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TRUCK DRIVER DECISIONS IN PERISHABLE CARGO TRANSPORT: THE CASE OF AGRICULTURAL AND FOOD TRADE IN EAST AFRICA¹

Key words: agricultural trade, agricultural commodity, survey data, logit, Tobit model, Kenya

ABSTRACT. The Northern Corridor (NC) is the main route connecting the land-locked countries of East Africa with the port of Mombasa and is heavily used for shipping goods, including perishable cargo. This paper examines how factors pertaining to truck features, job conditions, and truck driver characteristics influence the decision to accept perishable cargo and the size of an accepted perishable product shipment. The decision equation and the volume shipped equation are estimated using survey data collected from truck drivers interviewed at the border crossing between Uganda and Kenya in September and October 2018. Results show that independent truck drivers and drivers who are Kenyan citizens are more likely to accept perishable cargo and ship larger volumes than drivers working for trucking companies. The opposite influence is associated with drivers operating at set schedules and in response to the increasing truck age, possibly due to the risk of malfunction during a trip.

INTRODUCTION

Agricultural products account for over 40% of all intra-East African Community (EAC) traded goods [WB 2009]. Specifically, coffee, tea, rice, maize, and wheat are the predominant traded products among EAC states consisting of Uganda, Kenya, Rwanda, and Burundi. Between 2011 and 2015, 49% of Kenya's intra-EAC exports was destined to Uganda, 29% to Tanzania, 10% to Rwanda, and 12% to Burundi. Likewise, 50% of Kenya's intra-EAC imports originated in Uganda, 46% in Tanzania, and the remaining share was shipped from Rwanda and Burundi [The East African 2016]. Besides manufacturing and private consumption, intra-EAC trade has been hailed as one of the key drivers of economic growth in East Africa [AfDB 2018] despite obstacles in harmonizing various domestic regulations [Kafeero 2007]. Emphasis on intra-EAC trade has been a more recent approach applied to stimulate economic growth, while earlier the strategy

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involved export-led growth [Van der Lann 1993]. Among exported perishable commodities were fresh vegetables and flowers, while imported perishables include, among others, various vaccines.

Although intra-EAC trade is poised to contribute to the economic growth of participant countries, the total value of export earnings from intra-EAC partner states has been declining since 2015, [KNBS 2018]. In particular, Kenya's earnings from exports to Uganda, Tanzania, and Rwanda declined by almost 2% between 2015 and 2017. The decline in trade earnings could reflect a transitory phenomenon, which does not diminish the key role played by the Northern Corridor (NC) road, the sole route for Kenya's trade with Uganda, Rwanda, and Burundi. Near-term economic growth is projected to exceed five percent per year [TEA 2018]. NC stretches from the port of Mombasa, on Kenya's coast along the Indian Ocean, westward to Kampala, Uganda and Kigali, Rwanda.

This paper argues that since many agricultural and food products are perishable, there could be trip features and infrastructural constraints that drive the decision by EAC's freight transporters to ship perishable cargo, especially cargo that requires temperature control during transportation (e.g. refrigeration). Temperature control poses a challenge because if the temperature regime is compromised, the truck driver risks potential earning losses and may be held legally responsible for damaged cargo. In this regard, two research questions can be posed: firstly, what determines a freight transporter's decision to ship or not ship perishable cargo in East Africa; secondly, what determines the volume of perishable cargo the freight transporter ships?

In addition to high transportation costs characteristic of the NC, Grace Kamuruchi [2013] and AfDB [2018] identify long wait times for cargo clearance at the port of Mombasa, complex and inefficient customs clearance, and distance of travel as other factors that influence the type of cargo freight transporters chose for shipping. From a quality and control perspective, Cherg Lirn Taih and Rong Der Wong [2013] found the cargo damage ratio as an important attribute influencing cargo choice behavior. Similarly, the Boumol and Vinod model of transportation choice regards, among other factors, the potential for in-transit loss and damage as determinants of choice of cargo to ship [McGinis et al. 1979]. Drawing on the aforementioned literature on cargo choice behavior by freight transporters, this paper examines perishable cargo transportation in developing countries with a focus on the NC in East Africa. Understanding to what extent infrastructural constraints, trip and vehicle features, and driver characteristics shape cargo choice can assist traders in improving performance and enhancing intra-EAC trade. The identification of specific factors and the quantification of effects also enable a re-examination of policies, both domestic and regional, related to trade and growth. Improved trade will have a positive effect on the economic growth of EAC member state economies, and ultimately on poverty alleviation and food security.

RESEARCH METHODS

This paper focuses on the factors that underpin truck driver decisions to ship perishable cargo from Kenya to the land-locked countries of East Africa. Truck drivers face two decisions: the choice of whether to transport perishable cargo, associated with two options (i.e. yes/no), and what volume is transported, measured as a non-negative integer value.

A driver's decision to ship perishable cargo fits the modeling of choice decisions that has been a frequent subject of empirical studies. The logit technique permits the estimation of the question with yes/no responses offering flexibility by relaxing the assumption of normality. Logit estimation results are converted into probability changes arising from a change in explanatory variable yielding measures of practical relevance in analyzing the cargo type choice. The driver decision on volume of transported perishable cargo is a non-negative integer. The Tobit model is applicable in this estimation because the dependent variable always takes positive values, but is zero for a nontrivial fraction of the sample [Wooldridge 2002]. This could be because some truck drivers who used to transport perishable cargo do not do so during the time of survey implementation.

While data on the volume of cargo imported and exported by a country are readily available from most government trade ministries, data on the decision-making process with regard to truck driver and freight transporter choices on what cargo to ship are not. To the best of our knowledge, such data are virtually non-existent for that group of developing countries in sub-Saharan Africa. This study uses data collected through a survey among truck drivers intercepted along the NC in Kenya in September and October 2018. The structured questionnaire consists of several parts including a section on perishable cargo shipping and a section asking for socio-demographic and income information. During face-to-face interviews conducted by a team of 10 trained enumerators, 511 completed questionnaires were collected.

The summary of responses revealed that the average interviewed truck driver was 40 years old (ranging from 21-80 years of age), 86% were Kenyans, and all drivers were male. The majority had a formal education (57%) and averaged 13 years of driving experience, although the range stretched from one year to 56 years. The average truck was 9 years old, but the range of truck age was from 1-36, suggesting the majority of trucks were relatively new. Also, the majority worked for a company, but 42% were independent while 56% operated on a company-determined schedule. The average value of cargo shipped per trip was 3,376,222 Kenyan shillings (or USD 33,647 at the exchange rate as of October 1, 2018) and the company's monthly earnings from trucking were 130,641 Kenyan shillings (or USD 1,295 at the exchange rate as of October 1, 2018) [KCB 2018]. Almost one quarter (26%) of the trucks were used to ship perishable cargo with an average truck carrying 5.8 tons of perishables. The total cost incurred while shipping cargo amounted to 99,327 Kenyan shillings (USD 984 at the exchange rate as of October 1, 2018). Lastly, truckers reported to have been stopped an average of 4 times by the police in their last completed trip.

RESULTS

DECISION TO SHIP PERISHABLE CARGO

The logit estimation results show three factors that negatively affect the decision to ship perishable cargo, namely: truck age, operating on a set schedule, and cargo value (Table 1). Two binary variables, the driver is Kenyan rather than from another country, and the driver operates independently, show a positive influence on the decision. However, for practical purposes the coefficients have been converted into marginal effects indicating the probability change on the decision to accept perishable cargo corresponding to change in an explanatory variable (Table 2) to shed more light on truck driver shipping choice. The probability of a truck driver's decision to ship perishable cargo increases by 14% if he is Kenyan and by 17% if he owns the truck. Kenyan drivers seeking cargo at the port of Mombasa are likely to have more flexibility in perishable cargo selection since they operate in their own country and are, therefore subject to the laws and regulations of Kenya. Because Kenya is their domicile, they may be perceived as a lesser risk than drivers from other countries. In turn, independent truck drivers also have greater flexibility in accepting cargo and are possibly more opportunistic than drivers working for a company. The results corroborate Andreas Eberhard-Ruiz and Linda Calabrese's [2018] findings that Kenyan trucking firms dominate the NC because most trucking business originates from Mombasa and Ugandan truckers face disadvantageous asymmetric road user charges whenever they cross the border to Kenya. Perishable cargo shipping may be more challenging, but also more profitable and an independent trucker can make an instant decision without time-consuming consultations with company management.

Contrarily, driving an older truck lowers the probability of accepting perishable cargo by 8%. Perishability of cargo requires timely delivery and newer trucks are likely in better mechanical condition representing a lower risk of failure during a trip than older trucks. When a driver operated on a schedule, it lowered the probability of shipping perishable cargo by nearly 16%. Set schedules are possibly associated with the regular transportation of goods leaving less flexibility to accept perishable cargo, which appears at unpredictable intervals. There appears to be a trade-off between possibly earning higher shipping rates by accepting perishables and the degree of earning certainty associated with set schedules. Set schedules may be linked to shippers who have long-term contracts with shipping lines [Tongzon 2009].

VOLUME SHIPPED

The volume of shipped perishable cargo was estimated using the Tobit technique (Table 1). Among the five statistically significant factors, three negatively influenced the volume of perishable cargo, including truck age, operating on a set schedule, and cargo value. Specifically, a 1% increase (because of a linear – log relationship between the volume of perishable cargo and log of age) in the age of the truck decreases the perishable cargo volume by 37.5 kilograms. Under a more realistic scenario, a truck that is 30% older than

Table 1. Determinants of the truck driver's decision to transport perishable cargo and the shipped volume of perishable cargo, Kenya, 2018

Variable name	Shipped perishable cargo (logit results)	Volume of perishable cargo shipped (tobit results)
Log of truck age	-0.302** (0.143)	-3.749* (2.236)
Home country (1 = Kenya)	0.809** (0.349)	14.310*** (5.458)
Truck ownership (1 = independent trucker)	0.849*** (0.232)	11.742*** (3.757)
Set schedule (1 = operates by schedule)	-0.674*** (0.220)	-11.622*** (3.513)
Log of the value of cargo in Kenya shillings	-0.264** (0.103)	-3.703** (1.600)
Number of police roadblocks in the last trip	0.014 (0.015)	0.242 (0.235)
Log of trip distance in kilometers	0.141 (0.331)	3.367 (5.389)
Log of total costs incurred in the last completed trip	-0.059 (0.256)	0.854 (4.133)
Constant	2.131 (2.259)	-3.346 (36.144)
Sigma	- -	29.137*** (2.166)
Number of observations	493	493

Note: Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Source: own research

the average vehicle is associated with a more than one ton decrease of shipped perishable cargo. Similarly, a 1% increase in the value of cargo decreased the tonnage of shipped perishable cargo by about 37 kilograms. Indeed, the effect can be large because the value of perishable cargo tends to be high and in the case of some products quite high (e.g. animal vaccines). High value perishable cargo imposed additional responsibility on the driver, who may be reluctant to accept it given high road congestion and other contingencies. Additionally, a driver operating on a schedule was expected to ship 11.622 fewer tons of perishable cargo than one operating on no schedule (Table 1). Drivers working according to a schedule likely ship routine cargo that does not require temperature control.

Two factors increased the transported volume of perishable goods. Kenyan truck drivers were expected to ship 14.31 more tons of perishable cargo than truckers with different citizenship (Table 1). Non-Kenyan drivers were likely to ship goods from their country to Kenya or to the port of Mombasa, destined for overseas markets. Agricultural

Table 2. Marginal effects of explanatory variables changing the probability of the truck driver's decision to transport perishable cargo

Variable name	Marginal effects (Logit results)
Log of truck age	-0.0799***
	(0.029)
Home country (1 = Kenya) ^a	0.139***
	(0.051)
Truck ownership (1 = independent) ^a	0.170***
	(0.048)
Set schedule (1 = operates by schedule) ^a	-0.155***
	(0.045)
Log of the value of cargo in Kenya shillings	-0.0312
	(0.021)
Number of police roadblocks in the last trip	0.00132
	(0.003)
Log of trip distance in kilometers	0.0122
	(0.045)
Log of total costs in the last completed trip	-0.00228
	(0.021)
Number of observations	493

^a Binary variable assumes value 1 or 0.Standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Source: own research

products, such as fresh vegetables or cut flowers, are produced in Kenya for export and the location of production favors Kenyan drivers. In turn, foreign drivers arriving in the port of Mombasa might encounter obstacles in accessing shippers of perishable cargo, or are perceived as riskier drivers than Kenyan drivers, who are subject to Kenya's regulations. Further, an independent driver was expected to ship 11.742 more tons of perishable cargo than one who worked for a company (Table 1). Independent truck drivers have more flexibility in choosing cargo and can immediately make decisions accelerating shipping, which in the case of perishable cargo is essential.

CONCLUSIONS

This study highlights the factors that influence perishable cargo shipping choice behavior among long-haul truck drivers in lesser developed countries using the example of the NC route stretching from the port of Mombasa, Kenya, to Kampala, Uganda and Kigali, Rwanda. Perishable cargo requires special handling and expedited shipping, as it may not be shipped on a regular basis, precluding planning. The NC road is the main road for shipping imported cargo to land-locked countries in East Africa. Specifically, the study identifies that the determinants of choosing to ship perishable cargo and the shipped volume of perishable cargo differ across the two estimated relationships in significance and directional effects.

It appears the mechanical condition of the vehicle as reflected in truck age and the working conditions of the driver reflected in operating on a set schedule are negatively associated with accepting perishable cargo and lower perishable cargo volume, if transported. In contrast, the most likely shippers of perishable cargo tend to be independent truck drivers and drivers who are Kenyan citizens. The former may result from the speed and flexibility of making the acceptance decision. The latter effect could be linked to the perception that domestic drivers, subject to Kenya's laws, represent lower risk in shipping a perishable, typically more valuable cargo, than non-Kenyan drivers, but it also results from the port of shipping, Mombasa, which is located in Kenya, as noted in another study [Eberhard-Ruiz et al. 2018]. The findings can be used by East Africa's agricultural commodity traders to improve perishable cargo shipping performance, and also by EAC member states governments to draft policies that support smooth intra-regional perishable agricultural and non-agricultural trade. In particular, a policy that would streamline road user charges across EAC member states, in line with East Africa's trade agreements, would help improve trucking services through enhanced competition.

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DECYZJA KIEROWCY CIĘŻARÓWKI O PRZEWOZIE TOWARÓW PSUJĄCYCH SIĘ: STUDIUM PRZYPADKU HANDLU TOWARAMI ROLNYMI I ŻYWNOŚCIĄ W AFRYCE WSCHODNIEJ

Słowa kluczowe: handel rolny, surowce rolnicze, dane ankietowe, logit, model Tobit'a, Kenia

ABSTRAKT

Korytarz Północny (ang. *Northern Corridor* – NC) jest główną drogą łączącą kraje nieposiadające dostępu do morza z portem w Mombasie i droga ta jest często używana do przesyłki towarów, w tym ładunków szybko psujących się. Badano, w jaki sposób czynniki, takie jak: rodzaj ciężarówki, warunki pracy i osobowość kierowcy wpływają na decyzje kierowcy o przyjęciu do transportu ładunku szybko psującego się i o wielkości przewożonego ładunku. Równania dotyczące decyzji i wielkości ładunku obliczono na podstawie danych z badań ankietowych zebranych od kierowców ciężarówek podczas rozmów na przejściu granicznym pomiędzy Kenią a Ugandą we wrześniu i w październiku 2018 roku. Wyniki badań ankietowych pokazują, że kierowcy – właściciele ciężarówek oraz kierowcy będący obywatelami Kenii chętniej przyjmowali ładunki łatwo psujące się i transportowali większą ilość takiego towaru niż kierowcy pracujący dla firm przewozowych. Negatywny efekt wiązał się także z organizacją pracy kierowcy według terminarza oraz z wiekiem samej ciężarówki, prawdopodobnie z uwagi na ryzyko awarii podczas podróży.

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