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TRANSACTION COST EFFECTS ON MAIZE SPATIAL PRICE DIFFERENCES IN NJOMBE MARKET, TANZANIA

Mbise MN[1]*

Mirau Ndetaulwa Mbise

*Corresponding author email: mirau.mbise@muce.ac.tz

[1]Lecturer, Mkwawa University College of Education (A Constituent College of the University of Dar es Salaam, Tanzania) P.O. Box 2513 Iringa, Tanzania

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ABSTRACT

Previous studies have demonstrated that tangible and intangible transaction costs influence spatial price differences. The difference between the prices at which producers sell their goods, and the prices at which consumers purchase them is exacerbated by transaction costs. This indicates that farmers receive a lower price from buyers, who then charge consumers a greater price at urban marketplaces. However, existing documentation provides limited information on the relationship between spatial price differences and their drivers. Most research focused primarily on the co-movement of prices and the co-integration test, with little attention paid to the effects of transaction costs on spatial price differences. Thus, the paucity of information in the literature motivated the undertaking of this specific study. Therefore, this study assessed the impact of transaction costs on spatial price differences of maize in the Njombe District of Tanzania. A semi-structured questionnaire was developed and employed to collect information from maize traders. Also, checklists were used to collect information from market leaders. Both descriptive and quantitative analyses were undertaken. In the descriptive analysis, means and percentages were generated. On the other hand, in the quantitative analyses, the Ravalion model which is based on the co-movement of prices, was modified to fit the study in question and estimated. The outputs generated from the modified model were used for inferences. The estimated model results showed that transaction costs (transportation costs, years of schooling, bribery, and the number of maize bags carried in one trip) have significant effects on spatial price differences. Moreover, market leaders revealed that because of the poor quality of the roads, individual farmers find it challenging to deliver their produce to the Njombe market. Consequently, they obtain a low price when they sell their produce at the farm level. The study recommends deliberate measures to reduce transaction costs, such as improving urban and rural infrastructure, simplifying bureaucratic procedures that provide room for corruption, and, finally, promoting large-scale production or collective actions to reduce transaction costs.

Key words: Spatial price differences, transaction costs, markets, maize, farmers, traders

INTRODUCTION

The spatial price difference level has been the gauge for rating the market performance. Among other factors, the spatial price difference is determined by the level of transaction costs. Transaction costs wedged the difference between the prices at which producers sell their products and prices at which consumers buy them [1]. This fact implies that the price disparity between the village level, and the price observed at a more aggregate level is significant. Many studies suggest that an efficient output market, defined simply as one with minimal transaction costs, reduces the spatial price difference. Again, reduced spatial price discrepancies are crucial for food security since they benefit both producers and consumers. As a result, ensuring reduced price discrepancies is one method of tackling the problem of food insecurity. Furthermore, the holistic approach to solving food insecurity is vital, as food insecurity is associated with poverty and vulnerability, especially for rural farmers [2].

However, the output market is an overlooked aspect of food security. Output market performance is rated based on its ability to reduce transaction costs and low spatial price differences. This conclusion is consistent with the notion that transaction costs are a fundamental ingredient of economic life [3]. Low transaction costs motivate traders and smallholder farmers to produce more, and engage in crop marketing. More production and engagement in marketing occur because of traders' large profits, while farmers get comparably high prices as a result of lower transaction costs. The higher the transaction costs, the lower the market efficiency [4]. This is because reduced transaction costs minimise the price differential between farm-gate and urban markets. Indeed, the high transaction costs deter traders and smallholder farmers from entering the market [5]. Therefore, reasonable prices for farmers and traders between markets will encourage them to engage in crop production and marketing.

This will lessen food and nutritional poverty by providing farmers with food and money to buy inputs to increase output. They will also cover other family expenses. So, generally, market participation is fueled by a well-functioning market, which is signalled by low transaction costs between markets. Market engagement among smallholder farmers and merchants is increasingly recognised as a key determinant of resource use efficiency, improved production systems, and agricultural transformation [6].

Nevertheless, the functioning of crop markets in many developing countries is impeded by high transaction costs, including transportation costs, because farmers frequently live in remote areas with few, and poor-quality roads [7]. Notably, in most developing economies, including Tanzania, farmers and traders find it difficult to participate in markets. This is due to numerous constraints (including transaction costs). Some barriers are visible, while others are hidden, making access to input and output markets challenging. Reliable, effective production and marketing infrastructures are necessary to lower transaction costs in any nation seeking to develop its agriculture sector sustainably [8].

Spatial price transmission theory relies primarily on the concept of "the Law of One Price (LOP)," which is a theoretical requirement for markets to be integrated [9]. According to the Law of One Price, the prices of homogeneous goods must be the same across markets. That is to say, transaction costs are assumed to be zero or negligible. However, there is no profit if prices are the same throughout markets. Nevertheless, this factor may hurt supply since dealers will be demotivated from trading, and farmers will face low demand for their produce. Spatial price transmission theory predicts that in well-integrated and efficient markets, the same commodity should trade at the same price [10]. So, what is critical is the low transaction costs, which lead to relatively high prices for producers and maintain attractive profits for traders. In this regard, transaction cost is the most significant barrier preventing smallholder farmers from gaining access to markets and productive assets [11]. Essentially, this research emphasises that reduced transaction costs lead to relatively high prices for producers while maintaining attractive returns for traders. Transaction cost is defined differently by different scholars. Still, economic transaction cost generally refers to the interaction of three primary transaction characteristics (uncertainty, asset specificity, and transaction frequency) and two fundamental assumptions of human behaviour (bounded rationality and opportunism). Furthermore, in economic and related sciences, transaction costs are expenses linked with economic exchange, such as searching and information costs, bargaining costs, and monitoring and enforcement costs. Profoundly, transaction cost theorists separate a firm's total expenses into (1) transaction-related costs, and (2) production-related costs [12].

Infrastructure facilities, particularly roads, determine the size of transaction costs. Compliance requirements and corruption are the other aspects that magnify transaction costs [13]. Some peculiar features, particularly in Africa, such as pervasive government intervention, heavy taxes, and a lack of integration between disparate markets, have retarded growth. Due to these barriers, nationwide delivery and distribution have become difficult, resulting in small-scale trading dominance. Large-scale traders are discouraged as products are made less profitable. In other words, significant transaction costs will likely result in large pricing disparities between regions.

Remoteness and the associated high transaction, and transportation expenses are significant hurdles to commercial farming involvement [13]. Therefore, spatial price difference is used to measure market efficiency [14]. Reduced transaction costs improve resource allocation and increase pricing efficiency [15]. Dysfunctional markets can result from various limitations, including inadequate infrastructure, a lack of timely information, regulatory impediments and logistical, and other transaction bottlenecks [16]. Nevertheless, Mumtaz and Naresh [17] argued that prices differ solely by transfer and transaction costs in geographically linked markets. Therefore, increasing investment in roads, communication infrastructure, and public transit is helpful in reducing transaction costs and hence improves market participation by traders and farmers [18].

Empirical literature review

A study was conducted to investigate spatial milk and dairy product market integration between two neighbouring countries, Poland and Czechia, using regional data for both production and processing levels. The econometric analysis of time series covering the period 2001–2021 reveals that only long-run milk and skimmed milk powder (SMP) price relationships exist between the Czech Republic and Poland [19]. The study confirms that the factors influencing spatial price relationships between the Czech Republic and Poland are strong trade ties, the common moment of accession to the Eupean Union (EU), a close distance between markets, and region specialisation [19]. Another study was conducted to find out how fuel prices impact spatial price transmission between two Chilean horticultural wholesale markets. The study employed regime-dependent Vector Error Correction Model (VECM) where price transmission parameters depend on dynamics imposed by a stationary exogenous variable (fuel price). The study identified two price transmission regimes characterised by different equilibrium relationships and short-run adjustment processes, implying that fuel prices affect price transmission elasticities, and intermarket adjustment speeds. Valdes' results show increasing marketing costs as the distance from the farm to the market distance grows [20]. The focus of this study was to investigate the relationship between distance and marketing costs. Also, Anais [21] modelled correlation between maize markets across Tanzania to evaluate the benefit of pooling the risk and design a risk-sharing mechanism such as revenue insurance at an affordable cost by employing a Copula-GARCH model on prices. The results revealed that the correlation is relatively weak and that the risk of extreme prices is diversified by combining several regions together. Given the differences in climatic conditions and production levels across Tanzania, pooling is the only option. Additionally, a minimum-spanning tree was used to investigate the development of hog spatial market integration in China using provincial hog price data [22]. The results revealed that hog spatial market integration in China had increased gradually and reached a stable level after 2012. Hog spatial market integration underwent a structural break in April 2007, after which hog market integration was greatly strengthened. Moreover, the market power of hog markets in eastern China and central China is increasing, and Shandong is a price setter; hog markets in south-western, north-eastern, and northern China are price followers. Analysis was also done on the level and depth of market integration in India's main chickpea markets. The findings indicated that there was a strong level of short-term integration in market pricing for chickpeas in five major markets, suggesting that this integration could eventually lead to a stable long-run equilibrium in the system. Additionally, they discovered that the rate at which prices adjusted was weaker in several markets, and moderate in a few. The findings show that price has very little effect on market disequilibrium, with internal and external factors accounting for the majority of the excellent percentage [23]. Moreover, using data for the period 1995-2013, Gummagolmath *et al*. [23], conducted a study to analyse spatial price transmission and market integration of major maize markets in Ghana using a vector error correction model. The results revealed co-integration for a common domestic maize market where inter-market prices adjust to achieve long-run market equilibrium. The speed of adjustment, and half-lives from the Vector Error Correction Model show that, on average, 8.2% of any disequilibrium was corrected within a month by the producer markets. In comparison, 12.4% of such shocks were corrected within a month by consumer markets. The study was also conducted to assess how the sale method affected fish prices in the French fish market. In order to control for buyer and seller heterogeneity, local market conditions, and fish features, the study computed hedonic pricing regressions. The results showed that there was a 1.7% pricing difference between the two transaction methods. When the endogeneity of the selling method is taken into account by precisely matching auction and over-the-counter transactions, this conclusion still holds up well [24]. Furthermore, a study was conducted to propose fundamental model for understanding transaction costs including their composition, magnitude, and policy implications [25]. Investments in organizations that promote exchange, and the price of carrying out the trade itself were distinguished. The consequences for taxation and measurement concerns were among the various distinctions it brought to light with respect to models in which transaction costs are exogenous. On the other hand, the study attempting to develop empirical evidence of transaction costs that rice farmers incur in production, and other factors affecting farmers' demand for seed was conducted. It was noted that farmers developed an agricultural household model to estimate the proportion of costs accounted for by transaction costs due to quality seed in the formal and informal sectors, and analyse how these costs affect sourcing decisions. The findings indicated that transaction costs in rice seed acquisition in Tanzanian agriculture are added costs to farmers in purchasing seeds. Also, the econometric model was fitted to the household data to determine the factors hindering farmers from using purchased quality. The factors that were significant in influencing transaction cost include; information search, seed source, farmers' seed arrangements, trust, distance from farmers' homestead to the seed source, location, and age of the farmer. The study recommends reducing transaction costs to improve the profitability of the rice enterprise by increasing the demand for inputs [26].

Regarding the Tanzanian situation, a research was carried out in rural Tanzania to measure the extent to which market access limits agricultural productivity in remote areas. By using the collected granular data on farmer input and sales decisions, input and output prices, and travel costs in 1,183 villages in two regions of Tanzania, findings indicated a village in the 90th percentile of the travel-cost adjusted price distribution faces input and output prices 40-55% less favourable than a village at the 10th percentile. In reduced form, an additional standard deviation of travel time is associated with 20-25% lower input adoption and output sales. Also, they developed and quantified a spatial model of input adoption and conservatively estimated that farmers behave as if they face travel costs of 6% ad-valorem per kilometre of travel, equivalent to 40% when travelling to the closest retailer. Holding exogenous local factors fixed, they also estimate that reducing travel costs by 50% (approximately the effect of paving rural roads) doubles adoption and reduces the adoption-remoteness gradient by 18% [27].

Analysing the reviewed studies by different scholars in relation to the current study, the gap is identified. The literature analysis highlights three primary themes: co-integration, adjustment speed, and price transmission between markets over time. Therefore, the main query is whether or not the relationship's nature is reflected in the prices in various markets. The influence of particular factors on spatial price differences is rarely and informally discussed. The goal of the current study is to close this gap. Therefore, the current study will analyze the effect of transaction costs on spatial price differences using cross-sectional data. The study's findings will advance our understanding of how particular elements of transaction costs influence spatial price differences. The knowledge is crucial because it helps formulate specific policies that address the issue at hand.

METHODOLOGY

This section provides an overview of the study area, sampling procedures, data collection techniques, model specifications, and a summary of the study's variables.

The study area

The study was carried out in the Njombe district in Njombe Region. Njombe district, one of the districts that comprise the Njombe region, is known for its maize production. Land use planning for 2017/2018 indicated that the Njombe region has

2,129,900 hectares in total, of which 1,363,913 hectares (42.6 percent) were categorised as arable land. Notably, the Njombe town council registers the least utilisation of its arable land, as only 57,114 hectares (17.9 per cent) out of 319,240 hectares are allocated for crop production. Wanging'ombe is the leading council in terms of land utilisation, where 76.2 percent of its arable land is used for crop production, followed by Ludewa (33.5 per cent) [28]. The reasons for selecting Njombe district are as follows: First, the data above indicated that Njombe town council has a large untapped land resource that requires development in terms of crop production either by peasants or commercial farmers. The second reason is that, although it is referred to as a town, the areas where maize is grown face transportation challenges due to the road quality. Therefore, studying the nature of transaction costs which might discourage land utilisation in the region is crucial.

Sampling procedures and data collection
Before deciding on the sample size, a review of the traders list in the Njombe and Iringa towns' markets was done. This was done to get the total number of maize traders operating between the two markets. Although no exact number was obtained, market management estimated the total number of maize traders to be 100. The pilot survey results showed that only about 50% of all traders operate between Njombe and Iringa town markets because of different barriers along the market chain, which leads to high transfer costs. This information guides the decision on the sample size. Using the information obtained in the pilot survey, any maize trader who declared to have operated between Njombe and Iringa were interviewed. A total of 54 traders were interviewed. A semi-structured questionnaire was used to collect information from the maize traders. This study focused mainly on transfer costs such as transportation costs, bribery and other observable and unobservable transaction costs. Some traders collect maize from remote areas like Ludewa and Njombe districts.

Model specifications and description of variables used
The analysis model was chosen after a careful review of related literature and trial and error after data collection. Various approaches have been used to study spatial price relationships. The estimation of static bi-variate correlation coefficient is a traditional method of measuring spatial price relationships. From a modelling perspective, the spatial price analysis and market integration approaches can be grouped into two categories. In the first group are the law of one price (LOP) and the Ravalion model [29]. These approaches are based on the co-movement of prices. The second approach is the co-integration test. One of the approaches to test LOP is by regressing the price of one market on the price of another market, and testing whether the slope coefficient is 1. Considering the two markets, market 1 as the local market and market 0 as the central market, the basic model for it is

as follows:

$$P_{1t} = b_0 + b_1 P_{0t} + u_t$$

P_1 and P_0 are the prices in two markets expressed in logarithmic form. Assuming that products are homogeneous and there is an absence of transportation cost, the LOP holds if b_1=1 and b_0 = 0.

However, the interest of the current study is not the analysis of the co-movement of prices and the co-integration test but rather the analysis of the impact of the transaction costs aspects on spatial price differences. The reviewed literature gives the starting point for modelling the relationship of variables in this study. Therefore, the empirical model presented below was adopted from [29] and modified to suit the current study.

$$logP_{1t} = F_t + k(log_{1t-1} - F_{t-1}) + e_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 1$$

Where $logP_{1t}$ is a log of the retail price, and F_t is the vector of independent variables, including transfer costs. In this study, the model is modified to allow for the analysis of the effect of transaction costs on spatial price differences.
The spatial price difference is given by

$$\Delta P = P_1 - P_0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2$$

Where P_0 = the price of the maize at one market and P_1 is the price of the maize at another market. Only one season's prices were used to control other factors that may influence this spatial price difference.
Modifying model 1 above to suit the current study, the model below was developed.

$$log\Delta P = \beta_0 + \beta_{1\ldots k} logTC + \beta_{k+1} nbags + \beta_{k+2} nyrs + e \ldots\ldots\ldots 3$$

Where logTC donates the log of transfer costs (i.e. transportation costs, bribery); nbags is the number of bags carried in one trip; nyrs is the number of years the trader spent in school and is e the random error term. All costs are in Tanzanian shilling (TZS).

After trial and error, the model (3) did not fit the data nicely, suggesting further modification. A trial-and-error technique was employed, and finally, the model (4) below was found to fit the data correctly. The trial-and-error technique was necessary to determine whether the model was suitable because if the improper model is estimated, the explanatory variables cannot appropriately explain the changes occurring in the dependent variable. This inappropriateness will lead to a false conclusion.

$$lng\Delta P = \beta_0 + \beta_{1\ldots k} lngTC + nyrsedc + nbags + e \ldots\ldots\ldots\ldots\ldots\ldots\ldots 4$$

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Where LnTC is Ln of transfer costs per 100kg bag (these include transportation costs and bribery); nyrsedc is number of years the trader spent in school.and nbags is number of bags carried in one trip.

RESULTS AND DISCUSSION

Descriptive statistics indicated that the average price per 100kg bag is Tanzanian shillings (TZS) 110,000, and spatial price differences between the Njombe and Iringa town markets are about TZS. 18,733 per 100kg bag. Furthermore, bribery is about TZS 159 per 100kg bag, and transport cost is about TZS 12,480 per 100kg bag (Table 1). Traders collecting maize from remote areas claimed to face the challenge of poor roads. While only approximately 6% of traders claimed that rural areas had adequate roads, they were speaking about previous circumstances. Approximately 94% of them complained about the lousy quality of the roads.

A quote from one of the market leaders: "*It is difficult for individual farmers to bring their maize to the Njombe town market due to the poor quality of the roads. They are forced to sell their maize at the farm level due to this, where they receive a low price. It is rare to find farmers selling their maize directly from the farm to town market*".

These attributes (bribery, transport cost and poor quality of road) contribute to a gap between the price of one market and another. Moreover, before estimating model 4 as specified in the methodology section, Chi-square tests were conducted to find out if there is any significant relationship between spatial price differences and the number of years spent in school by traders, the number of 100kg bags carried per trip, transportation costs per a 100kg bag and bribery per 100kg bag. Every variable in the aforementioned model 4 was statistically significant.

The implication of these transaction costs (transport cost and bribery) is that they increase prices to the final consumers and reduce prices received by farmers. This means that traders pass the burden to farmers and final consumers. The repercussions are that farmers may be discouraged from producing for sale but, again, may even fail to produce enough food for home consumption as they do not get funds to buy inputs. On the other hand, final consumers may fail to afford food as the prices charged are high, resulting in food insecurity for both rural and town people.

Also, the Ordinary Least Square (OLS) approach was used to estimate model 4 described in the methods section (Table 2). Since the F- statistic (F = 6.71) is significant (ρ = 0.0002), the model fits the data quite well. This makes it possible to reject the null hypothesis, which holds that factors such as transfer costs, the

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number of years merchants spent in school, bribery, and the quantity of bags carried on a single trip do not influence spatial price differences.

'lntransp' represents Ln of transportation cost of a 100kg bag, 'nyrsedc' represents number of years trader spent in school, 'lnbribery' represents Ln of bribery per a 100kg bag, and 100kg bag represents number of 100kg bags carried in one trip. The results indicated a significant difference between spatial price differences, and the variables included in the model. However, some showed expected signs and others did not. For example, signs for bribery and the number of bags carried in one trip were expected. But, signs for the transportation cost and years spent in school were not as per expectations. The positive signs for bribery imply that the costs along the marketing chain increase the gap between the price of one market and another market simply because these costs are transferred to farmers and final consumers. This is done by traders offering low prices to the maize producers and selling to buyers at high prices. Therefore, farmers and final consumers are victims of the costs along the market chains. The repercussions are that farmers are getting little income from maize sales, which also reduces their purchasing power for agricultural inputs. Therefore, the biggest side effect of this, which affects both producing households and final consumers, is reduced production. Some households subsidise by engaging themselves in off-farm activities, which have minimal impact on income generation. Furthermore, bribery which is an unobservable cost, can be avoided entirely if the marketing system is well-controlled. Since bribery is not a formal payment, it is associated with unnecessary bureaucracy, which wastes time and inconvenience. In line with the results of the current study findings, the impact of transparency (referring to corruption) on marketing efficiency was explained by Anlu [4]. Although Anlu [4] did not conduct direct analysis of the correlation between transaction costs and corruption, they indicated that the costs of information searching and organization bargaining increase with decreasing levels of openness, equity, and justice, and consequently decrease market efficiency.

Nevertheless, the sign for the years spent in school makes little sense because we would have thought that it would strengthen the negotiating position. Traders with higher levels of education are probably better able to bargain with transporters and other service providers in the market channels, which will lower transfer costs. Additionally, better educated farmers are able to bargain with traders and obtain somewhat higher prices. As a result, surprising signs could be the result of trained people trying to follow the right procedures but, as was previously mentioned, the system is corrupted. Thus, education thereby amplifies spatial pricing disparities rather than diminishing them. Moreover, the negative relationship between transportation costs implies that an increase in transportation costs reduces spatial price differences, which is not the case. The high transaction costs, particularly transportation costs since farmers often reside in distant places with limited, poorly constructed roads hinder the operation of grain markets in many developing nations [7]. Theoretically, the transfer cost per bag will decrease as the number of bags increases because there is a possibility of traders enjoying economies of scale if they can manage to transport many bags.

CONCLUSION AND RECOMMENDATIONS FOR DEVELOPMENT

The study looked at how transaction costs in the Njombe district affected the spatial price differences of maize. The estimated model's results demonstrated that the transportation costs, years of schooling, bribery and the quantity of maize bags carried in a single trip all have significant effects on spatial price differences. Notwithstanding the surprise sign, findings suggest that transportation costs and years spent in school as the significant elements contributing to spatial price differences. The truth is that education lowers transaction costs by giving the agent the ability to negotiate. Additionally, bribery, which might result from a purposefully cumbersome system, hinders marketing efficiency by inflating transaction costs. Again, one important component that needs to be considered for the lowering of transaction costs is the quantity of bags carried on a single trip (this represents economies of scale). This suggests that the decrease of transaction costs requires either large-scale production or collective action. The study recommends deliberate measures to reduce transaction costs, such as improving urban and rural infrastructure, simplifying bureaucratic procedures that provide room for corruption and, finally, promoting large-scale production or collective actions to reduce transaction costs.

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Conflicts of Interest

The author has no conflicts of interest to declare.

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Table 1: Summary statistics of selected variables

Variable	Observation	Mean
Spatial price difference	54	18,733
Bribery	54	159
Transport	54	12,840
Number of years trader spent in school	54	8.11
Number of 100kg bags carried in one trip	33	127.14

Source: Computation from the filed data

Table 2: Results of the model estimated

Model	Coefficients	Standard error	t	Sig. (probability levels)
Intercept (Constant)	10.70	0.959	11.15	0.000
Intransp	-0.90**	0.10	-1.83	0.073
nyrsedc	0.05***	0.013	3.94	0.000
Inbribery	0.21***	0.09	2.46	0.017
Inbags	-0.003***	0.0009	-3.95	0.000
R Square = 0.35	Adjusted R Square = 0.30	Standard error = 0.16		F = 6.71 (sig 0.0002)

Note *, **, *** represent significance at 10%, 5% and 1% probability levels respectively
Source: Computation from the filed data

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