Productivity, Capital Mobilization and Moral Hazard in Fisheries Share Contracts: Lake Nasser, Egypt

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Abstract: As part of an international research project on reservoir fisheries productivity in developing countries, this paper examines contractual relations in the Lake Nasser fishery, seeking to understand why so many seemingly redundant contract types coexist and what effect they have on productivity. Based on the results of a socio-economic survey conducted in the fishery and drawing on the literature on agricultural sharecropping and share remuneration systems in fisheries, the paper analyses the roles of the different contracts observed in the Lake Nasser fishery. In particular, it discusses the incentives, limitations, and opportunities that these contracts offer to the different groups of actors (gear owners, license owners, crew members), and shows how these arrangements influence and shape the fishing strategies, capital mobilisation, and ultimately labour productivity of those different groups. While the debate on share contracts generally seeks to assess their efficiency relative to other types of contracts, this paper argues that the relevant question is not how efficient the contracts are, but what functions are served by the various co-existing contracts, and why different actors may choose each type. While the standard explanations of risk management and the impossibility of close supervision seem to provide some insight into this, it is also clear that the actors in the fishery use these contracts to mobilise capital and combine productive resources with other actors. This interlinking is a key function of the contracts, and the diversity of resource endowments and needs of the different actors helps explain the diversity of contract types.

Keywords: *Small scale fisheries, Contracts, Sharecropping, Incentives, Risk Management*

1. Introduction

The Lake Nasser fishery came into existence in 1961 with the construction of the Aswan High Dam and the subsequent creation of Lake Nasserⁱ. Rich in sedimentⁱⁱ and thus in food, the waters of Lake Nasser support an abundant fish population (Latif, 1974). Production is currently only one quarter of what has been estimated to be its potential, with official landings fluctuating around 20,000 tⁱⁱⁱ, worth an estimated US\$17 million per year (Béné, Bandi, and Durville, 2008). Tilapia (*Oreochromis Niloticus*) is the most common species and represents about 80 per cent of official catches. In addition, Nile perch (*Lates Niloticus*), tiger fish (*Hydrocynus Goliath*) and *Alestes spp.* are also important for the fishery (Latif, 1974; Rashed, 2005). While tilapia and Nile perch are sold fresh (along with other minor species), tiger fish and *Alestes* are usually processed by fishers before being sold as salted fish.

The fishery expanded rapidly, with production increasing from few hundred tonnes in 1965 to a peak of 34,206 t in 1981. As the fishery grew in the 1970s, it attracted increasing interest from local people and thousands of migrants from around the country, and the number of fishers on the lake increased rapidly. A system of boat licenses was introduced by the central government to control access to the fishery and reduce potential for conflicts. While licenses were issued initially on the basis of boat ownership, they could also be sold or exchanged. Some people managed to acquire dozens of licenses through this 'market', with the largest license holder now owning 154. By the time the sale of licenses was prohibited and the total number fixed at 3000, over half of the licenses belonged to non fishers. As a result, the main factors of production necessary to operate in the fishery – licenses, boats, gear, and labour power – are often possessed by different actors. Non fishing license holders act as 'license lords', leasing their licenses out to 'roasa' (fishing camp bosses) in exchange for either fixed cash rent or a share of the catch. These roasa, along with those roasa who own license(s), recruit labourers to live in their camps and work as crew on a seasonal basis. Far from being 'just' rental or labour contracts, these arrangements serve several other functions, including mobilising capital despite weak credit markets, managing risk,

providing incentives for higher production, and combining factors of production such as labour power, licenses, and fishing equipment.

As part of a larger international research project on reservoir fisheries productivity in developing countries, this paper seeks to shed light on the different types of contracts in the Lake Nasser fishery. Drawing on the existing literature on agricultural sharecropping but also on the (scarcer) literature on share remuneration systems in fisheries, it analyses the diverse functions served by the different contractual relations found in the Lake Nasser fishery, arguing this diversity of contractual arrangements is more likely to be a reflection of the varied resource endowments and needs of different fishers than an indication that some of them have more efficient contracts than others. In particular, it discusses the incentives, limitations, and opportunities that different contract types hold for fishers, and show how these influence and shape fishing strategies, capital mobilization, and ultimately labour productivity. The paper calls into question the ability of common explanations such as risk and moral hazard to fully account for the pervasiveness of sharecropping, and suggests that its persistence may instead be explained instead by its ability to enable different actors, endowed with different but complementary assets and resources, to combine those resources and put them to productive use.

2. The Lake Nasser Fishery

The analysis presented here derives from a socioeconomic survey carried out on the shore of Lake Nasser between January and May 2007 with the help of the Lake Nasser Development Authority (LNDA). One hundred and twenty five fishers were interviewed during this survey. The data collected included basic demographic information regarding family size, migratory status, age, and fishing history; employment details, including number of licenses, revenue sharing arrangements, affiliations to cooperatives, and engagement in other economic activities; and details of fishing activity, including production data, estimated operating costs, and information on boat and gear ownership. Table 1 summarises some of this information.

Table 1: Selected characteristics of Lake Nasser fishers (Std. Dev. in brackets)

	Owners	Renters	Partners	Labourers	Total
Household size (# of people)	10.2 (8)	6.7 (3.4)	9.4 (4.8)	7.9 (2.4)	9.2 (6)
Age (years)	45 (12.8)	33 (9.6)	42 (12.9)	38 (11)	41 (12.7)
Educated	44%	60%	40%	15%	41%
Has migrated	98%	90%	88%	100%	95%
Member of co-op	64%	30%	28%	15%	42%
Number of licenses	4 (1.17)	7 (3.39)	8 (2.95)	1	5 (1.07)
Annual catch per boat (tonnes)	4790 (4056.6)	3872 (3900.3)	4133 (3025.4)	6177 (3654.3)	4716 (3587.2)
Owns boat(s)	98%	70%	80%	0%	72%
Owns gear	98%	80%	86%	0%	75%

Far from comprising a homogenous and coherent social group, the majority of the individuals involved in the Lake Nasser fishery are seasonal, unsettled workers from different parts of the country. They operate from temporary fishing camps established along the 7800 km of the lake's shorelines. With no electricity, running water or access to public services, living conditions in these remote camps are rough. Only male fishers live there, staying in rudimentary cane shelters for up to seven months.

Four main types of gear are operated in the Lake Nasser fishery: *duk* (trammel nets), *kobok* (bottom gillnets), *sacarota* (floating gillnets), and *sinnar* (longlines) – Table 2. Trammel nets and bottom gillnets are used primarily for tilapia, floating gillnets to catch tiger fish and *Alestes* for salting, and longlines to target Nile perch (Barranaia, 2000). Trammel nets and bottom gillnets are the most common gears on the lake, with all fishers using trammel nets and 95 per cent using bottom gillnets. While there is some

variation in price between nets of different sizes and materials, both of these types of gear average around 200 Egyptian Pounds (EGP, roughly USD \$36), while floating gillnets are more expensive. Hooks for longlines average EGP 0.8 each, and are made into lines of approximately 100 hooks, including the cost of the line and labour, for EGP 100 (USD \$18).

Table 2: Overview of common fishing gear (Std. Dev. in brackets)

Gear	Local name	Target	Lifetime (months)	Fishing operation (hours)	Mean cost (EGP)
Floating Gillnet	<i>Sacarota</i>	Tiger fish & <i>Alestes spp.</i> for salting	6 - 12	24	261 (183)
Trammel Net	<i>Duk</i>	Tilapia & some Nile perch	2	1	193 (112)
Bottom Gillnet	<i>Kobok</i>	Tilapia, some Nile perch, others (catfish, etc)	3	12	213 (130)
Longline	<i>Sinnar</i>	Nile perch	6 - 12	24	100 (90)

3. Share contracts in Lake Nasser

Historically much of the debate on share contracts has revolved around their efficiency relative to other types of contract, with generations of economists seeking explanations for their apparently anomalous persistence (Smith, 1776; Marshall, 1890; Schickele, 1941; Johnson, 1950; Cheung, 1969; Bardhan and Srinivasan, 1971; Reid, 1987). Arguments were made and refuted about the efficiency (or inefficiency) of sharecropping, the incentives (or disincentives) it provides for inputs and outputs by the different parties, its compatibility (or incompatibility) with capitalism, and possible explanations for its pervasiveness across time and space.

While share contracts are still common in agriculture in some parts of the developing world, they are also ubiquitous in fishing (Zoetewij, 1956; Sutinen, 1979; Anderson, 1982; Plourde and Smith, 1989; Platteau and Nugent, 1992), constituting the primary remuneration system for all types of fishing, from industrial European trawlers to artisanal fisheries in the developing world (Firth, 1966; Alexander, 1982; Platteau and Balland, 1989; Béné, 1997). The fishery of Lake Nasser in Egypt is no exception. The remuneration of nearly all of the 8000 fishers of this small-scale fishery is at least partially determined by share contracts. Four main categories of contracts can be identified, of which three apply to *roasa*. Those contracts – which we propose to call ‘owners’, ‘renters’, and ‘partners’ contracts – differ from each other by the contractual arrangements through which the *roasa* access licenses, and to a lesser extent their ownership of boats and gear. Fishers in the fourth category, called ‘labourers’, work for one *raeis* (the singular of *roasa*), living in his camp, and using his boats, gear, and licenses. The features distinguishing the four contracts are detailed below, along with calculations of net income.

Owners: Owners own licenses (hence the name), boats, and gear, and bear all operating costs except for the portion that they share with the crew through the payment of net shares. While they fish (unlike licenselords), they must hire additional labour power in order to be able to put their equipment and license(s) to productive use. In algebraic terms, their net income (I_o) can be written as:

$$I_o = (1 - p) \cdot (X - C - Z - f) \quad (1)$$

Where X is the gross value of the catch, C is operating costs such as fuel, gear, and maintenance, Z is the allowances paid to the crew, f is the annual license fee^{iv}, and p is the crew’s share, typically 50 per cent. The owner category is also the most homogenous of the *roasa*, exhibiting the least intracategory variation in fleet size, investment, and production (see Table 2).

Renters: Renters are professional fishers who typically own boats and gear, but do not own licenses. Like owners, they need to hire labourers, but they also need to lease a license, and in some cases to access money for capital investments. They rent licenses from licenselords, paying a fixed annual rent per license R , and their income (I_R) can be written as:

$$I_R = (1 - p) \cdot (X - C - Z - R) \quad (2)$$

They are totally independent from the license lord except for rent payments R . The license lord does not provide any supervision nor does he participate in investment and strategy decisions. As rent is paid as a fixed amount, the license lord does not share operating costs either, though in some cases renters may jointly purchase boats or gear with their license lord. The data indicate that renters tend to be younger and more educated than other fishers^v (Table 2).

Partners: Like renters, partners are professional fishers who do not own licenses. They often own boats and gear, though slightly less frequently than renters do. The majority of partners share both costs and revenues with the license lord; though some of them ('none cost sharing' partners) share only revenues with the license lord. The rest of the partners ('cost sharing partners') own boats and gear, although it is not uncommon for them to share ownership of one or both with the license lord. They must hire labourers, lease a license, and access money for operating costs and in some cases capital investment. They share operational costs 'upward' with the license lord through the payment of license rent as a share of net income rather than gross, and 'downward' with labourers. If we let r be the share of net income paid to the license lord (nearly always 50%), their income (I_p) can be written as:

$$I_p = (1 - p) \cdot [(1 - R) \cdot (X - C - Z)] \quad (3)$$

'None cost sharing' partners on the other hand do not share costs 'upward' with licenselords, only 'downward' with labourers. Their license rent r^* is calculated as a share of gross income (between 10 and 35%). The income (I_p^*) of the non cost sharing partner can be written as:

$$I_p^* = (1 - p) \cdot (X - C - Z - r^*X) \quad (4)$$

Licenselords are much more involved with cost sharing partners than with non cost sharing partners or renters, participating in investment and strategy decisions, and visiting fishing camps regularly to supervise operations and bring food and supplies.

From the above, we can see that owners and renters have an 'upwards' rental contract, where they pay a fixed rent or fee for the license, and a 'downwards' share contract, where they hire labourers whom they pay on a share basis. Partners, on the other hand, have two share contracts - one with the labourers, and one with the license lord. In this sense, partners are 'share workers' vis-à-vis the license lord in addition to being *roasa* vis-à-vis their labourers. As is clear from the algebraic analysis in this section, however, partners have more in common with the other *roasa* than they do with labourers. This will be revisited in more detail in the section on incentives and supervision below.

Labourers: The last group is the 'labourers'. Labourers do not own boats or gear, and do not own or lease licenses. They possess only their own labour power, and work for a *raeis* who provides them with equipment and (access to) licenses in order to fish. They are paid their share at the end of the fishing season, and are provided with food while in the fishing camp, the cost of which is subtracted from gross income along with other costs before shares are calculated. The net income (I_L) of the crew (as a whole) can be written as:

$$I_L = p \cdot (X - C - L - Z) + Z \quad (5)$$

As above, X is the gross value of the catch, C is the operating costs, Z is the allowances paid to the labourers, and p is the labour share, typically 50 per cent. L represents the amount that the *raeis* pays for the license - in the form of an annual license fee, a fixed rent, or a share of the catch, depending on what type of contract he has. The crew income is then shared, usually evenly, amongst all the labourers in the camp. Note that this labourers' remuneration (5) is consistent with that described in the literature on share contracts in fishing. Sutinen (1979) demonstrated that when both crew and equipment owners (in our case the *roasa*) are risk averse, owners prefer mixed share/wage contracts, in which the crew's income consists of a share of the catch (here $p \cdot (X - C - L - Z)$) plus a fixed wage component (here Z). In developing countries, this fixed wage component often consists of a customary quantity of fish for home consumption, food and drink while fishing, or a cash allowance for tea, cigarettes and snacks (Platteau and Nugent, 1992). In Lake Nasser, the fixed component consists of fish for their consumption and meals while they are in the fishing camp, but not a cash allowance.

Functions of share contracts: The use of share contracts in agriculture has been the subject of much debate in the theoretical literature. Overall, the quest for explanations of what was once termed the 'paradoxical pervasiveness of share contracts' (Platteau and Nugent, 1992:386) revolves around two main functions and their implications for efficiency: (1) managing risk, in particular in the absence of insurance markets, and (2) reducing moral hazard in the absence of close supervision and providing incentives for higher production and optimal use of resources.

Risk Management: The first important function served by share contracts is that of risk management. While the use of share contracts to manage agricultural risk has been much discussed, risk management is arguably even more important in fishing, as fishing is a particularly risky occupation. Indeed, in addition to production and price risks (as in agriculture), there is also the ever present possibility that a fisher could lose all of his productive assets (and possibly his life) within the span of a few minutes (McGoodwin, 2001). Platteau and Nugent (1992) identify three main types of risk in fisheries: production risk deriving from fluctuations in catch, price risk from fluctuations in markets, and risk of loss or damage of assets (including injury or loss of life).

While there is little that can be done to reduce many of the risks faced by fishers, the use of share contracts described above enables risk of all three types to be shared through multiple links in the contract chain, thereby reducing the risk borne by each individual^{vi}. Production risk, for example, is largely due to factors beyond the control of fishers (such as weather, luck, water levels, and the natural productivity of the lake), and there is little that they can do to reduce it. In Lake Nasser, production costs and therefore risk are shared through at least two levels of the contract chain, leaving no single actor responsible for meeting all fishing costs in the event of poor landings. In the case of cost sharing partners, the risk is shared between three links of the chain (labourers, *roasa*, and licenselords).

Price risk in Lake Nasser is managed much the same way as production risk, though until recently it was limited by a pricing system in which the price of fresh fish was fixed fortnightly by a committee created especially for this purpose^{vii}. The fixed prices were below national market rates, and fish from Lake Nasser were typically sold in Cairo at a lower price than farmed or Nile caught fish of the same species. This system applied only to fresh fish, while the price of salted fish was determined by the market (Barranaia, 2000)^{viii}. In addition, a trader rota allowed only one of the six official private fish traders for each harbour to buy the landings each day. Fishers who targeted Nile perch, tilapia, and other fresh fish were therefore subject to production and loss/damage risk, but largely insulated from price risk. Only fishers who targeted tiger fish and *Alestes spp* to process and sell as salted fish were subject to all three types of risk^{ix}. A free market system was introduced in August 2008, and as all fish are now sold at market rates, it can be assumed that all fishers are now subject to price risk.

While risk of injury or death is obviously borne by each individual fisher^x, risk of loss or damage to boats and gear is managed in a similar manner as price and production risk – through payment in net shares. When shares are calculated at the end of the season, repair and replacement costs are included in the operational costs which are deducted from gross production, and are therefore shared by all actors who earn a portion of net proceeds. Owners, renters and non cost sharing partners share these costs (and therefore the associated risk) with their labourers, while cost sharing partners share them with both labourers and licenselords. This arrangement is not only a mechanism for sharing loss/damage risk, but also a strong incentive for the crew to take good care of the boat and nets, as they are partially responsible for the cost of any damage. In addition to *roasa* sharing risk downwards with labourers through the use of share contracts, this risk is also spread amongst the labourers, as shares are calculated as a percentage of net profit for the whole camp over the season. Seasonal rather than daily payment smoothes fluctuations in income due to weather and luck, and collective payment ensures that no labourer bears more risk than the others in the fishing camp.

Stiglitz (1974) argued, however, that risk sharing alone is not sufficient to explain the persistence of share contracts. He claimed that it is possible to achieve the same risk sharing benefits through a mix of wage and rental contracts, assuming that both workers and landlords can mix contracts. However, while it might be theoretically possible for landlords to subdivide their land and efficiently allocate parcels between rental and wage contracts, the assumption that workers can choose to work for many landlords simultaneously on a mix of rental and wage contracts is more difficult to envisage, particularly in fishing where workers often live in an isolated fishing camp or on a boat at sea with no option for physical mobility between employers. Furthermore, while land can be split into plots of any size, a boat or license cannot (Platteau and Nugent, 1992). Transferring this discussion to the case of the Lake Nasser fishery where labourers work for one *raeis* for the entire season and partners and renters lease licenses from one license lord on an annual basis, we see that the required assumption of both workers and landlords (labourers and *roasa* respectively, or partners/renters and licenselords, depending on which relationship is being examined) being free to mix contracts is clearly not met here.

4. Incentives and Supervision

In parallel to the discussion on risk, a large part of the debate in the sharecropping literature revolves around whether sharecropping provides positive or negative incentives for production. Adam Smith considered it a 'tax' that prevented optimal investment in the land, and later authors such as Marshall (1890) argued that it not only prevented long term investment, but was also a disincentive to intensive cultivation and provision of inputs in adequate quantities in the short term, as the tenant was only able to keep half of what he produced. Some more contemporary authors (Newbery, 1977; Newbery and Stiglitz, 1979) have taken the opposite position, arguing that one of the main benefits of share contracts is the positive incentives that they provide where supervision is difficult or costly and effort is unverifiable.

McConnell and Price (2006) extend this argument to fisheries, questioning the pure risk sharing explanation that Sutinen (1979) and Plourde and Smith (1989) proposed. They argue instead for an explanation based on moral hazard and team agency, claiming that share contracts reduce incentives for shirking when effort is unobservable or difficult to measure. Catch levels depend on factors such as weather, fluctuating fish stocks, and skill in addition to effort, making it very difficult for asset owners to distinguish shirking from bad luck and the effort of one crew member from another. By paying crew in shares, asset owners are able to discourage shirking, as crew directly benefit from providing extra effort. Platteau and Nugent (1992) identify labour shirking, asset mismanagement, output underreporting, input overreporting, and quality shirking as the main types of opportunistic behaviour to which fishing is vulnerable. In Lake Nasser, one can hypothesise that the incentives and opportunities for each of these will vary by contract type. The focus here will be on partners and labourers, as these are the two groups who can be considered 'share workers' – partners vis-à-vis licenselords, paying a share of their proceeds for use of the license, and labourers' vis-à-vis *roasa*, receiving a share of the proceeds for their work. While both are share workers, significant differences emerge when comparing the two contract types.

Partners are *roasa*, and, as such, are largely responsible for investment and strategy decisions. They can increase production (and therefore their own income) not only by eliciting additional effort from their crews, but also by investing in additional equipment or changing fishing strategy. But they are also share workers vis-à-vis their license lord (see equations (3) and (4) above). As such, they are prone to the incentive problems identified by early critics of agricultural sharecropping – if the marginal productivity gain from a given investment, input, or additional unit of effort is not substantially greater than the cost of the investment, it is not in the share worker's interest (Schickele, 1941). We could therefore expect this type of contract to be subject to a higher degree of labour and input shirking than a rental contract (Marshall 1890). Labourers, on the other hand, have no room for entrepreneurial decision making. Their contract is essentially an employment contract, while that of the partners is more of a joint venture between principals (Roumasset and Uy, 1987). While payment in shares constitutes a disincentive compared to rental contracts, it is an incentive compared to wage contracts, and this is the appropriate comparison here.

The small share size labourers receive could be seen as providing an incentive for higher production, as it requires them to work hard to earn even a small wage, paralleling the use of plot size to control effort in agriculture (Johnson, 1950; Cheung, 1969; Bhaduri, 1983; Braverman and Srinivasan, 1981). Indeed, labourers both carry out more fishing operations per week (Fig.1) and catch more per boat than any other category (Fig.2). While this incentive for higher production should apply in theory to all of the fishers whose income is calculated on a share basis (i.e. the *roasa* as well), the small share size received by the labourers means that extra income obtained through extra effort could be critical to maintaining a subsistence level of income. The ratio of their marginal utility of income to marginal disutility of effort is substantially higher than that of the *roasa*, whose income is safely above the subsistence level.

While it may seem strange that share contracts can be convincingly argued to be both an incentive (for labourers) and a deterrent (for partners) to increased production, looking at it this way makes it clear that partners and labourers have very different contracts, despite both being paid in shares. There are major differences in how much capital they control, what they are expected to contribute, how much risk they bear, and the degree of autonomy they have. Taslim (1992) applies a similar distinction to the agricultural sharecropping debate: cropshare tenants, analogous to partners, have significant autonomy and responsibility, while sharecroppers, analogous to labourers, are 'merely wage labourer[s] whose wage consists of a share of the output instead of a fixed sum.' (Taslim, 1992:260). He argues that the two sides of the sharecropping efficiency debate have been talking about two different types of contracts:

cropshare tenancy, claimed to be inefficient (Smith, 1776; Marshall, 1890; Schickele, 1941), and sharecropping, claimed to be efficient (Cheung, 1969; Reid, 1976).

Figure 1: Average number of fishing operations per week

Figure 2: Average catch per boat (kg)

Access to Factors of Production: While incentives may be a relevant factor in contract choice, and risk sharing almost certainly is, these are not sufficient to account for the diversity of contracts present in the fishery. This diversity is likely to be a result of diversity among the fishers themselves, as fishers who possess different types of productive resources have different requirements for what they need in a contract (Binswanger and Rosenzweig, 1986; Binswanger and McIntire, 1987; Laffont and Matoussi, 1995). If all *roasa* owned boats and gear, a relatively simple combination of one form of *roasa*-labourer contract and one form of *roasa*-license lord contract could achieve the risk sharing and incentive functions discussed above. The reality is more complicated, however, and this mix of contracts allows *roasa* not only to lease licenses and labour power, but also offers a variety of options for acquiring boats and gear, mobilizing capital for investment and operating costs in the absence of credit markets, and managing risk in the absence of insurance markets.

Access to capital is likely to be a key factor influencing contract choice among *roasa*. Lack of credit has been recurrently identified as a constraint to the development of small and micro enterprises in Egypt (UNDP, 2004; ENCC, 2006) and formal finance is often limited and fails to reach the poor (IFAD, 2005; Zeller and Sharma, 1998), with land ownership typically required as collateral for rural loans (Mohieldin and Wright, 2000; Kruseman and Vullings, 2007). *Roasa* therefore must either have enough cash to cover investment and operational costs or access informal credit through their licenselords. Those with less capital are limited to contract types which either do not require them to meet these costs upfront or those which give them access to informal sources of credit. Laffont and Matoussi (1995) describe a similar pattern among Tunisian sharecroppers, with working capital shaping contract choice and accounting for the coexistence of a range of contractual forms. While a detailed analysis of the assets of each fisher is beyond the scope of this study, we can identify some broad trends from the data which give us a general idea of the ways fishers in different categories access capital. Owners appear to have the most resources of any of the categories. In addition to owning a license, nearly all of them^{xi} own their own boats and gear, and they must have enough cash available to cover their operating costs. They also target tiger fish and *Alestes spp.* for salting more frequently than other categories do, which requires the use of powered boats and expensive specialised gear^{xii}, and could be another indication that they tend to be wealthier.

Renters also need to have cash available for initial operating costs, though many have the option to share gear or boat purchases with licenselords, and some work with partners instead of owning their own equipment. While a few renters report controlling a large number of licenses (up to 26) in their fishing camp, three out of the top five do not own the boats associated with those licenses, and a fourth shares ownership with the license lord. Most of those who own boats outright have just one or two. They have the least gear per boat of any category, which could further indicate that they have less money available for investment, as fewer of them purchase gear in conjunction with licenselords, and they are responsible for a larger share of the operating costs. Even though this contract allows for less risk sharing than a partner contract, it gives them more independence, both in determining their strategy and in keeping additional income that may come from a particularly good fishing season. This is consistent with the observation that renters are younger and more educated than other *roasa*, and may find this independence more appealing despite the risks that go with it.

Partners, on the other hand, have more gear per boat than other *roasa*, and handle the largest fleets. This may be attributable to many of them opting to share ownership of boats and gear with licenselords, as those partners who share ownership appear to be in charge of more boats (17 average v. 6) with more gear per boat than those who own all their equipment. Even those partners who own both boats and gear tend to have more boats (6 average v. 4) and more gear per boat than renters who also own boats and gear. It is plausible that some of the money which would otherwise be spent on operating costs is available to them for investment, allowing them to purchase additional gear and boats. This is the *roasa* contract with the most risk sharing, as risk is spread between all three layers of the contract chain (licenselords, *roasa*, and labourers).

We can therefore see how these contracts enable *roasa* to combine the resources that they control (boats, gear, and often limited capital) with resources controlled by other actors. Many partners and some renters access capital through their license lord to invest in boats and nets, and the majority of partners^{xiii} also use this relationship to partially cover their operating costs. It could even be argued that the deferral of payment to labourers until the end of the fishing season also constitutes a *de facto* form of informal credit for *roasa*, as they can use this money to cover interim costs as long as they are able to pay when required.

5. Concluding Remarks

The existence of share contracts in agriculture has been the subject of an intense debate in economic literature for many decades. While different reasons for this pervasiveness (spreading of risk between agents, limitation of moral hazard) have been considered, a large part of the debate has been framed around the relative efficiency of share contracts compared to other types of contract. Indeed, much of the discussion about risk management and moral hazard has revolved around their implications for efficiency. The search for a type of contract that is inherently more efficient than others may however have obscured the fact that in many cases, the socially efficient outcome involves a mix of contract types to suit the production needs of a whole range of different actors. In practice, share contracts take so many diverse forms with so many different outcomes that it is difficult to decisively say whether they are

inherently more or less efficient than other types of contracts. What appears clear, however, is that these contracts fulfil a range of important functions that enable or facilitate production in specific contexts. In a situation such as this one where multiple forms of contract coexist, the relevant question may be not 'which of those contracts is the most efficient?' but 'what purpose do they serve for the people who are engaged in them?' Rather than being the explanatory variable, contract type, along with other dependent variables such as strategy and investment decisions, might actually be a result of agents' initial capital and resource endowments: the differences in the resources which each type of actor possesses shape which strategies and investments are available to him and which contract type will allow him to access the remaining necessary factors of production.

More broadly, through this understanding of the wide range of actors which exist in real world economies, we have tried to shed some light on the much debated question of not only why share contracts continue to be used in so many contexts, but why they so often co exist under various (and sometimes relatively complex) contractual forms. Particularly in developing countries, interlinking of markets is common, and contracts (formal or informal) are often much more than simply arrangements for hiring labour or obtaining use of land or other productive resources. They often also compensate in various ways for underdeveloped or nonexistent capital and insurance markets, and as such, contract design varies according to the degree that mechanisms for accessing capital or managing risk are included in it. This enables actors to access the productive factors which they do not own, and facilitates production in contexts where it would otherwise be much more difficult.

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Endnotes

- ⁱ The lake spreads in both Egypt (300 km) and Sudan (190 km). The continuation of the lake in Sudan is called the Lake Nubia.
- ⁱⁱ The lake is characterised by a high primary productivity due to the millions of tonnes of the Nile's silts that slowly sediment in the southern part of the lake.
- ⁱⁱⁱ Crul and Roest (1995) estimated potential production at 80,000 t a year
- ^{iv} License fees vary depending on the characteristics of the boat, but they are typically less than EGP 100 (USD \$18) per year.
- ^v Given that the average age the fishermen surveyed began fishing is the same for all categories (17-18), it is possible that rental contracts may be gradually replacing partner contracts among the 'new generation' of non license-owning *roasa*, though it is not clear whether this is their choice or imposed by licenselords
- ^{vi} It is worth pointing out, however, that those share contracts do not offer any risk sharing advantage for labourers, as they are forced to bear more risk than they would under a pure wage contract.
- ^{vii} This committee is chaired by the chief of the harbor and composed of representatives of the Governorate of Aswan, LNDA, the Ministry of Supply, the cooperatives as well as the chamber of commerce.
- ^{viii} For a detailed description of this particular case and its political economy analysis, refer to Béné et al. (2008).
- ^{ix} Some fishermen sold their fish on the black market to fish smugglers rather than at fixed prices in the official harbors, and they would also have been subject to price risk.
- ^x In Lake Nasser, aside from the typical risks of death or injury common to many types of fishing, there are also 1000 - 1500 Nile crocodiles in the lake who pose an additional risk to fishers (LNDA, personal communication).
- ^{xi} One person (2%) owns a boat but not gear, and one person owns gear but not a boat. The remaining 96% own both.
- ^{xii} To buy and equip a boat for targeting these fish costs approximately EGP 25,000 (USD \$4500), while a boat and gear for tilapia costs approximately EGP 5000 (USD \$900)
- ^{xiii} Cost-sharing partners who pay their license lease as a share of net revenues instead of gross revenues.