Working paper 518

Trade facilitation, transport costs and the price of trucking services in East Africa

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Key messages

- Using a combination of qualitative and quantitative data from primary and secondary sources, this study gives a detailed account of the market structure of trucking services on a key trading route between Mombasa and Kampala and examines its impact on the price of trucking services.
- Trucking services on this route are already provided on a competitive basis, and increased trade facilitation would lead to even lower transport prices.
- In total, transport prices could fall by as much as 30% from their current levels through trade facilitation measures that reduce transit time and costs to a minimum.

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Acknowledgements

This paper was prepared under the project, 'Resolving the unresolved non-tariff barriers in the East African Community', which was funded by the East Africa Research Fund.

We are particularly thankful to Alan Winters and Olivier Cadot for their guidance and suggestions throughout this research project, and peer review of this study. Helpful comments were also received from Neil Balchin, Peter Holmes, Maximiliano Mendez-Parra, Jim Rollo and Dirk Willem de Velde. Errors and omissions remain our own.

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1. Introduction

Promoting trade is typically associated with tariff reduction or tariff removal, but many studies have also highlighted the fundamental role of trade facilitation in strengthening trading relationships (Hartzenberg, 2011; de Melo and Tsikata, 2014). Trade facilitation is particularly relevant for regions that have historically suffered from high internal transport costs, such as sub-Saharan Africa. Freight costs as a share of import value are higher in sub-Saharan Africa than in any other region of the world, and have been increasing since the early 2000s (African Development Bank, 2010). High transport prices reduce countries' economic competitiveness (Raballand and Macchi, 2009), hinder economies' participation in global production networks (Christ and Ferrantino, 2011; Nordas et al., 2006), and undermine regional integration efforts with neighbouring countries.

This paper examines the channels through which trade facilitation efforts can reduce the price for transporting goods between countries in East Africa. Specifically, we examine the market for overland cargo transport on the 1169 km stretch of road between Mombasa (Kenya) and Kampala (Uganda). This road segment belongs to the region's Northern Corridor. It is a key transnational infrastructure link, which provides vital access to the sea for East Africa's landlocked hinterland and serves as the main import/export route for goods entering or leaving Kenya, Uganda, Rwanda, South Sudan and the eastern parts of the Democratic Republic of Congo.[1]

Trade facilitation plays a key role in reducing transport costs. It addresses delays caused by bottlenecks in transit (excessive numbers of roadblock, weighbridges) and at the borders (slow custom clearance, congestion), which contribute to higher yearly mileages (Teravaninthorn and Raballand, 2009). Trade facilitation also reduces risks and uncertainty in transactions, which are high in the East African transport sector (Arvis et al., 2010). Uncertainty in delivery affects imports and exports, and the negative effects can multiply through the entire value chain (Hummels, 2007).

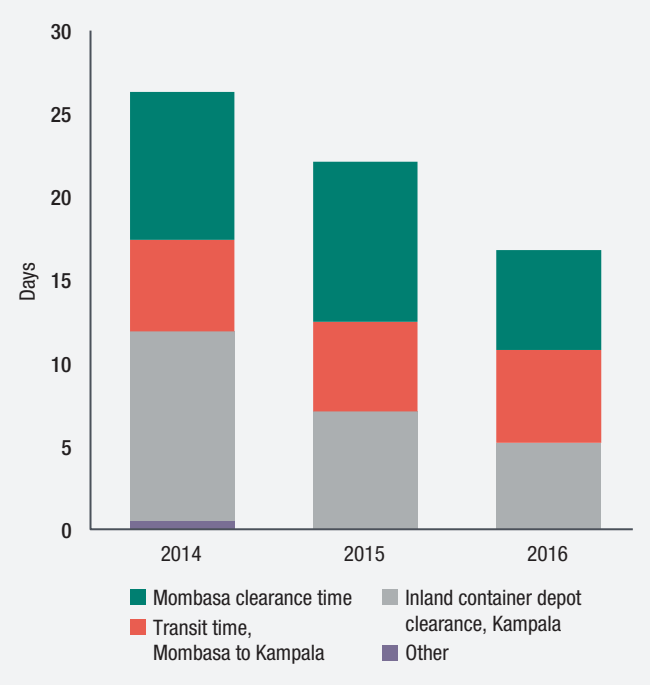
Christ and Ferrantino (2011) also highlight that investments in infrastructure have a low rate of return if they do not address 'soft' constraints through trade facilitation measures. This could explain why the literature finds uneven effects of infrastructure improvements on transport costs. For example, in a study conducted by Schurenberg-Frosch (2012), better infrastructure is found to lower transport costs, as the state of road infrastructure determines the life of trucks, maintenance costs and fuels consumption (Teravaninthorn and Raballand, 2009). However, in Ethiopia and Nigeria, Atkin and Donaldson (2015) find that intra-national transport costs remain high even when controlling for the quality and availability of roads. The impact of international aid appears to be equally inconclusive. While foreign aid efforts to improve infrastructure on transport corridors have not produced a clear impact on transport prices (Raballand and Macchi, 2009; Teravaninthorn and Raballand, 2009), other studies have found that aid for trade initiatives reduce trade costs (Cali and te Velde, 2011).

Other issues affecting transport costs include the presence of a competitive market for transport services. Several studies, including this paper, find the East African transport sector to be competitive (Teravaninthorn and Raballand, 2009). Additionally, corruption can be a major factor in determining not only transport costs but also pricing strategies and the choice of transport routes (Sequeira and Djankov, 2013), though this is not found to greatly affect the East African transport sector (Teravaninthorn and Raballand, 2009).

Across East Africa, recent policy efforts to strengthen regional integration, seen in the establishment of the East African Community (EAC) and the Common Market for Eastern and Southern Africa (COMESA), have facilitated the movement of goods along the Northern Corridor. Data from monitoring systems of freight forwarding companies that were gathered for the purpose of this study confirm that these efforts are already showing some positive results. Today, a Ugandan importer can expect a container to reach Kampala almost 10 days faster from the moment it arrives at the port of Mombasa than three years ago. Yet the same data also show that, although trade facilitation efforts have been particularly successful at the customs clearance stage, the reduction in cargo transit times between Mombasa and Kampala has been less impressive, as illustrated in Figure 1. Over the past three years, clearance times of imports with Kampala as their final destination have declined strongly

1 An alternative route to the Northern Corridor is the Central Corridor, which provides another regional transport link to the sea via the southern shores of Lake Victoria to Dar es Salaam. However, the route between Mombasa and Kampala is currently still being used by a larger number of countries to transport goods in the region. In 2015, the average monthly cargo throughput at the port of Mombasa was double that of the port of Dar es Salaam (NCTTCA, 2016; CCTTFA, 2016).

Figure 1. Time to import on the Northern Corridor



Note: data based on average time to import containerised products from Uganda through the port of Mombasa.
Source: performance monitoring systems of interviewed freight forwarders.

both at the port of Mombasa and at the inland container depot in Kampala, while en-route transit times have remained stagnant at around five to six days.

We examine how the failure to reduce transit times on East Africa's Northern Corridor contributes to higher prices of trucking services. We combine quantitative and qualitative data from both primary and secondary sources to shed light on the operating nature of the trucking services industry, and establish the potential savings that would emerge from different trade facilitation measures. We find that trade facilitation measures leading to a reduction in transit times have a higher savings potential than measures targeting direct pecuniary costs, such as bribery. At the margin, one additional day required to cover the route from Mombasa to Kampala leads to 6% higher transport prices. In total, we estimate that savings of up to 30% are attainable through a combination of several straightforward trade facilitation measures.

The remainder of this paper is structured as follows. In Section 2 we describe our data, followed by a detailed account of the market for trucking services in East Africa. Section 3 presents our theoretical framework. Our estimation of trade facilitation costs and a discussion of their implications can be found in Section 4. Section 5 concludes.

2. The EAC's trucking industry

In this study, primary data collected using both quantitative and qualitative survey methods provide us with a comprehensive picture of the EAC's trucking industry. An online survey targeting freight forwarders, transporters and manufacturers gave us an initial picture of the operating conditions of the EAC's transport sector. The online survey examined the common overland routes used to ship goods within the EAC, the price structure of EAC transport services, and the trade facilitation constraints encountered when operating different EAC routes. We complemented the data from the online survey with information gathered in a series of qualitative interviews with transport and logistics employees and managers. Consistency across interviews was ensured by focusing questions on a benchmark service defined as the transport of a containerised product weighing 27 tonnes on a semi-trailer truck from Mombasa to Kampala.[2] This was necessary due to the diverse nature of cargo transport services, which results in differing contractual conditions when transporting cargo of different weight and type.

We conducted interviews in Kampala and Mombasa, with interviewees selected from a range of backgrounds, including three senior managers of manufacturing firms with a regional presence; five senior managers of leading freight forwarding companies operating across the region; seven senior managers of trucking companies offering regional transport services; five senior truck drivers; and two senior managers of representative bodies. Interviews were structured into three sets of questions. First, we sought information on the operating nature of the transport sector in terms of transport capacity, technology, current prices for transport services and the structure of variable and fixed costs that transport firms face on the Northern Corridor. Second, questions were then asked about the current conditions of cargo transport along the Northern Corridor to understand average transit times, average border crossing times and the likelihood of delays. Third, we asked respondents about their views on the overall EAC integration process.

In addition to these primary data sources, we also relied on secondary data, including official government statistics which we downloaded from the respective websites of central banks and statistics offices. In addition to these, we used data provided by the Norther Corridor Transport Observatory, an online platform that provides information on transport volumes, costs and times along the Northern Corridor.[3] Finally, we also downloaded data from an online second-hand exchange platform to collect information on the prices for second-hand trucks.[4] This information was used to estimate the rate at which trucks depreciate in value. The narrative in Section 2.1 summarises the information gathered in these interviews and provides a characterisation of the market for trucking services along the EAC's Norther Corridor. The figures used for our analysis in subsequent sections has been included as a table in Annex 1.

2.1. Market characteristics

Most of the cargo transport between Mombasa and Kampala occurs in an outbound direction, i.e. trucks driving towards Kampala are typically fully loaded while trucks driving in the direction of Mombasa are often empty. This has important implications for the market structure of transport services on the Northern Corridor. On the one hand, it implies markedly different prices for transport services depending on the direction of travel. Hiring a semi-trailer truck to transport a containerised maximum load of 27 tonnes costs $2,200 to $2,300 from Mombasa to Kampala, whereas the same load would cost about half of that when travelling in the opposite direction. On the other hand, it results in Kenyan trucking firms dominating the market for Northern Corridor transport services, given that most of the trucking business originates

2 The semi-trailer is the most common transport vehicle on the Northern Corridor. It can carry a maximum load of 27 tonnes under the current EAC axle load regulations.

3 More information is available here: http://top.ttcanc.org.

4 This platform can be accessed here: https://www.olx.co.ke

from Mombasa.[5] In addition, truckers face asymmetric user charges depending on the country of registration of their vehicle. For example, Ugandan truckers face a user road charge of $249 every time they cross into Kenya, while the Ugandan road user charge for Kenyan trucks is only $50. Together with Mombasa's lower fuel prices, these factors put Ugandan truckers at a disadvantage, making it very difficult for them to compete with Kenyan trucking firms. As a result, Ugandan truckers are typically active on routes going west or north from Kampala, leaving the eastward routes between Kampala and Mombasa to Kenyan truckers.

Kenyan transporters prefer more expensive Mercedes trucks for their operations due to their greater reliability, longer life expectancy and higher fuel efficiency. A new Mercedes truck is estimated to cost about $120,000, excluding the necessary trailer which can be bought for an additional $30,000. By contrast, Ugandan transporters preferred cheaper trucks (often imported from China) which can be acquired at a significantly lower price of about $65,000 excluding the trailer. We interpret this difference in truck preferences as a further indication of the different industry maturity in the transport sectors of both countries, with Ugandan truckers not able to afford more modern technology under current market circumstances. On average, a semi-trailer truck is expected to burn 50 litres of fuel for each 100 km. Trucks are typically operated by a driver and an assistant, who receive an average monthly base salary of $330 and $172, respectively. In addition, truck drivers receive an allowance on every trip between Mombasa and Kampala of about $250, which is expected to cover all en-route expenses, including road usage charges, parking fees, fines, bribes and accommodation expenses.[6]

Trucking companies and freight forwarders expect road cargo to reach Kampala in 5-6 days once it leaves the port of Mombasa. This is long time for a trip of 1169 km, and implies that cargo moves at an average speed of only 8 to 10 km per hour. Truck drivers we interviewed, estimated that when driving a fully loaded truck, they are only moving 36% of the time. A total of 30% of the time is spent resting at night or taking breaks throughout the day. The remaining 34% of the time is attributed to waiting time at the border, queueing at weighbridges, roadblocks and other unforeseen circumstances.

2.2. The economics of trucking

The surveyed information allowed us to establish the actual operating conditions of the transport sector along the EAC's Northern Corridor. At current EAC transit times, we estimate that a newly acquired truck operating at full capacity is able to service the route between Mombasa and Kampala 38 times per year. This implies an average of 3-4 trips per month, which is in line with responses from our qualitative interviews. At a price of $2,237 per round trip, a truck thus currently generates a yearly revenue of $85,201. Total annual fuel expenses amount to $32,255 when operating at full capacity, while annual en-route expenses paid out in allowances to truck drivers amount to $9,484. The total annual wage bill, calculated as the sum of the base salaries of truck driver and assistants over the course of a year, stands at $3,961. Hence, variable en-route costs play a much less important role in the trucking industry's overall cost structure, which is predominantly driven by fuel prices.

A key piece of information that we were not able to establish from the interview responses is the rate at which the value of trucks depreciate. Therefore, in order to estimate the annual depreciation rate of a truck, we established the asking prices for second-hand semi-trailer Mercedes trucks advertised on a Kenyan online platform. Advertisements did not include data on truck mileage, which typically correlates strongly with truck prices. Instead, each advertisement was accompanied by a photograph showing the condition of the truck and its number plate. With odometer fraud prevalent across much of East Africa, number plates are typically used as a more objective source of information of a truck's mileage for the valuation of trucks on the second-hand market.[7]
Hence we used the number plate to establish the years since the truck's registration and estimated the following linear regression model:

$$TruckPrice_k = \alpha_0 + \alpha_1 Age_k + \varepsilon_k \,,$$

where $TruckPrice_k$ is the asking price of truck k; Age_k is the number of years elapsed since truck k's registration; and ε_k is an error term. Figure 2 illustrates this regression estimation graphically.[8] The estimated value of α_1 is -7,197, which implies that a truck depreciates by $7,197 each year, equivalent to 4.8% of the initial

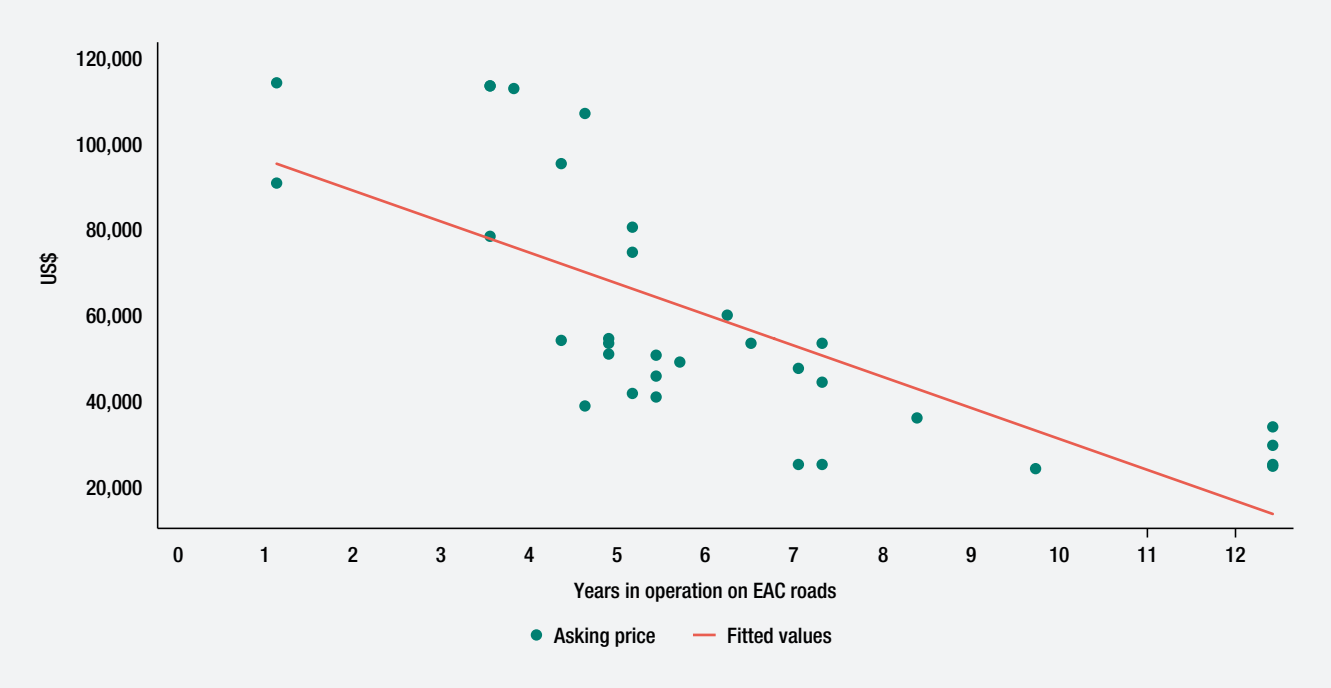
5 In a presentation at the SSTAP annual meeting, Hartman (2013) estimated the number of Kenyan trucking companies at almost 1,600, with a total fleet of over 17,000 vehicles in 2012. In the same year, Tanzania had only 732 companies with over 12,000 vehicles, and Rwanda had 220 companies with over 400 vehicles. For more information, see: http://www.ssatp.org/sites/ssatp/files/publications/HTML/Conferences/Dakar13/Presentations/Dec-11/Dec%2011-PM-Olivier%20Hartmann-EN.pdf

6 Ugandan truck owners generally have to pay higher allowances of up to $450 due to the higher road usage charges they face when travelling into Kenya.

7 See, for example, Daily Nation (2014), DutyCalc Kenya (2017), Huduma Bora (2011).

8 A full set of regressions is reported in Annex 2.

Figure 2. Depreciation of semi-trailer trucks operating on EAC roads



value of the truck. The intercept α_0 has a value of 103,150, which is significantly less than the cost of a new semi-trailer truck, which our interviewees estimated at $150,000. This is unsurprising, as our interviews confirmed that many imported trucks enter the EAC as used, and not as new trucks.

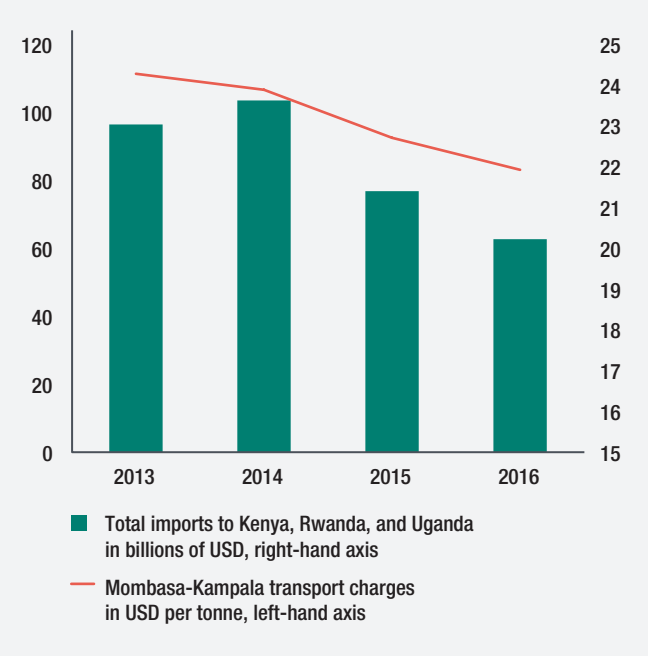
With the information on prices, cost and depreciation rates, we were then able to estimate the annual return of an investment involving the acquisition of a semi-truck. The resulting annual pre-tax cash flow (excluding depreciation) is $39,500, implying that it takes 3.8 years to recover the cost of our reference truck valued at $150,000. This corresponds well with information gathered in qualitative interviews, which suggests that under normal circumstances, cost recovery of a new truck is achieved in 3-4 years. Taking into account the annual depreciation of truck estimated above, the annual return on investment becomes $32,303, which is 21.5% of the initial cost of a truck. This aligns with returns on physical capital that have been reported to often exceed 20% in sub-Saharan Africa (e.g. Bigsten et al., 1998; Grimm et al., 2011; Siba 2015).

2.3. Market structure

In a recent comparative study of trucking services across major transport corridors in sub-Saharan Africa, Teravaninthorn and Raballand (2009) found evidence of a relatively competitive market structure among providers of transport services along the Northern Corridor.[9] We used responses from our respective interviews to establish the evolution of annual revenue, operating costs and profit margins over time to shed light on the competitive nature of the EAC's transport sector. Interviewed freight forwarders and manufacturing firms stressed that, overall, charges to import a container into Kampala through the port of Mombasa had declined significantly over the last five years, from $4,000-4,500 to $3,000-3500, including clearance, port and transport charges (but excluding sea freight charges). This reduction was, by and large, attributed to a decline in the cost of inland transport on the Northern Corridor. Figure 3 illustrates the data from the Northern Corridor Transport Observatory, which confirmed that the price charged by trucking companies to ship our reference cargo load of 27 tonnes from Mombasa to Kampala declined by over 30% between 2013 and 2016. Interviewees stressed that this reduction in trucking prices was predominantly due to lower fuel prices and a lower demand for transport services owing to a slowdown in imports (see Figures 3 and 4).

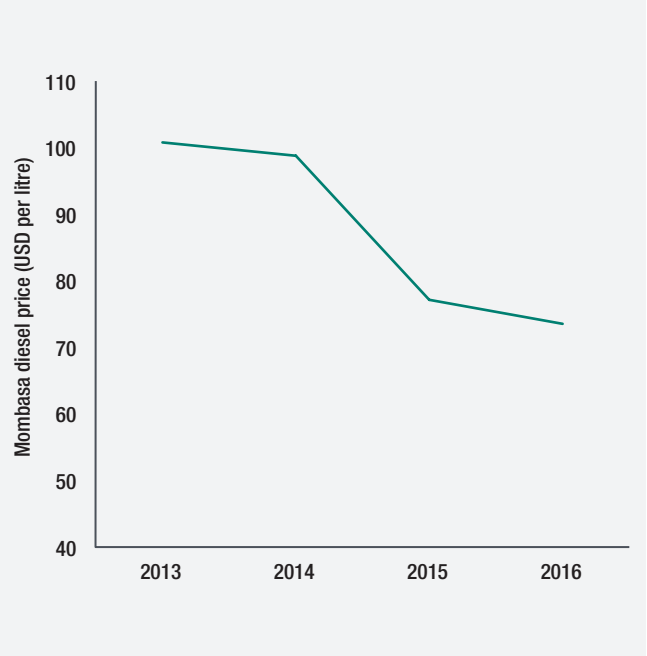
9 This is indicated by the realtively high truck mileage per year compared to other regions, and by the fact that the largest trucking companies in Kenya only cover 20% of the market, a share similar to the competitive markets of Europe and North America (Teravaninthron and Raballand, 2009).

Figure 3. Declining imports and transport charges, 2013-2016



Source: interviews with truck drivers, Northern Corridor Transport Observatory and respective central banks of each country.

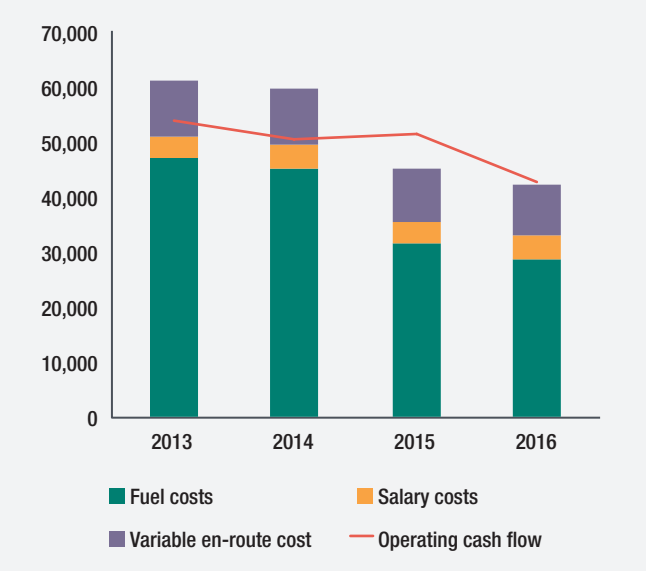
Figure 4. Declining fuel prices in Mombasa, 2013-2016



Source: Energy Regulatory Commission of Kenya.

Between 2013 and 2016, total operating costs of a truck fell by 26% (in nominal US$), as Figure 5 shows. Yet this did not lead to an increase in truck owners' margins, with the annual pre-tax cash flows of a new truck remaining relatively constant at around $45,000-$48,000 between 2013 and 2015, and even declining in 2016 to $39,500. This decline in 2016 reflects a reduction in the demand for transport services owing to fewer imports going through the port of Mombasa, as shown in Figure 3. Therefore, according to these estimations, the cargo transport industry in the EAC seems to operate in a relatively competitive environment, with cost savings being passed through in entirety to the clients of transport companies. Moreover, interviewed truck owners argued that the recent reduction in the demand for transport services had made these competitive forces particularly fierce, with margins coming under additional pressure. One company even reported having to sell part of their trucking fleet to companies based in Dar es Salaam.[10]

Figure 5. Annual cost and operating cash flow in the trucking industry of the Northern Corridor (in US$)



Note: figures based on operating a single new semi-trailer truck with a driver and an assistant on the Mombasa–Kampala route at maximum capacity (27 tonnes per trip).
Source: authors' own calculations based on interview data and several secondary sources.

10 This shift in capacity between corridors could imply an increase in the competitiveness of the Central Corridor relative to the Northern Corridor. We are not in a position to fully assess this possibility, but our data suggests otherwise. According to the Central Corridor Transport Observatory, transporting cargo between Dar es Salaam and Kampala continues to be over 50% more expensive than between Mombasa and Kampala. All our interviewed cargo owners in Kampala expressed a strong preference for using the Northern Corridor route when importing goods.

3. Theoretical framework

We developed a simple modelling framework to capture the operating conditions of the trucking industry in the EAC, as described in Section 2. For this purpose, we assume a representative truck owner, specialised in offering cargo transport services on a given route in the EAC, and operating in an environment with constant returns to scale and constant average cost functions in the number of trucks owned. Total annual profits of this trucking firm can be represented as:

$$\Pi_{ij} = p_j n_i X_{ij} - n_i C_{ij} \quad (1)$$

where n_i stands for the number of trucks owned by i, X_{ij} for the number of separate cargo loads delivered by each truck of company i in a given year on route j, and C_{ij} for the total cost faced by each truck of company i in delivering a single cargo load on route j. The first and the second terms in equation (1) represent firm i's total revenue and total costs, respectively, in a given year. Equation (1) implies that the profit of any single truck owned by company i is:

$$\frac{\Pi_{ij}}{n_{ij}} = \Pi_{ij} = p_j X_{ij} - C_{ij} \quad (2)$$

Furthermore, we assume that the market structure of the trucking industry is competitive and that firms are not able to exert any influence over the price of trucking services. The number of cargo loads, X_{ij}, that a truck delivers in a year depends on the efficiency of trucking services, i.e. the number of trips that a truck can undertake in a given year. Hence,

$$X_{ij} = \frac{T_i}{t_j} \quad (3)$$

where T_i is the total number of days firm i decides to operate on route j in a given year, and t_j is the number of days required to process a cargo load on route j (i.e. the total transit time required to cover a return trip on route j plus any additional time required to secure a new order). We show below that T_i will either be set to zero or the maximum possible amount of 365 days, implying that trucks will either operate at full capacity or not at all.

Total costs C_{ij} are assumed to exhibit a positive marginal cost and decreasing average cost. Specifically, we assume that C has a variable cost component which depends on the number of cargo loads X_{ij}; and a fixed component comprised of the truck driver salary, the annual depreciation of the truck and the opportunity cost of capital in the region:

$$C(X_{ij}) = \omega_j X_{ij} + \rho_j X_{ij} + W_i + (\delta + r)K_i \quad (4)$$

ω is the direct pecuniary costs involved when a cargo load is transported on route j, covering en-route expenses, accommodation of drivers and other incidental cost; ρ_j is the total cost of fuel required for a return trip on route j; and W_i is the annual cost of labour to operate a truck. $(\delta + r)K_i$ represents the user cost of initially invested capital K_i, with δK_i standing for the annual depreciation of a truck and rK_i the risk-adjusted opportunity cost of owning a truck. We thus define rK_i as a term including both the opportunity cost of capital as well as the truck owner's opportunity cost of time.

Therefore, firm i's profit maximisation problem can be characterised as involving two sequential decisions. First, firm i will have to decide how many trucks, n, to own in any given year, by setting n to satisfy $\rho_j X_{ij} = C_{ij}$. This means that it will set marginal revenue generated by each truck equal to the marginal cost incurred by a truck. Second, it will have to decide how many days, T, to operate each truck throughout the year by maximising:

$$\pi_{ij} = p_j \frac{T_i}{t_j} - \{(\omega_j + \rho_{ij}) \frac{T_i}{t_j} + W_i + (\delta + r)K_i\} \quad (5)$$

This sequential decision problem has several key implications. First, $p_j X_{ij} = C_{ij}$ is only satisfied if $p_j > \omega_j + \rho_{ij}$. Hence, over the course of a year, the price for transporting a single cargo load on route j will have to be higher than the marginal cost of doing so. Otherwise, firm i would be making a loss on the marginal truck and thus decide to sell part or all of its fleet. Second, T will always be set at the highest possible level, as long as $p_j > \omega_j + \rho_{ij}$. Thus, independent of the number of trucks company i owns, it will always choose to operate at full capacity as long as the market price for transporting a single load on route j covers at least the marginal costs of operating on route j. Third, the size of the trucking industry will depend on the average costs per trip over the course of a year, defined as:

$$\overline{C_{ij}} = (\omega_j + \rho_{ij})_j + \frac{W_i + (\delta + r)K_i}{T_i / t_j} \quad (6)$$

Firms will be increasing their trucking fleet when p_j is larger than $\overline{C_{ij}}$ and will be reducing their fleet when p_j is smaller than $\overline{C_{ij}}$. Hence, in a competitive equilibrium, the overall capacity of the trucking industry will adjust so that the market price for transporting a single cargo load on route j will equal the average costs of operating a truck in a given year on route j, satisfying:

$$p_j = (\omega_j + \rho_{ij}) + \frac{W_i + (\delta + r)K_i}{T_i / t_j} \quad (7)$$

Equation (7) shows how, in a competitive equilibrium, there are two channels through which improvements in trade facilitation along route j have an impact on p_j. The first channel comprises a direct reduction in en-route costs, ω_j, i.e. a reduction in road user charges, bribes and overnight security costs, among others. The second channel is indirect and involves a reduction in t_j, i.e. the number of days required to cover route j. A reduction in overall transit times, for instance, would allow the number of round trips per year to be increased and would thus allow firms to use their trucking fleet more efficiently, which in turn would put downward pressure on the market price p_j.

4. The impact of trade facilitation barriers

In this section, we investigate the impact of a reduction in trade facilitation barriers under perfect competition on the price of trucking services in the EAC. In line with the general market characteristics described in Section 2, we set route j as a return trip with a one-way load of 27 tonnes transported from Mombasa to Kampala. Specifically, we use equation (7) to establish the main drivers of transport costs on this route. The data allow us to measure all the variables affecting p_j with the exception of r, defined as the risk-adjusted opportunity cost of owning a truck. However, given the evidence we find for a competitively operating market implying zero economic profits, we set r equal to the annual return on investment of 21.5% calculated earlier.

Equation (7) establishes that in a competitive equilibrium, the price of trucking services is driven by two components: (i) a variable component determined by the cost of fuel and direct pecuniary costs; and (ii) a fixed component that depends on the number of trips carried out over the course of a year. Direct pecuniary trade facilitation barriers such as bribes or road usage charges impact the former variable component. Indirect trade facilitation barriers that result in higher transit times affect the latter fixed component. We examine each of these two channels in turn.

4.1. The cost of pecuniary trade facilitation barriers

Pecuniary trade facilitation barriers are represented by ω_j in equation (7). They have a direct impact on the marginal cost of trucking. Hence, in a competitive market, an increase in ω_j results in a one-to-one increase in the price for trucking services. On a return trip between Mombasa and Kampala, ω_j amounts to $249, which is the total allowance a truck driver receives to cover en-route expenses. We asked truck owners and their respective drivers to split this sum into its different components. Out of the total allowance of $249, 34% is typically used for personal expenses such as food and accommodation, 20% to cover road usage charges in Uganda, 13% to pay for bribes, and 9% to meet security expenses and parking fees. The remaining 23% is used as a buffer for unforeseen circumstances and minor en-route repairs to the truck.

From a policy perspective, the elimination of road usage charges, bribes and security expenses represent the most obvious trade facilitation policies. We consider three scenarios in which each of these trade facilitation barriers is removed, the results of which are reported in columns two and three in Table 1. The calculations make clear that the savings from these policies would be relatively modest: jointly eliminating all road usage, bribery and security costs would reap only 5% lower transport prices relative to their current level.

4.2. The cost of trade facilitation delays

Most trade facilitation barriers are felt in the form of longer cargo transit times. These have an indirect impact on transport costs, as they reduce the number of round trips a truck can undertake in a given year, resulting in a higher average cost $\overline{C_{ij}}$. In contrast, shorter cargo transit times allow for spreading the fixed costs of a truck over a larger number of trips t_j, causing trucking prices to fall if markets are competitive. Using equation (7), we can estimate the marginal impact of one additional hour spent in transit on the price of trucking services. For each additional hour, the price for trucking services rises by $5.33, or 0.24% relative to the current price of $2,237. According to our interviews, the current value of t_j for a return trip with a one-way cargo load of 27 tonnes between Mombasa and Kampala is 9.6 days, or 230 hours. This includes 5.6 days needed to complete the outbound trip from Mombasa to Kampala when the truck is loaded, 3 days for the return trip back to Mombasa, and 1 day turnover time between trucking orders.

Interviewed truck drivers specified that 34% of the outbound transit time of 5.6 days is lost while waiting at key transit points such as weighbridges, roadblocks and the border. Several surveys looking at border and weighbridge crossing times allow us to accurately establish these delays. For instance, a 2016 border crossing survey conducted at the main border post for cargo traffic between Kenya and Uganda in Malaba shows that it currently takes 22 hours to cross the border into Uganda due to slow customs processing and overall congestion at the border (Kuria, 2016). The time lost at weighbridges is more difficult to establish because it depends on the type of weighbridge in use. Modern weigh-in-motion technology has resulted in much shorter waiting times of less than 10 minutes at some weighbridges. Yet only four of the seven

fixed weighbridges between Mombasa and Kampala are equipped with this technology. In addition, there are also mobile weighbridges that are placed randomly throughout the route that add to the journey time. In total, interviewed truck drivers estimated that they expect to encounter up to 10 weighbridges. According to the data, our best guess is to allow for an average of 30 minutes per weighbridge, which would bring the total time lost due to the existence of weighbridges to five hours per trip (assuming that trucks are compliant with axle load regulations). Taking the total time lost at the border and time spent at weighbridges, we are only able to account for about 27 hours of the total 46 hours of delays truck drivers report. This highlights that there are other important sources of delays such as roadblocks and congestion, which can also increase overall transit times.

For illustrative purposes, we compare three additional scenarios. In all three scenarios, we hold the current work to resting time ratio of 0.43 constant. This implies that on a typical day en-route, a truck driver works 13.7 hours and rests 10.3 hours. Therefore, a reduction in en-route delays reduces total transit times directly, but also reduces transit times indirectly due to less resting time needed while en-route. Our first scenario assumes the elimination of all delays occurring at the border between Kenya and Uganda due to the existence of a hard border. This would result in a decline of total transit times on the Northern Corridor by 31.6 hours (i.e. 22 hours due the elimination of delays, and 9.4 hours due to a reduction in required resting time). The second scenario eliminates all weighbridges, which would result in a decline of total transit times by 7.1 hours (i.e. 5 hours due to the elimination of delays and 2.1 hours due to reduced resting time). In the third scenario, we eliminate all unaccounted for delays, which would reduce the total transit time by 26.1 hours (i.e. 18.3 hours directly, and 7.8 hours due to reduced resting time). The results are shown in columns five to seven of Table 1.

4.3. Discussion

Our results show that delays generally impose a larger cost on the transport of goods in the EAC than direct pecuniary measures. In policy circles, bribes and extra official payments made en-route are often attributed a key role in explaining high transport costs. However, the results in Table 1 show that even if all of these payments were to be eliminated, the total savings would only amount to 1.5% of the current price of transport services. Addressing the trade facilitation barriers responsible for delays would reap higher benefits. For instance, a 7% reduction in cargo transport prices could be achieved by speeding up clearance of cargo at the border.

It is important to note, however, that completely eliminating all of these cost factors is unfeasible. A limited number of weighbridges will have to remain to ensure trucks comply with axle load regulations and to preserve precious road infrastructure. Road usage charges may also play an important role in financing new infrastructure, which could be equally cost reducing. Yet it remains that there are potentially large savings to be made from increased trade facilitation. Rather than focusing on a single trade facilitation measure, it is possible to benchmark current transit times against transit times that would be achieved if trucks were to travel at higher average speeds. Interviewed truck drivers disclosed that they only spend about 36% actively driving when in

Table 1. Impact of different trade facilitation measures on the Mombasa–Kampala route

	Actual	Scenario 1 No road usage charge	Scenario 2 No security expenses	Scenario 3 No bribes	Scenario 4 No border	Scenario 5 No weigh-bridges	Scenario 6 No other delays	Scenario 7 Overall savings potential
Total transit time, (hours)	230.0	134.0	134.0	134.0	102.6	126.9	107.9	113.0
Driving time (hours)	89.7	89.7	89.7	89.7	89.7	89.7	89.7	70.4
Resting time, outbound (hours)	71.1	71.1	71.1	71.1	61.7	68.9	63.2	44.7
Delays (hours)	45.2	45.2	45.2	45.2	23.3	40.2	27.0	3.0
Turnover time (hours)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Implicit average speed when driving (km/hour)	24.1	24.1	24.1	24.1	24.1	24.1	24.1	40.0
Fuel cost (US$)	847	847	847	847	847	847	847	847
Allowance cost (US$)	249	199	227	216	249	249	249	166
Fixed cost (US$)	1,141	1,141	1,141	1,141	984	1,106	1,012	561
Price for trucking services (US$)	2,237	2,187	2,215	2,203	2,080	2,202	2,107	1,573
Savings relative to actual		-2.24%	-0.98%	-1.50%	-7.01%	-1.57%	-5.79%	-29.66%

transit. This implies that the average trucking speed when moving amounts to only 28 km per hour, which is possibly due to the inadequate infrastructure and congestion around major urban settlements and when approaching the border.

We thus consider a final scenario in which we allow travel speeds to increase to 40 km per hour, as reported in the last column of Table 1. To remain as realistic as possible, we allow for delays of three hours and assume a constant work to resting time ratio, as above. We also eliminate all payments for bribes and security from this final scenario. We find that in this scenario, the total transit time on a return trip would fall to 116 hours – almost half the current transit time of 230. Direct pecuniary costs would decline too, by $88 for each trip, resulting in overall savings of over 29% relative to current prices.

Our results are very similar to estimates provided elsewhere. In a previous study on transport logistics along the Northern Corridor, Arvis et al. (2010) provide a rough savings estimate of $130 for each one-day reduction in truck transit times. Although they do not provide a methodology of how they reach this figure, our calculations come remarkably close to their estimate, with daily cost savings of $128 implied by our results.[11] In another study, Djankov et al. (2010) estimate the impact of time costs on export volumes using a dataset compiled from freight forwarding companies worldwide. They find that that a one-day increase in the time it takes to move an export container from the factory to the nearest port is equivalent to extending the median distance between factory and port by about 70 km. Although our work aims to establish the impact of time delays on transport costs rather than trade volumes, a similar calculation using our data results in a very similar figure: with a one-day cost savings estimate of $128, a truck would be able to travel 67 km further for the same price if we hold our reference per kilometre trucking price of $1.91 constant.[12]

We note that we may well be underestimating the impact of lower transit times on transport costs. For example, we assume pecuniary trade facilitation barriers represented by ω_j to be independent of the total transit time. Yet, to the extent that the amount of money required for eating and accommodation falls with the total transit time, the savings impact of lower transit times may be even larger. Similarly, a reduction in delays and overall congestion may increase fuel efficiency and thus result in a greater overall impact. Moreover, our estimates in Table 1 do not consider the increases in transit predictability that may come hand in hand with the elimination of transit barriers. In fact, Arvis et al. (2010) argue that the benefit derived from halving the current inventory levels caused by the high variability in transit times could result in a much higher reduction in overland transport costs than would the mere reduction of delays.

11 For each additional hour, the price for trucking services rises by $5.33 (see Section 2.2), implying that an additional day in transit increases the price for trucking services by $127.92.

12 Despite the similarity of these figures, these comparisons ought to be treated with care given the strong differences between the methodologies used in this paper and in Djankov et al. (2010).

5. Conclusions

Trade facilitation, transport costs and trucking prices intertwine in East Africa. Our analysis sheds light on the market for trucking services on the key trading route between Mombasa and Kampala, which is used by importers and exporters across the region. Combining qualitative and quantitative data from primary and secondary sources, we are able to provide a detailed account of the costs of trucking services on this route. We find the market to be largely competitive. Moreover, we find that trade facilitation barriers play a key role in the continuing high prices charged for cargo transport in the region. Our results suggest that trade facilitation barriers that delay the movement of cargo are particularly costly. Direct pecuniary costs faced by truckers when transporting goods, such as bribery or security expenses, also contribute to higher prices, though to a lesser extent. In total, we estimate that transport prices could fall by as much as 30% from their current levels through a combination of trade facilitation measures that reduce transit time and transit costs to a minimum. Improvements in trade facilitation across East Africa could thus go a long way in increasing the economic competitiveness of the region and allow for better integration of the EAC's regional production centres with global value chains.

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Annex 1

Table A1. Current market conditions for trucking services

Indicator	Assumed baseline figure	Supporting evidence
Reference route	Mombasa port to Kampala (1169 km)	Distance figure taken from the Norther Corridor Transport Observatory (NCTO) of the Northern Corridor Transit and Transport Coordination Authority (NCTTCA)
Reference vehicle	Semi-trailer carrying up 27 tonnes	The semi-trailer is the most common transport vehicle on the Northern Corridor. It can carry a maximum load of 27 tonnes under current EAC axle load regulations.
Cost of semi-trailer	$150,000	Interviews with truck owners provided details about the costs of a semi-trailer depending on the brand. Most truck owners identified Mercedes trucks (Actor and Axor types) as their preferred choice, costing about $120,000 when new on the local market. The price of a trailer was quoted as about $30,000.
Annual rate of depreciation	$7,197	This was established using asking price data for second-hand trucks (only Mercedes Actor or Mercedes Axor were considered) sold in Kenya (retrieved from www.olx.co.ke in January and February 2017). Price data were then regressed on the number of years since the truck's registration in Kenya. This allowed generating average annual depreciation rates of trucks when operating on EAC's roads.
Average fuel consumption for return trip	50 litres per 100 km	Interviews revealed that a return trip from Mombasa to Kampala requires 950-1250 litres depending on the load and the age of the truck. Given the assumption of a maximum load (27 tonnes) and the relatively new trucks assumed for the purpose of this exercise, an average fuel consumption of 50 litres per 100 km is stipulated, implying a total fuel consumption of 1,169 litres for each trip.
Hiring cost of semi-trailer carrying a maximum load of 27 tonnes for Mombasa–Kampala route	$2,237	The qualitative interviews showed that transport costs for shipping cargo from Mombasa to Kampala varied strongly with the type and weight of container. Hence the collected information was used to estimate the hiring price for a fully loaded semi-trailer (max of 27 tonnes due to axle load regulations) on the Mombasa–Kampala route, which was estimated between $2,000 and $2,500 (excluding shipping line charges and cargo clearing charges). This is in line with the average 2015 price of $2,237 suggested by the most recent NCTTCA survey. This figure was used for the calculations.
Driver base salary per month	$330	Interviews provided details about truck drivers' salaries, which varied according to the type of company and the experience of the truck driver. The average salary provided by all truck owners interviewed in Mombasa was $330.
Assistant base salary	$172	Industry interviews revealed that truck drivers operating the Mombasa–Kampala route are typically accompanied by a truck driver assistant. The average reported base salary for truck driver assistants was $172.
Driver's allowance for each trip (direct transit cost)	$249	The qualitative industry interviews revealed that drivers get a lump sum for every trip. A Kenyan truck driver would receive about US$249 for a return trip between Mombasa and Kampala. Drivers reported that the allowance is used for truck maintenance (18%), parking fees and security (9%), personal expenses for accommodation and food (34%), bribes and extra official fines (13%), road usage charges (20%) and other miscellaneous expenses (5%).
Cost of fuel	$0.765 per litre	It is assumed that the truck refuels in Mombasa, where fuel is cheapest. The average pump price of fuel in the first two weeks of December 2016 was KHS78.79 (http://www.erc.go.ke/index.php?option=com_content&view=article&id=162&Itemid=666)
Overall transit time outbound from departure in Mombasa to arrival in Kampala	134 hours	The qualitative interviews revealed that trucking between Mombasa and Kampala currently takes about 5-6 days. This was corroborated by the KPIs provided by Bollore (in October 2016, it took 5.8 days to transport a container from Mombasa to Kampala). A recent GPS survey by the NCTTCA revealed that transit times from Mombasa to Kampala stood at 137.5 hours on average between October 2015 and March 2016. It should be noted, however, that this an average figure, which is likely to disguise some variation depending on whether customs clearance (this is not transit clearance) takes place at the border or not (for example, goods cleared under the Single Customs Territory are cleared at the port of entry, other goods are cleared either at Kampala's Inland Container Dedpot or at the border of Malaba or Busia).
Average border crossing time on outbound trip	22.0 hours	A baseline time and traffic survey was conducted at Malaba border post in 2016, reporting an average border crossing time of 21.95 hours.
Average time spent at weighbridges	5.0 hours	Stakeholder interviews revealed that truck drivers can expect up to 10 weighbridges between Mombasa and Kampala (five and two fixed weighbridges in Kenya and Uganda, respectively, and three mobile weighbridges placed randomly on the route). We assume 30 minutes per weighbridge. This allows for the smaller crossing times for weigh-in-motion weighbridges (e.g. Mariakani and Webuye) that have recently been confirmed in GPS surveys conducted by the NCTTCA, and somewhat higher times for static weighbridges.

Indicator	Assumed baseline figure	Supporting evidence
Average time spent resting	40.2 hours	Interviewed truck drivers estimated that, on average, they spend 30% of the total transit time either resting, eating or doing other personal activities.
Average time spent driving	48.6 hours	Interviewed truck drivers estimated that, on average, they spend 36% of the total transit time driving.
Average time spent on unaccounted activities	18.3 hours	Time spent on miscellaneous activities was calculated as a residual subtracting border crossing times, weighbridge crossing times, driving times and resting times from the total transit times.
Overall transit time return to Mombasa from Kampala	72.0 hours	An empty truck is assumed to return to Mombasa at an average speed of 40 km per hour, driving for 12 hours a day. Allowing for some minor delays at the border, this implies an approximate transit time of 72 hours for the return trip.
Truck idle time after each return trip	24.0 hours	A truck is assumed to stand still for 24 hours between every trip, allowing for repairs and maintenance and turnover of jobs.

Annex 2

Table A2. Regression results

VARIABLES	(1) Full sample	(2) Full sample	(3) Restricted sample	(4) Restricted sample
Age	-7,197***	-0.131***	-5,438**	-0.112**
	(1,215)	(0.0184)	(2,140)	(0.0380)
Constant	103,150***	11.67***	86,643***	11.46***
	(8,271)	(0.125)	(16,049)	(0.285)
Observations	33	33	14	14
R-squared	0.531	0.619	0.350	0.418

*Notes: Dependent variable in columns (1) and (3) is asking price of second-hand trucks. Dependent variable in columns (2) and (4) is asking price of second-hand trucks expressed in logs. The independent variable Age is defined as the number of years since the truck's registration on Kenyan roads. Full sample results in columns (1) and (2) include information from all adverts, where the prices of trucks advertised without trailer are adjusted upwards. The adjustment is calculated by comparing the price of trucks of the same age which are advertised with and without trailer. The restricted sample results are based only on trucks advertised with trailer. Standard errors are reported in parentheses, where ***, ** and * imply significance at the 1%, 5% and 10% level, respectively.*

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