Barriers of entry and capital returns in informal activities: Evidence from Sub-Saharan Africa[†]

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Abstract

This paper investigates the patterns of capital entry barriers into informal activities and capital returns in a number of Sub-Saharan African economies using a unique micro data set on informality covering seven West-African countries. Our findings lend support to the view of informal activities as being very heterogeneous. Our assessment of initial investment of micro and small enterprises (MSEs) suggests that notable entry barriers exist, in particular when current costs are taken into account. While there is also a segment with very low entry costs, some informal activities require substantial initial investment. In addition, we find very heterogeneous patterns of capital returns in informal MSEs. At very low levels of capital, marginal returns are high, but rapidly decreasing. In a medium range of capital between 150 and 1 000 international dollars, marginal returns tend to be low and unstable. Only at higher levels of capital, they become more stable and can be fairly high again. These results are consistent with a heterogeneous informal sector where subsistence activities co-exist with more capital intensive activities. We find some evidence that risk may play an important role in explaining this heterogeneity, in particular the high returns at low levels of capital. At the same time, most MSEs appear to be severely capital constrained.

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Introduction

Most urban dwellers in the poor developing world make their living from micro and small enterprises (MSEs) and the performance of those enterprises often decides upon livelihood success and failure. Successful entrepreneurs co-exist with the masses of petty traders or other menial workers who hardly can make a living from what they earn. It is widely assumed that the earnings potential of many of those entrepreneurs is not exploited, as they face important economic constraints, for example entry barriers and limited access to credit thus providing a rationale for policy interventions, such as micro-credit programs. The presence of entry barriers combined with capital market imperfections may indeed explain the heterogeneity amongst informal entrepreneurs in developing countries. In poverty trap models[1], returns to capital below a certain threshold of investment are often assumed to be very low or even zero, as entry of other poor individuals eats up potential returns. If entrepreneurs are wealthy enough or can obtain credit to overcome the barrier to entry, they can earn much higher returns. Returns to capital in MSEs can thus be regarded as a key indicator of the unexploited potential of informal entrepreneurship.

Microeconomic empirical evidence on the patterns of entry barriers into MSE activities in poor economies is scarce. Also, relatively few rigorous empirical studies have looked at the returns to capital of MSEs. Earlier studies on capital returns consistently find very high rates of more than 60 percent annual return (e.g. Banerjee and Duflo, 2004; de Mel *et al.*, 2008). McKenzie and Woodruff (2006) also find high returns, yet little evidence for the existence of high entry costs for the case of informal Mexican enterprises. For Sub-Saharan Africa, there is also evidence of extremely high returns to capital (Udry and Anagol, 2006; Schündeln, 2004; Kremer, Lee and Robinson, 2010). In addition, there are hints at considerable entry barriers into some activities (Udry and Anagol, 2006). Yet, what regards the causes of the observed pattern of high returns at relatively low levels the evidence is inconsistent, although some findings do suggest an important role for capital market constraints (Banerjee and Duflo, 2004; Schündeln, 2006; de Mel *et al.*, 2008). In general, high returns in MSEs point at the huge potential of this type of activities, as a very large share of urban employment is generated by MSEs: Based on the same dataset used in this paper, Brilleau, Roubaud and Torelli (2005) find the share of informal sector employment[2] to uniformly exceed 70 percent in urban West-Africa.

This paper therefore estimates capital returns for West-African MSEs and examines entry barriers into small-scale economic activities. By doing so, it also provides important feedback to economic theory. More specifically, it addresses the following questions in the context of

[1] See, for example, Banerjee and Newman (1993), Aghion and Bolton (1997) or Lloyd-Ellis and Bernard (2000).

[2] In Brilleau, Roubaud and Torelli (2005) and in this paper, informal sector employment is understood to comprise employment in firms that neither have formal written accounts nor are registered with the tax administration. Employment or self-employment in those enterprises can be considered informal by almost any definition of informality one may want to apply. These enterprises typically operate without any formal registration. Most MSEs are run by self-employed individuals, an important share employs some family members, and a minor fraction has paid employees. These employees only rarely have work contracts, are not covered by formal legislation, for example taxation or social security schemes.

Sub-Saharan Africa: First, do high entry barriers (start-up costs) relative to the wealth level of an entrepreneur exist and if so, which magnitude do they have? Second, how do capital returns vary with the size of the capital stock; is it true that MSEs with a low capital stock earn low returns to capital while returns at higher levels of capital stock are much higher? And third, what can be said about the causes of the observed patterns of capital returns? To answer these questions, we use a unique, albeit cross-sectional, micro data set on informal enterprises covering the economic capitals of seven West-African countries. In our empirical approaches, we very closely follow the study by McKenzie and Woodruff (2006).

The remainder of the paper is organised as follows. Section 2 provides an overview of the existing literature on returns to capital and entry costs in a developing country context. Section 3 outlines our analytical framework and formulates the hypotheses that are tested in Section 4. Section 5 concludes.

Literature review: Entry barriers and capital returns in the informal sector

Despite an abundant literature on the informal sector in developing countries (Moser, 1978; Peattie, 1987; Rakowsky, 1994; Maloney, 2004; Henley *et al.*, 2006), the empirical literature on entry barriers and returns to capital in micro and small enterprises is fairly recent and surprisingly little extensive. This is all the more remarkable since a very early insight from the literature on the informal sector is that it comprises very heterogeneous activities or, more specifically, heterogeneous forms of production (Hart, 1973). Along these lines, some authors posit that the informal sector and the self-employment can be divided into different segments characterised by different entry barriers in terms of skill or capital requirements (Fields, 1990; Cunningham and Maloney, 2001). Fields (1990), for example, distinguishes between a lower and an upper tier of the informal sector.

Theoretically, such heterogeneity can be attributed to the existence of entry barriers and imperfect capital markets. At very low levels of capital – below the entry barrier – returns to capital should be low and can be very high in capital scarce economies once this threshold has been passed. Before we take up these ideas in the subsequent section where we elaborate our analytical framework in more detail, the following paragraphs review the existing evidence on returns to capital in MSEs and (their relationship to) entry barriers.

De Mel *et al.* (2008), for instance, use data from a randomised experiment to estimate returns to capital of Sri Lankan microenterprises. In this experiment, the authors randomly give cash or in-kind transfers, which represent 55 to 110 percent of the median investment, to microenterprises. In a first step, the authors examine the impact of the transfers on capital stocks, profits and hours worked by the owner of the enterprise. They find a significant and positive correlation between transfers and real profits of the enterprises. Afterwards, they use the random treatment as an instrument for changes in the capital stock. By doing this and also correcting for the potential change in working hours as a consequence of the cash/in-kind transfer the authors compute returns to capital in a range from 55 to 70 percent per year. Furthermore, by analysing the heterogeneity in treatment effects, they are able to show that the high marginal returns are likely to be caused by credit constraints rather than insurance market failure.

Banerjee and Duflo (2004) use policy changes in a directed lending program as a natural experiment to compute returns to capital. The lending program under consideration came into effect in 1998 and was withdrawn only two years later. The authors assume that credit constrained firms will use the additional available funds for expansion while unconstrained firms will substitute other borrowing with this cheaper source of credit. Using a firm level panel dataset of Indian MSEs the authors provide evidence that some MSEs in India are indeed severely credit constrained. Furthermore, Banerjee and Duflo (2004) estimate returns to capital that are similar to the estimates of de Mel *et al.* (2008).

Udry and Anagol (2006) analyse both agricultural and non-agricultural investment in Ghana. They compare the returns earned in pineapple cultivation using a new technology and food crops using a traditional technology. The authors find average returns to investment in pineapple cultivation to be extremely high, up to 250 percent. However, this activity requires considerable initial investment: Exporters require farmers to plant a minimum of 0.135 hectares with pineapples, which implies an initial investment of at least 135 USD. However, with an order of magnitude of 30 to 50 percent, returns on food crops also turn out to yield fairly high returns and imply much lower entry costs. Udry and Anagol (2006) concede that their estimates may only be taken as an upper limit of the returns to capital, as it is not possible to distinguish between returns to capital and those to entrepreneurship. The high returns may hence be partly explained by the unobserved returns to taking entrepreneurial risk of a new technology. Therefore, in order to estimate a lower bound for returns to capital the authors use data on pairs of durable goods (here fan blade motors for taxis) that are equal in all respects but the life expectancy. Assuming that nothing else but the differences in the expected usage period of the goods, i.e. higher opportunity costs of capital, are the reason for the price differences the authors compute returns to capital of 60 percent.

Schündeln (2004) analyses panel data of Ghanaian manufacturing firms with less than 30 employees. He also finds high average marginal returns, but only low investment rates. Interestingly, the correlation between investment rates and returns to capital is very weak, especially for the group of firms with the largest returns. In a second paper (Schündeln, 2006), he then examines to what extent financing constraints can explain this puzzle by estimating a structural dynamic model. His results indicate that the smallest firms would take particular advantage of relaxed financing constraints that would trigger substantial increases in investment and capital stocks as well as consumption. These findings, however, do not explain why high marginal returns are not retained to finance investment.

Very high returns (an average annual real marginal rate of return of 113 percent) are also reported by Kremer *et al.* (2010) who study retail firms in rural Kenya. These rates of returns are derived, first, from information on foregone earnings due to insufficient inventory or stockouts. Second, the authors assess whether firms take advantage of quantity discounts from wholesalers, a procedure that yield similar estimates. Furthermore, returns are found to be very heterogeneous across firms, as illustrated by a standard deviation of more than 150 percent in the distribution of rates of return.

To our knowledge, these studies by Udry and Anagol (2006), Schündeln (2004, 2006) and Kremer at al. (2010) are the only studies from the SSA context that try to quantify the

returns to capital in the informal sector. There is, however, empirical evidence of African manufacturing firms based on panel data from Cameroon, Ghana, Kenya, Zambia and Zimbabwe. Using a production function approach Bigsten *et al.* (2000) compute mean returns to physical capital between 10 (Zambia) and 35 (Zimbabwe) percent.

McKenzie and Woodruff (2006) estimate returns to capital for microenterprises in Mexico using data from Mexico's National Survey of micro enterprises (ENAMIN). As we follow their empirical approaches very closely, our findings can be readily compared to theirs. They examine the heterogeneity of returns to capital at different sizes of capital stock as well as entry barriers for entrepreneurs into different economic activities. Using semi-parametric estimation techniques the authors detect high returns to investment at low levels of capital (20 percent per month). When looking at capital levels of 400 to 800 USD these returns fall by five percent (per month). McKenzie and Woodruff (2006) also examine start-up costs of micro enterprises that can be interpreted as entry barriers. Although start-up costs vary considerably by sector (for example, the transport sector shows relatively high start-up costs) they do not find that business start-up costs are high relative to income levels of the entrepreneurs.

To sum up, the existing empirical evidence suggests that in certain fields entry barriers to business activities exist for MSEs in poor countries. The reviewed literature on returns to capital of firms in developing countries shows that these enterprises show a great heterogeneity in returns to capital that range from 60 to 250 percent. In general, however, returns tend to be fairly high, in particular at lower levels of capital, a finding that most studies attribute to capital constraints. Overall, evidence on capital returns in small-scale activities is still scarce and somewhat inconclusive. Therefore, this paper addresses returns to capital and entry barriers into various economic activities of informal enterprises in the context of informal enterprises in SSA.

Analytical framework and hypotheses

The evidence presented above is partly consistent with a view of a technology with fixed costs and the presence of capital or insurance market imperfections. Incomplete capital markets have long been stressed as a major economic constraint on entrepreneurial activity in developing countries (e.g. Tybout, 1983; Bigsten *et al*., 2003). If capital markets function poorly because credit contracts cannot be easily enforced, capital fails to flow to its most productive uses and marginal returns across entrepreneurial activities are not equalised. Faced with different costs of capital, borrowers/entrepreneurs, e.g. because of differences in wealth and their capacity to provide collateral, may choose (or be forced) to invest in different technologies (Banerjee and Duflo, 2005).

The informal sector may then be divided into different segments characterised by different entry barriers in terms of skill or capital requirements (e.g. Fields, 1990; Cunningham and Maloney, 2001). These entry barriers pose a constraint to the entrepreneur if capital markets do not function properly, which, again, is likely to be the case in the SSA context. This basic idea is reflected and formalised in a number of models of economic development and poverty traps, which put forward the role of the distribution of wealth (e.g. Banerjee

and Newman, 1993; Galor and Zeira, 1993). In these models, the segmentation of economic activities and the co-existence of high and low returns is caused by the interaction of non-convex production technologies and capital market imperfections. If gainful entrepreneurial activities require a certain level of start-up capital that cannot be obtained from capital markets, poorly endowed individuals will be prevented from entry. This implies that poor individuals get stuck in low-productivity activities and hence the whole economy may end up in a poverty trap; the higher the share of initially poor people, the higher the share of those in low-productivity industries.[3]

Hence, these models typically assume very low levels of returns, or subsistence returns, at very low levels of capital and higher returns once a certain threshold has been passed. In the simplest of worlds, the entrepreneur maximises the difference between output *y* and the costs of capital (*rk*), i.e. profit π subject to his borrowing constraint $\overline{B}$. He can only produce a non-zero output using neoclassical technology f if he is able to raise at least $\overline{K}$. Otherwise his production will be eaten entirely by the costs of capital and his profit will be zero.

Max. $\pi = y - rK$ (1)

s.t. $y = f(K)$ if $K > \overline{K}$ (2)

$y = rK$ if $K \leq \overline{K}$ (3)

$K \leq \overline{B}$ (4)

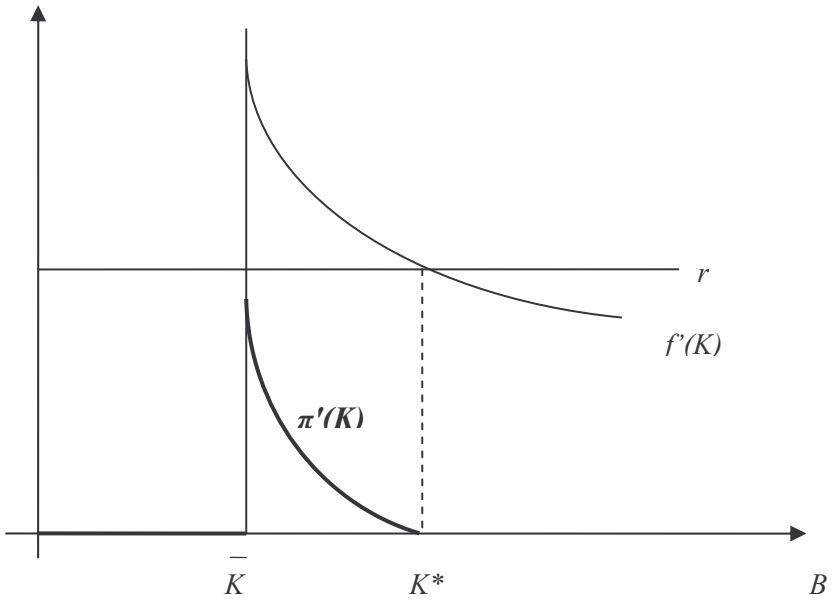
The entrepreneur will chose his capital stock such that

$f'(K) = r$ if $\overline{B} > \overline{K}$ (5)

If his borrowing constraint is binding, i.e. $\overline{B} \leq \overline{K}$, then the entrepreneur will be indifferent between different sizes of capital stock, as he earns zero profits anywhere between $0 \leq K \leq \overline{K}$. Returns to an additional unit of capital, i.e. $\pi'(K)$, will hence be 0 between $0 \leq K \leq \overline{K}$. Once his borrowing capacity allows the entrepreneur to pass the threshold $\overline{K}$, he earns very high marginal returns that fall to zero when he reaches the optimal level of capital K^*. The resulting patterns of marginal returns to capital as a function of the borrowing constraint B are presented in the graph below.

[3] Uncertainty can also create such poverty traps.

Figure 1: Borrowing constraints and marginal returns to capital



Source: Authors' compilation.

This small exposition allows us to formulate two basic hypotheses to be tested subsequently: First, the existence of a threshold $\overline{K}$ should be observable in the distribution of initial investment undertaken by MSEs. Second, returns to capital should be low at low levels of capital, and high but decreasing in K at higher levels.

Entry costs and capital returns in African MSEs

Data

We test these hypotheses by using data that stems from a set of surveys called 1-2-3 surveys (Enquêtes 1-2-3) in seven economic capitals of the West-African Economic and Monetary Union (WAEMU) in the early 2000s.[4] A 1-2-3 survey is a multi-layer survey organised in three phases and specially designed to study the informal sector.[5] Phase 1 is a representative labour force survey collecting detailed information on individual socio-demographic characteristics and employment. Phase 2 is a survey which interviews a representative sub-sample of informal production units identified in Phase 1. The focus of the second phase is on the characteristics of the entrepreneurs and their production unit, including the characteristics of employed workers. It also contains detailed information on input use,

[4] These urban centres are Abidjan, Bamako, Cotonou, Dakar, Niamey, Lomé and Ouagadougou. The surveys have been carried out by AFRISTAT and the National Statistical Institutes (INS) with the support of DIAL as part of the Regional Program of Statistical Support for Multilateral Surveillance (PARSTAT) between 2001 and 2003. For a more detailed description of the data see Brilleau, Ouedraogo and Roubaud (2005).

[5] See Roubaud (2008) for a detailed assessment of this type of survey instrument.

investment, sales, profits and the unit's forward and backward linkages. Phase 3 is a household expenditure survey interviewing (again) a representative sub-sample of Phase 1. The data of all three phases is organised in a way so that it can be linked. For this paper we use data from Phase 2 which hence is a sub-sample of informal entrepreneurs in seven West-African urban centres (Brilleau, Ouedraogo, and Roubaud, 2005).

Basic MSE characteristics

The 1-2-3 surveys define informal enterprises as production units that (a) do not have written formal accounts and/or (b) are not registered with the tax administration. Part (b) of this definition varies slightly between countries, as registration may not always refer to registration with tax authorities. The so-defined informal sector accounts for the vast majority of employment in the WAEMU cities covered by the surveys, as illustrated in Table 1. The share of informal sector employment exceeds 70 percent in all cities considered – in Cotonou and Lomé even 80 percent. Employment in informal firms is typically self-employment, i.e. the employed individual is also the MSE owner, but employed and/or helping family- and non-family workers account for 30 to 40 percent of employment in this sector.

Table 1: Employment by sector in seven West-African urban centres (in percent)

Principal employment	Cotonou	Ouaga.	Abidjan	Bamako	Niamey	Dakar	Lomé	Total
Public administration	6.3	10.4	5.5	7.5	13.5	5.7	5.2	6.6
Public firm	2.2	2.3	1.1	2.5	1.8	1.8	2.3	1.8
Private formal firm	9.9	11.8	17.6	11.4	11.8	15.0	10.5	14.2
Private informal firm	80.3	73.4	74.7	77.5	71.1	76.4	81.0	76.2
of which								
Owners	63.7	67.5	60.4	73.4	72.2	65.2	68.6	65.0
Family workers	19.2	16.3	16.1	8.6	14.5	17.6	13.6	15.5
Non-family workers	17.1	16.2	23.5	18.0	13.3	17.2	17.8	19.5
Associations	1.3	2.1	1.1	1.1	1.8	1.1	1.0	1.2

Source: Brilleau, Roubaud and Torelli (2005), and authors' computations based on 1-2-3 surveys (Phase 2, 2001/02, AFRISTAT, DIAL, INS).

The 1-2-3 surveys do not (explicitly) apply a size criterion, but more than 90 percent of the enterprises employ a maximum of three people including the owner and possibly employed family members. As shown in Table 2 below, around 70 percent of informal enterprises function in 'pure self-employment' mode, i.e. they only consist of the owner her- or himself. Accordingly, the average enterprise size – including all employed family- and non-family-members – is only 1.6 individuals. The information in Table 2 has been computed from a sample of 6,521 informal enterprises from all seven countries that will be used for all the subsequent empirical analyses. This number includes 243 MSEs reporting zero profits and 892 MSEs with zero capital stock.

Table 2: Basic descriptive statistics of informal MSEs

	Mean	Median
Age of the enterprise	7.4	5.0
Owner's age	36.3	35.0
Owner's years of schooling	3.7	3.0
Owner's experience	6.9	4.0
Owner female	0.51	
Firm size	1.6	1.0
Share of pure self-employment	0.69	
Monthly profit (in 2001 1000 CFA Francs)	87.6	25.8
Monthly profit (in 2001 Euro)	133.2	39.2
Monthly profit (in 2001 international Dollar)	380.3	112.0
Capital stock (in 2001 1000 CFA Francs)	229.8	17.7
Capital stock (in 2001 Euro)	349.2	26.9
Capital stock (in 2001 international Dollar)	997.2	76.8
Number of observations	6521	

Source: Authors' computation based on 1-2-3 surveys (Phase 2, 2001/02, AFRISTAT, DIAL, INS).
Notes: Monetary values are in current international dollars on the basis of the Purchasing Power Parity converters for GDP from the World Development Indicators (World Bank, 2010).

Albeit small, these enterprises had been in operation since more than seven years on average. The median age, however, is significantly lower with only five years. Owner's experience in the business is typically lower than the enterprise age, mainly reflecting that some MSEs are transferred within the family. MSE owners have only 3.7 years of schooling on average and about half of them are female.

Average monthly profits of informal enterprises are about 90 000 CFA Francs (about 135 Euro or 380 International Dollar, Int. $) with median profits at only 25 000 CFA Francs, i.e. close to 1.25 Euro a day. Profits are computed as value added (sales minus input costs including expenses for products for re-sale) minus expenses for hired labour. The questionnaire has very detailed sections on sales of transformed, non-transformed/re-sold products as well as offered services. The same holds for the input side that covers raw materials, intermediates, products for re-sale, taxes, rents and other utility costs. All these items are covered for the last month in the survey. Please note that interest payments must not be deducted from value added.

Average capital stock is fairly high with about 230 000 CFA Francs, but this result is driven by a few MSEs with very high capital stocks – the median MSE capital endowment stands at only 18 000 CFA Francs, around 25 Euro or 75 Int. $. We measure capital stock by the replacement value of all business-related assets, including the business establishment, machines, furniture, vehicles and utilities. More specifically, the entrepreneur is asked to report all the equipment that he has used in the last year to operate his business and the replacement value of each item.[6] While this implies that the corresponding equipment is used for the operation of the business, it is impossible to determine whether this is its sole use or whether it is also used for other purposes in the household. We will come back to this

[6] Unfortunately, we do not have any information about sales of or damage to capital goods

point in the discussion of our results. Another complication of computing capital stocks stems from the fact that capital is also bound by inventories (or stocks of raw materials). This is ignored in the above calculation, but we will take this into account when we analyse entry barriers and returns to capital below.

For a first assessment of MSE heterogeneity, we also report the above characteristics by capital quintiles (Table 3). The first quintile basically works without capital and these MSEs mainly comprise trading activities and other services (industry composition not reported). The profits of these enterprises are around 200 Int. $, almost double median profits. Typically, these MSEs are self-employed individuals. This also holds for entrepreneurs in the second capital quintile. They resemble those without capital, but are significantly less educated and earn about 30 Int. $ less per month. In the third quintile, profits are more than 70 percent higher than in the second quintile while the average capital stock approximately quadruples. Yet, it remains low at only about 80 Int. $ on average. The MSEs have owners who still have below average years of schooling, but 0.7 years more than those with very little capital. Fewer owners are female and their firms are slightly bigger than in the lower quintiles. From the third to the fourth quintile, changes are similar to moving from the second to the third. Capital stock again quadruples, owner's average education increases, as does firm size and the share of male owners. However, monthly profits only increase by 70 Int. $ on average to 370 Int. $. Much more pronounced are the differences in capital and profits between the fourth and the fifth quintile. Average capital stock of MSEs in the fifth quintile is almost 5 000 Int. $ and monthly profits are much higher than in other enterprises. These entrepreneurs also tend to be much better educated than the average and more than half of them employs at least a second person.

Table 3: Basic descriptive statistics of informal MSEs, by quintiles of capital stock (values in 2001 international Dollar)

	Quintiles of capital (min and max capital in Int. $ in parentheses)				
	1 (0-10)	2 (10-42)	3 (42-155)	4 (155-731)	5 (733-106166)
Age of the enterprise	6.7	7.1	8.2	7.7	7.4
Owner's age	35.2	35.8	36.8	36.1	37.8
Owner's years of schooling	3.3	2.5	3.2	3.9	5.5
Owner's experience	6.1	6.6	7.6	7.1	6.9
Owner female	0.6	0.7	0.5	0.4	0.3
Firm size	1.1	1.2	1.5	1.9	2.5
Share of pure self-employment	0.9	0.9	0.7	0.6	0.4
Monthly profit (in 2001 international Dollar)	206.7	179.9	323.0	412.0	783.3
Capital stock (in 2001 international Dollar)	2.1	23.4	83.6	351.8	4554.4
Number of observations	1324	1293	1306	1302	1296

Source: Authors' computation based on 1-2-3 surveys (Phase 2, 2001/02, AFRISTAT, DIAL, INS).

These descriptive statistics indeed hint at a considerable degree of heterogeneity within the informal sector although MSEs of the bottom 40 percent of the capital distribution share a number of common characteristics. This heterogeneity – also in profits – seems to be linked to capital stock, which, in turn, may be associated to the respective sector of activity.

Therefore, Table 4 shows the industry distribution of the MSEs for each country and for the sample as a whole. Overall the most important sector is 'petty trading' (27.1 percent), followed by 'other manufacturing and food' (16.1 percent) and 'other services' (11.8 percent), i.e. services that are not covered by the other listed industries. The smallest sector in terms of its share is the transport sector, which is likely to require substantial start-up costs, including investment in physical capital and cost for licences (4.6 percent). The relative importance of the various industries is in line of what one would expect when looking at demand patterns. Whereas small services, small traded goods and food have a high share in the households' budgets, transport or repair services have a rather small share. It is also interesting to see that the industry distribution is relatively homogenous across the seven countries, with two exceptions though: 'Other manufacturing and food' are particularly frequent in Ouagadougou and Niamey. These cities have in turn relatively low shares for the sector 'hotels and restaurants', so it might be that the border between 'producing or processing food' and 'selling food in a restaurant' was not drawn exactly in the same way in the seven cities under study. The industry composition seems to be relatively unrelated to the level of GDP per capita; the richer centres in the sample such as Abidjan and Dakar have not a substantially different distribution than Niamey and Lomé.

Table 4: Industry composition of informal MSEs by country (number of observations and shares in percent)

Industry/City	Cotonou	Ouaga.	Abidjan	Bamako	Niamey	Dakar	Lomé	Total
Clothing and apparel	98	78	122	137	56	98	117	706
	10.5	*8.2*	*12.3*	*14.0*	*7.9*	*9.8*	*12.3*	*10.8*
Other manufacturing & food	102	223	103	134	225	151	106	1,044
	11.0	*23.3*	*10.4*	*13.7*	*31.6*	*15.2*	*11.1*	*16.0*
Construction	70	68	68	101	39	91	55	492
	7.5	*7.1*	*6.9*	*10.3*	*5.5*	*9.1*	*5.8*	*7.5*
Wholesale/retail shops	104	103	102	92	46	109	100	656
	11.2	*10.8*	*10.3*	*9.4*	*6.5*	*10.9*	*10.5*	*10.1*
Petty trading	235	251	262	265	194	283	279	1,769
	25.3	*26.2*	*26.5*	*27.1*	*27.2*	*28.4*	*29.2*	*27.1*
Hotels and restaurants	89	78	80	40	8	50	66	411
	9.6	*8.2*	*8.1*	*4.1*	*1.1*	*5.0*	*6.9*	*6.3*
Repair services	67	51	63	49	41	36	68	375
	7.2	*5.3*	*6.4*	*5.0*	*5.8*	*3.6*	*7.1*	*5.8*
Transport	80	22	43	37	26	54	39	301
	8.6	*2.3*	*4.3*	*3.8*	*3.7*	*5.4*	*4.1*	*4.6*
Other services	85	83	147	124	78	125	125	767
	9.1	*8.7*	*14.9*	*12.7*	*10.9*	*12.5*	*13.1*	*11.8*
Total	930	957	990	979	713	997	955	6,521
	100	*100*	*100*	*100*	*100*	*100*	*100*	*100*

Source: Authors' computation based on 1-2-3 survey (Phase 2, 2001/02, AFRISTAT, DIAL, INS).
Note: Shares (in percent) in italics.

Entry barriers

We now turn to the empirical analysis of the existence of entry barriers into informal activities. We expect that MSEs engage in petty (or subsistence) activities that require little

capital as well as more capital intensive activities that involve considerable initial investment. In some industries, for example trade, we expect more of these activities than in others, for example transport. We therefore first analyse distributions of initial investment in equipment that should reflect these patterns. In a second step, we also consider other start-up costs including expenses for other inputs and inventories.

Before we quantitatively examine these entry barriers, we briefly report and comment some evidence from questions that ask entrepreneurs for the problems they face. Table 5 reports the share of entrepreneurs who report to have problems in a specific area. We distinguish MSEs (only in the clothing and apparel sector to reduce heterogeneity) by their age in order to determine whether those problems are different when an enterprise starts operating. Two groups of problems figure prominently for MSEs in the clothing and apparel sector; on the one hand, those related to the lack of demand (not enough clients, too much competition) and, on the other, those associated to the access to capital in broad sense (access to credit, lack of locality, machines, and equipment). Access to raw material is a problem only for 25 percent of the MSEs, but much more so for younger ones. Demand-related problems seem to be equally important for MSEs at all ages, and so for a vast majority. Half of the firms report to have inadequate access to credit. The answer to this question (and the next question on credit too expensive) is likely to be biased by actual experience of demanding/being declined credit, which might explain why more of the older firms report to have problems in this area. This seems plausible, as problems that result from credit constraints, such as the lack of locality, machines, and equipment, are indeed cited more frequently by younger firms suggesting that these costs may represent important barriers to entry. Other constraints, such as the lack of qualified personnel, technical or management problems, and institutional or governance constraints appear to be much less important. There is also no evidence that these problems are more important when firms start operating.[7]

[7] We are aware that these descriptives are biased by the fact that some constrained firms never set up shop. This also holds for the subsequent analyses and is a bias that is impossible to address with the data at hand.

Table 5: Perceived problems faced by MSEs in the clothing and apparel sector by enterprise age

	All	Enterprise age			
Problem		less than 1 year	2-3 years	4-8 years	more than 8
Access to raw materials	0.25	0.35	0.22	0.25	0.23
Not enough clients	0.67	0.68	0.72	0.67	0.64
Too much competition	0.59	0.56	0.59	0.59	0.60
Access to credit	0.48	0.46	0.46	0.47	0.51
Credit too expensive	0.28	0.27	0.34	0.25	0.27
Recruitment of qualified personnel	0.12	0.13	0.14	0.10	0.11
Lack of adequate locality	0.38	0.43	0.38	0.40	0.34
Lack of machines, equipment	0.44	0.46	0.46	0.45	0.40
Technical difficulties of production	0.16	0.16	0.19	0.17	0.15
Management difficulties	0.13	0.07	0.14	0.14	0.13
Too many regulations and taxes	0.10	0.07	0.09	0.11	0.11
Number of observations	706	93	164	194	255

Source: Authors' computation based on 1-2-3 survey (Phase 2, 2001/02, AFRISTAT, DIAL, INS).

Although our dataset is cross-sectional, it allows us to identify investment paths since, for each enterprise asset, we know the date of purchase. Furthermore, we know when an enterprise has been established. As a proxy for initial investment in equipment we therefore use the accumulated investment undertaken during the first year of operation. As we expect measurement error in the investment history of MSEs in our data to be severe for investments undertaken a long time ago, the subsequent analysis of this section only considers enterprises that have been established four years before the survey or later. This leaves us with a sub-sample of 3144 informal enterprises.

We first examine initial investment by industry. Table 6 hence shows the replacement value of business assets accumulated in the first year of operation at certain quantiles of the initial-investment distribution. The statistics are again based on the pooled data from all seven countries in the dataset.

Table 6: Entry barriers to informal enterprises (values in current Int. $)

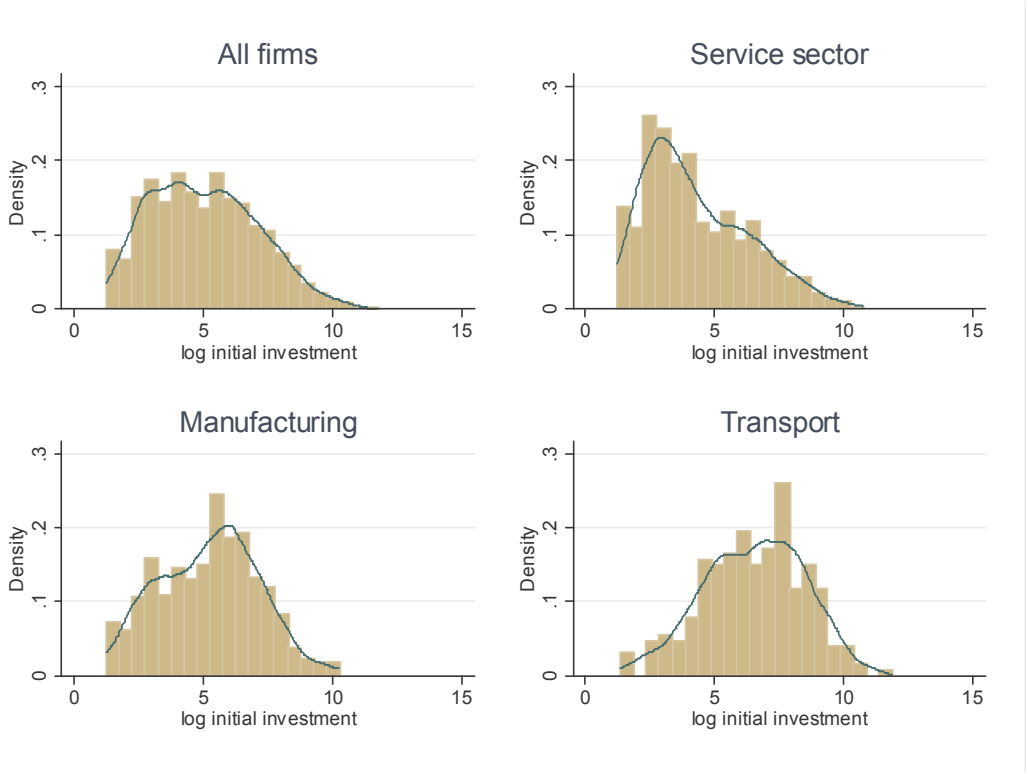
	Obs.	Share 0 init. inv.	Mean	Mean (>0)	p10	p25	p50	p75	p99
Clothing and apparel	319	0.18	813	994	0	14	233	615	10955
Other manfg & food	493	0.23	708	919	0	5	46	364	20781
Construction	128	0.30	262	377	0	0	31	119	3961
Wholesale/retail shops	329	0.39	684	1119	0	0	24	193	14974
Petty traders	943	0.38	177	288	0	0	10	35	2607
Hotels and restaurants	229	0.14	802	937	0	30	93	396	8860
Repair services	159	0.17	1150	1386	0	36	200	708	30347
Transport	171	0.29	3645	5109	0	0	932	3397	34074
Other services	373	0.42	760	1318	0	0	15	296	15401
Total	3144	0.31	734	1060	0	0	30	275	12740

Source: Authors' computation based on 1-2-3 survey (Phase 2, 2001/02, AFRISTAT, DIAL, INS).

Overall, levels of initial investment in equipment are fairly low. Quite a number of activities do not seem to require any initial investment. This holds for 31 percent of all enterprises and somewhat less for "capital intensive" informal industries, such as repair services and hotels and restaurants. In most activities, initial investment however remains low also at higher quantiles. The median petty trader, for example, still does not invest more than 10 Int. $ during the first two years after establishing the enterprise. However, although 29 percent of all enterprises in the transport sector do report zero initial investment, the median initial investment of investing MSEs is about five times larger than for the repair services sector and the clothing sector, the industries with the second and third largest values. The top 25 percent in the transport sector invested more than 3400 Int. $ in the first two years. Overall, there is substantial heterogeneity of start up costs across industries,[8] as also illustrated by Figure 2 showing the distribution of (log) initial investment for all enterprises, the service, the manufacturing and the transport industries. These figures allow checking for discontinuities in this distribution. Such discontinuities would be a sign of entry barriers into more capital intensive activities in a given sector. The service sector seems to have such a barrier at very low levels of capital at around 50 Int. $. The distribution for the manufacturing sector shows several discontinuities but they are not sufficiently pronounced to truly call them entry barriers. The transport sector shows a spike between 7 and 8 in log initial investment, i.e. above 1000 Int. $. Overall, this brief descriptive analysis does not lend support to significant entry barriers in terms of investment into equipment that would separate different segments of MSE activities, neither across nor within specific industries. Rather, except for the fact that many firms do not invest at all in physical capital, we do not find evidence for major entry barriers.

[8] It turns out that the distributions of start-up costs across industries in the different countries are fairly similar to those reported in Table 5.

Figure 2: Histograms of initial investment (values in current Int. $)



Source: Authors' computation based on 1-2-3 surveys (Phase 2, 2001/02, AFRISTAT, DIAL, INS).
Note: The histograms exclude zero investment.

To test whether these initial investments are high relative to profits of informal entrepreneurs we divide the required initial investment by monthly MSE profits. Table 7 thus shows the number of months necessary to earn the amount equivalent to accumulated business assets shown in Table 6. The numbers illustrate again that in some industries equipment costs are indeed substantial – albeit not insurmountable – while they are negligible in others. In the transport and the clothing and apparel sector, for instance, almost three months of earnings are necessary to cover median initial investment. Assuming that an entrepreneur can save about 10 percent of his earnings, it would take him about 30 months to bear the median costs in that sector. However, in most other industries, equipment costs represent on average about one or two weeks of earnings.

Table 7: Initial investment relative to income levels (values in current Int. $)

	Median monthly profits	Implied months of earning needed for initial median investment
Clothing and apparel	76.8	3.0
Other manfg & food	97.9	0.5
Construction	187.4	0.2
Wholesale/retail shops	130.7	0.2
Petty traders	69.9	0.1
Hotels and restaurants	169.7	0.5
Repair services	125.4	1.6
Transport	293.3	3.2
Other services	102.2	0.2
Total	104.8	0.3

Source: Authors' computation based on 1-2-3 surveys (Phase 2, 2001/02, AFRISTAT, DIAL, INS).

However, as indicated above, entrepreneurs incur additional costs when they want to start a business. These costs include recurrent expenses, such as expenses for raw materials and building up inventories. While these costs will in principle be recovered once the final product is sold, they need to be financed when the business starts operating. Unfortunately, our dataset does not allow us to compute those costs at start-up. We only know the monthly recurrent expenses that we report in Table 8 (based on the same sample as Tables 6 and 7) along with initial investment. Admittedly, these monthly expenses are an imperfect proxy of this component of start-up costs. For some industries, for example the wholesale and retail sector, it may be reasonable to assume that inventories bought during the last month correspond to what would be needed if a shop were set up. A petty trading activity, however, can possibly be started with a fraction of the reported monthly purchases of inventories. The interpretation of these figures will hence be somewhat speculative.

Table 8: Additional start-up costs compared to initial investment (values in current Int. $)

	Initial investment		Non-labour expenses		Raw material		Inventory		Labour expenses	
	Mean	p50	Mean	p50	Mean	p50	Mean	p50	Mean	p50
Clothing and apparel	813	233	164	58	111	27	5	0	5	0
Other manfg & food	708	46	396	170	308	105	27	0	8	0
Construction	262	31	624	34	509	0	9	0	32	0
Wholesale/retail shops	684	24	1477	414	48	0	1318	359	4	0
Petty traders	177	10	511	182	52	0	424	136	3	0
Hotels and restaurants	802	93	944	545	590	384	263	0	9	0
Repair services	1150	200	306	88	87	0	95	0	11	0
Transport	3645	932	683	284	92	0	31	0	17	0
Other services	760	15	230	35	28	0	66	0	8	0
Total	734	30	560	151	157	0	304	0	8	0

Source: Authors' computation based on 1-2-3 surveys (Phase 2, 2001/02, AFRISTAT, DIAL, INS).
Note: Non-labour expenses include raw materials, inventories, and all other recurrent expenses (for example fuel).

While labour expenses seem to be negligible, monthly non-labour expenses can be substantial compared to initial investment. The patterns correspond to expectations with raw materials being more important for manufacturing and construction, while inventories account for the major part of non-labour expenses for trading activities. It seems that investment in equipment indeed accounts for a large part of start-up costs in manufacturing activities (with the likely exception of food processing). The figures suggest that this is less the case at lower levels of capital, as the difference between mean and median is much smaller for non-labour expenses than for initial capital. For trading activities, the costs of building-up inventories may be as important as initial investment in equipment, albeit there is likely to be quite some heterogeneity in this sector in this regard.

In sum, while the above analysis of initial investment in equipment indicates low or no entry barriers for a large part of informal activities with some capital-intensive exceptions, the analysis of additional expenses at start-up – albeit using imperfect information – suggests that entry barriers for an important share of activities may be considerable. When we combine the information on expenses on equipment capital accumulated during the first 12 months of operation and recurrent monthly costs, this adds up to less than 30 Int. $ for only 12 percent of the MSEs. Hence, while there exists an informal sub-sector, for which fixed costs of entry are negligible, there seem to be some fixed cost associated to entry into a considerable fraction of informal activities.

Returns to capital

We now turn to the estimation of the returns to capital. Unfortunately, the cross-sectional character of our data does not allow us to estimate the returns to initial investment (or to additional investment), but only to total capital stock. In our empirical model, profits π_{ihj} of MSE *i* in household *h* residing in country *j* are not only a function of capital K_{ihj}, but also of a vector of exogenous variables X_{ihj} and two unobserved factors, one at the household level ϑ_{hj}, for example household wealth, and one at the individual level ϑ_{ihj}, which we primarily think of as entrepreneurial ability. These factors do not only influence profit directly, but simultaneously determine the size of the capital stock.

$$\pi_{ihj} = f(K_{ihj}(\vartheta_{hj}, \vartheta_{ihj}), X_{ihj}, \vartheta_{hj}, \vartheta_{ihj}) \tag{6}$$

In log-linearised form and with u_{ihj}, a random error, the equation can be expressed as

$$\ln(\pi_{ihj}) = \alpha + \beta_K \ln K_{ihj} + X'_{ihj}\delta + \beta_{\vartheta 1}\vartheta_{hj} + \beta_{\vartheta 2}\vartheta_{ihj} + u_{ihj}. \tag{7}$$

The observable exogenous characteristics of the entrepreneur in the models estimated below are the MSE owner's years of schooling, experience and gender. We also include total labour input in hours (including both household and hired labour). Further 'exogenous' variables include industry dummies as well as country dummies. The cross-sectional estimation of equation (7) is confronted with a number of potential biases. First, β_K may be biased due to the omitted variables mentioned above that are, again, correlated with both the capital stock and profits. The classical example for such a variable in this context is unobserved ability of an entrepreneur. Certain managers will have abilities that allow them

to accumulate more capital and to generate more profits than others. The omission of these abilities in equation (7) will lead to an upward bias of β_K. Another important unobserved factor may be positive social network effects that help to overcome imperfections in the capital and labour markets. Moreover, the estimation of equation (7) is confronted with a potential problem of reverse causality, i.e. higher profits allow faster capital accumulation. This bias would also lead to un upward bias of β_K. Finally, the estimation of equation (7) has to deal with classical measurement error, in both profits and capital stocks, which will downward bias the coefficient β_K. We explain below how we address these different biases. A test for heterogeneity in returns, i.e. in β_K as a function of *K*, can be introduced in various ways. Our approach is to simply split the sample into entrepreneurs with different levels of capital stock.

Without the intention to ignore the above caveats, Table 9 below reports the results from OLS regression of different specifications for all enterprises and for sub-samples of low (lower than 150 Int. $), medium (higher than 150 Int. $ and lower than 1000 Int. $) and higher capital stock (higher than 1000 Int. $). These thresholds were chosen rather ad-hoc on the basis of the above shown distribution of initial investment (specifically the 1000 Int. $ threshold) as well as non-parametric plots of capital profitability (profit/capital) against capital (not reported). The latter suggest very high capital profitability at low levels of capital that falls very quickly with increasing levels of capital. At around 150 Int. $ capital profitability starts to decrease much slower than at lower levels. In addition, the thresholds were chosen such that the sub-samples remain sufficiently large. The applied thresholds imply a split of the sample into about 50 percent of low-capital, 30 percent of medium-capital and 20 percent of high-capital MSEs.

We estimate the profit function in two different specifications. First, in a double-log-specification, i.e. we regress log profits on log capital and log labour (as in equation 7); second, a specification where monthly profits are explained by a second-degree polynomial in both capital and labour. Albeit trivial, we briefly want to point at the differences between these specifications. The double-log specification assumes a constant capital elasticity of profits and marginal returns of capital – our main variable of interest – eventually depends on capital profitability (π/K). More precisely marginal returns will be the product of β_K and (π/K). Since the estimated elasticity is an average effect, we should compute (average) marginal returns at the average of (π/K). Yet, evaluating returns at different levels of capital with possibly different levels of capital profitability may yield interesting insights as well. Econometrically, an advantage of the double-log specification is that estimated parameters are known to be less influenced by outliers, in particular large values of profits and capital, compared to a linear specification. A specification in polynomials, however, is more flexible. It can be written as follows:

$$\pi_{ihj} = \alpha + \beta_{K1} K_{ihj} + \beta_{K2} K_{ihj}^{\ 2} + X'_{ihj}\delta + \beta_{\vartheta 1}\vartheta_{hj} + \beta_{\vartheta 2}\vartheta_{ihj} + u_{ihj}\,. \qquad (8)$$

Marginal returns will then be a linear function of capital: $\beta_{K1} + 2\beta_{K2}K$. In both specifications we include the abovementioned control variables. The regressions exclude enterprises that report to operate without any capital (and/or zero profits), which leaves us

with 5 403 observations (of 6 584). We will address to the possible biases introduced by this procedure later. Finally, we drop influential outliers from our sample (and sub-samples) that we identify by the DFITS-statistic. As suggested by Belsley, Kuh, and Welsch (1980), we use a cutoff-value $|DFITS|_{ihj} > 2\sqrt{k/N}$ with k, the degrees of freedom (plus 1) and N, the number of observations. As illustrated in Table 9, this procedure reduces the samples quite considerably. For the whole sample, we lose another 308 observations (a reduction from 5403 to 5095). This may partly be due to measurement and reporting errors, but it may also reflect the great heterogeneity of informal MSEs.

Table 9: Returns to capital – results from OLS

	Dependent variable: (Log) monthly profits							
Sub-sample	All		Capital < 150 Int. $		Capital >150 Int. $ & < 1000 Int. $		Capital > 1000 Int. $	
	log OLS	no-log OLS	log OLS	no-log OLS	log OLS	no-log OLS	log OLS	no-log OLS
Log capital	0.227***		0.299***		0.139*		0.440***	
	(0.009)		(0.024)		(0.058)		(0.044)	
Capital		0.048***		2.190***		0.008		0.048**
		(0.007)		(0.406)		(0.216)		(0.016)
Capital squared		-0.000		-0.010**		0.000		-0.000
		(0.000)		(0.003)		(0.000)		(0.000)
Controls	Labour, owner's education/experience/gender, industry dummies, country dummies, industry-country interactions							
R-squared	0.372	0.238	0.302	0.178	0.306	0.192	0.354	0.199
N	5104	5267	2753	2833	1407	1449	936	965
Sub-sample means and median profits and capital and marginal returns to capital (MRK)								
Average profit (P)	326	290	195	176	364	310	722	656
Median P	129	123	95	92	155	146	318	298
Average capital (K)	1054	850	45	45	420	420	5280	4985
Median K	108	108	33	33	349	349	2507	2496
Implied MRK (at average P and K)	0.07	0.05	1.29	1.29	0.12	0.01	0.06	0.05
Implied MRK (at median P and K)	0.27	0.05	0.87	1.54	0.06	0.01	0.06	0.05

Source: Authors' computation based on 1-2-3 surveys (Phase 2, 2001/02, AFRISTAT, DIAL, INS).
Notes: * p<0.05, ** p<0.01, *** p<0.001. Robust standard errors corrected for clustering at the 'segment'-level (around 10 observations) in parentheses. MRK = marginal monthly return to capital. The full results are shown in Appendix 1.

The first two columns in Table 9 report the results from the full, albeit reduced, sample. A capital elasticity of 0.23 looks high at first sight, but when evaluated at mean capital-profitability the marginal return to capital (MRK) turns out to be fairly low with a return of 7 percent per month on additional investment. At lower levels of capital, for example the median, capital profitability is higher and gives a monthly marginal rate of return of approximately 27 percent. This number refers to a hypothetical entrepreneur with median

level of capital and median level profits. In the second specification, only the linear term related to capital turns out to be significant. Hence, monthly marginal rates of return are close to this coefficient, which yields a three percent monthly MRK. The no-log specification explains less of the variation in profits than the double-log specification, as illustrated by the consistently higher R-squared. However, the latter specification also loses considerably more observations identified as highly influential outliers. Here, the higher flexibility of the polynomial may thus be able to accommodate more of the observed outcomes. This holds as well for the estimates based on sub-samples. Overall, the estimations explain an acceptable portion of the variation in profits, and the coefficients of the control variables (reported in Appendix 1) turn out to be reasonable and yield some interesting additional insights that we comment in more detail below.

Before we do so, however, we examine what happens to the return estimates when we split the sample according to the thresholds defined above.[9] The main results are surprising: We find very high marginal returns at low levels of capital. At levels of capital above 1000 Int. $, returns are much lower, but still reasonably high with a monthly marginal rate of return of about five percent. However, at medium levels of capital between 150 and 1000 Int. $, we cannot establish a robust positive relationship between capital and profits. At low levels of capital, the average monthly MRK even exceeds 100 percent – in both specifications. The polynomial specification suggests very high but also strongly decreasing marginal returns to capital. The coefficients on both capital and capital squared are highly significant. In contrast, the coefficient on capital turns out to be significant for the medium range of capital stock only in the double-log specification (at the 90 percent level) and insignificant in the polynomial specification. While the MRK thus computed is 12 percent at the mean and 6 percent at the median with the log-specification, it is hardly different from zero at the sub-sample mean and median capital under the alternative specification. For higher levels of capital, the estimated profit elasticity is very high, but lower capital profitability yields average returns of 6 percent monthly. The no-log estimates are slightly lower with non-decreasing marginal returns, as the coefficient on the quadratic capital term is almost zero. In sum, this first set of estimates suggests very heterogeneous returns to capital – with very high and strongly decreasing marginal returns initially, a range of very low or even zero marginal returns at medium levels of capital and stabilizing returns of 6 percent at levels above 1000 Int. $.

To put these results on capital returns into perspective, it is instructive to consider the effects of the control variables, which are reported in Appendix 1. In contrast to the returns to capital, the returns to labour appear to be fairly homogeneous across the sub-samples. The returns to one additional year of schooling are 2.8 percent for the entire sample (in the log-specification). The returns to schooling turn out to be higher, 5.6 percent, at high levels of capital compared to only two percent at low and medium levels. These results have to be taken with a grain of salt since they are very likely to be contaminated by ability bias. The returns to experience are somewhat higher at medium levels of capital than for both low and high levels. For medium levels of capital, the return to one additional year of experience

[9] All the results are robust to slight variations in the thresholds.

(2.8 percent) even exceeds the return to an additional year of schooling. For both low and high levels of capital, this is not the case. The coefficient of the female dummy is of similar magnitude in all specification (on all sub-samples). Female entrepreneurs earn around a third less (this corresponds to a coefficient of -0.4 in the log-specification) than their male counterparts. We return to gender differences in more detail later.

The coefficients of the country dummies have to be interpreted against Dakar (Senegal), one of the richest cities in the sample, as reference category. The regressions yield the expected pattern across countries. Profits are lower in the poorest cities Cotonou, Ouagadougou, Niamey, and lowest in Lomé. These differences are similar across the different sub-samples. The reference group for the industry dummies are the petty traders, presumably one of the groups in the informal sector with lowest earnings. The regression results indicate that this is only partly true, as only construction and hotels and restaurants turn out to have consistently higher profits than petty trade. The repair service sector even exhibits lower returns in a number of specifications. In sum, the results with regard to the control variables can be taken as an indication of the appropriateness of the above specifications – including mid-range levels of capital. We rather exclude the possibility that measurement error is responsible for the very low returns at levels of capital between 150 and 1000 Int. $, since we can think of no obvious reason why capital stocks would be measured in this segment with more error than in other parts of the capital stock distribution.[10]

In the following, we present the results of a number of robustness and specification checks. We first address the possible implications of how we measure our key variables. Then, we address parameter heterogeneity across countries, industries, and also gender. We continue with an investigation of the problem of missing or zero values for capital and profits and address the possibility of omitted variable biases, in particular ability bias.

Measurement error of both profits and capital should tend to bias the estimated coefficients towards zero, so this source of bias does not give rise to major concerns in light of the significant strong effects. It is difficult to judge whether and how measurement error changes with higher or lower levels of profits and capital stock. We think there is little reason to assume that measurement error is less pronounced at lower levels of capital stocks, which would then partly explain higher returns at lower levels of capital. For capital, we have briefly discussed the problem that capital might not just be used for business purposes. Whether and how this affects our estimates depends on whether non-business use is systematically higher or lower at higher levels of capital. If non-business use is higher for expensive capital goods, for example a car, our return estimates at higher capital levels would be too low, as actual capital is lower than measured capital stock. Whether this is indeed the case is again difficult to determine, as one can also argue that more expensive capital goods, like machines, are also likely to be of exclusive use to the business. In fact, the

[10] Semi-parametric estimates (not reported) confirm the identified patterns of capital returns. This approach also reveals considerable heterogeneity within the sub-samples. In particular, the estimates show that marginal returns are (extremely) high – up to several hundred percent – at (very) low levels of capital, but decline very rapidly.

finding that return estimates are similar across industries can be taken as evidence against such systematic differences in non-business use of reported capital stock. [11]

As parameter heterogeneity across countries, industries, or other groups of entrepreneurs, for example male or female, may explain some of the above results, we now examine and formally test whether the implicit assumption of constant parameters, i.e. constant returns to capital, across the respective groups can be maintained. Table 10 provides a first piece of evidence that this is only partially the case. More specifically, it reports the results of a log-log-specification (profits and capital) that additionally includes interactions of log capital with six economic capital dummies (the left-out city is Dakar). Labour input and owner's education are also interacted with these dummies. In the bottom three rows, Table 10 shows the results of so-called Chow-Tests, i.e. *F*-Tests of the joint significance of these sets of interactions, respectively. As above, the regression is run on the entire sample as well as sub-samples distinguished by the size of capital stock. The first column of Table 10 shows that the coefficient for log capital is not homogeneous across countries. A number of parameters differ significantly across countries, i.e. the interaction terms are significant, and the *F*-Test confirms the joint significance of the log capital-country interactions. This also holds for labour and the returns to schooling. Some of these differences, however, may stem from different levels of capital stock in the presence of heterogeneous returns. That this is indeed the case is confirmed by the results for the regression on sub-samples of low and high levels of capital stock, respectively. Only some log capital-country interactions remain significant and the Chow-Test fails to reject parameter equality at low levels of capital. This is not the case for the other inputs though. At medium levels of capital stock, the results suggest substantial heterogeneity, which may partly explain the above result of zero returns in that capital stock range. Re-running the above regressions on more homogeneous country groups in terms of log capital coefficients at medium capital stocks, for example Côte d'Ivoire, Mali, and Niger, does not lead to fundamentally different results from those reported above.[12] While the coefficient of log capital in the medium capital range turns out to be higher and more significant on some sub- or single-country-samples than on the pooled sample, marginal returns typically remain low because of low capital profitability. Hence, while there is certainly a considerable degree of heterogeneity between countries, this heterogeneity does not drive our main results from above.

[11] We also distinguish between different types of capital goods (machines, transport means, or furniture) with no major implication with regard to our results. Similarly, including inventories into capital stocks does not affect the results.

[12] In Appendix 2, we report the results of the log-log-specification by country. Further regression results are not reported.

Table 10: Chow-Test for parameter equality across countries

		All	Capital < 150 Int. $	Capital >150 Int. $ & < 1000 Int. $	Capital > 1000 Int. $
Log capital		0.180***	0.290***	0.343**	0.493***
		(0.021)	(0.049)	(0.167)	(0.117)
Log capital x dummy for	Cotonou	0.049	-0.005	-0.105	-0.235*
		(0.034)	(0.099)	(0.218)	(0.141)
	Ouaga.	0.062**	-0.006	-0.201	0.207
		(0.029)	(0.074)	(0.233)	(0.161)
	Abidjan	-0.002	-0.091	-0.450**	-0.104
		(0.034)	(0.079)	(0.215)	(0.163)
	Bamako	0.080**	0.089	-0.422*	-0.036
		(0.033)	(0.075)	(0.224)	(0.216)
	Niamey	0.071*	0.146*	-0.411*	-0.320*
		(0.037)	(0.083)	(0.246)	(0.180)
	Lomé	0.049	-0.048	0.080	0.002
		(0.030)	(0.071)	(0.211)	(0.154)
Log labour, log labour country interactions		Yes	Yes	Yes	Yes
Owner's education, owner's education country interactions		Yes	Yes	Yes	Yes
Additional controls		Owner's experience, owner female, industry dummies, country-industry interactions			
R-squared		0.392	0.339	0.350	0.425
N		5082	2742	1400	935
F-Test: All log-capital interactions = 0		0.0890	0.1219	0.0410	0.0243
F-Test: All log-labour interactions = 0		0.0000	0.0000	0.0051	0.0000
F-Test: All owner's edu interactions = 0		0.0000	0.0004	0.0522	0.0494

Source: Authors' computation based on 1-2-3 surveys (Phase 2, 2001/02, AFRISTAT, DIAL, INS).

The same holds true for heterogeneity across industries that we also examine in more detail. Appendix 3 reports the results of the regressions (log-log-specification) by sector and also reports the implied marginal returns to capital. It is evident from these results that there is indeed parameter heterogeneity across sectors and there is also heterogeneity in the corresponding marginal returns. Marginal returns in construction, for example, are still very high at relatively high levels of capital stock (at the average of approximately 750 Int. $ still about 40 percent), while marginal returns are relatively low (17 percent) at fairly low levels of median capital stock (116 Int.$) in other services. Overall however, the patterns of returns reflect the capital intensity of the different industries and the identified patterns of very high returns at low levels of capital that decrease fairly quickly. This is also confirmed by examining the results based on sub-sub-samples of different capital stock sizes in industries with a sufficient number of observations, for example petty trade or other manufacturing (not reported).

Heterogeneity in returns may also stem from gender differences, as shown for example by de Mel *et al.* (2008) for Sri Lankan MSEs. Appendix 4 shows the results for regressions (on

the entire and the split samples) that include, as in the test for heterogeneity across countries, interactions of key inputs with the female-owner dummy.[13] For all inputs, including capital, the coefficients are only found to be significantly different for females at higher levels of capital stock. What regards capital profitability, there seem to be major differences between males and females; yet, only at higher levels of capital stock. This implies that marginal returns to capital are very high for both males and females at low levels of capital stock (albeit a bit lower for females). In both the medium and the high capital stock range, female marginal returns are much lower with about 2 percent compared to 8 and 7 percent for males, respectively. Thus, while we again find considerable heterogeneity across the groups considered, the findings do not fundamentally alter the main results from above. Rather, these robustness checks across countries, industries, and gender have generated additional insights into the patterns of capital returns.

The inclusion of zero and missing values (as zeros) for the capital stock into the regressions lowers the estimated returns to capital, but the estimated coefficients still indicate very high but decreasing returns at low levels of capital. In turn, the coefficients on labour, education, and experience are much higher. The results of such a regression on the low-capital sub-sample are reported in Appendix 5, column 1. The size of the sub-sample, which again is reduced by excluding influential outliers, increases by almost 1000 observations. We have also run Tobit regressions that explicitly model censoring without however major implications for the results.

The omitted variable biases cannot be easily removed. Yet, a first straightforward solution to this problem is to include ability proxies into the estimated equation. We have constructed two such proxies from the information available in the 1-2-3 surveys using principal component techniques. The first is an 'intellectual ability index', which includes information on literacy, language spoken at home, type of school (private or public), and father's schooling. The second index tries to capture 'financial literacy' and is constructed using questions regarding the knowledge of credit and other financial products. A third index measures whether the household has a tradition of being engaged in a particular business. Including these proxies into our regression does not affect the results (reported in columns two and three of Appendix 5). The intellectual ability index is not significant in any specification, while the financial literacy index has a significant albeit small positive effect on profits.

Returns to capital with a household fixed-effect

An alternative to the inclusion of admittedly imperfect proxies to control for ability is to include a household fixed-effect into the above regressions. Quite a number of households own more than one enterprise, allowing to explore the co-variation of profits and capital across firms within the same household, thus removing the omitted household-level variables from the estimated equation. This procedure may also mitigate ability bias if

[13] Note that female entrepreneurs account for 62 percent of low capital, 40 percent of medium capital, and only 26 percent of high capital entrepreneurs.

entrepreneurs in the same household are more similar to each other in terms of their ability than they are compared to entrepreneurs outside the household.

An analysis of intra-household differences, however, has to rely on (and, in fact, allows us to test) the assumption that returns to capital (and other inputs) are equated across different activities within the household. A rational household should just do this to rule out the possibility of Pareto-improving input, in particular capital re-allocations. In other words, given fixed characteristics of the household certain constraints, for example credit or labour market constraints, faced by the individual entrepreneur should not be visible – within the household![14] Instead, were we to find differences in marginal returns to capital this can be an indication of inefficient capital allocations. Theoretically, such inefficiencies could arise, for example, due to non-cooperative behaviour within the household. Optimal capital allocations, however, can also be consistent with differing marginal returns across activities in the presence of (a) some non-linearity in capital stocks that prevents the household from equalizing returns, or (b) risk and risk aversion. The above fairly smooth distributions of entry costs seem to suggest that non-linearities are unlikely to be of great importance in most of MSE activities, at least at lower levels of capital stock. Yet, if activities are associated with different risks and households choose to hold portfolios with different risks, they should equate risk-adjusted returns. In this case, the fixed-effects estimates should reflect the differences in returns that can be attributed to risk differences. Finally, while risk may be the main reason for ($d\pi/dK$) to be different from zero within-households, it cannot be ruled out that single activities, in some cases operated by different individuals, are faced with different constraints, for example different access to capital. In sum, the below fixed-effects results should not only be seen as a robustness check and an attempt to address ability bias, but rather as a first attempt to reveal the possible causes of the observed pattern of returns to capital.

Before we discuss the results, it should be noted that the fixed-effect estimation is prone to selection bias because of the implied reduction of the sample to only those MSEs in households with more than one enterprise. The results of the fixed effects estimates are reported in Table 11. To start with, we have 946 households owning 2 079 enterprises (i.e. with at least two MSEs). Most of these enterprises are operated by the same person in the household (1 766). Again, we exclude MSEs that report zero profits and/or zero capital and remove influential outliers from the respective (sub-) samples. In the case of the whole (sub) sample, this leads to a considerable reduction of the sample. The first set of estimates is based on only 600 households with 1 301 firms. Because of the smaller sample size, we additionally estimate a linear model without a squared term.[15]

[14] In this case, the no-log specification should render zero coefficients for capital, while the log-specification should allow us to test the equation of marginal returns using capital profitabilities.

[15] Note that the sub-samples by capital size include only households, in which all enterprises have a capital stock that meets the sub-samples' conditions, for example capital stock smaller than 150 Int. $.

Table 11: Fixed effects specification

	Dependent variable: (Log) monthly profits											
Sub-sample	All			Capital < 150 Int. $			Capital >150 Int. $ & < 1000 Int. $			Capital > 1000 Int. $		
	log OLS	no-log OLS	no-log OLS	log OLS	no-log OLS	no-log OLS	Log OLS	no-log OLS	no-log OLS	log OLS	no-log OLS	no-log OLS
Log capital	0.245***			0.257***			0.233			0.510**		
	(0.022)			(0.049)			(0.213)			(0.156)		
Capital		0.040***	0.050**		0.876***	1.088		0.094	-1.086		0.089***	0.144**
		(0.011)	(0.016)		(0.250)	(0.971)		(0.168)	(0.888)		(0.016)	(0.041)
Capital squared			-0.000			-0.002			0.001			-0.000*
			(0.000)			(0.008)			(0.001)			(0.000)
Log labour	0.071**			0.099***			0.163**			0.090		
	(0.024)			(0.030)			(0.053)			(0.105)		
Labour		0.507*	0.563**		-0.017	-0.021		0.442	0.295		0.065	-0.029
		(0.203)	(0.192)		(0.190)	(0.192)		(0.529)	(0.495)		(0.787)	(0.887)
Labour squared		0.000	0.000		0.001	0.001		-0.000	0.000		0.000	0.000
		(0.000)	(0.000)		(0.000)	(0.000)		(0.001)	(0.001)		(0.001)	(0.001)
Owner's education	0.012	5.415	5.854	0.027	6.137*	6.122*	-0.123**	-15.982	-13.867	0.020	20.260	26.753
	(0.010)	(4.524)	(4.459)	(0.015)	(2.541)	(2.562)	(0.045)	(11.509)	(11.302)	(0.031)	(35.740)	(37.230)
Owner's experience	0.014**	1.995	1.677	0.017**	1.936	1.928	0.006	12.813*	12.495*	0.073	1.249	17.266
	(0.005)	(1.957)	(1.975)	(0.006)	(1.352)	(1.352)	(0.016)	(5.415)	(4.964)	(0.038)	(24.817)	(28.575)
Owner female	-0.533***	-117.9***	-121.7***	-0.409***	-32.807	-32.512	-0.702*	-64.994	-103.779	-1.038***	-225.928	-310.233
	(0.083)	(30.871)	(30.548)	(0.118)	(22.671)	(22.705)	(0.305)	(68.158)	(70.959)	(0.169)	(128.134)	(155.621)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.469***	142.4**	142.93**	3.46***	116.30**	113.12**	2.97*	-66.996	161.726	0.49	-378.29	-479.08
	(0.170)	(49.270)	(48.992)	(0.264)	(37.754)	(40.238)	(1.427)	(171.838)	(271.955)	(1.173)	(284.925)	(336.852)
N	1301	1496	1498	521	567	567	105	113	111	73	77	79
Number of groups	600	689	690	245	267	269	50	54	53	36	38	29
R-squared within	0.4505	0.2528	0.2211	0.2854	0.1839	0.1841	0.5771	0.5498	0.5835	0.8152	0.7332	0.6767
R-squared between	0.1798	0.1767	0.1616	0.1743	0.0715	0.0720	0.3120	0.2030	0.2608	0.1229	0.2327	0.1750
R-squared overall	0.2738	0.2060	0.1839	0.2109	0.1010	0.1016	0.3836	0.3463	0.3964	0.3040	0.3409	0.2731

Authors' computation based on 1-2-3 surveys (Phase 2, 2001/02, AFRISTAT, DIAL, INS).
Note: * p<0.05, ** p<0.01, *** p<0.001.

Overall, the fixed-effects estimates yield similar results to the estimates without fixed-effects.[17] Capital returns are of similar magnitude at low levels of capital. For the medium range, capital is neither significant in the log-specification nor when only the linear term is included. The no-log non-linear specification suggests decreasing and then increasing marginal returns with a turning point at around 400 Int. $. With monthly marginal returns of more than 10 percent (last column of Table 11) the marginal returns at higher levels of capital are much higher than those obtained via the specification without fixed effects. These higher returns may, on the one hand, reflect the selection of more talented and entrepreneurial households into the sub-sample of those with at least two MSEs. It seems plausible that this selection effect is stronger at higher levels of capital. On the other hand, higher returns may also stem from the ability of diversified households to take (some more) risks and earn higher returns.

In the log-specification, returns to labour are in a reasonable range, although not significant in the medium range of capital stocks. Without taking logs, no significant coefficients are found possibly implying that returns to labour are less risky and equated within the household. While capital stocks and profits between different MSEs within the same household (co-) vary enough to allow for estimating the fixed-effects model, other characteristics, like education and gender (and to some extent experience) vary little within the household given that most MSEs are operated by the same individual. Little variation in these variables should be the reason why the other control variables are in most cases not significant.

The estimates hence support our finding of very high returns at low levels of capital. Of course, the reductions in sample size are considerable and one has to be careful not to draw too far-fetching conclusions from these estimates. Yet, the consistency of these household fixed-effects results with those obtained with the much larger sample is remarkable. Furthermore, in the interpretation of the fixed effects estimates it should be taken into account that the two key variables under consideration, profits and capital stock, are likely to be measured with error. This problem is reinforced when only within-household variation is being used. Such measurement error would bias the returns to capital against zero; an effect that would be opposite to the ability bias, which we may have mitigated but certainly not eliminated by estimating a household-level fixed effects model. In light of the potential bias due to measurement error, the fairly robust results in terms of capital returns are even more surprising.

We can only speculate about the meaning of these results in terms of the causes of the observed patterns of returns, as highlighted in the above discussion. We think that these results may be taken as an indication that risk indeed plays a major role in explaining the high returns at low levels of capital. At high levels of capital, other factors, such as activity-specific capital constraints, but also non-linearities, for example machinery, are also likely to come into play.

[17] This also holds when we estimate the earlier specification without fixed effects on the much smaller samples.

Some more thoughts on the causes

A thorough investigation of the causes of the observed pattern of capital returns goes beyond the scope of this paper and is left to future work. Yet, this section briefly presents some suggestive evidence on the channels that might explain these patterns. More specifically, we assess the risks associated with activities at different levels of capital. Risks should be higher at low levels of capital if this factor was behind the observed high returns, as suggested by the fixed-effects estimates. We then make an attempt to proxy capital constraints and again look at these proxies at different levels of capital. We would expect MSEs with low levels of capital to be more constrained than those with more capital.

Although it is generally difficult to proxy risks – and more so in a cross-sectional dataset – our survey offers a number of possibilities to construct admittedly imperfect risk proxies. First, it is of course possible to construct 'classical' proxies for risk as the variation of profits or sales. We chose to measure this variation at the country-sector level, where industries are disaggregated as finely as possible while keeping the number of observations in each country-sector cell at least at 30. Such a procedure yields 123 country-sector cells, for which we compute the coefficients of variation in profits and sales. Furthermore, we can use business risk perceptions of the entrepreneur to construct further proxies. We use answers to the question 'which are major threats to the existence of the MSE' to construct a 'risk-of-closure dummy' that is set to 1 if the entrepreneurs sees the lack of clients or too much competition as a major business risk – which about 60 percent of all MSEs do. The values for these three risk proxies by capital stock range are reported in Table 12.

Table 12: Risk proxies at different levels of capital stock

	Capital < 150 Int. $	Capital >150 Int. $ & < 1000 Int. $	Capital > 1000 Int. $
Coefficient of variation in sales	1.98	2.01	1.97
Coefficient of variation in profits	2.04	1.93	1.91
Risk of closure due to lack of clients or too much competition	0.61	0.65	0.59

Source: Authors' computation based on 1-2-3 surveys (Phase 2, 2001/02, AFRISTAT, DIAL, INS).

The descriptive statistics in Table 12 support the view that risk may partly explain the observed pattern of returns. Both the coefficient of variation in profit and sales are lowest for higher levels of capital. The coefficient of variation of profits, likely the better indicator for risk, is higher for low levels of capital compared to the other two groups. In other words, high capital MSEs (with lower returns) are more frequently found in sectors with lower variation in profits. However, the differences in these indicators are far from being significant (the standard errors of the above means of the coefficients of variation are in a range of 0.5 to 0.9). According to the third indicator, risk is not highest for activities at low levels of capital. Rather, the threats to business survival appear to be strongest at medium levels of capital, a finding that does not fit with the idea of marginal returns reflecting high

risks. This finding would only make sense if capital stocks were not chosen optimally by the entrepreneurs. In such a case, we should be able to find low and very volatile returns in the presence of high risks – as we do.

More detailed analysis of the above risk indicators, for example by country or by capital profitability (not reported), does not always render consistent results. This is also why we think that the presented evidence provides at best some weak support for risk as major factor behind the above pattern of capital returns. Yet, in our view, these non-findings can almost certainly be attributed to some extent to the lack of adequate risk (and risk aversion) proxies as well as the rather simple empirical approach. Furthermore, the effects of risk on returns (and capital stocks) may interact with capital market constraints, an interaction, which is ignored in our analysis.

Finally, we hence briefly examine the possible role of capital constraints in explaining the observed pattern. To this end, Table 13 reports three proxies of capital constraints, again by capital stock range. At least for low levels of capital, for which we find extremely high marginal returns, we would expect MSEs to be severely capital constrained.

Table 13: Capital constraint proxies at different levels of capital stock

	Capital < 150 Int. $	Capital >150 Int. $ & < 1000 Int. $	Capital > 1000 Int. $
No access to external capital	0.88	0.81	0.77
Liquidity constraints	0.14	0.10	0.10
Access to formal credit	0.03	0.03	0.07
Share in lowest wealth quintile	0.26	0.16	0.09
Share in highest wealth quintile	0.15	0.22	0.32

Source: Authors' computation based on 1-2-3 surveys (Phase 2, 2001/02, AFRISTAT, DIAL, INS).

Table 13 shows that MSEs with low levels of capital stock are indeed more capital constrained than others. 88 percent of these firms have financed their capital stock only out of own savings without recurring to any source of external funds, including formal and informal credit, family funds or support from friends.[18] This 'only' holds for 81 and 77 percent at medium and high levels of capital stock, respectively. Similarly, 14 percent of the entrepreneurs report to be liquidity constrained[19], compared to 10 percent in the other two groups. When we split up the enterprises by the wealth of the households, in which they are operated, the empirical picture is also in line with expectations. 32 percent of the high capital MSEs can be found in households in the highest wealth quintile. Yet, there are both rich households with low capital MSEs and poor households with high capital MSEs.

[18] For each item of capital stock, the entrepreneur is asked for the source of funding. From this information, we construct the dummy for 'No access to external capital'.

[19] The 'liquidity constraints' dummy is set to 1 if entrepreneurs perceive the lack of liquidity as a major threat to survival of their enterprise.

While these findings are all in line with expectations, they hardly provide convincing evidence of the importance of capital constraints. In fact, the descriptive statistics are somewhat fuzzy – consider, for example, the relatively high share of capital MSEs in high wealth households – so that they may rather be taken as an indication that there should be further explanatory factors. In addition, as has also been noted by McKenzie and Woodruff (2006) MSEs should, in principle, be able to re-invest their very high returns to accumulate capital. Capital constraints should then not or only partly be reflected in high returns.

Conclusions

In this paper, we have analysed the patterns of capital entry barriers into informal activities as well as returns to invested capital using a unique micro data set on informality covering seven urban centres in West-African. Our assessment of initial investment of MSEs suggests that quite a few activities seem to exhibit important entry barriers, at least when operating costs are also taken into account. We can also identify an informal sub-sector, for which fixed costs of entry are negligible. In contrast, there is also a relatively small fraction of informal entrepreneurs who undertake substantial initial capital investments, in particular in the transport sector. These findings and our descriptive analysis of MSE characteristics point at quite some heterogeneity among informal activities.

This heterogeneity is also reflected in our estimates of capital returns at different levels of capital stock. Our findings suggest that the informal sector is indeed of a heterogeneous nature where activities with rather low capital returns co-exist with activities with rather high capital returns. We cannot, however, identify a segment of informal MSEs with low capital stocks and close to zero returns, as suggested by our simple theoretical exposition. Rather, we find extremely high marginal returns of more than 100 percent at very low levels of capital. However, we also show that marginal returns decline very rapidly and leave the entrepreneur with little incentive to invest much more than 100 to 200 Int. $. This implies that informal entrepreneurs may be stuck at these fairly low levels of capital.

Only when capital exceeds a threshold of at least (about) 500 Int. $, entrepreneurs seem to be able to earn a significant positive marginal return. For this segment we find monthly marginal returns of five to six percent (around 10 percent) using a simple OLS (fixed-effects) approach. The annualised return would thus be around 60 to 70 percent, which is much higher what typical micro-credit providers effectively charge in interest (between 15 and 25 percent) and within the range of informal money lenders' rates (60 percent and more).

This finding of higher returns at higher levels of capital can be seen as consistent with a scenario of fixed costs of entry in the presence of capital market imperfections (or some other form of increasing returns to capital). For such a scenario, which we parsimoniously expose theoretically in this paper, we provide some more direct evidence. Our admittedly imperfect proxies for capital constraints suggest that high capital MSEs are indeed less capital constrained than others. While this finding hardly provides robust evidence in favour of capital constraints, the descriptive statistics at least point towards the general importance of this type of constraint for MSEs.

While MSEs with low levels of capital stock are likely to be severely capital constrained, their access to capital is not different enough from other MSEs to explain the extreme differences in returns across the capital stock distribution. A possible factor that might explain the high returns at low levels of capital is risk. Our approach to asses the role of risk is somewhat innovative, as we interpret our finding of high marginal returns at low levels of capital stock in a household fixed-effects profit function estimation to mainly result from differences in risks between the informal activities operated by the household (and often the same individual). We hence think to be able to provide some evidence in favour of a prominent role for risk in explaining high returns to capital in small-scale economic activities. Yet, this piece of evidence should be taken with care, as our results cannot be corrobated by other indicators of risk. These indicators suggest that high risks of activities in the medium capital range may explain the close to zero returns, which then can only result from non-optimal capital allocations, for example resulting from misjudgement of business risks.

Finally, we understand this work as a first step towards a better understanding of the constraints and opportunities faced by informal entrepreneurs. However, much more detailed investigation into the causes of the heterogeneity in returns is needed, in particular since informal activities are likely to remain the main income source of the world's poor in decades to come.

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Appendices

Appendix 1: Regression results

	Dependent variable: (Log) monthly profits							
Sub-sample	All		Capital < 150 Int. $		Capital >150 Int. $ & < 1000 Int. $		Capital > 1000 Int. $	
	log OLS	no-log OLS	log OLS	no-log OLS	log OLS	no-log OLS	log OLS	no-log OLS
Log capital	0.227***		0.299***		0.139*		0.440***	
	(0.009)		(0.024)		(0.058)		(0.044)	
Capital		0.048***		2.190***		0.008		0.048**
		(0.007)		(0.406)		(0.216)		(0.016)
Capital squared		-0.000		-0.010**		0.000		-0.000
		(0.000)		(0.003)		(0.000)		(0.000)
Log labour	0.085***		0.072***		0.104***		0.086***	
	(0.011)		(0.017)		(0.020)		(0.022)	
Labour		0.536***		0.134		0.537***		0.199
		(0.083)		(0.106)		(0.157)		(0.427)
Labour squared		-0.000		0.000		-0.000		0.000
		(0.000)		(0.000)		(0.000)		(0.000)
Owner's education	0.028***	10.789***	0.021***	2.750*	0.020*	8.172*	0.056***	34.550***
	(0.004)	(1.771)	(0.006)	(1.245)	(0.009)	(3.188)	(0.009)	(8.678)
Owner's experience	0.021***	4.647***	0.018***	1.661**	0.028***	6.309**	0.019**	7.236
	(0.002)	(0.836)	(0.003)	(0.540)	(0.005)	(2.042)	(0.006)	(3.975)
Owner female	-0.432***	-90.359***	-0.372***	-56.212***	-0.509***	-106.81***	-0.399***	-84.725
	(0.041)	(14.164)	(0.054)	(12.862)	(0.080)	(24.628)	(0.102)	(68.547)
Cotonou	-0.614***	-87.425*	-0.639***	-83.456***	-0.050	13.559	-0.264	-450.166
	(0.129)	(34.584)	(0.156)	(24.590)	(0.299)	(61.846)	(0.300)	(367.327)
Ouaga.	-0.213	-60.139	-0.250	-77.797***	0.188	92.039	0.759*	-129.768
	(0.131)	(31.988)	(0.147)	(22.471)	(0.351)	(86.069)	(0.294)	(390.739)
Abidjan	0.315*	127.129**	0.325*	77.230*	0.394	241.918**	2.059***	652.269
	(0.128)	(39.149)	(0.138)	(37.041)	(0.301)	(88.234)	(0.429)	(543.888)
Bamako	0.142	66.986	0.110	4.576	0.535	76.852	0.718*	-242.057
	(0.131)	(36.669)	(0.140)	(24.942)	(0.323)	(65.229)	(0.289)	(367.453)
Niamey	-0.094	-52.015	-0.197	-54.012	-0.020	-64.601	2.209***	1256.554
	(0.130)	(34.738)	(0.140)	(29.084)	(0.289)	(62.045)	(0.450)	(802.049)
Lomé	-0.913***	-139.08***	-0.951***	-122.75***	-0.680*	-94.873	-0.378	-395.570
	(0.118)	(25.779)	(0.129)	(20.072)	(0.322)	(69.975)	(0.315)	(365.369)

Clothing and apparel	0.031	37.142	0.435*	17.957	0.052	17.960	0.971**	-18.622
	(0.148)	(58.897)	(0.196)	(55.734)	(0.253)	(88.283)	(0.296)	(395.683)
Other manufacturing & food	0.140	70.013	0.277	16.487	-0.260	62.701	1.319***	254.748
	(0.147)	(44.403)	(0.164)	(32.310)	(0.304)	(73.819)	(0.305)	(399.816)
Construction	0.932***	371.208***	0.853***	225.612***	1.214***	367.286***	2.545***	1281.380*
	(0.145)	(75.631)	(0.180)	(63.295)	(0.262)	(108.684)	(0.393)	(627.999)
Wholesale/retail shops	0.076	-5.383	0.110	-57.971	0.348	20.611	0.852**	-9.487
	(0.132)	(47.526)	(0.173)	(39.769)	(0.280)	(75.226)	(0.320)	(387.323)
Hotels and restaurants	0.664***	184.401**	0.373	6.763	1.370***	411.851**	1.185**	-60.290
	(0.179)	(66.427)	(0.242)	(50.572)	(0.348)	(142.693)	(0.391)	(390.470)
Repair services	0.472***	23.003	0.520***	41.770	0.660*	14.044	0.787**	-120.890
	(0.135)	(60.931)	(0.141)	(53.654)	(0.305)	(111.240)	(0.274)	(475.851)
Transport	0.410*	189.111	0.251	-46.528	0.070	-104.889*	1.318***	434.088
	(0.163)	(104.626)	(0.274)	(57.441)	(0.238)	(51.865)	(0.245)	(391.511)
Other services	0.245	-4.344	0.387**	5.301	0.050	-25.887	0.873**	-253.702
	(0.133)	(39.484)	(0.150)	(33.277)	(0.316)	(61.968)	(0.324)	(368.826)
Country-industry interactions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.435***	96.555**	3.329***	114.163***	3.453***	54.873	0.747	174.120
	(0.118)	(32.714)	(0.155)	(26.899)	(0.414)	(68.753)	(0.400)	(373.510)
R-squared	0.372	0.238	0.302	0.178	0.306	0.192	0.354	0.199
N	5104	5267	2753	2833	1407	1449	936	965

Source: Authors' computation based on 1-2-3 surveys (Phase 2, 2001/02, AFRISTAT, DIAL, INS).
Notes: * p<0.05, ** p<0.01, *** p<0.001. Robust standard errors corrected for clustering at the 'segment'-level (around 10 observations) in parentheses.

Appendix 2: Regression results by country

	Dependent variable: (Log) monthly profits						
Sub-sample	Benin	Burkina	Côte d'Ivoire	Mali	Niger	Senegal	Togo
Log capital	0.224***	0.256***	0.183***	0.272***	0.253***	0.184***	0.205***
	(0.026)	(0.020)	(0.027)	(0.028)	(0.033)	(0.022)	(0.022)
Log labour	0.298***	0.136***	0.153***	0.169***	0.086***	0.055***	0.009
	(0.063)	(0.020)	(0.033)	(0.025)	(0.032)	(0.021)	(0.018)
Owner's education	0.050***	0.071***	0.014	0.008	-0.013	0.026***	0.025**
	(0.013)	(0.010)	(0.009)	(0.013)	(0.016)	(0.008)	(0.010)
Owner's experience	0.012**	0.031***	0.029***	0.021***	0.022***	0.019***	0.020***
	(0.006)	(0.006)	(0.007)	(0.004)	(0.006)	(0.005)	(0.004)
Owner female	-0.677***	-0.257**	-0.281***	-0.350***	-0.401***	-0.439***	-0.541***
	(0.135)	(0.103)	(0.094)	(0.114)	(0.135)	(0.097)	(0.091)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.889***	2.594***	3.450***	2.997***	3.250***	3.785***	3.081***
	(0.386)	(0.193)	(0.242)	(0.233)	(0.216)	(0.176)	(0.196)
R-squared	0.419	0.434	0.214	0.390	0.240	0.320	0.354
N	726	725	855	674	538	845	715
Average profit (P)	384	443	598	550	305	435	134
Median P	116	130	204	163	98	162	66
Average capital (K)	2153	1436	880	876	1047	753	848
Median K	424	135	152	76	64	77	104
Implied MRK (at average P and K)	0.04	0.08	0.12	0.17	0.07	0.11	0.03
Implied MRK (at median P and K)	0.06	0.25	0.25	0.58	0.39	0.39	0.13

Source: Authors' computation based on 1-2-3 surveys (Phase 2, 2001/02, AFRISTAT, DIAL, INS).
Notes: * p<0.05, ** p<0.01, *** p<0.001. Robust standard errors corrected for clustering at the 'segment'-level in parentheses.

Appendix 3: Regression results by sector

	Dependent variable: (Log) monthly profits				
Sub-sample	Clothing and apparel	Other manufacturing & food	Construction	Wholesale/retail shops	Petty traders
Log capital	0.201***	0.202***	0.331***	0.211***	0.209***
	(0.028)	(0.021)	(0.033)	(0.028)	(0.021)
Log labour	0.267***	0.178***	0.340***	0.037**	0.089***
	(0.054)	(0.040)	(0.061)	(0.018)	(0.026)
Owner's education	0.022*	0.042***	0.012	0.068***	0.014
	(0.012)	(0.010)	(0.014)	(0.011)	(0.009)
Owner's experience	0.026***	0.035***	0.022***	0.019**	0.014***
	(0.006)	(0.005)	(0.006)	(0.008)	(0.004)
Owner female	-0.174*	-0.813***	-0.775***	-0.514***	-0.299***
	(0.092)	(0.084)	(0.222)	(0.121)	(0.077)
Country dummies	Yes	Yes	Yes	Yes	Yes
Constant	2.422***	3.306***	2.592***	3.696***	3.487***
	(0.352)	(0.242)	(0.343)	(0.223)	(0.186)
R-squared	0.365	0.380	0.494	0.400	0.229
N	579	874	418	455	1316
Average profit (P)	296	380	882	535	230
Median P	93	120	290	154	81
Average capital (K)	986	1105	757	1404	348
Median K	294	100	115	188	33
Implied MRK (at average P and K)	0.06	0.07	0.39	0.08	0.14
Implied MRK (at median P and K)	0.06	0.24	0.83	0.17	0.52

Sub-sample	Hotels and restaurants	Repair services	Transport	Other services
Log capital	0.396***	0.156***	0.281***	0.161***
	(0.043)	(0.034)	(0.036)	(0.023)
Log labour	0.035	0.188***	0.058*	0.147***
	(0.029)	(0.034)	(0.030)	(0.027)
Owner's education	0.024	-0.004	0.040**	0.044***
	(0.015)	(0.015)	(0.017)	(0.011)
Owner's experience	-0.001	0.026***	0.028**	0.024***
	(0.009)	(0.008)	(0.013)	(0.006)
Owner female	-0.039	0.203	0.194	-0.307***
	(0.159)	(0.181)	(0.219)	(0.092)
Country dummies	Yes	Yes	Yes	Yes
Constant	3.144***	3.627***	3.456***	3.501***
	(0.381)	(0.279)	(0.316)	(0.207)
R-squared	0.351	0.353	0.341	0.411
N	358	316	241	520
Average profit (P)	408	360	784	441
Median P	191	163	315	124
Average capital (K)	962	1348	5407	1342
Median K	169	301	2221	116
Implied MRK (at average P and K)	0.17	0.04	0.04	0.05
Implied MRK (at median P and K)	0.45	0.08	0.04	0.17

Source: Authors' computation based on 1-2-3 surveys (Phase 2, 2001/02, AFRISTAT, DIAL, INS).
Notes: * p<0.05, ** p<0.01, *** p<0.001. Robust standard errors corrected for clustering at the 'segment'-level in parentheses.

Appendix 4: Regression results by gender

	Dependent variable: (Log) monthly profits			
	All	Capital < 150 Int. $	Capital >150 Int. $ & < 1000 Int. $	Capital > 1000 Int. $
Log capital	0.240***	0.305***	0.138	0.498***
	(0.012)	(0.036)	(0.076)	(0.049)
Log capital x female owner	-0.026	-0.014	-0.052	-0.245*
	(0.018)	(0.046)	(0.125)	(0.103)
Log labour	0.087***	0.066**	0.110***	0.081***
	(0.012)	(0.021)	(0.021)	(0.023)
Log labour x female owner	0.044	0.030	0.087	0.084
	(0.024)	(0.029)	(0.049)	(0.046)
Log schooling	0.034***	0.016	0.027*	0.064***
	(0.005)	(0.008)	(0.011)	(0.010)
Log schooling x female owner	-0.011	0.010	-0.014	-0.044*
	(0.008)	(0.011)	(0.017)	(0.019)
Additional controls	Owner's experience, owner female, industry dummies, country-industry interactions			
R-squared	0.375	0.305	0.313	0.352
N	5100	2748	1403	934
median K (male)	252	50	358	2608
median P (male)	203	145	205	351
Implied MRK (male, at median P and K)	0.19	0.88	0.08	0.07
median K (female)	54	27	340	2123
median P (female)	84	73	93	170
Implied MRK (female, at median P and K)	0.34	0.79	0.02	0.02

Source: Authors' computation based on 1-2-3 surveys (Phase 2, 2001/02, AFRISTAT, DIAL, INS).
Notes: * p<0.05, ** p<0.01, *** p<0.001. Robust standard errors corrected for clustering at the 'segment'-level in parentheses.

Appendix 5: Results of additional specifications

	Dependent variable: (Log) monthly profits				
Sub-sample	Capital < 150 Int. $ (including 0 profits and 0 capital stock)	All (plus additional controls)		Capital < 150 Int. $ (plus additional controls)	
	no-log OLS	log OLS	no-log OLS	log OLS	no-log OLS
Log capital		0.225***		0.283***	
		(0.010)		(0.025)	
Capital	1.274***		0.046***		1.914***
	(0.341)		(0.009)		(0.418)
Capital squared	-0.005		0.000		-0.009**
	(0.003)		(0.000)		(0.003)
Log labour		0.085***		0.057**	
		(0.011)		(0.017)	
Labour	0.050		0.367***		0.196
	(0.108)		(0.099)		(0.110)
Labour squared	0.001*		0.000		0.000
	(0.000)		(0.000)		(0.000)
Owner's education	6.638***	0.029***	10.002***	0.015*	2.013
	(1.300)	(0.005)	(2.262)	(0.008)	(1.531)
Intellectual ability		-0.003	2.533	0.036	6.288
		(0.013)	(5.322)	(0.020)	(3.866)
Financial literacy		0.040***	3.941	0.061***	4.992
		(0.011)	(4.466)	(0.016)	(3.175)
Entrepreneurial tradition		0.019	-3.829	0.030*	1.777
		(0.012)	(4.087)	(0.015)	(2.870)
Owner's experience	2.129***	0.020***	4.319***	0.015***	1.334*
	(0.550)	(0.002)	(0.931)	(0.003)	(0.563)
Owner female	-68.330***	-0.416***	-93.036***	-0.350***	-49.341***
	(11.089)	(0.043)	(15.117)	(0.055)	(13.004)
Industry dummies	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes
Country-industry interactions	Yes	Yes	Yes	Yes	Yes
Constant	139.528***	3.499***	134.788***	3.587***	112.727***
	(24.165)	(0.138)	(40.199)	(0.178)	(30.194)
R-squared	0.164	0.373	0.243	0.306	0.167
N	3814	4619	4766	2456	2532

Source: Authors' computation based on 1-2-3 surveys (Phase 2, 2001/02, AFRISTAT, DIAL, INS).
Notes: * p<0.05, ** p<0.01, *** p<0.001. Robust standard errors corrected for clustering at the 'segment'-level in parentheses.