etc. It is not necessary for trading contacts to conduct a trading business.	ln(x+1)
	No. of Employees engaged in price search (HUMAN CAPITAL & SEARCH COST)	Number of people in the enterprise that participate in collecting price information.	ln(x+1)
	No. of Trader's Substitutes (HUMAN CAPITAL & COST OF THE HUMAN CAPITAL)	Number of people (among family helpers, permanent workers and manager, apart from the owner) who are authorised to buy and/or sell in the name of the enterprise.	ln(x+1)
CONTRACTUAL PERFORMANCE, Costs	**Annualised Physical Marketing Costs**	Annualised sum of variable costs for all transactions realised in a twelve-month period (ex. costs for bagging and sewing, loading and off-loading, transport, bribes and tips at road stops, storage etc.).	ln
	Fixed/ Operational Costs	Operating costs for a twelve-month period (ex. costs for rental of shops and/or storage facilities, maintenance and insurance of vehicles, inland revenue tax for trading business etc.).	ln
ACCESS TO FINANCIAL INSTITUTIONS	**Bank**	Availability of at least a financial institution in the wholesaler's main market.	yes=1

Reasons underlying the choice of selection instruments

Number of Trading Contacts in the Trader's Main Market (Social Capital): The number of trading contacts could impact on the probability that a trader uses brokers. Yet, once a trader has decided to use brokers, we assume that the share of brokered transactions will depend on the number of current (regular) trading partners only. This is because trading

contacts are not necessarily traders, but people that wholesalers engage in conversations with regard to market conditions.

Number of Employees engaged in price search (Human Capital): Evidence shows that 88 percent of traders rely on personal observation (seeing and/or eavesdropping) to get information on market partners, market flows and price patterns for grain products or coffee. Only 4 percent of all wholesalers consider speaking with intermediaries (including buying agents, selling agents and brokers) as their primary source of information (GABRE-MADHIN et al., 2007). Thus, it seems that traders mostly decide their share of brokered transactions based on services offered by brokers other than the provision of information on market prices. In other words, there seems to be no trade-off between the share of brokered transactions and the number of employees engaged in price search.

Number of Trader's Substitutes (Human Capital): Trader's substitutes are people authorised to conclude purchase and/or sale contracts for the trading business. From the *ECX Traders' Survey 2007* (GABRE-MADHIN et al., 2007), we can infer that substitutes are particularly important when the owner/manager is absent and their role is limited to contract negotiation. It is not the primary responsibility of substitutes to conduct a series of activities that brokers usually perform as part of their services to traders (to mention a few, searching for buyers and sellers, offering credit, buying/selling goods if no match is found). Therefore, we suspect that the presence of trader's substitutes could determine the probability of brokerage use, but is less directly related to the share of brokered transactions.

Annualised physical marketing costs and fixed/operational costs (Contractual performance): Brokers are paid 'so much per bag/ton/measurement unit' (i.e. a flat fee per quantity transacted[9]) and physical marketing costs (as well as the search cost associated to the number of employees engaged in search) are variable costs. As the quantity transacted increases, the variable costs and/or the brokerage fees increase. We assume that traders cover brokerage fees (as well as variable costs) with their working capital. Thus, the amount of working capital, not the amount of variable costs, eventually determines the share of brokered transactions that each trader can afford. This is supported by the evidence of limited imperfectly competitive behaviour. Buyers reduce the purchase cost they pay to farmers by a modest 3 percent only in small and remote agricultural markets in Ethiopia, not in larger market centres centrally located (OSBORNE, 2005; RASHID and MINOT, 2010). Similarly, 67 percent of sellers determined their sale price mainly following the prevailing market prices

[9] In 2008, evidence shows that 97 percent of brokers were reimbursed for their services with a flat fee per quantity transacted (GABRE-MADHIN et al., 2008).

in 2006/07 (GABRE-MADHIN et al., 2007). Fixed costs are also assumed not to impact on the chosen share of brokered transactions.

Bank (Access to Financial Institutions): The availability of a bank in a wholesaler's main market could make that trader more prone to using brokers, but we suspect that the share of his/her brokered transactions will eventually depend on his/her actual access to (in)formal credit.

Table B. Other Regressors, apart from Exclusion Restrictions

	VARIABLE	DESCRIPTION	UNIT
ASSETS	**Regular suppliers/ customers** (SOCIAL CAPITAL)	Number of people from whom the trader purchases/sells regularly in his/her main market (regularity entails a number of interactions greater than three over a production year)	ln(x+1)
	Working Capital & Access to Credit	Working Capital: amount of funds at the trader's disposal for the purpose of buying and marketing grain	ln(x)
		Access to Credit: since the start of 2006/7 production year, the trader got access to any form of credit (including informal sources) AND/OR if s/he needed additional funds for the trading business, s/he knew whom to ask for a loan AND/OR s/he belongs to an ekub (rotating savings and credit association)	yes=1
TRADING PRACTICES	**Distance**	Euclidean distance (in km) between the trader's main market and the market where s/he is based	ln(x+1)
ACCESS TO PHYSICAL INFRASTRUCTURE	**Storage Capacity**	Maximum quantity storable (quintals) in one or more storage facilities under the trader's exclusive control	ln(x+1)
	Road Type: Asphalted Dry-Weather All-Weather Non-Relevant	Type of road linking the trader's main market with the market where s/he is based (non-relevant=omitted category, in case the two markets coincide). All-Weather & Dry-Weather represent one category for sellers.	yes=1 (categorical variable)
MAIN CROP TRADED	**Cereals Beverages (coffee) Pulses Oilseeds**	The produce for which the trader purchased/sold the greatest quantities during 2006/7 production year is identified and classified following crop-specific dummies (oilseeds=omitted category)	yes=1 (categorical variable)
LOCATION (BASE MARKET) AGRICULTURAL DEVELOPMENT DOMAINS (Smallholder-Relevant Domains)	**AGRICULTURAL POTENTIAL:** Drought-Prone Pastoralist Moisture-Reliable Central Market	Binary variables indicating where the trader's base market is located (central market=omitted category)	yes=1 (categorical variable)
	ACCESS TO MARKET & POPULATION DENSITY: The trader's base market is characterised by: Low Market Access & High Population Density; High Market Access & High Population Density; Low Market Access & Low Population Density (=omitted category)		yes=1 (categorical variable)

7. REFERENCES

AJALA, M. K., and A. O. K. ADESEHINWA. "Roles and Efficiency of Participants in Pig Marketing in the Northern part of Nigeria." *Journal of Central European Agriculture* 8, no. 3(2007): 311-326.

BAILEY, D. et al. "Livestock Markets and Risk Management Among East African Pastoralists: A Review and Research Agenda." *SSRN eLibrary* (1999).

BARRETT, C. B., and E. MUTAMBATSERE (2005) Agricultural markets in developing countries. In *The New Palgrave Dictionary of Economics, 2nd Edition*, ed. L. E. BLUME, and S. N. DURLAUF. London, Palgrave Macmillan.

BAUM, C. F. *An Introduction to Modern Econometrics Using Stata* College Station, Texas: Stata Press, 2006.

BEAR, M. A., and R. H. GOLDMAN (2005) Enhancing Local Sourcing of Fresh Fruit and Vegetables in Uganda's Domestic Market, International labour Organisation (ILO) and the British Department For International Development (DFID)

BOLWIG, S., P. GIBBON, and S. JONES. "The Economics of Smallholder Organic Contract Farming in Tropical Africa." *World Development* 37, no. 6(2009): 1094-1104.

CHAMBERLIN, J., J. PENDER, and B. YU (2006) Development Domains for Ethiopia: Capturing the Geographical Context of Smallholder Development Options, ed. E. S. S. PROGRAM, and (ESSP). Addis Ababa, Ethiopia, International Food Policy Research Institute (IFPRI), Ethiopia Strategy Support Program (ESSP), Ethiopian Development Research Institute (EDRI).

DESSALEGN, G., T. S. JAYNE, and J. D. SHAFFER (1998) Market Structure, Conduct, and Performance: Constraints of Performance of Ethiopian Grain Markets. Addis Ababa, Ministry of Economic Development and Cooperation (MoEDC).

DOW, W. H., and E. C. NORTON. "Choosing Between and Interpreting the Heckit and Two-Part Models for Corner Solutions." *Health Services & Outcomes Research Methodology* 4, no. 1(2003): 5.

ESKOLA, E. (2005) Agricultural Marketing and Supply Chain Management in Tanzania: A Case Study, Working Paper Series No. 16, Economic and Social Research Foundation (ESRF).

ETTNER, S. L. (2004) Methods for Addressing Selection Bias in Observational Studies. Los Angeles, Division of General Internal Medicine and Health Services Research, UCLA (University of California, Los Angeles).

FAFCHAMPS, M., and E. Z. GABRE-MADHIN (2001) Agricultural Markets in Benin and Malawi: Operation and Performance of Traders. Washington, DC, The World Bank

FAFCHAMPS, M., J. W. GUNNING, and R. OOSTENDORP. "Inventories and Risk in African Manufacturing." *The Economic Journal* 110, no. 466(2000): 861-893.

FAFCHAMPS, M., and B. MINTEN. "Relationships and traders in Madagascar." *Journal of Development Studies* 35, no. 6(1999a): 1 - 35.

FAFCHAMPS, M., and B. MINTEN (1998) Returns to Social Capital among Traders. Washington, D.C. , International Food Policy Research Institute.

FAFCHAMPS, M., and B. MINTEN. "Social Capital and Agricultural Trade." *American Journal of Agricultural Economics* 83, no. 3(2001).

FAFCHAMPS, M., and B. MINTEN (1999b) Social Capital and the Firm: Evidence from Agricultural Trade. In *Social Capital and Economic Development*, ed. C. GROOTAERT, and T. VAN BASTELEAR.

GABRE-MADHIN, E. Z. (2006) Building Institutions for Markets: The Challenge in the Age of Globalization. Frösundavik, Sweden.

GABRE-MADHIN, E. Z. (2001) Market Institutions,Transaction Costs, and Social Capital in the Ethiopian Grain Market, International Food Policy Research Institute (IFPRI).

GABRE-MADHIN, E. Z., and S. HAGGBLADE (2003) Successes in African Agriculture: Results of an Expert Survey. Washington, D.C., International Food Policy Research Institute (IFPRI)

GABRE-MADHIN, E. Z., IFPRI, and EDRI (2008) ECX Market Intermediaries' Survey 2008.

GABRE-MADHIN, E. Z., IFPRI, and EDRI (2007) ECX Trader Survey 2007.

HECKMAN, J. "Sample Selection Bias as a Specification Error." *Econometrica* 47, no. 1(1979): 153-161.

IMBENS (2004) Limited Dependent Variable Models II: Selection Models (W 17.4.1), UC Berkeley Department of Agricultural and Resource Economics.

JABBAR, M. et al. "Market Institutions and Transaction Costs Influencing Trader Performance in Live Animal Marketing in Rural Ethiopian Markets." *J Afr Econ* 17, no. 5(2008): 747-764.

JAYNE, T. S., A. NEGASSA, and R. J. MYERS (1998) The Effect of Liberalization On Grain Prices and Marketing Margins in Ethiopia. East Lansing, Michigan, Michigan State University.

KHERALLAH, M., and J. KIRSTEN (2001) The New Institutional Economics: Applications for Agricultural Policy Research in Developing Countries. Washington, D.C., International Food Policy Research Institute (IFPRI).

LEUNG, S., and S. YU. "On the choice between sample selection and two-part models." *Journal of Econometrics* 72(1996): 197-229.

LOKANATHAN, S., and H. DE SILVA (2010) Leveraging Mobile 2.0 in India for Agricultural Market Access, The International Development Research Center (Canada) and the Department for International Development (UK).

MADDEN, D. "Sample selection versus two-part models revisited: The case of female smoking and drinking." *Journal of Health Economics* 27(2008): 300–307.

MELINO, A. "Testing for Sample Selection Bias." *The Review of Economic Studies* 49, no. 1(1982): 151-153.

MOON, W., S. K. BALASUBRAMANIAN, and A. RIMAL (2004) Two Stage Decision Model of Soy Food Consumption Behavior. Denver, Colorado.

NEGASSA, A., and T. S. JAYNE (1997) The Response of Ethiopian Grain Markets to Liberalization. Addis Ababa, Ethiopia, Ministry of Economic Development and Cooperation.

OSBORNE, T. "Imperfect competition in agricultural markets: evidence from Ethiopia." *Journal of Development Economics* 76, no. 2(2005): 405-428.

PESSÔA, A. S. M., and M. S. JANK (2002) Grain Markets: a South-American Perspective. Arlington (VA), The United States Department of Agriculture (USDA).

RASHID, S., and N. MINOT (2010) Are Staple Food Markets in Africa Efficient? Spatial Price Analyses and Beyond. Maputo, Mozambique, Comesa-MSU-IFPRI African Agricultural Markets Project (AAMP).

REARDON, T., and C. P. TIMMER (2005) Transformation of Markets for Agricultural Output in Developing Countries Since 1950: How Has Thinking Changed? In *Handbook of Agricultural Economics, Volume 3: Agricultural Development: Farmers, Farm Production and Farm Markets*, ed. R. EVENSON, P. PINGALI, and T. P. SCHULTZ, Elsevier and North-Holland.

SCHMIDT, E., and H. SHIFERAW (2009) Spatial Analysis of Cereal Market Prices: Effects of Remoteness on Market Price. Addis Ababa, Ethiopia, International Food Policy Research Institute (IFPRI).

SCOTT, G. J. *Markets, Myths and Middlemen: A Study of Potato Marketing in Central Peru*. Lima, Peru: International Potato Center, 1985.

SHIFERAW, B. et al. "Leveraging institutions for collective action to improve markets for smallholder producers in less-favored areas." *Afjare* 3, no. 1(2009).

STAAL, S., C. DELGADO, and C. NICHOLSON. "Smallholder dairying under transactions costs in East Africa." *World Development* 25, no. 5(1997): 779-794.

THE WORLD BANK (2004) Ethiopia: Country Economic Memorandum, Background Report: Can Agriculture Lead Growth in Ethiopia? The Importance of Linkages, Markets and Tradability. Addis Ababa, Ethiopia, Unpublished background report of the World Bank.

TIMMER, C. P. *Getting Prices Right: The Scope and Limits of Agricultural Price Policy*. Ithaca: Cornell University Press, 1986.

USAID, and FEWS NET (2009) Production and Market Flow Maps on Ethiopia (on maize, wheat, sorgum and teff).

WOOLDRIDGE, J. M. *Econometric analysis of cross section and panel data*. Cambridge (Massachusetts), London (England): The MIT Press, 2002.

YAMAGATA, T., and C. D. ORME. "On Testing Sample Selection Bias Under the Multicollinearity Problem." *Econometric Reviews* 24, no. 4(2005): 467 - 481.