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Trade and Informal Taxation on the Congo**

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Tolling on the River: Trade and Informal Taxation on the Congo[†]

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Abstract

It is by now generally agreed that government corruption is a serious impediment to economic growth. An intensive use of informal tolls and bribes on roads and waterways still prevail in several developing countries, hampering trade and economic development. On the basis of a general model of a trader travelling downstream past multiple stations and taxing authorities, we study the extent and magnitude of informal taxation on traders in Democratic Republic of Congo. River Congo is arguably one of the most important transportation routes in Africa in one of the world's poorest countries. We show that informal tax payments per individual journey still make up about 14 percent of the variable costs and 9 times the monthly salary of a public official. Price discrimination in taxing is present in the sense that the value of the cargo is the main determinant of informal taxes paid whereas personal or other characteristics do not seem to have a strong impact. In line with hold-up theory, the average level of informal taxation tends to increase downstream closer to Kinshasa, but authorities that were explicitly banned from taxing instead extract more payments upstream.

Keywords: Informal taxes, Congo, trade, corruption, river transport.

JEL code: D60; D73; D80; H20; K42; O55; R48.

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1. Introduction

Government corruption remains a recurring problem in many developing countries. There is a broad consensus that bribes and other types of informal and illegal payments to government officials in exchange for basic services have numerous detrimental effects, including a misallocation of resources and an erosion of trust in public officials, ultimately resulting in a lower level of economic growth (Mauro, 1995). In recent years, a growing scientific literature has studied the determinants and effects of everyday petty corruption (Fisman and Svensson, 2007; Olken, 2007; Burgess et al, 2011; for overviews, see Banerjee et al, 2012, and Olken and Pande, 2012). One of the greatest obstacles to growth is inefficient markets. This is a crucial issue in many developing countries where transport to market places often have to pass formal and informal stations where operators are taxed. Olken and Barron (2009) and Foltz and Opeku-Agyemang (2016) both examine the hands-on bribing behavior of police and military towards truckers at road checkpoints and weighing stations in Indonesia and Ghana/Burkina Faso respectively.

In this paper, we study the differential informal taxing strategies of multiple government agencies visavi traders in a developing country environment where some government agencies are explicitly forbidden to charge any informal taxes on traders whereas other agencies are not.³ We outline a general hold-up model featuring on the one hand a trader, who passes several stations on his journey downstream, and taxing government agencies on the other, predicting that informal taxation should be highest downstream, closest to the trader's final destination. Government officials from agencies forbidden to charge informal taxes and who fear punishment from extracting such taxes, would be expected to charge more upstream, further away from the final destination (which, in our setting, is the seat of the central government). We also analyze how participating government agencies might be able to practice first-degree price discrimination, in the sense that their informal taxation increase with the value of the taxed enterprise, and third degree price discrimination, whereby agencies discriminate between different commodities.

We apply these general research questions to an empirical study of traders in one of the most corruption-prone countries in the world; the Democratic Republic of the Congo (henceforth

³ We define "informal taxes" as fees or tolls charged by government agencies with no (or a very weak) foundation in laws or government regulation. We recognize that parts of the literature on corruption would explicitly refer to such taxation as "bribes". Given the complexity of the Congolese policy environment and the difficulty of establishing what is illegal and what is not, we will refer to all trader payments to government officials on the river as "informal taxes".

DR Congo). More specifically, we study traders transporting agricultural commodities on Congo river from the hinterland to the capital Kinshasa. As far as we know, our paper is the first to analyze informal taxation on a key waterway. Our most basic finding is that a plethora of more than 20 different government agencies charge informal taxes on traders at 10 different stations downstream. The total average cost of such informal taxes amount to almost 14 percent of the variable costs of a single journey, equivalent to more than 1.5 times the official GDP per capita in DR Congo and 9 times the average wage of a public official.⁴ Our evidence suggest that government officials from different agencies are able to practice both first- and third-degree price discrimination in their extraction of tolls: Average total tax payments increase with the value of gross revenues and profits and officials manage to single out boats carrying certain types of cargo to pay higher taxes. In line with standard hold-up theory, we show that levels of informal taxes tend to increase downstream as boats approach the final markets in Kinshasa but the reverse pattern holds for agencies that were explicitly ordered by the central government to cease with most or all of their taxation. All in all, our findings demonstrate that informal taxation remains a significant obstacle to an efficient and profitable trade of basic commodities on Congo river. We believe that the results of our study provide insights that should be relevant for government policy on how to combat informal taxation on transport in developing countries also outside DR Congo.

Tolls, informal taxation and outright bribes along roads and waterways have a long history in most parts of the world. They are often associated with decreasing economic prosperity, hindering the spread of new technology and cultural interaction between peoples. During the Holy Roman Empire 800-1806 AD, traffic along the Rhine - the second largest river in Europe - was taxed for centuries, at one point in time at no less than 79 different tolling stations (Gardner and Neston, 2002). When French military forces took control of river administration in 1804, there were 32 toll stations between the Swiss and Dutch border, making river transport exceedingly costly and inefficient. When the Rhine tolls were eventually abolished as part of the broader process of a German Zollverein (customs union) in the 1830s, river transportation expanded greatly as a consequence (Klemann, 2013).

Although the extensive use of internal tolls and taxes on roads and rivers have been abolished and informal taxation and bribes became extinct in many developed countries, more or less informal infrastructure taxes remain an impediment to transportation and trade in several developing countries. It is notoriously difficult to estimate the costs of informal taxes and

⁴ Lower level police officers receive a wage of about 70 USD per month in 2015.

bribes, but some previous studies have shown that repeated bribes at truck weighing stations on Sumatra and to port officials in southern Africa have amounted to 13-14 percent of total variable costs of the goods (see overview by Olken and Pande, 2012).

DR Congo is one of the poorest countries in the world and is the second largest country in in Sub-Sahara Africa. Ranked 178 out of 183 in the 2012 World Bank's Doing Business Report, DR Congo is generally portrayed as an exceptionally unfriendly place for business. This is typically explained by the political instability, the protracted armed conflict in the eastern parts, and the crippled and deteriorated infrastructure. However, a large part is also attributed to the informal workings of the state and what is often described as a 'dysfunctional public administration' (ibid) – creating unpredictability, weak protection of property rights and the imposition of a plethora of informal fees and taxes, i.e. manifestations of corruption.

The country mostly consists of inaccessible rain forest and the transport network to supply the 12 million people living in the capital Kinshasa with food and other goods is limited to a few roads and to Congo river. For example, only four provincial capitals out of ten can be reached by road from Kinshasa (Ali *et al.*, 2015). Congo river is the longest river in Sub-Saharan Africa and the second largest river in the world after the Amazon in terms of water discharge.⁵ Thus, it has enormous potential for river transport and hydropower and it has played a key part in the country's history as a means of transportation of both goods and people. The distance from Kinshasa to second largest city Kisangani offers about 1750 kilometers of navigable waters.

However, as a result of widespread conflict, political turmoil, and economic stagnation during the last two decades, even traffic on Congo river has been severely constrained. One of the most important impediments to river transportation has been the rent seeking activities of numerous government authorities along the river.⁶ Commercial boat operators, bringing staple food such as maize and fofu (dried manioc) to Kinshasa, are repeatedly intervened at several stations on their journey downstream by government officials claiming "taxes" (usually equivalent to "bribes") in order to let the operators pass with their cargo and passengers. These informal taxes, most often referred to as *tracasseries* (harassment) in local terminology and with an, at best, very dubious basis in any recorded government regulation make up a

⁵ For comparison, the length of river Congo is about four times that of the Rhine and its discharge of water is about 18 times greater.

⁶ This practice is part of a more general practice in DR Congo sometimes referred to as *debrouillez-vous* whereby officials at times were encouraged by the government to feed themselves by using their position in public office for increasing their meagre earnings (MacGaffey, 1991).

serious physical and economic obstacle to the development of river traffic. After lobbying from various boat operation organizations, the government recognized the problem and President Joseph Kabila and several ministers issued a decree in June 2014 declaring that the majority of the identified river taxes were illegal and demanded that illegal taxation must cease.

Our approach is perhaps most closely related to Olken and Barron's (2009) study of the "industrial organization" of bribe payments made by truck drivers to military and police at checkpoints and provincial transportation department officials at weigh stations on Sumatra, Indonesia. By direct participatory observation, the authors recorded more than 6,000 illegal payments on 304 trips. On average, truck drivers paid bribes amounting to about 40 USD or 13 percent of the marginal cost of a trip. The level of bribes was positively correlated with the value of the cargo and also tended to increase as the truck approached its final destination.

Another closely related work is Foltz and Opoku-Agyemang's (2016) recent study on the bribing behavior of truckers on roads in West Africa. Using USAID data from more than 2,100 truck trips in the Ghana and Burkina Faso, the authors find, somewhat counterintuitively, that a policy reform aimed at raising police salaries actually increased the level of bribes after the reform.

Some key differences to Olken and Barron's study is that while we observe a lower number of trips and use a retrospective survey methodology our complex Congolese political environment includes a broader range of at least 20 different government agencies and where the average absolute level of payments per journey by traders is more than 15 times higher.⁷ Like our investigation, Foltz and Opoku-Agyemang (2016) observe multiple (seven) government agencies charging tolls. However, the average total sum paid in bribes during a truck journey in their sample amounts only to about 15 USD (2-10 percent of variable cost), which is less than 1/40 of the average total payment made in our sample (624 USD per journey). Whereas trucks typically only bring the trucker and his cargo, the river boats in our study often bring more than 20 passengers, a handful of crew, and up to 2000 bags with food for Kinshasa's 9 million inhabitants.

In addition to contributing to the more general economic research on informal taxation and trade, the paper also builds and contributes to knowledge on the specific – but generally under researched – case of the DR Congo (cf. MacGaffey 1991; Trefon 2009; Eriksson Baaz and

⁷ Furthermore, our enumerators explicitly attempted to interview the universal set of operators during a specific period whereas Olken and Barron (2009) used a non-random sample of volunteering truckers.

Olsson 2011; Sanchez de al Sierra, 2016). While there are studies on informal taxation in the DRC, many of these come from the Mobutu era, such as the seminal work of MacGaffey (1991) attending to the emergence and workings of a large informal trade in Zaire in the 1980s, including the fees charged by authorities on truckers and traders. Moreover, while there exist more recent qualitative research which partly addresses the dynamics and driving forces behind informal fees (Felices-Luna 2012; Herdt and Titeca 2016; Titeca and Herdt 2011; Rubbers and Gallez 2012; Trefon 2009; Eriksson Baaz and Verweijen 2013; Eriksson Baaz and Olsson, 2011)⁸, such studies focus mostly on one government actor and moreover rarely – as this study does – quantitatively investigate the levels and (economic) consequences of the fees imposed. Moreover, the paper is also unique in that it, as far as we know, is the first study of informal taxes on river traffic to government authorities.⁹

The paper is structured as follows: In section 2, we provide a historical background to trade on the river and present the characteristics of the market and the 2014 reform. In section 3, we present a theoretical framework to guide our empirical analysis. Section 4 presents the research design and descriptive statistics from the data collected. The regular empirical analysis is carried out in section 5 and section 6 discusses the tradeoffs between formal and informal taxation and some future policy issues. Section 7 concludes.

2. Congo river

2.1 Historical overview of river taxation

The informal workings of the Congolese state have strong historical roots. While dating back to colonialism, it is mostly associated with the 1980s and the politics of Mobutu and the subsequent collapse of the (formal) economy. In the wake of the drying up of state resources and the irregular (if any) salaries to state agents, the latter came to take an increasingly active part in the informal sector of the economy. Importantly, the drying up of state resources was not accompanied by a disintegration or collapse of state functions (Engelbert, 2003; Trefon, 2009). Rather, state agents, deprived of formal salaries, became increasingly involved in the ‘real economy’ (MacGaffey, 1991) through the opportunities and advantages that state office offered. Hence, state agents increasingly resorted to rent-seeking by using bureaucratic and

⁸ Most of these studies, which seldom use the term corruption, provide valuable insights into how various parts of the Congolese state apparatus continue to survive and transform themselves in a context of limited resources.

⁹ More generally, Olken and Singhal (2011) show that informal taxation, often paid in kind, can be a heavy burden on village households in developing countries.

military power (when involving the state security forces) to control commercial networks through a range of different practices such as granting market access and permission and protection through shares in businesses and the imposition of a range of informal taxes, coercion and intimidation (MacGaffey, 1991; Young and Turner, 1985; Schatzberg, 1988). Such practices were also tolerated and partly encouraged by Mobutu by various, well documented and famous dictums, such as *debrouillez-vous* (fend for yourself) (Callaghy, 1984; MacGaffey, 1986; 1991; Williams 1992; Schatzberg, 1988).

While the government has embarked on a series of reforms after the elections in 2006, the results are mixed and DR Congo remains a very challenging place to conduct business in, particularly for those lacking connections to crucial networks. Given the rampant levels of informal taxation during the Mobutu era, informal taxation on the river is possibly one of the few examples of increasing, rather than decreasing informal taxes in the Western parts of the country¹⁰. In fact, most of the present posts along the rivers in the western parts – including the various taxing authorities – did not exist during the Mobutu era, but emerged as a result of the war. What is often termed the first Congo war started in 1996, when Mobutu was ousted from power by the AFDL, led by Laurent Kabila. This take-over soon transformed into the second Congo war (1998-2003), triggered by Kabila's efforts to outmaneuver his Rwandan and Ugandan allies, who subsequently created and supported various armed groups. The second Congo war involved nine African countries and approximately 20 armed groups.

It was in the beginning of the second war that the army deployed marines along the river Congo, which in parts borders Congo Brazzaville. When the war ended, these army deployments were transformed into administrative posts; various authorities arrived and started taxing *armateurs* (boat operators), along-side with the marines. During the time of Mobutu there was only one administrative post between Oshwe and Kinshasa on the Lukenie line (Kwamouth) while there are presently 7 posts.¹¹ Before the reform in June 2014 (see below) - there were 17 authorities (linked to 8 ministries)¹² issuing in total 59 fees along the

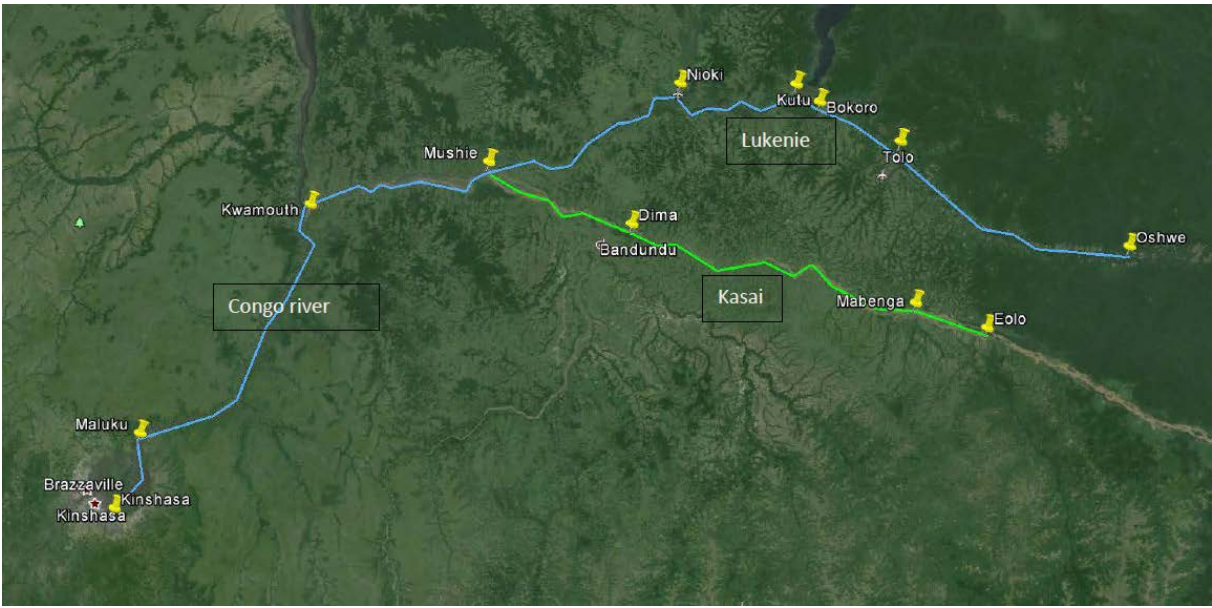
¹⁰ While the eastern parts of the country have been plagued by protracted and ongoing conflict for over 15 years and is characterized by a militarized economy, including large scale informal taxation by armed groups and the state security services, the western part of the country has been largely unaffected by the conflict, particularly after the second war ended in 2002.

¹¹ Interview with UCAB officials, January 2015.

¹² The following ministries: 1) Transport; 2) Interior; 3) Environment; 4) Culture and Arts; 5) Economy and Commerce; 6) Finance; 7) Infrastructure, and 8) Defense.

waterways in DR Congo.¹³ Only four of these taxes/fees were unique to the lakes/waterways in the eastern part of the country. Hence, in total up to 55 taxes and fees were collected along the waterways in focus of the present study, at several stations. Among the main authorities taxing on the river were the Commissariat fluvial, various branches of the state security services, and the government of Bandundu province. Also more unexpected authorities such as the Ministry of Environment and Tourism and that of Culture and Arts, have found ways of charging taxes along the river.

Figure 1: Map of the stations covered in our study along the Lukenie and Kasai tributaries of the Congo river.



Note: Own map created using Google Earth. The upper, blue line shows the Lukenie-Congo stretch which most operators in our sample used.

All the taxes and fees had a more or less fixed sum and had specific names, such as *Taxe visa arrivé* (arrival visa tax), *Taxe visa départ* (departure visa tax) (issued by Commissariat fluvial), *Taxe fonds de promotion touristique* (promotion of tourism tax), (issued by Fonds de promotion touristique), *Taxe fonds de promotion culturelle*, (promotion of tourism tax) (issued by Fonds de promotion culturelle), *Feuille de Route* (Roadmap) (issued by the Marines) etc. Hence, they were(are) not arbitrarily imposed, even though there was(is) some

¹³ June 19, 2014: “Arrête Interministériel interdisent les perceptions illégales dans le secteur du transport fluvial et lacustre en République Démocratique au Congo », available at <http://www.radiookapi.net/actualite/2014/06/23/rdc-les-armateurs-saluent-la-suppression-de-38-taxes-illegales/>

room for negotiation. Moreover, as reflected in the names, many taxes were collected by authorities that one would not usually associate with river traffic transporting agricultural goods. In addition to the 55 informal taxes along the river at the stations, 10 different informal taxes were also collected in the harbors in Kinshasa. In addition, the marines and river police can also be encountered on the river at *postes flottante* (floating posts) asking boat operators for additional contributions.

While the level of each tax was rather small, amounting to 1-20 USD, the sheer number of taxes and fees constituted a heavy burden for boat operators. The most burdensome informal tax, according to the boat-operators interviewed in 2013, was the *recouvrement* – a provincial tax paid at Mushie station on agricultural produce which in 2013 was taxed at the rate of 1500 FC/bag (1.61 USD), whatever the product (kimpuka, maize, fofu). Even charcoal, which is not an agricultural produce, was taxed in a similar way.¹⁴

2.2 The 2014 reform

After lobbying by various associations of boat operators from different parts of the country, an investigation was conducted, listing all the informal taxes on the river. In June 19, 2014, 38 of the 59 taxes and fees (64.4 percent) identified in the commissioned report were removed by a ministerial decision, signed by nine ministers.¹⁵ According to the decree, these 38 taxes are illegal and should not, under any circumstances, be imposed on boat operators in the ports.

While some authorities remained with a right to impose some fees/taxes, like Commissariat Fluvial (10 taxes were named as illegal in the decree out of 12 taxes identified in the report) and DGM (migration authority) (8 out of 9 taxes were declared illegal), some authorities were banned from taxing altogether, such as DGDA (La Direction Générale des Douanes et accises, Customs), the FPT (Fonds de Promotion du Tourisme), FPC (Fonds de Promotion Culturelle), and the armed forces/Marines and other state security forces, such as the ANR (the intelligence services) and the Police fluvial. Moreover and importantly, the provincial government was forbidden to tax agricultural produce, the fee/tax or *recouvrement*, which as explained above was most burdensome for the boat-operators.

¹⁴ Yet here a part of the fee issued went/still goes to the Ministry of environment.

¹⁵ June 19, 2014: “Arrête Interministériel interdisent les perceptions illégales dans le secteur du transport fluvial et lacustre en République Démocratique au Congo », available at <http://www.radiokapi.net/actualite/2014/06/23/rdc-les-armateurs-saluent-la-suppression-de-38-taxes-illegales/>. The ministers who signed were heads of the following ministries: 1) Transport; 2) Interior; 3) Environment; 4) Culture and Arts; 5) Economy and Commerce; 6) Finance; 7) Infrastructure, and 8) Defense; the vice minister/minister of Budget.

2.3 The market

Until recently, the river was the only available route for the transportation of agricultural produce from the inland to Kinshasa. While some roads have been rehabilitated and some goods now are transported to Kinshasa by trucks, much is still transported on the river. Most boats are made of wood and are referred to as *bailniers*. They are produced both in the inland and in Kinshasa for a cost of between 8.000 and 10.000 USD, depending on the size and where it is produced (more expensive in Kinshasa). The quality of the boats is typically rather poor. Already after a couple of years they start to take in water and many boats require that people constantly bail water during the journeys. The normal life expectation of a boat is limited to approximately 10 years. Due to the poor quality and over-loading, shipping disasters occur frequently, particularly during the dry season (June – August) when the water levels are low¹⁶, increasing the risk to hit submerged sandbanks in the river. Since many do not know how to swim and life-jackets are very rare, accidents often leave many dead.¹⁷

Some operators with smaller boats also travel with other smaller boats on the side filled with cargo. The boats are driven by outboard engines – usually two – with between 15 and 25 horse power each. From 2010 many boat operators started to use new Chinese produced diesel engines, so called *daka-daka* (named from the sound they make). While these engines have had many technical problems, requiring operators to travel with a large stock of spare parts, they have lowered the fuel costs substantially, compared to the previous petrol engines.

The goods transported are mainly agricultural produce in the form of fofu, kimpuka (non-dried manioc) and maize. Yet also other goods are transported such as peanuts, charcoal, dried fish and livestock. During the time in which the survey was conducted, the proportion of charcoal was unusually high.

The boat operators do not always own the boats themselves, but sometimes rent them. The price for renting a boat is on typically about 200 USD but that sum does not include engines or any equipment. Some operators borrow money in order to rent the boat, while many others also borrow money for fuel, renting engines and tarpaulins/tarps, needed in order to cover the cargo from the heavy rains. The interest rate is most often 50 percent on such loans, following

¹⁶ For that reason many boats have people standing in the front with a stick to measure the water depth.

¹⁷ For recent accidents see for instance <http://www.abc.net.au/news/2014-12-26/congo-river-boat-accident-kills-30-sparks-riot/5989266>, 2014 and <http://www.aljazeera.com/news/africa/2010/09/201095175054772572.html> 2010

the general practice of the informal credit system, often called *Banque Lambert* (Kaparay, 2006). The combined sum of loans and interest payments that a boat operator has to make after the journey, given that he has borrowed money, is on average 845 USD. The one renting is most often responsible for all expenses on the river.

Most operators transport a mix of own goods and goods of passengers, striving to increase the proportion of their own goods. All operators interviewed in the qualitative part of the study conducted in 2013 (see methodology section) said that you need to have your own merchandise (the amounts mentioned were in the range of 100-300 bags) in order to make profits, and that if you only travel with the produce of the passengers you will not make any profit. Many also calculate their profits only in terms of their own merchandise whereas the money from the passengers should cover costs (including the informal taxes in focus of this article).¹⁹ Passengers pay two types of fees to the boat operator, one for their own transport *ticket ya nzoto* (ticket for the body) and one for the produce they bring. The costs for the goods that passengers bring are usually calculated in proportion to the selling price in Kinshasa, varying between $\frac{1}{2}$ and $\frac{1}{5}$ of the selling price. Since the price of the produce varies according to quality, this price is often set based on the selling price of the boat-operators own produce, not the actual selling price that the passengers get. Yet, some boat operators use other arrangements for payment. Rather than paying in the form of percentage of the sale, some passengers can also pay in kind, in the form of bags of merchandise. Once in Kinshasa, the goods are bought in the harbor by middle-men (most often women) who then sell them at the market-places.

Most boat-operators (with the exception for operators who own shops in the interior and buy goods in Kinshasa and transport these upstream), calculate the profit on the travel downstream (i.e. the profits they make by selling agricultural goods). Hence, the goal with the upstream travel is often simply to break even (i.e. that they charge the boat with enough passengers and goods to pay for fuel and costs at posts upstream). However, the fees paid to authorities upstream are much lower than the fees downstream.

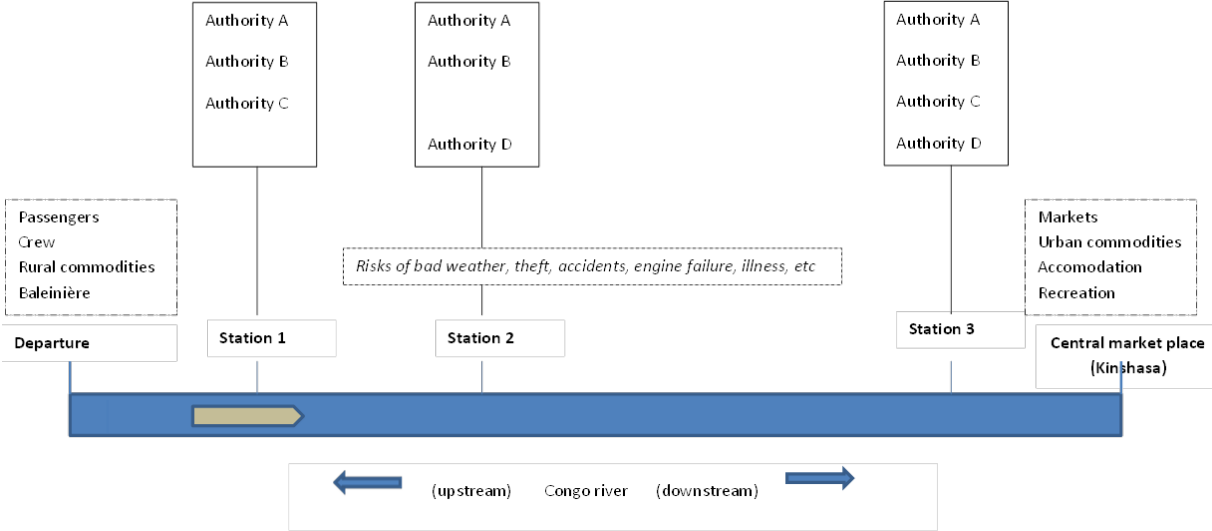
¹⁹ Interviews conducted July 2013.

3. Theoretical framework

Figure 2 provides a basic description of the transport along the Congo river. The model is however generally applicable to any type of transport passing several control stations on its way to a central market place, which is a typical setting in most developing countries.

From the initial port of departure along the river, a boat operator departs on a boat fully loaded with agricultural goods in bags, crew, and passengers and travel downstream towards the market place (in our case, Kinshasa). Along the way, the boat is held up at a number of stations where the operator encounters a varying number of authorities. Let us denote an individual authority as $i \in \{A, B, C, \dots Q\}$ and a station by $j \in \{1, 2, 3, \dots S\}$ where Q is the number of authorities and S is the total number of stations. Let us refer to the individual boat operator as $k \in \{1, 2, 3, \dots l\}$.

Figure 2. Stylized scenario for a commercial boat journey from hinterland to central market place (Kinshasa) with three stations and four authorities.



Along their way downstream, the boat operators face numerous risks to the whole enterprise, including bad weather, accidents, and technical boat problems. When the boat reaches the

market place, the operator and the passengers sell their agricultural goods during a few weeks. When the boat is re-supplied, the operator returns upstream to his home village.²¹

What is the calculation that the boat operator makes about whether it is worthwhile to undertake a journey or not? Let us define the realized gross profits of the enterprise for an operator k to be equal to total revenues minus total costs in a standard manner

$$\pi_k(X_k) = P \cdot X_k - C(X_k) \quad (1)$$

In this expression, P is the price of the goods, X_k is the number of bags, and $C(X_k)$ is a total cost function where costs always increase with the number of bags, $C'(X_k) > 0$, but where it is also the case that $C(0) > 0$, i.e., there is a substantial fixed cost component associated with each journey (for instance including boat rent). Total revenues PX_k are only realized if the boat and its operator actually complete the journey past all stations and eventually reach the market.²² Both total revenues PX_k as well as the cost function contain random components, reflecting random price fluctuations and the many natural hazards along the river such as accidents.

Apart from this standard calculation of revenues and costs, the operator must also make an assessment of the expected costs of informal taxation (*tracasseries*) along the journey. Let an actual individual tax payment to authority i at station j by operator k be denoted $t_{ijk} \geq 0$. Since contracts about these payments are impossible, there is a big element of uncertainty ex ante about the actual levels of taxes that have to be paid. The individual operator's participation constraint is that expected net profits, after the deduction of expected taxes, must be positive:

$$E_k(PX_k - C(X_k) - \sum_{i=A}^Q \sum_{j=1}^S \tau_{ijk}) > 0 \quad (2)$$

In (2), E_k is an expectations indicator specific to boat operator k at the time of departure, and $E_k \sum_{i=A}^Q \sum_{j=1}^S \tau_{ijk}$ is operator k 's expected sum of all taxes to all authorities at all stations downstream that he/she will need to pay. Ex ante informal taxes τ_{ijk} is a stochastic variable with actual outcome $t_{ijk} \geq 0$. Clearly, if the participation constraint in (2) is not fulfilled, the enterprise is expected to make a net loss and will not be undertaken. Since entry into river boat traffic is unregulated, we should expect that risk neutral operators enter the market until

²¹ An alternative representation of an individual journey enterprise would have been to consider the combined revenues, costs and taxes of a downstream *and* upstream journey. After all, in the choice whether to undertake a downstream journey, the operator should take into account also the costs of returning. Based on qualitative evidence, we decided against this approach since it was clear that the boat operators themselves only based their calculation on profits from the downstream journey and then only left Kinshasa to go home when they expected to break even.

²² Actual total revenue also includes passenger fees that need to be paid to the operator, as discussed above.

expected net profits are slightly above zero. If actual profits are normally distributed, the mean level of profits should, according to this logic, be close to zero with a certain number of operators making a loss. We will test this prediction in the empirical section.

How can we explain the tolling behavior of $Q > 1$ authorities at $S > 1$ stations downstream? We argue that there are two main countervailing forces that influence the level of each individual tax t_{ijk} ; the “hold-up” mechanism and the potential costs of getting caught charging illegal taxes. Olken and Barron (2009) provide a well-known version of a classical hold-up scenario of truckers travelling along a road and our illustration below of this first force follows the same basic logic apart from the fact that we have multiple authorities downstream rather than a single one.

Let us consider the behavior of an individual authority A . The officials working for this authority aim at maximizing the total sum of rents extracted on the river from boat operators at the various stations and take the taxes set by all other authorities as given.²³ At each station, the officials Nash bargain with boat operators over the level of taxes to be paid. If no agreement is reached, the operator cannot pass the station and does not receive any revenue from his journey, whereas the A official gets no tax payment. Given the unattractiveness of these options, there is a strong incentive to reach an agreement. Let us assume for now that the bargaining strength of authority A 's officials is $\alpha < 1$ at all stations and that the individual boat operator k thus has a strength of $1 - \alpha$. Given the extensive number of authorities, we imagine the typical α to be rather small.

An authority's bargaining strength α might of course be function of many different things, including the number of officials present at the station or whether they are armed or not (Olken and Barron, 2009). Bargaining strength might also strongly depend on the legitimacy and support in terms of laws and regulations that the particular authority has to charge informal taxes. We will return to this issue below.

A boat on the river, fully loaded with passengers and food products, is a typical example of a journey-specific type of investment that is vulnerable to hold-up by rent seeking authorities. We showed above that boat operators would only commence a journey downstream if expected net profits are positive. Returning back home before reaching the market is typically

²³ An alternative scenario might be that informal tax payments are coordinated collusively or non-collusively among agency officials at a particular station. Anecdotal evidence from the marine suggests however that loyalty is mainly with fellow members of the same authority, which would suggest a within-authority, across-station coordination, as assumed here.

not a viable option and will result in a loss since products can typically not be sold. Arguably, even if authorities' bargaining strength is the same at all stations, the gain from passing the last station before the markets is greater than the gain from passing the second last, which in turn is greater than the third last, etc.

In a similar spirit as in Olken and Barron (2009), we capture this idea in the following way. For simplicity, let us imagine that there are only two stations, an upstream station 1 and a downstream station 2. Informal taxes are first paid at station 1 and then at station 2 but authority A takes into account what will happen at station 2 already at station 1 using backward induction. We assume that authorities do not make binding commitments regarding the level of taxes charged at each station but act opportunistically. The sum of total taxes paid to all other authorities at both stations are taken as given by authority A and amounts to $\sum_{i \neq A}^Q \sum_{j=1}^2 \sum_{k=1}^l t_{ijk} = T_{-A}$. Total actual net profits for an operator k after dealing with all other authorities at station 2 (but before paying taxes to A) is $\pi_k(X_k) - T_{-A}$. The officials from authority A observe this potential net profit and Nash bargain with operator k over the level of the informal tax t_{A2k} to be paid. Since authority A has bargaining power α , the officials will be able to extract a tax equal to

$$t_{A2k} = \alpha(\pi_k(X_k) - T_{-A}) . \quad (3)$$

Already at station 1, the officials from authority A realize that k 's net profits are going to be affected by the taxes charged at the final station 2. Given the hold-up power of the officials at the last station, net profits at station 1 are perceived to be $(1 - \alpha)(\pi_k(X_k) - T_{-A})$ which is lower than at station 2. The officials take this into account in the bargaining where they extract an informal tax of

$$t_{A1k} = \alpha(1 - \alpha)(\pi_k(X_k) - T_{-A}) . \quad (4)$$

From these expressions, it is straightforward to infer that $t_{A1k} < t_{A2k}$. In other words, given the typical hold-up scenario sketched in the model, taxes to a single authority A will increase the closer the operator gets to the market place. This result holds also if we allow for more than two stations.

However, we mentioned above a potentially countervailing factor against this tendency; that authorities might be cautious since there is a probability that they will be monitored and

punished by the government for charging illegal taxes at stations closer to the central market place (the capital Kinshasa).

In our model, we might capture this by assuming that the bargaining power of authority A is stronger at station 1 than at station 2 so that $\alpha_1 > \alpha_2$. If that is the case, then the comparison between the two tax levels in (3) and (4) is given by

$$t_{A1k} - t_{A2k} = (\alpha_1(1 - \alpha_2) - \alpha_2)(\pi_k(X_k) - T_{-A}). \quad (5)$$

The sign of this expression depends on the size relationship between the two parameters. It is straightforward to show that we might even have the reverse relationship of $t_{A1k} - t_{A2k} < 0$, i.e. lower taxes closer to the market place, if $\frac{\alpha_1}{(1+\alpha_1)} > \alpha_2$ holds.

The combined effect of hold-up and penalties for charging illicit taxes implies that there are micro-founded rationales for both increasing and decreasing total tax levels downstream. However, if we differentiate between authorities, we know that some authorities were very explicitly forbidden in the 2014 decree to charge any taxes along the river, such as all the state security forces, the DGDA and the province of Bandundu (*recouvrement*). In terms of our model, authorities that were forbidden to charge taxes should have a bargaining power satisfying $\alpha_1 > \alpha_2$, i.e. a weaker power downstream, whereas some authorities might be closer to the standard case of $\alpha_1 = \alpha_2$. For the former group, we might hypothesize that taxes decrease closer to Kinshasa whereas for the latter, unconstrained authorities, we would expect that the hold-up situation ensures increasing taxes closer to Kinshasa. We address these hypotheses in the empirical section.

Furthermore, the total tax level charged by authority A , equivalent to the sum of the expressions in (3)-(4), clearly increases with the level of gross profits $\pi_k(X_k)$. We argue that this reflects a general tendency that the total informal taxes paid by an individual operator to all Q authorities should increase with gross profits. Let us refer to the total actual amount of informal taxes paid by an individual operator k as $\sum_{i=A}^Q \sum_{j=1}^S t_{ijk} = T_k$ for short. Our main hypothesis is thus that total taxation T_k increases with gross profits $\pi_k(X_k)$. This would imply a kind of first degree price discrimination in the sense that authorities charged taxes based on the operators' maximum willingness to pay. This type of tax extraction might however be rather difficult to carry out in practice since operator gross profits are not readily observable to the authorities.

The most easily observable factor is probably the revenue side PX_k . We know for instance that a substantial provincial toll per bag (*recouvrement*) was charged in Mushie, amounting to about 1500 FC (1.60 USD). Authorities can without too much effort find out how many bags that a boat carries and also what type of goods that are contained in the bags (i.e. maize, fofu, etc). Combining this information with general knowledge about market prices in Kinshasa's harbors, officials from authorities should be able to make a rough estimate of the journey's net surplus. They might also be able to conduct a kind of third-degree price discrimination if they charge different levels of taxes depending on what type of goods that the boat is carrying. We will test these hypotheses in the empirical section.

Another distinct hypothesis, which is not founded in the theoretical analysis above, is that taxation is determined by the personal characteristics of the operator and his passengers. The tax collectors might for instance be more likely to charge heavy tolls on operators and passengers that appear to be have more money regardless of the profits from the specific journey. More experienced operators might further have a negotiation advantage and manage to escape heavy taxes or time consuming negotiations.

4. Research design

In this section, we first provide information about the data collection process and present descriptive statistics. In the second part, we outline the econometric specification for the regression analysis in section 5.

4.1. Data

The project was initiated with a pilot study of about 30 operators in July 2013, hence prior to the reform. This part of the investigation included interviews as well as the collection of some data on taxes, cargo, etc. in order to get a basic understanding of the market. The quantitative data collection on which this article is based on takes the form of a retrospective survey methodology whereby two locally hired surveyors carried out extensive interviews with boat operators in Kinshasa's four ports Kinkole, Baramoto, Zelo and OCC. The survey instrument was developed and pre-tested in Kinshasa in January 2015, through interviews with boat operators and with the union of boat operators (UCAB). One week after our pre-test about 30 people had been killed by security forces in widespread riots in the capital against the

government.²⁵ Yet, during the period of our survey, the security situation was relatively stable in Kinshasa and in the area where the boats operate.

It soon became clear that the survey could not exactly establish which of the tolls and taxes paid that are legal or illegal, due to the following circumstances: Firstly, the identification and naming of fees and taxes differ a bit between the report commissioned (to make an overview of the fees) and the ministerial decision, including the number of fees deemed illegal (46 in the report and 38 in the ministerial decree), imposing some confusion already at the time of the decree. Secondly, many boat operators are not aware of all the names of the taxes, which taxes that are illegal/legal and exactly which authority that claims them and often mix up the names of the taxes with the authority issuing the tax. Thirdly, a number of new or newly named tolls and taxes appear to have emerged after the decree (with an unclear status). In combination with the fact that some authorities such as the Commissariat Fluvial (river agency) and the DGM (migration authority) remained with the right to impose some taxes, it turned out to be impossible to exactly distinguish the illegal from the legal fees imposed by these authorities. Fourth, some boat operations choose to pay the taxes to various authorities through a facilitator, namely the UCAB (union of boat operators), rather than going through the hustle themselves. While the representatives for the UCAB stated that their aim was to facilitate and help boat operators so that they do not have to pay illegal fees, they also concluded that this is impossible in practice. Hence, it is impossible to divide the quite large part paid through the UCAB (6.59 percent, see Table 3) into authorities, let alone into legal and illegal informal taxes.

For the reasons cited above, we had to resort to referring to all tolls imposed along the river as *informal taxes*. While this is a necessary simplification which should be kept in mind while reading the paper, it does not have major consequences for the overall findings and conclusions. As discussed above, a majority of the taxes (64.4 percent) imposed were named illegal in the decree. Moreover and importantly, as we will show, 78.85 percent of the taxes imposed in our sample were imposed by authorities that were totally banned from issuing any fees (see Table 2). Hence they are per definition illegal.

The interviewers were instructed to approach *all* operators of *bailinières* who had arrived in Kinshasa from journeys on either the Lukenie or the Kasai rivers. The data collection period

²⁵ The January riots were provoked by President Joseph Kabila's alleged intentions to postpone the presidential elections.

started on Feb 14, 2015 and lasted until the final interview on June 1. The majority of the operators interviewed had left their port of origin sometime during March-May. In total, we collected data on 137 boat operators. Only 16 operators declined to answer the detailed questions about cargo, implying an attrition rate of about 11.7 percent.²⁶ We have no information about how many operators who started on a journey but did not reach Kinshasa.

The interviewers approached boat operators in the ports and explained that they were conducting a scientific investigation for a Swedish academic institution about river traffic on the Congo. A date for the interview was decided when the boat operator had sold all or most of his goods. The boat operators were informed that they would be offered refreshments and a simple meal during the interview. They were also asked to bring their logbook to the interview so that we could obtain the most accurate information about taxes, costs, etc. If the logbook was available, the information on taxes to authorities was obtained from there.

The interviews were based on a questionnaire form that included questions about boat and personal data, as well as detailed information about the taxes paid downstream to different authorities at different stations during the latest journey, making up a rather long and complex survey, given the multitude of authorities, stations and taxes. In addition to the quantitative parts, some qualitative questions were added probing into perceptions on the relevance and utility of the various taxing authorities. A typical interview lasted about two hours. No representatives from government authorities intervened during any of these interviews. This might perhaps be explained by that interviews were typically carried out right outside the harbour itself.

Table 1 shows some descriptive statistics of boats, operators and eventual outcomes in our sample of downstream journeys to Kinshasa. The average operator on Kasai and Lukenie was thus a male, about 47 years old who had about 9 years of experience from bringing goods down the Congo, conducting 4-5 journeys during a year, owning the boat in 68 percent of the cases and keeping a logbook in 70 percent. The average actual size of cargo was 563 bags with fairly wide range in the distribution with the biggest boats carrying up to 1800 bags. The most common commodity was maize followed by fofu. The mean level of total operator

²⁶ We asked the interviewers to include and take notes on observable characteristics of operators who declined to answer the questions in the written survey in order to ensure a universal sample. The characteristics of those declining to answer about the composition of their boats's cargo are not clearly different from those who did answer. The average age among non-respondents is 45 compared to 47 years among respondents, average experience is 7 years (compared to 9.4 years), 50 percent owned the boat (71 percent), and the boat's average capacity was 767 bags (563).

revenue from a journey (6791 USD) indicates the rather sizeable nature of a standard enterprise. A typical boat carried about 20 passengers and 4 members of crew, apart from the operator himself. On a typical journey, the boat passed 7-8 stations during 9-10 days of travel downstream.

Table 1. Descriptive statistics of operator, boat and journey.

	Obs	Mean	St dev	Min	Max
<i>Operator</i>					
Age	130	47.12	9.43	28	75
Experience (years)	132	9.22	8.25	0.5	40
Journeys per year	127	4.51	5.20	1	36
Boat ownership (yes=1)	133	0.684	0.467	0	1
Logbook (yes=1)	122	0.697	0.462	0	1
<i>Boat/journey</i>					
Total revenue (USD)	137	6791	6290	0	27755
Total no bags	121	563	367	0	1825
- Fofu	121	145	233	0	1400
- Maize	121	168	160	0	800
- Kimpuka	121	112	149	0	600
- Coal	121	122	278	0	1825
No of passengers	123	20.2	15.5	0	90
No of crew	123	4.0	1.3	2	8
Lukenie journey (yes=1)	137	0.70		0	1
No of stations passed	137	7.7	1.7	4	10
Days of travel	128	9.6	9.7	1	62
<i>Taxes and waiting hours</i>					
Total informal taxes (USD)	122	624	380	0	2929
- Recouvrement in Mushie	122	340	361	0	2624
- Total taxes excl recouv.	122	284	196	0	1174
Average level of taxes per station (USD)	114	86	3	0	418
Average level of taxes per station, excl recouvrement (USD)	114	40	31	0	192
Total hours spent at stations	137	79.9	63.7	0	339
Average hours spent per station	127	10.8	8.0	0	34.7

Source: Data from our study.

In our sample, the mean amount of informal taxes paid during a journey by a single boat operator is 624 USD. This sum is equivalent to 9.2 percent of total revenue and considering that GDP per capita (current prices) in DR Congo was 407 USD in 2014 (World Development Indicators, 2014), the amount paid must be regarded as a sizeable sum. By far the largest

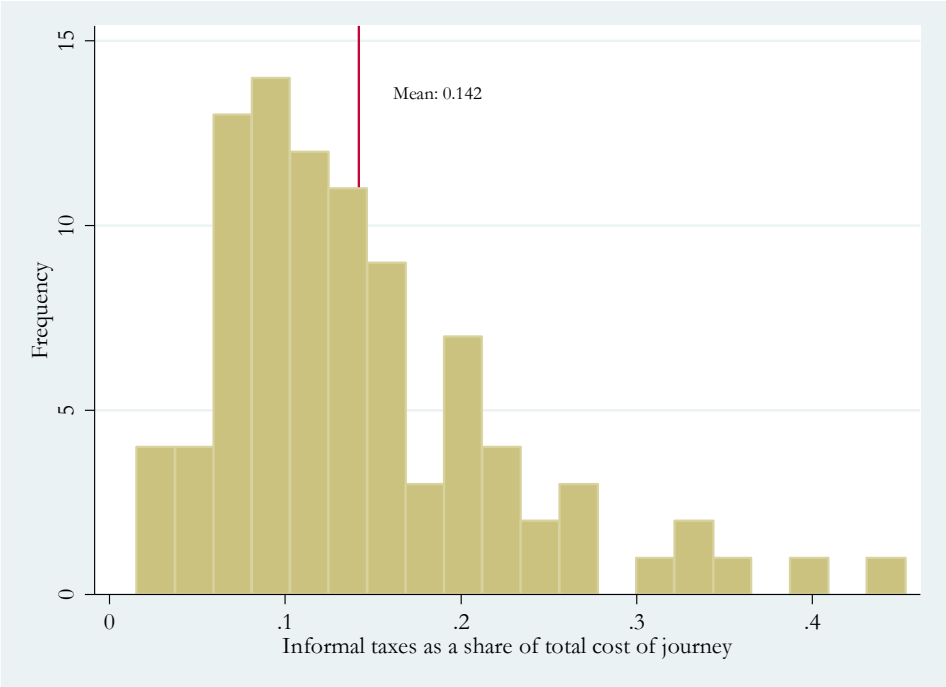
individual tax is referred to as *recouvrement* (mean 340 USD) which is paid at the station in Mushie. This tax stems from a provincial tax paid per bag of about 1.60 USD which was officially abolished in the government decree from 2014 but which is apparently still charged. The total average sum of other taxes is 284 USD (about 40 USD per station). The average operator spent almost 80 hours in total at the different stations with a mean of 10.8 hours per station.

How important is the mean total tax 624 USD in relation to the boat operator's total cost? The distribution of total informal taxes paid as a share of the variable costs of a journey are shown in Figure 3. This is a standard measure of overall corruption in the literature. In their overview of the recent corruption literature, Olken and Pande (2012) find that estimates of bribery varied between 4-14 percent of variable costs of a firm or an enterprise. In our sample, the average is at a similar (yet still at the higher end) level: Total informal taxes paid amount on average to 14.2 percent of a boat operator's marginal cost. This is quite remarkable considering that the ambition of the presidential decree in 2014 was to abolish this kind of taxation. Most operators pay less than 20 percent of costs in taxes but a few operators pay as much as 40 percent.

How are these tax payments distributed over different authorities? Table 2 shows the level of 20 different taxes to almost as many authorities, sorted in falling order by the total level of taxes paid.²⁷ In total, 2226 informal tax payments were recorded among the sampled boats, adding up to a total sum of 76,148 USD. On average, boat operators made about 18 payments per journey. The authority that received the greatest number of payments was the Marine (n=447) followed by Commissariat fluvial (n=253). After this followed the payments made to authorities through the boat operator union UCAB (n=207). The large number of individual payments to the Marine implies that each operator typically made 3-4 payments to that authority on every journey. As shown above, by far the greatest sums were paid as *recouvrement*. The boat operators in our sample paid almost 50,000 USD in total in *recouvrement*, which actually made up almost 2/3 of total informal tax payments.

²⁷ We include the boat operator union UCAB among the authorities studied. UCAB accepts payments from operators and then negotiate and pay taxes to the authorities on behalf of the operator.

Figure 3. Distribution of total informal taxes as a share of total cost of journey among 121 boat operators.



The average size of taxes varied greatly between the authorities, possibly reflecting their varying bargaining strength. The Hygiene and Tourisme taxes - both charged by officials from the Ministry of Environment and Tourism - were only able to extract on average 1.44 and 3.39 USD respectively, whereas the Marine - which many boat operators found to be rather useful in different situations (see Eriksson Baaz et al., 2016) – would typically be paid about 11 USD on every occasion. Despite the fact that Commissariat fluvial officially lost the right to charge 10 out of 12 existing taxes according to the presidential decree, they were still able to extract an average sum of 23 USD per payment. Moreover, 75.85 percent of total taxes were collected by authorities that – in the decree – had no rights to issue any fees or taxes (see Table 2).

It is further far from obvious what the rationale is for some authorities to charge taxes on the river. The presidential guard FPI collected taxes on 135 occasions and the government intelligence agency ANR received payment 129 times in our sample. These fees are often imposed by references to national security concerns and the need to control river traffic. Apart from the 20 authorities listed, there is a rather substantial fraction payed to other non-named authorities (7.14 percent of total taxes).

Table 2. Total informal taxes paid, by authority.

Tax/Authority	Total no of pay-ments	Total taxes (USD)	Average size (USD)	Share of total taxes (%)
*Recouvrement (provincial tax)	135	49,924	369.80	65.56
Commissariat fluvial (river agency)	253	5776	22.83	7.59
UCAB (union of armateurs)	207	5020	24.25	6.59
*Marine	447	4902	10.97	6.44
DGM (immigration office)	195	1196	6.13	1.57
*FPI (presidential guard)	135	1038	7.69	1.36
*Police fluvial (river police)	185	926	5.00	1.22
DGI	51	719	14.10	0.94
*ANR (gov intelligence)	129	311	2.41	0.41
*DGDA (Bourdereau en douane)	84	198	2.36	0.26
*Demiap (military intelligence)	56	165	2.95	0.22
*Tourisme (Ministry Env & Tou)	42	142	3.39	0.19
Fuit	35	95	2.73	0.13
Hygiene (Ministry Env & Tou)	59	85	1.44	0.11
*Police frontier (frontier police)	20	81	4.03	0.11
*Td force (part of armed forces)	11	54	4.94	0.07
Hydrocarbure	13	28	2.15	0.04
Sonas (insurance)	2	32	16.13	0.04
Rvf	4	16	3.98	0.02
Other	163	5438	33.36	7.14
Total	2226	76,148	34.21	100

Note: Authorities that were totally banned from imposing fees in the decree are marked with an (*).

4.2 Econometric specification

The key focus of this paper is to understand the determinants of informal taxes paid. To this end, our empirical analyses are conducted on two levels: (i) a journey level analysis on 121 operators, starting either on Lukenie or on Kasai tributaries of the Congo river and (ii) an authority-station-journey level analysis of 760 passages by 95 operators passing by up to 9 stations with about 20 authorities along the Lukenie-Congo stretch to Kinshasa.

The journey level analysis estimates the following regression

$$T_k = \mu + Operator'_k \beta + Boat'_k \gamma + \varepsilon_k . \quad (6)$$

As before, T_k is the total level of taxes by operator k , μ is a constant, $Operator_k$ is a vector of operator characteristics and $Boat_k$ is a vector of boat and journey characteristics, including the number of bags of different commodities and value. In this specification, we are mainly interested in the γ -estimate to test whether tax officials are able to conduct price discrimination in their determination of taxes so that they charge higher taxes from operators with a more valuable cargo or if they set taxes depending on the type of goods carried. If neither boat nor operator characteristics matter so that taxes are set randomly or on the basis of unobserved circumstances, our estimate of the constant μ should be positive and significant.

Apart from this general equation, we are also interested in the authority-specific determinants of taxes as boats travel downstream to Kinshasa. In order to capture these effects, we conduct an authority-station-journey level analysis with the set-up:

$$t_{ijk} = \mu + Operator'_k\beta + Boat'_k\gamma + \lambda_j + \varepsilon_{ijk} \quad (7)$$

We focus here on a homogenous set of operators who pass the same stations on the same river (Lukenie). We also exclude the heavy *recouvrement* tax paid in Mushie from the analysis in order to focus on the more diverse set of multiple smaller taxes. The dependent variable t_{ijk} is the informal tax paid to authority i at station j by operator k , starting his journey on the Lukenie. We include a station fixed effect λ_j in order to remove the impact of particular stations. Again, our interest is mainly in γ and in whether taxes on this disaggregated level of analysis appear to be set in response to the fixed value of the cargo.

Lastly, we explore in more detail the station dynamics of taxes downstream by estimating

$$t_{ijk} = \mu + \theta_1 s_j + \theta_2 s_j^2 + x_k + \varepsilon_{ijk} . \quad (8)$$

In this equation, s_j is a variable capturing the order of stations where the first station upstream on Lukenie is Oshwe ($s_1=1$) and the last one is the harbor in Kinshasa ($s_5=9$). We also include a quadratic term in order to allow for potential non-linear effects. Our hypothesis from the theoretical section is that the estimate should be $\theta_1 > 0$ if hold-up effects dominate whereas the reverse should be true if the fear of penalties from the central government are strongest. For authorities where both concerns are equally large, we might find non-linear effects when also θ_2 is significantly different from zero. In the specification above, we also include an operator fixed effect x_k in order to ensure that our estimates of station order-effects are not biased by individual operator/boat characteristics.

5. Empirical analysis

In this section, we start by making a journey level analysis of the determinants of informal taxes and waiting times in section 5.1. In section 5.2, we switch to the authority-station-journey level of analysis of operators travelling on the Lukenie only.

5.1 Journey level analysis

If we consider a downstream journey with a boat and an operator as the unit of analysis, what are the determinants of the informal taxes that the operator has to pay? In the theoretical section, we posed three different hypotheses: 1) The taxes are mainly based on the commercial value of the cargo where authorities potentially also price discriminate in their taxing behavior between different types of goods. 2) The taxes are mainly based on the characteristics of the operator and passengers. 3) Taxes are randomly charged with no clear relationship to any of the characteristics above.

In Table 3, we show the results from regression analyses with the total level of informal taxes as the dependent variable in columns (1)-(3). In column (1), we test the simplest version of our first hypothesis where we proxy the commercial value of the cargo during the journey with the ex post observed total revenue in USD.²⁸ If our hypothesis about a taxation aimed at extracting the operator's surplus in a kind of first degree price discrimination is correct, then we should expect that the estimate is positive and significant. This indeed appears to be true. On average, for every additional 100 dollar of revenues in Kinshasa, operators paid 1.80 USD in informal taxes to authorities, starting at a level of 484 USD. The scatter plot from the bivariate relationship in column (1) is shown in the left-hand side of Figure 4. As is readily observable from the graph, a great deal of variation is unexplained.

In column (2), we instead investigate whether the number of carried bags matter for taxation. We differentiate between the four main types of goods that are carried; fofu, maize, kimpuka, and coal. Our aim here is to investigate whether it seems that officials are able to conduct third degree price discrimination, i.e. if they are able to discriminate between boats with different types of cargo. Olken and Barron (2009) found for instance that officials in Aceh forced truck drivers to pay more in bribes if they were transporting steel. Interestingly, officials from authorities on the Congo appear to be able to price discriminate among

²⁸ An alternative and perhaps more straightforward way of estimating the value of the cargo would have been to multiply the price per bag with the number of bags of each commodity. However, prices per bag typically vary depending on seasonal supply and demand factors. Furthermore, fofu and kimpuka are not homogeneous goods and prices can differ greatly depending on color and other characteristics. For this reason, we decided to use the ex post revenue in Kinshasa as a proxy for the value of the cargo during the downstream journey.

commodities so that every bag of maize is typically charged 1.16 USD whereas a bag of coal is only charged 30 cents. Formal pairwise F-tests on the basis of the parameters show that the difference in the estimate for maize is significantly different from those of coal and fofu.

In column (3), we include both total revenue and the total number of bags as explanatory variables. As one would expect, the two variables have a strong positive correlation (Pearson coefficient=0.56). Nonetheless, running the two variables together give us a hint of whether authorities are able to extract taxes mainly based on the size of cargo or if they make a more sophisticated calculation based on profitability. The estimated parameters in in column (3) show that the coefficient for total revenue is surprisingly stable (0.017) and significant at the 10-percent level.

Column (3) also includes individual boat and operator characteristics in order to test our second hypothesis. Remarkably, most of the included variables do not appear to be strongly related to tax payments, not even the number of stations passed. Neither the age nor the experience of the operator appears to matter. Boat ownership or the keeping of a logbook have no association with taxes paid. The number of crew members is the only variable with a positive and somewhat significant coefficient in column (3).

In the remaining columns of the table, we divide up total taxes into two separate dependent variables; the heavy recouvrement tax paid in Mushie in columns (4)-(6) and a measure of the average amount of all the other taxes excluding recouvrement paid per station, in columns (7)-(9). The combined coefficients in columns (5), (6), (8), and (9) strongly suggest that most of the impact from payment per bag comes from the recouvrement tax. The coefficients in column (5) suggest a much lower marginal tax of per bag on the different commodities, although officials charge a substantially higher tax for maize bags (0.92 USD). Note that the coefficient for total revenue is positive but insignificant in column (6). For the other taxes per station in columns (7)-(9), it does not seem that number of bags matter for how much an operator pays in taxes.

As for the other included variables, the coefficients are mostly insignificant. Results in column (9) indicate though that taxes actually decrease with the number of passengers and that taxes increase with the number of crew. Controlling for other variables, one additional crew member increases average taxes per station by about 5.11 USD.

In summary, third degree price discrimination based on the type of commodity traded does appear to be in place when payments of recouvrement are made in Mushie, whereas the

hypothesis of first degree discrimination, based on the value of the cargo (total revenue of journey), receives some support for all other tax payments, although the marginal effect is very small. Personal and other boat characteristics do not seem to matter to any greater extent. This is rather surprising given the importance of personal connections and access to influential networks emphasized in other research. For instance, previous research on the imposition of informal fees by the Police Forces (Eriksson Baaz and Olsson 2011) clearly demonstrated that people with such connections (often named *les intouchables*/untouchables) are not (as reflected in the name) exposed to such demands. That study also demonstrated that ‘newcomers’ with no personal relations to the police and who lacked the negotiation skills, most often developed with experience, were taxed higher.

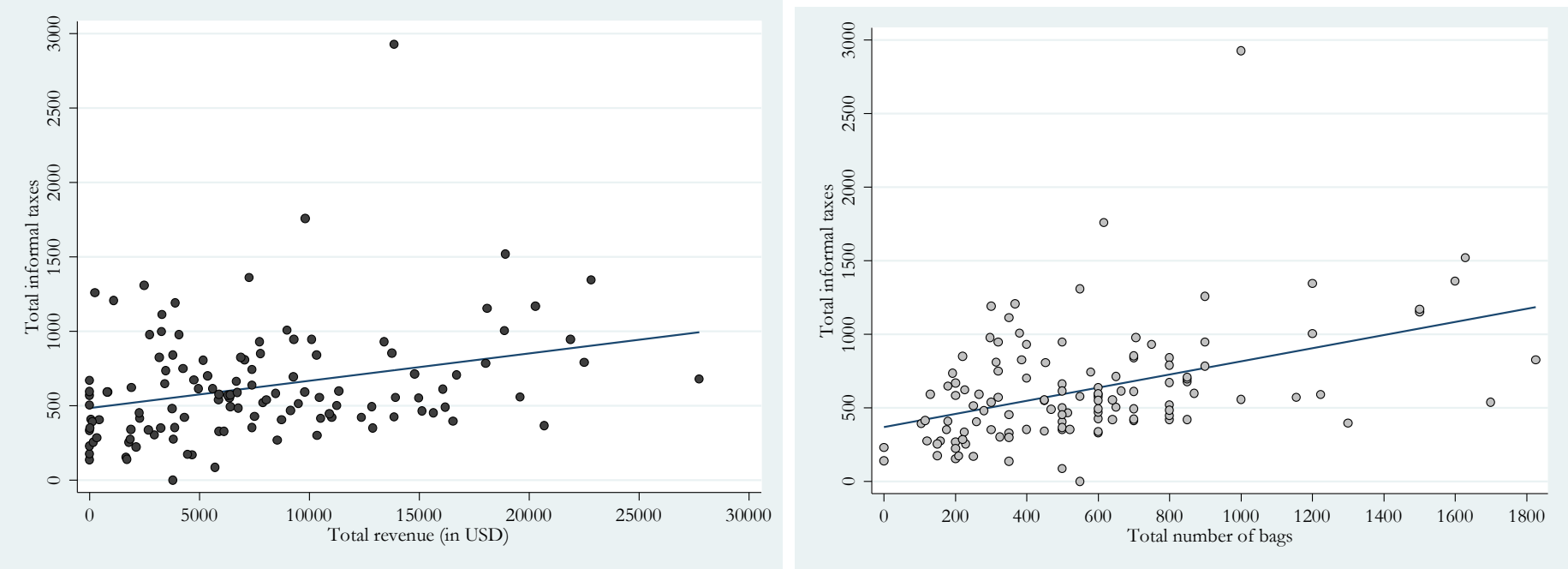
The most plausible explanation for the limited connection between personal characteristics and level of fees paid in the present study is probably simply that such traits have not been sufficiently covered in the categories used in the survey. Particularly, it is possible that the category of ‘untouchables’ is neither covered through years of experience, nor numbers of trips/year or size of boat. The limited correlation might also be due to possible frequent rotations of office (common in the DRC) making it difficult for boat operators to establish personal contacts with state officials at the various posts.

Table 3. Determinants of informal taxes paid per journey (OLS regressions).

	Dependent variable is:								
	Total informal taxes (USD)			Recouvrement in Mushie (USD)			Average taxes per station excluding recouvrement (USD)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Total revenue (USD)	0.018*** (0.006)		0.017* (0.009)	0.011* (0.006)		0.010 (0.009)	0.0010* (0.0006)		0.0009* (0.0005)
Bags (total no)			0.239** (0.109)			0.212* (0.115)			0.004 (0.008)
- fofu		0.369***			0.182			0.035	
- maize		1.157***			0.921**			0.020	
- kimpuka		0.432**			0.417*			-0.016	
- coal		0.303***			0.277**			-0.004	
<i>Operator/boat</i>									
Stations passed			1.51						
Age			-4.09			-2.46			-0.45
Experience (years)			2.44			3.30			0.01
Ownership (yes=1)			89.56			50.00			6.81
Logbook (yes=1)			17.74			-8.45			4.15
Trust in authorities			-17.47			-9.48			-0.06
Passengers (total no)			-1.67			0.39			-0.33*
Crew (total no)			70.4**			19.87			5.11*
Lukenie (yes=1)			81.6			305.52***			-43.90***
Constant	484.1*** (45.1)	291.68*** (59.00)	184.81 (257.34)	258.71*** (41.86)	78.96 (62.08)	-104.80 (212.91)	32.082*** (4.24)	33.46*** (5.09)	68.44*** (24.37)
Observations	122	121	107	122	121	115	114	113	107
R-squared	0.09	0.30	0.32	0.03	0.21	0.31	0.04	0.08	0.31

Note: The dependent variable is *Total informal taxes* in columns (1)-(3). *Recouvrement in Mushie* in columns (4)-(6). and *Average taxes per station excluding recouvrement* in columns (7)-(9). Robust standard errors in parentheses (when shown). *** p<0.01. ** p<0.05. * p<0.1.

Figure 4. Bivariate relationship between total informal taxes paid and total revenue/total number of bags among 122 downstream journeys.



Note: The figure shows the unconditional correlations between total informal taxes (in USD, on the vertical axis in both figures) and total number of bags among 122 downstream journeys. The estimated slope coefficient for the associated regression to the left is shown in Table 3, column (1). The slope coefficient for the regression to the right is $Total\ informal\ taxes = 369.0^{***}(50.8) + 0.448^{***}(0.099) \times Total\ number\ of\ bags$; $N=121$; $R^2=0.187$.

Arguably, although we did not explicitly include time aspects in the theoretical model, a boat operator might not only suffer from having to make informal tax payments to authorities. A standard finding from corruption research and the World Bank Doing Business surveys is further that commercial operators might lose a lot of time from waiting on permits and licenses if they fail to make payments. On the Congo, one might think of the boat operator's waiting time at each station as a possible indicator of authority harassment. This is also supported by the fact that boat operators who choose to use the UCAB-representatives at the posts as "middle men" cited a wish to limit the time at each post (not simply the fees) as a major reason. A potential hypothesis would then be that a higher payment of taxes actually "bought" operators free from time consuming negotiations with authority officials. If this was the case, we should expect a negative association between the taxes paid and the time spent at each station. However, it should be recognized that time spent at stations might not only be used for bargaining with officials but also for buying food and supplies, as well as loading additional passengers.

From Table 1, we know that a boat operator stayed roughly 80 hours at stations while travelling downstream and about 11 hours at each station. In Table 4, we study more in detail the determinants of waiting times. The dependent variable is average hours spent per station. The hypothesis regarding a negative association between tax payments and waiting hours does not receive any support from Table 4. The relationship appears to be, if anything, positive but not significant when including controls. The coefficients in column (3) suggest (not surprisingly) that more experienced operators have lower waiting times at stations, indicating also that experiences in negotiation and personal connections (enabling such operators to jump the 'service queue') might play a role. The marginal effects regarding experience are however not very large: A one standard deviation increase in years of experience (8.25) is associated with a 1.5 hour shorter time at each station.

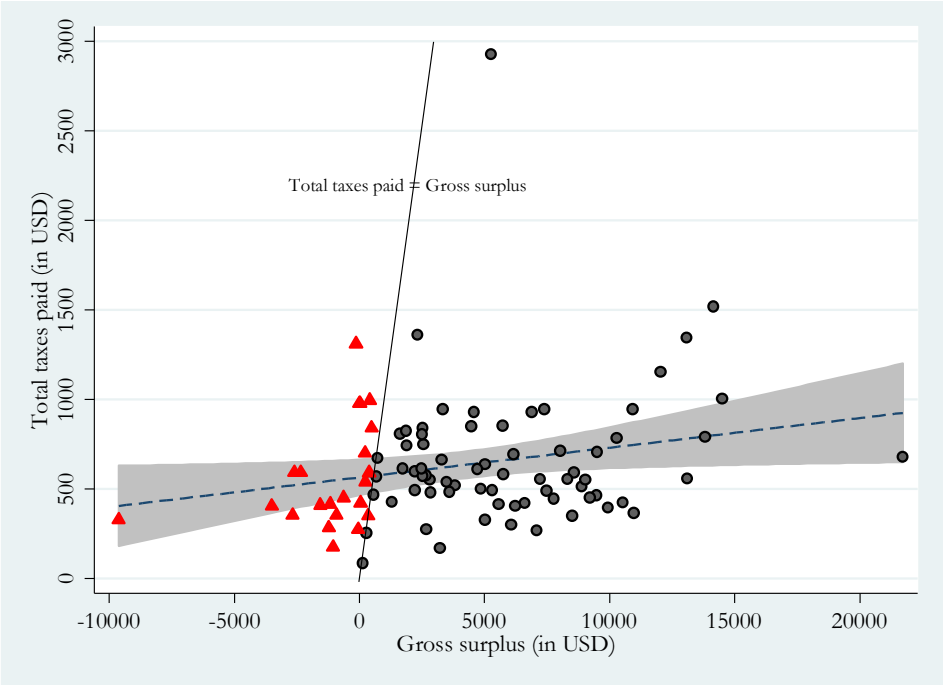
Lastly, we study the profitability of journeys down Lukenie and Kasai. It was proposed in the theoretical section that risk neutral boat operators should enter the market until the expected profit net of taxes for the average operator was slightly larger than zero. Figure A1 shows the distribution of calculated total net profits among the 121 boat operators in our sample. The red, triangular observations in the histogram show operators who are making a net loss when total taxes paid are subtracted from the gross surplus (normal revenues minus normal costs). Most operators do make a positive profit however and the mean level is 3669 USD.

Table 4. Average hours spent per station.

	Dependent variable is: Average hours per station		
	(1)	(2)	(3)
Average taxes per station	0.026* (0.014)	0.018 (0.015)	0.028 (0.017)
Bags (total no)		0.004* (0.002)	0.004 (0.003)
Experience			-0.187* (0.095)
Trust in authorities			0.820* (0.485)
Constant	9.741*** (1.298)	8.072*** (1.581)	4.832 (6.212)
Additional controls	No	No	Yes
Observations	114	113	107
R-squared	0.03	0.07	0.14

Note: The estimator is OLS in all columns. The dependent variable is *Average hours per station*. Robust standard errors in parentheses. The set of additional controls includes *Stations passed, Age, Ownership, Logbook, Passengers, Crew, and Lukenie*. *** p<0.01. ** p<0.05. * p<0.1.

Figure 5. Bivariate relationship between total taxes paid and gross surplus.



Note: The figure shows a fitted (dashed) regression line with the associated 95-percent confidence interval capturing the bivariate relationship between Total taxes paid (on vertical axis) and Gross surplus (on horizontal axes) among 121 boat operators in our sample. The steep line shows observations where Total taxes paid = Gross surplus. The red triangles to the left of this line indicate journeys that make a net loss when taxes are subtracted from the surplus whereas grey circles to the right indicate operators making a net profit. The

regression coefficients for the fitted line is (with robust standard errors in parenthesis) $Total\ taxes\ paid = 564.3(40.9) + .0166(.0063) \times Gross\ surplus$.

In Figure 5, we show the relationship between total taxes paid and gross surplus. The results in Table 3 indicated that authorities seemed to be able to carry out first degree price discrimination on the basis of total revenue. The fitted linear regression line clearly indicates that there is a positive and significant relationship also between taxes paid and gross surplus where we have subtracted all journey-specific costs. In other words, it appears as if authorities manage to identify and squeeze more taxes from operators that actually have made a substantial surplus when they reach Kinshasa. However, it should be noted that the economic significance is not very strong: The slope coefficient (0.017) suggests only a 1.7 percent informal tax rate on profits. A one standard deviation increase in gross surplus (4890 USD) is associated with extra taxes amounting to only about 81 USD. Thus, the level of taxes paid does not at all resemble a proportional corporate or profit tax, as in more advanced economies.

The steep line in the figure further distinguishes between those operators that make a net profit after taxes (grey circles to the right) and those who make a net loss (red triangles to the left). It is clear that several of the latter would have made a loss even without taxation but some would have been close to breaking even without the taxes.

5.2 Authority-station-journey level

In this section, we now study the journeys of 95 boats on the Lukenie-Congo stretch of the river past up to 9 stations and about 20 authorities, excluding recouvement payments at Mushie. We exclude recouvement because it is such an outlier among the types of taxation in terms of levels. By focusing on boats that start on the Lukenie, we further obtain a more homogenous sample where all boats take the same route and are exposed to the same authorities downstream.²⁹ Our unit of analysis is 760 authority-station-journey passages. We also include a more detailed analysis of the four agencies with the heaviest taxing: the Commissariat fluvial, the Marine, DGM, and the funds transferred to authorities through the boat operator union UCAB. This disaggregated analysis allows us to exploit the rather substantial variation between stations and authorities in levels of taxes charged.

²⁹ Operators might however originate their journeys from different upstream ports, implying that the number of stations passed will vary. Some operators pass fewer than 9 stations downstream.

Table 5 shows the first set of regressions that estimate the equivalent of eq. (7). All specifications include station fixed effects, standard errors are clustered at station level and the coefficients in the table show the marginal impact of the fixed operator and boat/journey characteristics as operators pass stations on their way to Kinshasa.

In the first specification (1), we find that operators pay on average 28.50 USD to authorities per station. The overall tax level seems to increase with more crew members so that one more crew implies a 2.25 USD higher payment. Taxes have the reverse relationship with the number of passengers, in line with what we showed above. The average number of passengers on Lukenie is about 18 and the regression coefficient implies that an increase of passengers by ten people decreases taxes by 1.45 USD, which is a fairly modest effect. None of the other coefficients in column (1) are significant.

The table suggests that the three major authorities Commisariat fluvial, Marine, and DGM have different grounds for taxation, partly reflecting also their official mandate. For instance, Commisariat fluvial charges on average 6.70 USD per station and payments increase with the number of crew, reflecting their official mandate to regulate river traffic and the logic ‘more pays more’ explained above, while the pattern of payments to the Marine is more difficult to explain. This in turn could perhaps reflect the fact that the Marines – in addition to general national security concerns – legitimize the fees imposed through references to the assistance they give to boats in need of securing (which is more equal for all boats, regardless of size etc.). The price discrimination hypothesis is not supported at the authority-station-journey level.

However, the results in Table 5 do not capture a rather interesting differential dynamics among authorities in their taxing behavior along the river. In our theoretical section, we conjectured that authorities that are banned by the central government from charging any taxes should have a weaker bargaining position closer to Kinshasa and should thus tax mainly upstream. Authorities that were not explicitly forbidden to charge taxes should instead charge higher taxes closer to Kinshasa since the standard hold-up problem would suggest that they should have greater bargaining power downstream.

Table 5. Determinants of informal taxes paid to different authorities per station passage on the Lukenie-Congo (OLS regression).

	Dependent variable:				
	Total informal taxes per station (in USD) paid to:				
	All	Com. fluv	Marine	DGM	UCAB
	(1)	(2)	(3)	(4)	(5)
Bags (total no)	0.001 (0.004)	-0.001 (0.002)	-0.000 (0.001)	-0.000 (0.000)	0.003 (0.002)
Age	-0.215 (0.191)	-0.015 (0.075)	0.046 (0.061)	-0.052** (0.017)	-0.067 (0.121)
Logbook (yes=1)	1.728 (1.947)	1.778** (0.689)	0.562 (1.249)	0.202 (0.589)	-1.168*** (0.344)
Passengers (total no)	-0.145** (0.047)	0.005 (0.038)	-0.011 (0.010)	-0.018 (0.012)	0.017 (0.020)
Crew (total no)	2.243* (1.155)	1.149** (0.484)	0.702 (0.593)	-0.130 (0.143)	0.326 (0.188)
Constant	26.700** (10.464)	2.111 (3.502)	0.771 (5.425)	4.710** (1.506)	3.956 (4.329)
Station FE	Yes	Yes	Yes	Yes	Yes
Mean (dep var)	28.50	6.69	4.95	1.11	5.62
Observations	712	712	712	712	712
Stations	≤9	≤9	≤9	≤9	≤9
Operators	95	95	95	95	95
R-squared	0.02	0.01	0.01	0.02	0.03

Note: Regression with station fixed effects in all columns. All regressions include additional controls for *Experience* and *Ownership* with unreported, insignificant estimates. The dependent variable is total taxes paid by 95 operators at up to 9 different stations, excluding recouvrement at Mushie. The unit of analysis is operator-station passages. The table also includes the mean of the dependent variable for comparison. Robust standard errors, clustered at Station level, in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 6. Trends in informal taxes paid downstream (in USD) to different authorities from Oshwe to Kinshasa (OLS regression).

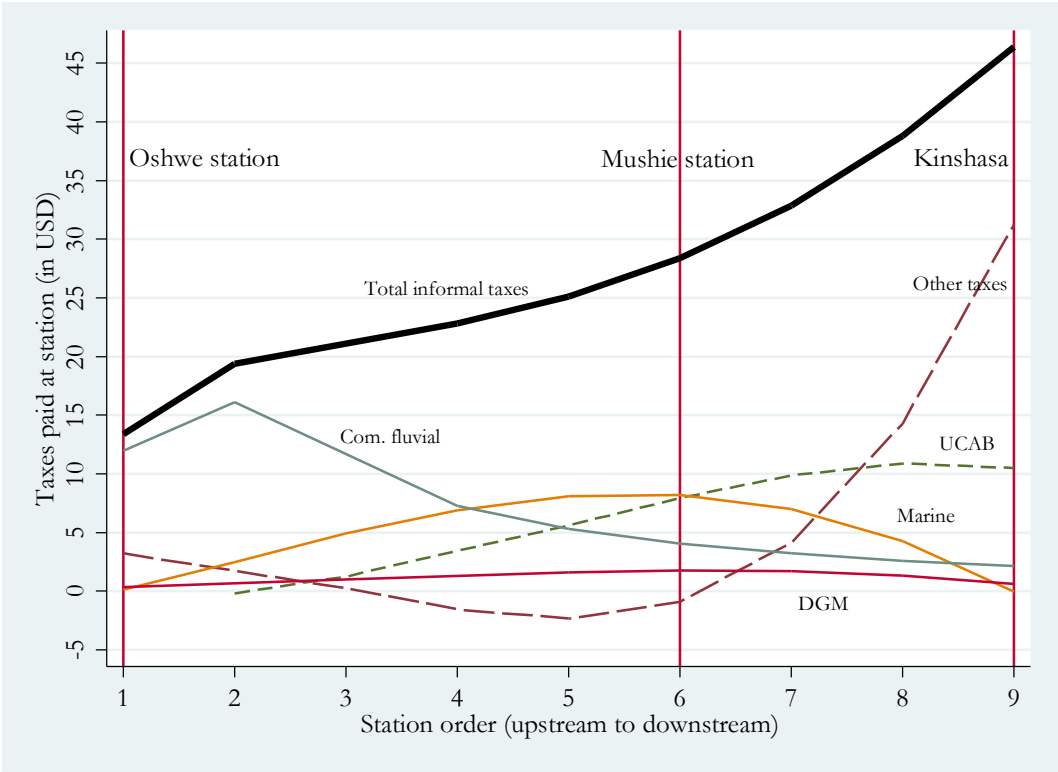
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	All authorities		Commisariat fluvial		Marine		DGM		UCAB	
Station order	3.361*** (0.569)	-0.638 (2.527)	-1.823*** (0.253)	-3.123*** (1.123)	0.076 (0.245)	5.467*** (1.069)	0.032 (0.085)	0.776** (0.376)	1.664*** (0.161)	1.959*** (0.718)
Station order squared		0.389 (0.240)		0.127 (0.106)		-0.524*** (0.101)		-0.072** (0.036)		-0.029 (0.068)
Constant	10.419*** (3.327)	18.216*** (5.838)	16.158*** (1.478)	18.693*** (2.595)	4.423*** (1.433)	-6.085** (2.470)	1.017** (0.496)	-0.435 (0.869)	-2.981*** (0.944)	-3.555** (1.659)
Operator FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	760	760	760	760	760	760	760	760	760	760
Operators	95	95	95	95	95	95	95	95	95	95
R-squared	0.05	0.05	0.07	0.07	0.00	0.04	0.00	0.01	0.14	0.14

Note: Regressions with operator fixed effects in every specification. The dependent variable is total taxes paid by 95 operators at up to 9 different stations to different authorities. The unit of analysis is operator-station passages. The independent variables are *Station order* and *Station order squared* where *Station order* runs from 1-9. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

In Table 6 and in Figure 7, we show the actual pattern of these trends. In Table 6, we estimate the equivalent of regression (8) where *Station order* from Oshwe to Kinshasa, in linear and squared format, are the key independent variables. In all specifications, we include operator fixed effects in order to capture the effect of the trend in the journey downstream. In Figure 7, we display polynomial fitted lines to visualize the trends in a clear manner.

In line with our hypothesis, Commisariat fluvial, which was very explicitly discussed in the decree, taxes operators very heavily early on (more than 15 USD at second station Tolo) but a lot less closer to the capital. The Marine and the DGM reach their maximum taxation levels midway, roughly at Mushie station, and then decline. UCAB, on the other hand, is not a formal authority at all and was not mentioned in the decree, as explained above. The estimates in Table 6 and the trend in Figure 7 both suggest a gradually rising curve for UCAB.

Figure 7. Trends in the level of informal tax payments to different authorities on the Lukenie-Congo river from upstream station Oshwe to terminal station Kinshasa.



Note: The dependent variable is the level of informal taxes (in USD) excluding recouvrement paid at each station. The figure shows fractional polynomial fitted lines based on 760 authority-station-journey passages on the Lukenie-Congo stretch. The thick black line shows the predicted total level of informal taxes at each station whereas the five lower lines show the predicted level of taxes for Commisariat fluvial, Marine, DGM, UCAB, and all other taxes. Station 1 upstream is Oshwe and the final station 9 is Kinshasa’s harbor.

Indeed, the total amount of taxes paid increases as operators approach Kinshasa from about 15 USD upstream to 45 USD downstream. This is evident also from the positive, significant estimate in Table 6, column 1. As Figure 7 indicates, the increase appears to be driven by other, unspecified taxes, presumably charged by opportunistic smaller units of government agencies, somehow operating with (even more) freedom from control from the authorities in Kinshasa. It might be argued that their tolling behavior might serve as a kind of control group for how authorities would optimally have behaved if they had not been constrained by the decree.

On the whole, the results above on the trends are consistent with an interpretation that the variation downstream in informal taxation to a great extent is explained by the hold-up problem in the sense that overall taxation keeps increasing up to the last station in the capital. For some of the bigger authorities, however, the reverse pattern is present, probably because of the high profile of the decree that officially abolished their right to tax.

6. Discussion: Formal vs informal taxation

Clearly, a number of operators would have made a bigger net profit if the informal and sometimes illegal taxes had not been charged. But would this necessarily be welfare improving? In the absence of a functioning formal tax system, the informal taxes that are extracted perhaps still benefit the Congolese government and hence the Congolese people?

In our view, there are a number of arguments against such an interpretation of the situation. First, and most obviously, both the government and the union of boat operators jointly regard most of the taxes on the river to be illegal. The local term *tracasseries* indicates that operators view most of the fees as illegitimate. With a few exceptions such as the Marines, which according to operator interviews, provide useful services, and parts of the services offered by the Commisariat fluvial, most other authorities such as other state security services or the Province of Bandundu are presented as illegitimate and as having no logical connection whatsoever with river traffic. Hence, the boat operators' perceptions resonate with research from other contexts showing that people generally make quite sharp distinctions between legitimate and illegitimate payments (i.e., informal taxes or bribes) to government agencies (Rothstein, 1998) (questioning the assumption that the problem is located in lack of knowledge or an acceptance of a culture of corruption).

Second, the current situation with de facto existing informal taxation and de jure abolished taxes is most likely detrimental for the willingness to trade on the Congo river. One of the striking findings of our study is that it is very difficult to predict the level of taxes that an individual operator needs to pay. Even when we include all cargo, journey, operator and boat variables in Table 4, we are not able to explain more than a fraction of the variation in any of the regressions. Hence, risk averse individuals who are well informed about the system will not be prone to enter such an unpredictable market.

Third, micro studies on the Congolese security forces show that extracted taxes tend to be distributed among employees within the authority in question rather than to the government treasury. Most of the money eventually ends up in the pockets of senior officers in a complicated sharing system (Eriksson Baaz and Olsson, 2011). The qualitative material collected indicates a similar system when it comes to authorities taxing on the river, though it appears that part of the funds collected by the Marines goes to rehabilitation and social services of the main military camp in Kinshasa (see Eriksson Baaz, et al., 2016). However, there are no indications that the extracted fees benefit the broader Congolese populace.

Our argument is not that the ideal situation on the river is necessarily no taxes at all, on the contrary. For instance, the formal sector in most African countries has corporate taxes where companies pay a percentage of profits in taxes on an annual basis. Charging the boat operators annually rather than on every journey would of course increase predictability significantly and would imply that operators who make a loss would not pay corporate taxes. Furthermore, the goods that are sold in the harbors should be subject to a standard VAT type of taxation such that part of the buyer price contributed to the government budget. However, such types of formal taxation are unlikely to be introduced on the river in the near future.³⁰

7. Conclusions

We develop a general model that is typical for transportation in developing countries with a trader on a journey passing by several stations with informal tax payment to multiple authorities. The trader or operator can either own the goods himself or have a stake in the

³⁰ A critical issue, apart from taxation, is the state of the infrastructure along the river. The loading and storage capacities in Kinshasa's harbors are in an extremely poor condition. The security situation in the harbors is bad despite the presence of police and military. The situation at the stations upstream is even worse. Large sections of the river need to be dredged in order to allow for larger ships. All indications suggest that river trade on the Congo has a great future potential, but it will require massive investments in infrastructure. The Congolese government will probably not be able to undertake such investments without the assistance of the international community.

profit. We derive different hypotheses regarding the determinants of informal taxation and these are empirically applied to commercial boat operators on river Congo.

In the empirical study, we surveyed 137 boat operators on river Congo, bringing essential food products to capital Kinshasa during the first part of 2015. Despite a presidential decree that officially abolished a plethora of taxes and tolls on the river, our study documents that informal taxation still makes up about 14 percent of the variable costs of a journey. An average operator has to pay to almost 20 different authorities at up to 10 stations downstream where they are typically held up 11 hours at each station. The absolute level of informal taxes paid per journey far exceeds results from previous studies.

A key finding is that authorities manage to practice price discriminate in their tax collection, based on the profitability of the cargo that the operators bring. Operators bringing maize have to pay the most and the number of bags is the strongest determinant of the highest informal tax; the recouvrement in Mushie. The average level of taxes further increases closer to Kinshasa, suggesting a hold-up mechanism in tolling behavior. Despite the heavy taxation, it is noteworthy that most operators still manage to make a net profit from their journeys.

We believe that the current study introduces a number of questions for future research. In ongoing work, we exploit qualitative data from interviews with the boat operators and the interview material with the Marines (see Eriksson Baazet al, forthcoming) in order to better understand the inherent structure of taxation and the negotiations with authorities over payments. We would also like to learn more about the coordination of taxes between authorities and within authorities across stations. If managed properly, commercial traffic on Congo river has an enormous future potential.

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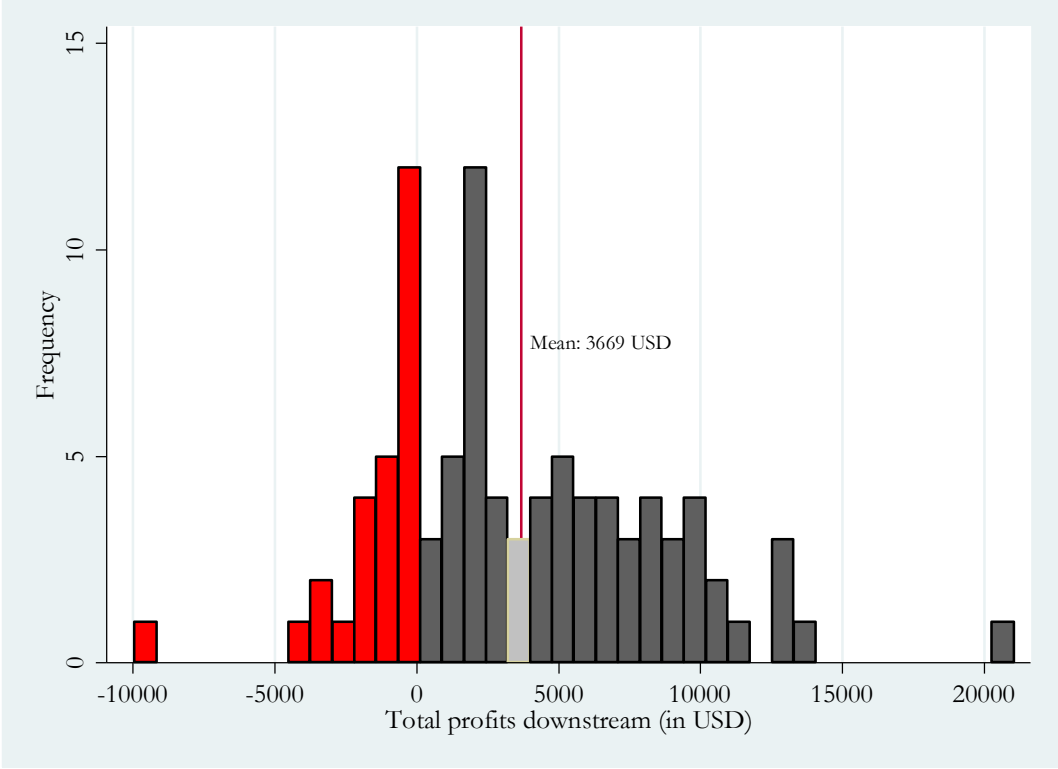
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Appendix

Figure A1. Distribution of total profits downstream among 117 boat operators.



Note: Data from our study.