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Is investment in Africa low despite high profits?

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Abstract:

To my knowledge this study undertakes the first comprehensive and systematic empirical test of the hypothesis that while returns to invested capital in Sub-Saharan Africa are high compared to select Asian and South American markets, investment rates are low. I investigate three sources: detailed World Bank surveys of 6,500 manufacturing firms, a new panel constructed from financial statements of 6,900 quoted industrials and performance indicators of emerging stock markets. I find returns to be high throughout. Micro-evidence and sectoral FDI data confirm that investment remains low outside the mining industry and that the link between past profitability and current investment is weak in Africa. Low investment despite high returns poses a puzzle and I evaluate several possible explanations under assumptions of both symmetric and asymmetric information. After allowing for risk premia and other factors, my findings suggest that we observe a temporary disequilibrium, largely due to an information deficit on African markets.

Keywords: Africa, Profitability, Investment, Emerging Markets, Risk, Expectations.

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1. Introduction

When Kofi Annan unveiled ten years ago that “Africa's profitability is one of the best kept secrets in today's world economy” (in Harsch, 1999:29), international investors did not follow his call. To my knowledge this study undertakes the first comprehensive and systematic empirical test of the hypothesis that while returns to invested capital in Sub-Saharan Africa are high compared to select Asian and South American markets, investment rates are low. Reliable information on returns to investment and firm performance is not easily available. The standard tools and databases employed by investors to evaluate profitable opportunities elsewhere are absent in countries such as Nigeria, Kenya and Ghana. I investigate three different sources.

First, a cross-section survey offers an in depth look at firm characteristics across different sizes and captures effects at the margin in a least-squares estimation of Cobb-Douglas production functions. Second, a new panel constructed from detailed financial statements of 6,800 publicly quoted industrials provides a snapshot of very large enterprises that drive economic performance and investor perceptions. I compute Sharpe ratios to adjust for risk and use fixed effects as well as difference and system GMM to investigate if profits drive investment. Finally, inflation adjusted returns on emerging stock markets proxy investor expectations about future profitability. While these indicators differ in scope and interpretation, they provide alternate measures of the returns to doing business in Africa. This serves to narrow the gap between the standard concepts of returns to capital employed in most economic studies and those that in fact guide investors’ decisions. All three sources present scope for further analysis. This study attempts to merge different pieces of newly emerging evidence and starts to disentangle the central puzzle posed here. Clearly, more work is required to unravel it.

The next section reviews the literature and sets up the conceptual framework. The third section contains the empirical analysis on profitability and firm performance. The fourth

section investigates the link between profitability and investment rates. The final section concludes.

2. Returns to capital in poor countries: theory, empirical findings and some need for clarification

Every year Forbes (2008) publishes a colourful map of the world showing the 2,000 largest global companies ranked by a set of criteria including the size of their assets. Sub-Saharan Africa is consistently blank except for a dozen companies in South Africa and a green dot representing Royal Caribbean Cruises, located in Liberia. Neoclassical theory predicts higher marginal returns to the factor that is relatively scarce and thus suggests that capital should flow from rich countries to Sub-Saharan Africa.

Let production be represented by the standard Cobb-Douglas form:

$$Y=AK^{\alpha} L^{1-\alpha}, \qquad (2.1)$$

where K is the capital stock, L is labour, A is total factor productivity and α the share of capital in production, here assumed to be 40%. It follows that the marginal product of capital is given by

$$r= \alpha A k_L^{\alpha-1}, \qquad (2.2)$$

where k_L is the capital-labour ratio. If production is given by a constant returns Cobb-Douglas technology with a common intercept A and capital-per-worker is 15 times higher in Britain than it is in Africa, marginal returns would be $(15)^{0.6}$=5 times higher in Africa and capital flows should respond to equalise this differential[1]. In his seminal paper Lucas (1990) challenges the assumption of identical technology and revises the model to align it more closely with the empirical record by introducing human capital externalities to capture variations in TFP between countries.

In this paper I propose to unravel Lucas' central puzzle from the other end by taking both directly observed and estimated return differentials as a starting point. Let's assume that a rational fund manager with perfect knowledge and fully mobile capital allocates its

funds solely based on the expected profits in time t. This follows directly from theory. Most models of company investment show that adjustments to the capital stock depend on expected future profits, most commonly proxied by Tobin's Q, the firm's stock market valuation divided by the replacement cost of capital. Hayashi (1982) shows that for perfectly competitive markets and constant returns to scale production technology the average Q would be a sufficient statistic for investment rates. Now assume actual returns in period t-1 were twice as high in Africa. Then it must be the case that expected returns in Britain and Africa at least equalize if the fund does not invest in Africa[2]. This implies that there's an unobserved factor θ that depresses the expected returns sufficiently such that the following condition holds:

$$E(r_{SSA,t})=\theta r_{SSA,t-1} \leq E(r_{UK,t}), \text{ where } 0\leq \theta\leq 1. \qquad (2.3)$$

θ is best thought of as an adjustment factor which downweighs the signaling power of actually observed returns to prospective investors. As θ is calculated ex post country characteristics that impact on returns, e.g. human capital endowments, are assumed to already be incorporated in $r_{SSA,t-1}$ and $r_{UK,t-1}$. I decompose θ into four broad components, initially considering two cases under full information followed by two accounts of asymmetric information. This is by no means an exhaustive list, but it serves as a useful structure:

Returns may be high, but not replicable at the margin. This may be because they are largely based on rents from protection or natural resources. In a scenario of low or no competition, additional entry would reduce prices and dissipate high profits presently made. The case is even stronger for firms in agriculture or mining, who may hold monopoly rights to scarce natural resources. If these companies are large and vital for the domestic economy, they may enjoy concessions which would not necessarily accrue to new investors. The second issue relates to risk and uncertainty. There is an extensive literature on the degree of risk entrepreneurs face in Africa (e.g. Collier and Pattillo, 2000). These risks include volatility in the domestic price level, often exacerbated by exchange rate fluctuations, failure of essential infrastructure, corruption, conflict and expropriation. Gunning and Mengistae (2001) argue that investments in African manufacturing have been held back by high risk rather than low returns to investment.

High uncertainty implies a high risk premium in the required return on capital and Serven (1997) finds that this severely depresses investment in Africa.

The presence of asymmetric information adds a layer of complexity to the analysis of θ. I initially consider the option value of delay put forward by Dixit and Pindyck (1994). By postponing an irreversible investment and staying liquid a firm can take advantage of new opportunities that may open in the next period or in a different location. With high uncertainly, this option value of delay exceeds the discount rate applied to compute the net present value of an investment. The degree of irreversibility depends on the future marketability of the investment project and this is likely to be much lower in, say, Ghana than it is in China. We would expect that there are simply fewer potential buyers for a Ghanaian plant, largely due to an information deficit and sticky prior beliefs of high risk and uncertainty. This leads to a positive correlation between the degree of informational asymmetries and the option value of delay and hence requires a higher rate of return.

More fundamentally, investors may simply be unaware of the returns made in Africa, hence $r_{SSA,t-1}$ is unobserved and investors can only estimate a highly speculative future return $S(r_{SSA,t})$. Suppose no one knows whether activity *x* is profitable and that the uncertainty can be resolved only by making a sunk investment, which cannot be recovered if the outcome is unfavourable. If, however, the activity turns out to be profitable, other entrepreneurs will be attracted to it, thereby eliminating all rents (Hausman and Rodrik, 2003). This model can be extended by adding prior search costs. It now has to be the case that $S(r_{SSA,t}) > E(r_{SSA,t}) > E(r_{UK,t})$ for investment to take place, where the difference between the speculative return under asymmetric information and the expected return under symmetric information has to be sufficiently high to provide an incentive to incur the irreversible costs ex ante. This could lead to a temporary disequilibrium where high profits exist alongside low investment rates as information asymmetries and high search costs act as de facto entry barriers.

Several studies have estimated the return to capital in developing countries, providing initial direction on the likely magnitude of the rate of return $r_{SSA,t-1}$. Banerjee and Duflo (2005) quote evidence of returns to capital of at least 74% for a subset of Indian firms, while Bigsten et al (2000) find annual returns to physical capital of 23% at the margin

across a sample of five African countries. Others have looked at small-scale agriculture and micro-enterprises. Golstein and Udry (2006), for example, find that mean annual returns to the adoption of new technology for Pineapple growers in Ghana are in excess of 250%. Using a randomized field experiment, Cull, McKenzie and Woodruff (2007) estimate returns between 20% and 33% a month for very small enterprises in Mexico.

Two issues in this literature require clarification. First, the capital stock measure varies widely. Many studies use equipment and machinery only, while others employ the net book value or fail to offer a precise definition (e.g. Benn et al, 2005). Bigsten et al (1999) report very high average returns on fixed capital of 363% for manufacturing firms in Ghana, 182% in Kenya, 136% in Cameroon and 85% in Zimbabwe. This points to the second issue, namely a substantial gap between the financial and economic literature on returns to capital. The return on capital employed, a key performance signal for investors, measures the entire capital tied up in the firms operations. This broader concept is arguably more useful to investors, but implies a larger denominator and hence much smaller returns than are estimated in most economic studies. The next section incorporates these concerns.

3. Profitability in Africa in a comparative perspective

3.1. Panel of quoted industrial companies

I construct a new panel for 6,922 firms across the three regions with a total of 28,842 observations spanning the years 2002-2007. The panel is unbalanced with an average of 4.2 observations per firm and covers all of Africa and selected Asian and South American countries, including Brazil, Argentina, India and China[3]. The majority of firms are in manufacturing and services with a smaller proportion in agriculture, mining and construction. I sourced the data from balance sheets, cash flow statements and profit & loss accounts made available by Bureau van Dijk Electronic Publishing, regarded as a leading provider of business performance data both in terms of quality assurance and coverage of emerging markets.[4] The data is taken directly from published annual reports. It does not represent a random sample, as it is comprised of very large firms for which data is available. It thus constitutes an accurate medium-term snapshot of major

companies, which combined make a significant contribution to their economies' GDP, but are not representative of the whole population of firms.

Table 1 shows that profitability in Africa is high with ratios exceeding those in Asia and South America across the three core measures. The core performance measures constructed are identical to those reported to shareholders and as such have a high expected signaling power for prospective investors. The return on capital employed, here using the broader accounting definition, is between 65-85% higher for both the median firm and the firm at the 75th percentile of the distribution. This holds also for the sub-sample of manufacturers. The difference would be even more pronounced if I exclude Egypt and Tunisia from the sample. Usually the return on capital is constructed by adding interest paid to profits, but these are only available for a proportion of the firms. Using the standard ratio would increase the return by a few percentage points without altering the overall distribution between regions.

Table 1: Performance of quoted companies (period average)

Profit measures (%)$		***Africa***	***Asia***	***South America***
All industrials				
Profit margin	Median	11	6	7
	75th pctile$$	20	13	17
Return on equity	Median	16	12	11
	75th pctile	28	21	21
Return on capital	Median	13	7	7
	75th pctile	23	14	14
Firms		954	4,606	815
Manufacturing firms				
Profit margin	Median	10	5	6
	75th pctile	16	11	12
Return on equity	median	17	12	12
	75th pctile	27	21	21
Return on capital	Median	14	7	8
	75th pctile	24	14	15
Firms		395	2,829	314

$-Calculated as the arithmetic mean over the years 2002-2007.
$$-firm at the 75th percentile of the distribution.

While the table offers an unobstructed view of published financial statements, several caveats remain. Identical concepts are used throughout, but internationally agreed accounting standards are not yet fully adhered to (see van Gruening (2005) for an overview). This may lead to a higher degree of noise in the data. The panel uses the net book value of fixed assets as part of the capital measure. With high inflation and years of underinvestment, the net book value may be much lower in Africa, hence inflating the return on capital. I test for this using the cross section data, where I have both the net book value and the replacement value for about 6,000 firms. I find that the ratio of the net book value to the replacement value is not significantly lower in Africa. I also investigate if the results could be influenced by higher indebtedness of African firms. This would not affect the return on capital, which by definition includes total equity and non-current debt, but may imply a low stock of equity in the firm and thus inflates the return to shareholder funds. The current ratio as a measure of liquidity and short-term financial strength, defined as current assets divided by current liabilities, ranges between 1.4-1.6 for the median firm across regions and hence does not reveal substantial differences. It's broadly stable over the past six years, but shows a slight upward trend in the South American sample. The non-current debt-to-capital and the solvency ratio also do not reveal any noteworthy regional discrepancies.

3.2. Does risk drive away excess returns?

The standard deviation of returns is most commonly used as a measure of risk. Pattillo and Soderbom (2000) test for a mean-variance trade-off in profits by estimating firm specific means and standard deviations for a panel of Ghanaian manufacturing firms and compute their correlation. They find a strong and statistically significant correlation and take this as an initial indication that entrepreneurs shift resources to less risky production activities, enjoying a lower volatility at the expense of higher mean earnings. However, such a correlation would be expected purely by mathematical construction and is not a useful proxy of the actual risk faced. In addition, upward volatility, e.g. caused by strong earnings growth, is weighted identical to downward volatility.

In response the financial literature offers several measures of risk-adjusted performance, such as the Sortino and Sharpe ratios[5]. Proposed by Nobel laureate William F. Sharpe

(1966 & 1994) the latter concept is rooted in portfolio theory, but the basic insights can, I argue, easily be adapted to firm performance. Let $R_{x\,t}$ be the return achieved by a firm in period t and R_{ft} the risk-free opportunity cost of capital, for example T-Bills, R_E the average excess return over periods T and σ_{R_E} the standard deviation of excess returns:

$$\overline{R}_E = \frac{1}{T}\sum_{t=1}^{T}(R_{xt} - R_{ft}) \qquad (3.2.1)$$

$$\sigma_{R_E} = \sqrt{\frac{\sum_{t=1}^{T}[(R_{xt} - R_{ft}) - \overline{R}_E]^2}{T-1}} \qquad (3.2.2)$$

The Sharpe-ratio is then given by

$$S = \frac{\overline{R}_E}{\sigma_{R_E}}, \qquad (3.2.3)$$

and gives the return achieved per unit of risk. I construct the Sharpe ratio for each company in the panel to investigate if risk significantly dampens the high returns found earlier. The benchmark return is here set arbitrarily at 5% per year.

Table 2: Risk adjusted returns - Sharpe Ratios

		Africa	*Asia*	*South America*
Industrials				
Sharpe Ratio	Median	.81	0.40	0.33
	75th pctile	1.86	1.31	1.22
Firms		1,093	4,720	901
Manufacturing firms				
Sharpe ratio	Median	0.87	0.37	0.43
	75th pctile	2.05	1.29	1.26
Firms		395	2,829	314

This 5% figure is, of course, a gross simplification and does not take the real, risk free opportunities set into account, which is likely to differ widely among regions. Table 2 is indicative that after taking financial risk into account, the gap in performance between African companies and those in other regions is widened, not reduced. The next section investigates if this trend in comparative performance is robust to taking a random sample of firms across varying sizes and characteristics.

3.3. Cross-section of manufacturing firms

As part of the Regional Program on Enterprise Development (RPED), the World Bank collects extensive firm-level data. I standardize and merge the most recent surveys for 15 countries in Sub-Saharan Africa, 8 in South America as well as Bangladesh, India and Vietnam[6]. The smallest enterprises have at least five employees, the largest employ over 500. Comparability is enhanced by the fact that despite differences in coding, both the South American and Bangladesh surveys used a global questionnaire, while the Sub-Saharan African surveys have all been carried out by a Canadian company again relying on an identical instrument. Figures are quoted for the last complete fiscal year. I use both the new 2005 PPPs (World Bank, 2008) for specific cost items and U.S. exchange rates. All figures are in 2005 prices[7]. I construct two standard measures of profitability, the margin, i.e. profit over sales, and the profit rate, i.e. profit over capital. In keeping with the previous literature on firm-level survey data, I here use the narrow definition of the capital stock as it has proven advantageous for econometric testing[8]. The appendix provides detail on definitions, missing values and the treatment of extreme values.

The measurement of the replacement value of the capital stock is a challenge and researchers have noted the possible upward or downward bias that may arise from that[9]. For small African firms, rental and second-hand markets for capital goods may not exist, making accurate pricing of the replacement value difficult. Measures such as the profit margin and profits per worker are, however, not sensitive to these types of errors and help reinforce the central message. In addition, larger firms in Africa are often over-sampled, rendering the findings less representative of the whole population. Another concern is voluntary survey participation. For example, better performing and better managed enterprises may be more willing to partake, leading to a systematic upward bias. This bias may be more severe in Africa, where the population of formally registered firms is comparably small. And while detailed data on costs is available, including water, communication, transport and rental, the impact of taxes, interest rates and bribes can not be modeled with this particular dataset.

Table 3 provides firm characteristics and productivity measures. In several African countries value-added and capital per worker of the median firm are higher than in the

three Asian countries. The South American countries display much higher labour productivity throughout, which is partly explained by more capital-intensive production technology, but also rooted in higher value-added per unit of capital employed. This is underlined by the regional totals.

Table 3: Firm characteristics and productivity

	Workers	***Value-added/worker (PPP)***			***Capital/worker (PPP)***			***Value-added/ capital (PPP)***			***Firms***
	Mean	Mean	Median	Sd	Mean	Median	Sd	Mean	Med	Sd	
Angola	18	9,088	6,465	9,372	9,235	3,891	18,542	3.5	1.8	4.2	181
Botswana	52	19,17	9,179	26,458	19,430	12,028	21,500	1.8	0.9	2.2	94
Burundi	36	9,218	4,579	18,734	6,793	3,028	8,915	3.5	2	3.4	77
DRC	39	5,089	3,199	6,228	4,176	1,636	11,294	3	2	2.9	140
Gambia	40	6,554	2,726	10,363	5,336	2,454	7,182	2.4	1.2	3.8	23
Ghana	50	6,025	2,581	12,584	4,134	918	10,768	3.7	2.7	3.3	231
Guinea	29	8,921	2,907	22,790	5,240	785	16,650	4.6	3.5	3.6	81
Guinea-	16	6,089	4,083	6,907	6,125	3,144	7,468	2.7	1.4	3.6	34
Mauritania	34	10,53	7,566	9,602	18,242	8,237	24,579	3.3	1.1	4.8	71
Namibia	75	26,39	16,391	30,996	18,611	11,292	22,016	2.5	1.3	2.8	88
Rwanda	232	14,44	4,981	22,647	15,458	5,950	27,328	3.1	1.8	3.8	52
Swaziland	141	17,00	11,125	19,038	10,827	4,299	16,594	4.2	2.8	3.9	48
Tanzania	72	17,96	7,981	22,556	16,351	6,502	24,279	3	1.5	3.6	222
Uganda	52	9,009	4,493	13,881	7,421	3,616	11,620	2.7	1.4	3.3	253
Zambia	70	10,72	6,023	15,325	7,926	3,711	12,144	3.2	1.9	3.7	274
Region[$]		16,558			15,231			1.09			
Bangladesh	316	5,507	3,327	7,618	6,279	2,311	12,155	2.6	1.6	2.8	946
India	75	13,25	7,983	17,336	8,327	3,908	14,307	3.2	2.2	3.1	1,158
Vietnam	368	8,738	5,181	11,005	10,349	4,873	15,631	2.1	1.1	2.7	913
Region		11,005			9,908			1.11			
Argentina	139	43,60	35,965	34,545	26,174	17,212	28,522	3.4	2.1	3.4	354
Bolivia	60	24,89	12,381	32,022	17,251	9,000	22,694	3.1	2	3.2	178
Chile	83	29,36	21,578	26,823	20,558	10,370	26,059	3.3	2	3.4	385
Colombia	81	20,62	15,080	20,466	10,956	6,046	14,743	3.8	2.4	3.7	476
Ecuador	74	33,64	23,560	30,430	31,206	18,116	33,163	2.2	1.2	2.5	227
Paraguay	49	24,44	16,343	27,418	17,970	11,058	21,387	2.6	1.4	3	112
Peru	160	25,31	17,847	26,049	17,260	7,740	24,116	3.4	2.2	3.4	190
Uruguay	45	26,31	14,914	28,425	18,186	9,845	21,465	2.9	1.8	3.1	131
Region		42,834			28,955			1.48			

$- The regional totals are constructed by summing value-added and capital of all firms and dividing it by the numbers of worker in each sub-sample, hence this measure does not give equal weight to small and large firms.

The figures on profitability presented in table 4 are striking and depart from the stylized fact that the expansion of the African manufacturing sector is held back by high costs and low profit margins (Benn et al, 2005). The ratios are constructed in local currency. Both the mean and the median firm show substantial profit margins above 20% for most African countries, taking account of both direct and indirect costs. This sets them on par with South American firms, though the latter have higher standard deviations. This is mirrored by average returns to capital where the mean exceeds 100% in all countries except Gambia, Mauritania and Uganda. Given the relatively high cost of capital goods in Sub-Saharan Africa, the profit rate would be higher if PPPs were used. For example, the price level index (world=100) for machinery and equipment is 128 in Zambia, 74 in India and 100 in Argentina (World Bank, 2008). The profit rate would be effectively halved if include land and buildings in the capital stock measure.

Table 4: Firm Profitability

	Profit margin (%)			***Profit rate (%)***			***Profit per worker (PPP)***		
	Mean	Median	Sd	Mean	Median	Sd	Mean	Median	Sd
Angola	27	26	16	146	71	183	4,995	2,580	7,402
Botswana	25	22	27	128	45	200	13,436	4,174	23,239
Burundi	26	26	21	127	62	170	6,205	2,403	15,938
DRC	20	19	13	171	105	196	3,213	1,639	5,478
Gambia	16	11	15	39	16	56	4,437	902	9,119
Ghana	22	21	18	119	78	145	4,067	1,081	11,260
Guinea	26	24	14	145	93	134	7,254	1,214	22,085
Guinea-Bissau	18	16	22	97	44	188	3,179	1,460	6,181
Mauritania	10	10	8	82	27	126	5,946	3,215	8,149
Namibia	32	32	26	151	83	202	19,175	9,563	28,622
Rwanda	20	19	15	100	39	138	10,318	2,486	18,612
Swaziland	32	33	19	138	78	137	11,691	5,518	17,406
Tanzania	33	30	22	114	56	139	14,599	5,076	20,877
Uganda	19	19	18	57	26	105	5,892	1,807	12,301
Zambia	27	26	16	118	66	144	7,620	3,347	13,354
Region	0.29			0.82			12,504		
Bangladesh	19	17	12	119	67	142	3,879	1,728	7,119
India	22	20	17	154	97	174	10,054	5,115	16,138
Vietnam	15	13	13	100	48	150	5,737	2,469	10,118
Region	0.21			0.81			8,047		
Argentina	25	24	21	137	80	174	27,609	19,667	30,569
Bolivia	32	29	24	114	63	138	18,576	8,038	29,117
Chile	26	26	22	174	94	224	18,205	11,473	24,233
Colombia	27	24	21	165	91	192	12,878	7,844	17,092

Ecuador	28	28	24	119	59	175	22,380	12,009	28,581
Paraguay	23	27	35	87	39	143	16,807	8,936	24,735
Peru	23	21	24	159	84	209	15,726	10,138	22,921
Uruguay	26	24	23	151	82	201	16,824	8,428	21,787
Region	0.29			0.97			28,110		

The literature discussed above points to very high returns especially in smaller firms with low capital intensity, but the magnitude of returns is often very low, which makes them less attractive propositions for investors. Table 4 shows that this is not a feature of this new dataset. The calculation of profit per worker allows a comparison of the profits achieved standardized across firms of varying size. Profits per worker are in many instances higher than in Asia and comparable to those in the South American middle income countries. Throughout I use conservative estimates where extreme values have been removed.

3.4. From the average to the margin

Average returns may differ substantially from marginal rates of return when controlling for other inputs and firm characteristics. To test whether these high returns persist at the margin requires a production function. According to theory, two opposing forces are the main drivers of differences in marginal returns: low total factor productivity lowers the return on physical capital, whereas a low capital per worker ratio increases the relative price of capital and its expected return.

I use a simple Cobb-Douglas production function to arrive at a stylized illustration of the relationship for the cross section:

$$\ln Y_i = \beta_0 + \beta_1 \ln L_i + \beta_2 \ln K_i + \beta_3 \ln Z_i + \beta_4 age_i + \varepsilon_i \qquad (3.4.1)$$

where Y is output, L is labour, K is the stock of physical capital and Z represents a number of dummies controlling for the average education of production workers, foreign ownership, size, sector and country fixed effects.

The analysis of returns at the margin contains sources of bias that the cross section nature of the data is ill-equipped to address. A critical property for unbiasedness of OLS estimates is the zero conditional mean assumption, i.e. no correlation between the explanatory variables and the error term. The stock of capital may be correlated with

omitted variables. More efficient firms and better managed firms, i.e. those with higher total factor productivity, may invest more. This is the classic endogeneity problem first discussed by Marschak and Andrews (1944), leading to inconsistent and biased estimates. In a test of various parametric and non-parametric production functions, van Biesebroeck (2007:531) argues that OLS ignore heterogeneity among firms and the "well-known simultaneity problem between inputs and unobserved productivity". In my model, this is partly countered by the availability of a range of relevant controls. In addition, several empirical findings imply that the OLS estimates perform well when compared to firm fixed effects and instrumental variable techniques (e.g. Bigsten et al, 2000; Soderbom and Teal, 2004).

Even when allowing for potential sources of bias, this methodology illustrates an initial approximation of return differentials across a wide spectrum of firms and countries. Future cross region studies of marginal returns would certainly benefit from a panel dimension and a more sophisticated specification. However, while randomized field experiments as undertaken in a study by Duflo, Kremer and Robinson (2008) on returns to fertilizer in Kenya or by McKenzie et al (2007) on Sri Lankan microenterprises provide unbiased insights, the data to conduct them across varying firm sizes and countries is not yet available.

Lack of appropriate local deflators is a further drawback. Variations in input and output prices that mask the true efficiency of the firm and bias the coefficient estimates are partly addressed by using specific PPPs for consumption, capital, transport and communication. However, firms which are able to charge monopoly prices may still appear more productive than those that face a high degree of competition. One explanation for changes in TFP estimates between value-added and gross-output specifications is that the latter controls for input prices directly, considerably narrowing the regional productivity gaps in my sample.

Table 5 shows the regression outputs. I use the log of value added (A) as a dependent variable. The capital and labour coefficients have the expected sign and magnitude. Cobb-Douglas functional form is rejected by the data and I find evidence of increasing returns to scale. The cross-product of capital and labour and their respective squared terms are both

jointly and individually significant, albeit quantitatively small. However, the Cobb-Douglas coefficient estimates on the country dummies and firm characteristics hold in the translog production function and I am thus inclined to impose Cobb-Douglas to ease interpretation and use size dummies to proxy differences in technology and in the quality of the capital stock across varying firm sizes. With these controls, the data accepts constant returns to scale. The size dummies are all highly significant and positive, which is expected given the non-linearities revealed by the translog. Finally, I test for different production technology using slope interaction dummies first for sectors and then for countries, which all display very low coefficients and t-stats. Formal testing confirms that at the 1% level this does not significantly alter the capital and labour coefficients and I thus accept specification (A) with shift dummies only. The results are also robust to a specification in US dollars and as a gross-output function, i.e. controlling for material inputs directly. As an alternative to the use of size dummies, I transform the production function (3.4.1) in order to impose constant-returns to scale in regression (B). Both methods produce strikingly similar results.

Foreign owned firms and those where the average production worker has benefited from higher education are significantly more productive, although the coefficients are smaller than might be expected. Moving from 0-3 years of education, the omitted category, to 4-6 years has no effect across all three specifications, while firms with production workers with 7-12 years of schooling are only marginally more productive. I use the top manager's years of experience as a proxy for ability, but this turns out highly insignificant. The data suggests that only machinery & equipment, electronics and chemicals are more productive than the omitted food sector[10].

To ease presentation, only the arithmetic mean of the country dummy coefficients are reproduced for each region. The omitted country is India. Vietnam and Bangladesh produce 50% less output holding the other explanatory variables constant. It is remarkable that the coefficient for Sub-Saharan Africa, though negative, is much smaller and even turns positive in the gross-output function, i.e. when material inputs are directly controlled for. For Sub-Saharan Africa, this masks regional disparities. For specification (A), most countries show coefficients for the size dummies close to those of Vietnam and

Bangladesh, yet Namibia and Swaziland are 40% and 30% more productive than India. The South American countries are consistently more productive.

Table 5: Production functions

	A	*B*	*C*	*D*
	[$]Value-added (PPP)	Value-added per worker (PPP)	Labour	Capital per worker
Log of capital	0.366***	0.378***		
	(0.0085)	-0.0084		
Log of labour	0.637***			
	(0.023)			
Foreign	0.226***	0.290***	0.889***	0.560***
	(0.043)	(0.043)	(0.056)	(0.059)
Log of firmage	0.0664***	0.0935***	0.370***	0.163***
	(0.013)	(0.012)	(0.018)	(0.019)
3-6 years education[$$]	0.0352	0.0586	0.325***	0.325***
	(0.046)	(0.045)	(0.070)	(0.074)
7-12 years education	0.0754*	0.110**	0.453***	0.537***
	(0.045)	(0.044)	(0.067)	(0.070)
Higher education	0.153***	0.199***	0.592***	0.570***
	(0.052)	(0.052)	(0.077)	(0.080)
Size: medium	0.164***			
	(0.035)			
Size: large	0.299***			
	(0.065)			
Size: very large	0.309***			
	(0.100)			
Machinery & equipment	0.238***	0.226***	-0.220***	0.490***
	(0.043)	(0.043)	(0.065)	(0.063)
Chemicals	0.290***	0.287***	-0.110*	0.607***
	(0.041)	(0.041)	(0.057)	(0.055)
Electronics	0.160**	0.131**	-0.439***	0.370***
	(0.063)	(0.063)	(0.094)	(0.095)
South Asia[$$$]	-0.561	-0.429	1.710	0.094

Sub-Saharan Africa	-0.146	-0.140	0.112	0.127
South America	0.413	0.410	0.068	0.957
Test for CRS	0.910			
Constant	5.513***	5.401***	1.785***	6.989***
	(0.097)	(0.087)	(0.094)	(0.094)
Observations	6511	6522	6522	6522
R-squared	0.83	0.53	0.33	0.28

*** p<0.01, ** p<0.05, *p<0.1. Robust standard errors in parentheses, p-values for tests of CRS only. [$]Dependent variables in logs. [$$]For the dummies, 0-3 years of education, small firm size, the food sector and India are the omitted categories. [$$$]Arithmetic mean of country dummies. Insignificant dummies are set to zero.

To investigate the issue further, I regress firm characteristics on the log of labour (C) and the log of capital per worker (D). The steep increase in the respective coefficients is striking. Foreign ownership, workers' education and age are strongly correlated with the size of the firm and the amount of capital employed. The sectoral dummies have the expected signs for capital vs. labour intensive industries and are not reproduced here. Regressions (C) and (D) also reveal strong regional differences. Firms in Bangladesh and Vietnam are much larger in terms of employees than those in other countries, while South American enterprises operate with vastly more capital per worker.

The highly significant size dummies and the fact that the data displays increasing returns to scale once they are dropped implies that marginal returns to capital diminish more slowly as larger firms can partly offset the effect by higher operating efficiency.

Table 6: Marginal rates of return to physical capital

	Median K/L		***U.S. K/L***	
(% p.a.)	Net	Total	Net	Total
Argentina	35	41	18	21
Bangladesh	23	43	3	6
Ghana	65	86	5	7
Tanzania	36	43	10	12
Namibia	36	42	14	16
Vietnam	24	40	6	9

Table 6 shows marginal rates of return to physical capital implied by equation (2.2) for selected countries. Median K/L is taken from Table 1 for each country whereas in columns U.S. K/L I set the capital per worker ratio equal to 50,000[11]. Net refers to the TFP residual once I control for firm characteristics such as workers' education levels, ownership, firm size and sector. Total takes into account the efficiency

differentials implied by variations in these firm characteristics[12]. This methodology incorporates Lucas' (1990) critique as I allow TFP levels to be determined empirically for both observable and unobservable country differences.

It is striking that allowing for differentials in K/L and education etc., returns converge with only Ghana remaining as an outlier. If firms had the same average capital per worker as in the U.S., returns in Tanzania and Namibia would be higher than in Bangladesh and Vietnam, but lower than in Argentina. It is noteworthy that with this assumption, returns are now in the vicinity of the stylized 9% return to invested capital often quoted for the S&P 500 (Banerjee and Duflo, 2005). Of course, we would expect that efficiency is endogenous and rises with the amount of capital inflow and the knowledge and skill attached to it. This is offset by price-effects, which are likely to be more severe for non-exporting African firms facing a downward-sloping demand curve. Table 6 also highlights the strong gains in efficiency and hence returns particularly due to education and size for the Asian sub-sample. While returns appear much lower once firms operate with more substantial amounts of capital, they are still in excess of 10% for Tanzania and Namibia, suggesting high intra-marginal returns and considerable scope for expansion of the capital stock.

3.5. Looking ahead: returns on emerging stock markets

We would expect this trend to be mirrored by very high returns on emerging Sub-Saharan African stock markets. The price signals the expected future income stream from holding equity and, in theory, the return on a stock should be directly related to firm performance, but especially emerging markets are often prone to bubble-type behaviour where prices do not adequately capture real profitability. This indicator nevertheless complements the picture as it proxies investors' expectations about the future direction of key markets in Sub-Saharan Africa.

Firm-level price data is not yet available for these emerging trading floors and I hence use capitalization weighted indices in local currency at market prices, sourced from Global Financial Data (2008). The total annual return is composed of the stock price appreciation plus the dividend yield less the rate of inflation. Over the past five years ending December 2007, investors enjoyed real returns close to 30 percent, almost triple that of investors in

S&P 500 companies. Measured in US dollars, returns would be even higher given the appreciation of most African currencies against the dollar during that period. A low P/E ratio, comparing the price of a stock to the companies' reported earnings per share issued, is another core indicator of the attractiveness of a stock to investors. Kenya and Nigeria show P/E ratios comparable to or slightly higher than for companies in the S&P 500, while the other African markets have lower ratios. More formal tests are beyond the scope of this essay, but P/E ratios are an indication that we do not observe a bubble, where shares are grossly overvalued and do not adequately reflect the firms' underlying income generating potential. Market capitalization, the share price times the number of shares outstanding, has grown considerably in all African markets, but the Johannesburg Stock Exchange remains ten times larger than the five frontier markets combined.

Table 7: Returns on emerging African stock markets

		2002	*2003*	*2004*	*2005*	*2006*	*2007*	*Annual for period*[$]
Nigeria	P/E ratio	16.4	18.5	23.5	20.7	21.34	30.68	
	Return		46%	12%	-7%	32%	70%	**28%**
	Market cap[$$]		65%	52%	34%	70%	110%	**64%**
Botswana	P/E ratio	12.1	10.7	13.3	16.9	17.6		
	Return		16%	11%	69%	53%	19%	**32%**
	Market cap		0%	15%	23%	77%	38%	**28%**
Kenya	P/E ratio	31.9	31.9	19	31.6	25.5		
	Return		98%	-4%	30%	28%	-16%	**22%**
	Market cap		194%	-7%	64%	78%	17%	**56%**
Namibia	P/E ratio	4.9	5.9	7	7	8.5		
	Return		17%	19%	38%	43%	5%	**24%**
	Market cap		24%	21%	6%	45%	3%	**19%**
Ghana	P/E ratio	3.6	7.2	15.8	8.5	10.5		
	Return		132%	80%	-41%	11%	32%	**29%**
	Market cap		93%	85%	-48%	135%		**45%**
South Africa	P/E ratio	9.7	11.7	13.9	14.2	15.6	14.3	
	Return		15%	22%	42%	34%	10%	**24%**
	Market cap		43%	70%	24%	29%	16%	**35%**
S&P 500	P/E ratio	31.89	22.81	20.7	17.85	17.4	18.65	
	Return		26%	7%	1%	13%	1%	**9%**
	Market cap			27%	10%	3%	10%	**10%**
Market cap at end 2007 (million USD)		Frontier markets[$$$] 91,472			South Africa 828,185		S&P 500 12,865,648	

$- geometric mean using decimal multiplier equivalents. $$-annual growth, accounts only for domestic companies, i.e. excludes those listed also on the JSE or LSE. $$$- African sample countries, excluding South Africa.

According to the theory of capital asset pricing the substantial difference in returns reflects a risk premium for African markets (Markowitz, 1952; Sharpe, 1964). At the same time, the rise in market capitalisation and stock prices is a function of investors' confidence about expected future company earnings, which are negatively correlated with risk. A dynamic perspective reconciles these seemingly conflicting explanations. Encouraging market signals reward the group of less risk-averse agents, who bought shares early and now benefit from the appreciation in prices and returns caused by the late entry of a group of more conservative investors.

4. Do domestic and foreign investors respond to high returns?

4.1. Rates of investment in Sub-Saharan Africa

Low investment rates in Africa are a stylized fact and are often blamed for the long period of economic stagnation (Collier and Gunning, 1999). According to Lucas' (1990) central puzzle, we would expect investment rates in developing countries to vastly exceed those of OECD member states. While there is no considerable difference in net 2005 FDI inflows for the survey countries, most ranging between 3-4 percent of GDP, all except Gambia are well below the UK's rate of 7.2 percent (World Bank, 2008). Gross capital formation, again expressed as a percentage of GDP, is slightly higher in most sample countries, but almost double the UK's rate at around 30-35 percent in India, Vietnam, Botswana, Namibia and Ghana. Whether investment is higher or lower than would be expected requires a benchmark for comparison. Devarajan, Easterly and Pack (2003), for example, note that investment in Africa is unproductive and could be considered too high, not too low. An answer to this question requires a move away from the aggregate to the micro-level evidence:

First, the above discussion makes a strong case that investment is not constrained by the lack of a potentially viable set of opportunities. Across the whole spectrum of firms, returns to invested capital are very high. Second, looking at total figures only hides the

underlying distribution and the puzzles this presents. The IMF's Regional Economic Outlook (2008) highlights a dramatic surge in private capital inflows to Africa, but does not provide a breakdown by sector. Detailed sectoral FDI data from the UK's Office of National Statistics (2008) and the U.S. Bureau of Economic Analysis (2008), the first and second largest contributor to global FDI flows respectively, allow for a disaggregation. Of the UK's 2006 net international investment position of roughly £15 billion, about two thirds is located in South Africa and Nigeria alone. The vast majority of total FDI is in mining and financial services with only 5% attributed to manufacturing. The 2005 U.S. data paints a similar picture. Over half of the $100 billion worth of total assets of majority-owned foreign affiliates is in mining, while only around 10% are in manufacturing, with regional totals just slightly above the manufacturing position of either Hong Kong or New Zealand. Again, the majority of these investments are in South Africa. A look at capital expenditures is even more striking, where 90 percent of the $7.6 billion accrue to mining.

I use the cross section and the panel to investigate firms' investment behavior more closely. Table 8 shows that only around half of firms are investing in Sub-Saharan Africa and South Asia, a smaller proportion than in South America. There is, however, strong heterogeneity in the South Asian sample. In India, less than 30% of firms recorded investment, compared to close to 70% in Vietnam. While the investment rate is low in South America, largely due to the much higher capital intensity of production, investment per worker is substantially higher. The per-worker figures for Sub-Saharan Africa exceed those in Asia, but firms in Bangladesh and Vietnam in particular are much larger and more labour intensive (tables 3&5). The investment rates for the panel appear much lower and are not directly comparable as both the definition of capital and of investment are much broader. Figures for net investment are taken from the firms' cash flow statement, which records both additions to fixed assets but also takes sales of assets into account. They show that for large companies, average annual investment is slightly lower in Africa than in the other regions.

Table 8: Micro-evidence on investment

		Sub-Saharan Africa	***South America***	***South Asia***

Proportion of firms investing (cross section)		0.54	0.62	0.48
Investment rate (cross-section)	Total	0.17	0.10	0.19
	Median	0.22	0.12	0.13
Investment per worker (PPP, cross-section)	Total	2,575	2,781	1,881
	Median	629	1,251	469
Investment rate (panel)[$]	Median	0.07	0.08	0.08

$-2002-2007 average as in table 5, includes other African and Asian countries.

4.2. Linking profits with investment at the firm level

While foreign investors may not be aware of lucrative opportunities, we would expect highly profitable companies in the panel to display high rates of investment as they expand their operations, inducing a positive correlation between past profits and current investment. This sections tests if this holds for both African and Asian firms. Econometric models of company investment face the problem that current investment decisions depend on expectations of future conditions, and these expectations are generally not observed. I discussed above that Tobin's Q is often used as a proxy for expected future profits. Unfortunately, data for market capitalization could not be obtained for the panel. Bond et al (2002) suggest alternative proxies such as cash flow terms and lagged sales if Tobin's Q is likely to suffer from measurement error. I use the return on capital, a key indicator in quarterly reports and earnings forecasts. High returns in period t-1 may not trigger more investment in time t if the firm faces substantial current liabilities and I control for this potential downward bias on my coefficient of interest. I experiment both with a levels and a dynamic specification. While Hayashi's (1981) seminal exposition estimates a levels equation, most studies include dynamics to account for adjustment costs and lumpy investment patterns[13].

Even allowing for current liabilities, the coefficient estimate on the lagged rate of return is still subject to differing interpretations. Several empirical studies on company investment employed profits or related cash-flow variables to detect financing constraints, where a

significant coefficient is interpreted as “excess sensitivity” of investment to the availability of internal funds (e.g. Fazzari et al, 1988 & 2000; Bigsten et al, 1999). Kaplan and Zingales (1997 & 2000) on the other hand show theoretically and empirically that this is not a valid measure for financing constraints. More recent attempts have found robust evidence that cash-flow variables are informative proxies of expected future profitability. The main insight of Bond et al (2004) in a study on UK companies is that cash-flow terms only become insignificant once they include earnings forecasts as a more direct measure of future profitability. In addition they find coefficient estimates to be broadly similar between firms that suffer from substantial financing constraints, proxied by low dividend payout and small size, and those that don’t.

I estimate the following model:

$$(I/K)_{it} = \beta_0 + \beta_1 (I/K)_{i,t-1} + \beta_2 (P/K)_{i,t-1} + \beta_{3(}D/K)_{it-1} + \beta_4 Year + (a_i+\varepsilon_{it}),\ t=1,2,\ldots,6, \quad (4.2.1)$$

where I/K is investment over capital, P/K is the return on capital and D/K is the level of indebtedness measured as current liabilities over capital, a_i are unobserved time-invariant firm-specific effects and ε_{it} is a normally distributed error term. Given that I have an unbalanced panel with short T, I restrict the model to one lag[14].

The presence of unobserved firm-specific effects are likely to impact both on investment rates and on profitability. For example, Kraay (2006) notes that certain firms may have more able and energetic managers, who not only run efficient operations, but also employ aggressive firm growth strategies by investing in latest technology, additional plants and new markets. This leads to a correlation of the explanatory variable with the error term and renders OLS estimates inconsistent. Hsiao (1981) shows that the lagged dependent variable is correlated with the time invariant firm effects a_i *and* β_1 is thus biased upward. If these firm specific effects are indeed time-invariant, fixed effects estimation eliminates the source of unobserved heterogeneity by time demeaning the variables for each firm. This is transformation is akin to adding a dummy for each firm to specification (4.2.1). However, fixed effects will also be biased and inconsistent by inducing a correlation between the lagged dependent variable and the lagged error term, violating the strict exogeneity assumption required for consistent fixed effects estimates (Nickel, 1981: Bond, 2002). As opposed to the pooled OLS estimation, β_1 now suffers from a downward bias.

This source of bias can be addressed by differencing and using lagged values of the explanatory values as instruments. Consider model (4.2.1) in differences where the additional explanatory variables are simply denoted by X_{it} to ease illustration:

$$(I/K)_{it} - (I/K)_{i,t-1} = \beta_1 ((I/K)_{i,t-1} - (I/K)_{i,t-2}) + \beta_2 (X_{i,t-1} - X_{i,t-2}) + (\varepsilon_{it} - \varepsilon_{i,t-1}), \quad t=1,2\ldots,6, \qquad (4.2.2)$$

By construction $((I/K)_{i,t-1} - (I/K)_{i,t-2})$ is correlated with $(\varepsilon_{it} - \varepsilon_{i,t-1})$. However, we can use $(I/K)_{i,t-2}$ as an instrument for the differenced lagged dependent variable. We know that an increase in $(I/K)_{i,t-2}$ leads to a decrease in $\Delta(I/K)_{i,t-1}$, hence the instrument is informative. In addition, our instrument will be uncorrelated with $\Delta\, \varepsilon_{it}$ provided that ε_{it} is not serially correlated. The Arellano-Bond (1991) test for second order autocorrelation in first differences (m_2) tests this property and hence the validity of the instrument.

The Nickel bias would disappear with large T, but unfortunately this is not a feature of this dataset (Rodman, 2006). Arellanno and Bond (1991) propose to use lagged values of the explanatory variables as valid instruments for differences in samples with small T and large N, denoted difference GMM. I use this method in a two step estimation, which is considered more efficient, but typically leads to a downward bias in the standard errors. I adjust for this by means of the Windmeijer (2005) finite-sample correction[15].

Table 9: Investment functions

	Africa			***Asia***		
	OLS	FE	Diff GMM[$]	OLS	FE	Diff GMM[$]
$(I/K)_{i,t-1}$	0.187***	-0.221***	-0.868**	0.197***	-0.247***	-0.0621
	(0.031)	(0.026)	(0.42)	(0.014)	(0.014)	(0.40)
$(P/K)_{i,t-1}$	0.0539***	0.00472	-0.0327	0.106***	0.0297**	0.295**
	(0.018)	(0.027)	(0.12)	(0.013)	(0.015)	(0.15)
$(D/K)_{i,t-1}$	0.00697	0.0112	0.00185	-0.000257	-0.00521	0.0163
	(0.0056)	(0.0076)	(0.021)	(0.0034)	(0.0042)	(0.014)
Constant	0.0514***	0.0805***		0.0500***	0.109***	
	(0.013)	(0.011)		(0.0060)	(0.0063)	
m1[$$]			0.995			0.124
m2			0.14			0.956
Sargan[$$]			0.057			0.13
Obs	2429	2429	1527	9835	9835	5870
Firms		881	717		3925	2837

Dependent variable is the investment rate. Robust standard errors in parentheses. *** p<0.01,

** p<0.05, * p<0.1. $-2nd and 3rd lags as instruments. 17 instruments used. $$-p-values reported. See text for time dummies and further robustness tests.

In table 9 I subdivide the sample and directly compare Africa with Asia. This is a standard approach used in the literature on financing constraints (e.g. Bond et al, 2004), but can usefully be applied to unravel the question posed here. The pooled OLS specification shows that past investment and past profit rates positively impact on current investment. The coefficient on lagged profits is statistically significantly lower in Africa than in Asia. The r-squared, which is not reported here, is very low at 0.1, but this is a common feature in this literature (e.g. Bigsten et al, 1999). As expected, the coefficient on the lagged dependent variable is lowered considerably and β_2 revised downwards by the fixed effects estimation for both regions. Past profits remain highly significant in Asia, but not in Africa. If we accept the core theoretical predictions of the investment model discussed above, the results further imply that past returns in Africa are a weaker proxy for expected future profits. Given the noted likelihood of an upward bias on the profit term in Africa, we would expect the gap between the coefficient estimates and significance levels to widen even further once we could control directly for financing constraints.

I further test the robustness of the result by using difference GMM. Bond (2002) suggests that a good health check for difference GMM is whether β_1 lies between the OLS and fixed effects estimates, widely considered as an upper and lower bound. The results for Asia satisfy this condition. The m_2 statistic further suggests that serial correlation of ε_{it} can be rejected and the Sargan/Hansen test is indicative that the instruments are jointly valid. Year dummies are not reported in the table but show a statistically highly significant, but small growth effect of the residual component over time. Past profits now display a much higher coefficient, but the lagged dependent variable is not significant anymore. We get more plausible and consistent results with highly significant coefficients on past investment and profit close to 0.10 if I experiment with different lag lengths as well as system GMM and forward orthogonal deviations. While these alternative specifications are very robust, the Sargan/Hansen test signals that instruments are invalid, implying that we may not have expunged all endogenous components. A trade-off exists between validity and relevance of instruments. Using deeper lags solves the 'validity' problem, but renders instruments less informative, leading to weaker correlation and insignificant

coefficients on the lagged dependent term. The use and misuse of the Hansen test is a common feature in this literature. Rodman (2008) provides a useful discussion.

The GMM results for Africa are not plausible as β_1 lies far outside of the expected range. I test for a multitude of different specifications and methodologies, which do not solve this issue. This and the low p-value on the Sargan/Hansen test are indicative that investment patterns in Africa are somewhat erratic and discontinuous, implying a weak correlation of past investment and current investment and hence limited scope to rely on internal instruments. The objective of this analysis is not to arrive at precise estimates, but to test the hypothesis that the link between past profitability and current investment significantly differs in Africa. The findings from the OLS, fixed effects and difference GMM regressions give support to this hypothesis. Past profits in the Asian sample are consistently more significant both statistically and quantitatively when compared to African firms.

4.3. A temporary disequilibrium

The preceding section confirms that realized returns appear to be a bad proxy for expected future returns. With the estimated returns we can now arrive at a value for θ.

Let's take the differential of the annual return on capital for manufacturing firms at the 75th percentile in both Asia and Africa, 14% and 24% respectively. For simplicity, suppose the expected return in Asia is equal to the realized return in the last period. For our hypothetical fund to continue investing in Asia only it must be that:

$$E(14_{Afr,t})=\theta(24)_{Afr,t-1} \leq E((14)_{Asia,t}), \text{ where } \theta= 0.58 \qquad (4.3.1)$$

Alternatively, consider the choice between the average annual real return of 28% at the Nigerian stock market compared to 9% at the S&P 500:

$$E((9)_{Afr,t})=\theta(28)_{Afr,t-1} \leq E((9)_{Asia,t}), \text{ where } \theta= 0.32 \qquad (4.3.2)$$

A different way to conceptualise this would be that returns in Africa are only worth 58% or 32% of their observed past value, i.e. their signalling strength for investors is severely adjusted downwards. The second section briefly elaborated four possible explanations both under assumptions of symmetric and asymmetric information. In addition, theta is likely to be influenced by borrowing constraints, lack of contract enforcement and

coordination failures, investors' home bias and the high cost of capital. It is beyond the scope of this paper to evaluate these factors, which each occupy an extensive literature. Instead, I'll aim to advance an explanation which has received less attention.

Ceteris paribus, we expect high rates of return to lead to high investment either by existing firms or by new entrants. Again, risk and non-replicability may prevent this from occurring. While Sharpe ratios are very high for the African sample, financial risk measured in terms of performance volatility may only marginally influence risk perceptions. This type of information is not generally available and political and macroeconomic risks clearly dominate. The second point, market structure and the lack of competition, certainly serves to explain the survival and good performance of much of the African firms in the sample. However, lack of competition is a blessing as much as a burden. The gradual removal of current obstacles to doing business, such as the quality of electricity and telecommunications supply, high capital costs, small market size and low levels of purchasing power, is partly endogenous to the number of new entrants and to the amount of capital inflows. These types of agglomeration benefits are well documented (e.g. Krugman and Venables, 1995) and may more than offset the potential drop in output prices brought about by competitive forces. In addition, there are several case studies where new entrants in underdeveloped markets such as Haiti, Pakistan and Bangladesh, often with vastly superior technology, outperformed incumbent firms by offering dramatically lower prices, while still substantially raising profitability through economies of scale (e.g. Warnholz, 2008). Matsuyama (2002) formally models these dynamics between scale effects, efficiency gains and price reductions. The increasing returns observed for the cross-section give support to this angle.

The third and fourth components of θ are driven by a pervasive information deficit which gives rise to a temporary disequilibrium with high profits and low investment rates. Africa is particularly prone to this for three reasons: first, decades of stagnation, political turmoil, war and economic mismanagement have led to deeply entrenched prior beliefs about doing business in the region. Second, the low stock of existing capital offers limited scope for direct knowledge transfer to occur and finally, the division into 56 states dramatically raises the costs to obtain information. This information deficit is not a novelty, but carries more severe implications once the economic reality departs from

longstanding beliefs[16]. Investigating information flows and the driving factors behind the formation of perceptions on the African business environment is a distinct research agenda, but a large part of this study was an experimental exposure to search costs.

I benefited from access to every major gateway used by international investors, including Bloomberg, Datastream, Thompson One Banker and Emerging Market Information Service, yet most queries return blank pages. Bloomberg's Professional Service, for example, claims to have data on every listed company around the globe. Every listed company outside of Africa, that is. The strong uptake of the ideas of C.K. Prahalad (2005) and others on the 'Bottom of the Pyramid' provides a further insightful 'natural experiment'. The fact that with relatively sparse and factually inaccurate information he sparked a global movement of scholars, NGOs and multinational companies is indicative of the lack of knowledge about low-income markets (Warnholz, 2007).

This information deficit on African markets is, though only one of several factors, likely to be of central importance. There is an extensive body of research on the role of expectations in determining real economic outcomes (e.g. Krugman, 1991). Factors that currently depress θ and investment, e.g. coordination failures, high capital costs and borrowing constraints, may unravel as evidence of viable business opportunities slowly tilts expectations of an increasing group of entrepreneurs in favour of Africa. The recent election in Kenya and the eruption of violence against foreigners in South Africa will have less of an impact on perceived risk as news of high, broadly stable returns and improving sovereign credit ratings (e.g. Standard & Poor's, 2008) are disseminated more widely.

This account appears at odds with the insignificant link between past profits and investment found for the panel of existing companies. It suggests that returns must be low at the margin if highly profitable companies fail to expand, for example because a rise in output reduces prices considerably for the bulk of non-exporting firms. These two propositions may be reconciled by comparing the relative strengths of the negative price-effect on profitability with the positive externalities of agglomeration and better access to global markets. With an information deficit and lack of additional entry, we would expect the price-effect to dominate as the offsetting factors largely rely on the noted shift in expectations.

5. Conclusion

Three core findings emerge from this study. First, there is robust evidence of high returns in Africa. Second, investment rates remain low outside the mining sector and finally, the relationship between past profits and current investment is insignificant for the African sub-sample of companies. I discuss several explanations for this puzzle such as non-replicability, risk and information asymmetries. They are all likely to be individually and jointly important in dampening the signaling strength of past returns to prospective investors. However, there is some evidence that a pervasive information deficit on African markets is a dominating factor, leading to a temporary disequilibrium where high profits exist alongside low investment rates. Resolving this deficit potentially serves to alter investors' expectations and this shift in expectations may unravel many of the second-order constraints to investment typically advanced in the literature.

Appendix:

Definitions of variables:

Profits before tax:
Cross-Section: sales less material inputs and labour costs less indirect costs (rental, fuel, electricity, communication, water, transport). Panel: as above, but net of depreciation and financial revenue and expenses, such as interest paid.

Capital: Cross-section: replacement value of machinery and equipment. Panel: the concept of capital employed is used, i.e. total equity plus non-current debt.

Investment rate: Cross-section: purchases of equipment and machinery divided by capital. Panel: additions to fixed assets less sales of fixed assets plus other net investments divided by capital.

Value-added: profits plus labour costs.

Indebtedness: current liabilities divided by capital.

Return on shareholder funds: profits/shareholder funds, where shareholder funds are the total equity in the firm.

Profit margin: profits divided by total sales.

Profit rate or return on capital: profits divided by the capital stock.

Labour: full time permanent and temporary employees.

Education: average education of a typical production worker, classified as 0-3 years, 4-6 year, 7-12 years and higher education. For Vietnam, this question was asked differently and I construct the classification corresponding to the education levels of the largest share of the workforce (in most cases exceeding 50%).

PPPs: I use individual consumption to convert sales, PPP rates for gross fixed capital formation for the capital stock and specific PPPs for transport and communication costs. I decide against the use of PPPs for housing, fuel, electricity and water, which would inflate the costs for African firms substantially. Relatively cheap housing drives these numbers and they may not adequately capture the price of utilities. PPPs for machinery and equipment would allow for the high costs for capital goods facing many African firms, but they are only available for about half of the African countries and I choose not to compute them.

Missing and extreme values:

Conservative estimates are reported throughout. All data sets have been especially constructed for this exercise and this required a detailed analysis of the methodology used in collection, the underlying questionnaires, sources and concepts. Irregularities were resolved in personal communication with the respective teams at the World Bank, the US Bureau of Economic Analysis, Bureau van Dijk and Global Financial Data.

For the cross section I drop all observations where data on sales, capital stock, employees, material inputs and labour costs is missing. Indirect costs are set to zero if missing. I loose less than 1% of observations for the African countries and Bangladesh. The South American sample in particular suffers from missing values. The World Bank assured me that the systematic bias arising from this is limited as it is not caused by a lack of information, but by reluctance to share this type of information which is prevalent across the whole spectrum of firms.

I follow Bigsten et al (2005) in dropping extreme values if:

Value-added<0
Capital to value-added<0.05
Capital to value-added>50
In addition: profit rates >1000% & <-1000%

Some observations appear to have been entered in incorrect units, leading to highly inflated and unrealistic productivity measures. This affects India in particular, where a small part of the sample has not been entered in thousands of LCU as stated in the questionnaire. I thus take out the top and bottom 1% of the whole sample for both value-added and capital per worker (both in PPP).

For the panel I set the top and bottom percentile of each performance, investment and debt measure to missing and loose a few observations where sales or assets are negative.

References:

Arellano, Manuel and Stephen Bond. 1991. "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations." *Review of Economic Studies*, 58:194, pp. 277.

Babilis, Sofia and Valpy Fitzgerald. 2005. "Risk Appetite, Home Bias and the Unstable Demand for Emerging Market Assets." *International Review of Applied Economics*, 19:4, pp. 459-76.

Banerjee, Abhijit V. and Esther Duflo. 2005. "Growth Theory through the Lens of Development Economics," Elsevier, pp. 473-552.

Benn, Eifert, Gelb Alan, and Ramachandran Vijaya. 2005. "Business Environment and Comparative Advantage in Africa: Evidence from the Investment Climate Data." Center for Global Development.

Bigsten, Arne, Paul Collier, and et al. 2000. "Rates of Return on Physical and Human Capital in Africa's Manufacturing Sector." *Economic Development & Cultural Change*, 48:4, pp. 801.

Bigsten, Arne, Paul Collier, Stefan Dercon, Gauthier Bernard, Jan Willem Gunning, Anders Isaksson, Abena Oduro, Remco Oostendrop, Cathy Pattilo, Mans Soderbom, Michel Sylvain, Francis Teal, and Albert Zeufack. 1999. "Investment in Africa's Manufacturing Sector: A Four Country Panel Data Analysis." *Oxford Bulletin of Economics & Statistics*, 61:4, pp. 489.

Bigsten, Arne, Paul Collier, Stefan Dercon, Marcel Fafchamps, Bernard Gauthier, Jan Willem Gunning, Remco Oostendorp, Catherine Pattillo, Mans Soderbom, and Francis Teal. 2005. "Adjustment Costs and Irreversibility as Determinants of Investment: Evidence from African Manufacturing." *B.E. Journals of Economic Analysis & Policy: Contributions to Economic Analysis & Policy*, 4:1, pp. 1-29.

Bigsten, Arne and Mans Soderbom. 2006. "What Have We Learned from a Decade of Manufacturing Enterprise Surveys in Africa?" *World Bank Research Observer*, 21:2, pp. 241-65.

Blundell, R. and S. Bond. 1998. "Initial conditions and moment restrictions in dynamic panel data models." *Journal of Econometrics*, Vol. 87: 115-43.

Bond, Stephen, Julie Ann Elston, Jacques Mairesse, and Benoit Mulkay. 2003. "FINANCIAL FACTORS AND INVESTMENT IN BELGIUM, FRANCE, GERMANY, AND THE UNITED KINGDOM: A COMPARISON USING COMPANY PANEL DATA." *Review of Economics & Statistics*, 85:1, pp. 153-65.

Bond, Stephen, Alexander Klemm, Rain Newton-Smith, Murtaza Syed, and Gertjan Vlieghe. 2004. "The roles of expected profitability, Tobin's Q and cash flow in econometric models of company investment." *Bank of England Quarterly Bulletin*, 44:3, pp. 323-23.

Bond, Stephen R. 2002. "Dynamic panel data models: a guide to micro data methods and practice." *Portuguese Economic Journal*, 1:2, pp. 141.

Bureau of Economic Analysis. 2008. *International Economic Accounts Data*. Washington, D.C.: U.S. Department of Commerce.

Bureau Van Dijk Electronic Publishing. 2008. *Orbis Company Data*. Brussels: Bureau van Dijk Electronic Publishing

Collier, Paul and Jan Willem Gunning. 1999. "Explaining African Economic Performance." *Journal of Economic Literature*, 37:1, pp. 64.

Collier, Paul and Catherine Pattillo. 2000. "Investment and Risk in Africa." *Investment and Risk in Africa B2 - Investment and Risk in Africa*. Macmillan: Hampshire.

Cull, Robert , David McKenzie, and Christopher Woodruff. 2007. "Experimental Evidence on Returns to Capital and Access to Finance in Mexico." *Mimeo*. World Bank: Washington, D.C. .

Devarajan, Shantayanan, William R. Easterly, and Howard Pack. 2003. "Low Investment Is Not the Constraint on African Development." *Economic Development & Cultural Change*, 51:3, pp. 547.

Dixit, Avinash K. and Robert S. Pindyck. 1994. *Investment under uncertainty*. Princeton, N.J.: Princeton University Press.

Duflo, Esther, Michael Kremer, and Jonathan Robinson. 2008. "How High are Rates of Return to Fertilizer? Evidence from Fiel Experiments in Kenya." *American Economic Association Meetings*.

Fazzari, Steven M., R. Glenn Hubbard, and Bruce C. Petersen. 1988. "Financing Constraints and Corporate Investment." *Brookings Papers on Economic Activity*:1, pp. 141-206.

Fazzari, Steven M., R. Glenn Hubbard, and Bruce C. Petersen. 2000. "INVESTMENT-CASH FLOW SENSITIVITIES ARE USEFUL: A COMMENT ON KAPLAN AND ZINGALES." *Quarterly Journal of Economics*, 115:2, pp. 695-705.

Fitzgerald, Valpy. 2002. "International Tax Co-operation and Capital Mobility." *Oxford Development Studies*, 30:3, pp. 251-66.

Forbes Magazine. 2008. "Global 2000." Forbes Magazine: New York.

Global Financial Data. 2008. *Selected Emerging Stock Market Series*. Los Angeles: Global Financial Data.

Gunning, Jan Willem and Taye Mengistae. 2001. "Determinants of African Manufacturing Investment: the Microeconomic Evidence " *Journal of African Economies*, 10, pp. 32.

Harsch, Ernest. 1999. "Africa's untapped investment potential." *Africa Recovery*, 13:2.

Hausmann, Ricardo and Dani Rodrik. 2003. "Economic Development as Self-Discovery." *Journal of Development Economics*, Vol. 72: 603-33.

Hayashi, Fumio. 1982. "TOBIN'S MARGINAL q AND AVERAGE q: A NEOCLASSICAL INTERPRETATION." *Econometrica*, 50:1, pp. 213-24.

Hsiao, C. 1986. *Analysis of Panel Data*. Cambridge University Press: London.

IMF. 2008. *African Regional Economic Outlook* Washington, D.C. : International Monetary Fund.

IMF. 2008. *Global Economic Outlook* Washington, D.C.: International Monetary Fund.

Kaplan, Steven N. and Luigi Zingales. 1997. "DO INVESTMENT-CASH FLOW SENSITIVITIES PROVIDE USEFUL MEASURES OF FINANCING CONSTRAINTS?" *Quarterly Journal of Economics*, 112:1, pp. 169-215.

Kaplan, Steven N. and Luigi Zingales. 2000. "INVESTMENT-CASH FLOW SENSITIVITIES ARE NOT VALID MEASURES OF FINANCING CONSTRAINTS." *Quarterly Journal of Economics*, 115:2, pp. 707-12.

Kraay, Aart. 2006. "Exports and Economic Performance: Evidence from a Panel of Chinese Enterprises," in *Global Integration & Technology Transfer*. Bernard Hoekman and Beata Javorcik eds. Washington, D.C. : World Bank.

Krugman, Paul. 1991. "History versus expectations." *Quarterly Journal of Economics*, 106:2, pp. 651.

Krugman, Paul and Anthony J. Venables. 1995. "Globalization and the inequality of nations." *Quarterly Journal of Economics*, 110:4, pp. 857-80.

Lucas, Robert B. and Jr. 1990. "Why doesn't capital flow from rich to poor countries?" *American Economic Review*, 80:2, pp. 92.

Markowitz, Harry. 1952. "PORTFOLIO SELECTION." *Journal of Finance*, 7:1, pp. 77-91.

Marschak, J. and W. Andrews. 1944. "Random simultaneous equations and the theory of production." *Econometrica*, Vol. 12: 143-53.

Matsuyama, Kiminori. 2002. "The Rise of Mass Consumption Societies." *Journal of Political Economy*, 110:5, pp. 36.

McKenzie, David, Christopher Woodruff, and Suresh De Mel. 2007. "Returns to Capital in Microenterprises:Evidence from a Field Experiment." *IZA Discussion Paper* No. 2934.

Nickell, S. J. 1981. "Biases in dynamic models with fixed effects." *Econometrica*, Vol. 49: 1399-416.

Office of National Statistics. 2008. *Selected Series of Foreign Direct Investment Position*. London: Office of National Statistics.

Pattillo, Catherine and Mans Soderbom. 2000. "Managerial Risk Attitudes and Firm Performance in Ghanaian Manufacturing: an Empirical Analysis Based on Experimental Data." *CSAE Working Paper*:17, pp. 28.

Prahalad, C. K. and Allen Hammond. 2002. "Serving the World's Poor, Profitably." *Harvard Business Review*, 80:9, pp. 48-57.

Roodman, David. 2006. "How to Do xtabond2:An Introduction to “Difference” and “System” GMM in Stata." *Centre for Global Development Working Paper*:103.

Roodman, David. 2008. "A Note on the Theme of Too Many Instruments" *Centre for Global Development Working Paper*:125.

Serven, Luis. 1997. *Uncertainty, instability, and irreversible investment : theory, evidence, and lessons for Africa*. Washington, DC: World Bank, Policy Research Dept., Macroeconomics & Growth Division.

Sharpe, William F. 1964. "CAPITAL ASSET PRICES: A THEORY OF MARKET EQUILIBRIUM UNDER CONDITIONS OF RISK." *Journal of Finance*, 19:3, pp. 425-42.

Sharpe, William F. 1966. "MUTUAL FUND PERFORMANCE." *Journal of Business*, 39:1, pp. 119.

Sharpe, William F. 1994. "The Sharpe ratio." *Journal of Portfolio Management*, 21:1, pp. 49.

Soderbom, Mans and Francis Teal. 2004. "Size and efficiency in African manufacturing firms: evidence from firm-level panel data." *Journal of Development Economics*, 73:1, pp. 369.

Standard & Poor's. 2007. *Ratings Direct Nigeria*. London: Standard & Poor's.

Todd, Moss, Ramachandran Vijaya, and Standley Scott. 2007. "Why Doesn't Africa Get More Equity Investment? Frontier Stock Markets, Firm Size and Asset Allocations of Global Emerging Market Funds." Center for Global Development.

Udry, Christopher and Santosh Anagol. 2006. "The Return to Capital in Ghana." *American Economic Review*, 96:2, pp. 388-93.

van Biesebroeck, Johannes. 2007. "ROBUSTNESS OF PRODUCTIVITY ESTIMATES." *Journal of Industrial Economics*, 55:3, pp. 529-69.

van Greuning, Hennie. 2005. *International Financial Reporting Standards*. Washington, D.C.: World Bank.

Warnholz, Jean-Louis. 2007. "Poverty Reduction for Profit? A critical examination of business opportunities at the Bottom of the Pyramid." *QEH Working Paper Series*:160, pp. 27.

Warnholz, Jean-Louis. 2008. "Even the Poorest Can Be a Thriving Market." *Harvard Business Review*, 86:5, pp. 26-26.

Windmeijer, Frank. 2005. "A finite sample correction for the variance of linear efficient two-step GMM estimators." *Journal of Econometrics*, 126:1, pp. 25-51.

World Bank. 2008. 2005 International Comparison Program: Tables of Final Results. Washington, D.C.: World Bank.

World Bank. 2008. *World Development Indicators*. Washington, D.C.: World Bank.

Endnotes:

[1] Note that Lucas uses the difference in labour productivity instead to calculate r. This exposition draws on Banerjee and Duflo (2005).

[2] This would not hold if there is home bias (e.g. see Babilis and Fitzgerald, 2005) or if capital controls or taxation prevent inflows (e.g. see Fitzgerald, 2002).

[3] In addition: Vietnam, Bangladesh, Indonesia, Peru, Chile, Colombia, Uruguay, Panama and Paraguay.

[4] I did a direct comparison with Bloomberg, Thomson Financial, Datastream and Standard and Poors'.

[5] The Sortino ratio measures only downside volatility against a target benchmark. However, given the small number of available periods per firm, I am unable to construct a reliable semi-deviation required to compute this performance indicator.

[6]The Bangladesh, Ghana and Zambia surveys were done in 2007, India and Vietnam in 2005 and all others in 2006.

[7]Ghana, Zambia and the Asian countries are deflated using CPIs from the IMF's (2008) World Economic Outlook.

[8] Land and buildings may be allocated by non-market mechanisms. In addition, it is considered relatively less problematic to provide an accurate valuation for machinery and equipment, leading to a lower degree of noise in the data.

[9] Bigsten and Soderbom (2006) discuss some of these concerns in their survey paper.

[10] Textiles, garments, non-metallic minerals, wood & wood products, metal & metal products as well as 'other manufacturing' are not significantly different from zero and are thus not reported here.

[11] The 1992 PWT (1993) estimate adjusted to reflect 2005 prices.

[12] Based on the country mean of the dummies in table 5, I calculate how much each category contributes to TFP and add this to net TFP. For example, 13% of Bangladeshi firms are in the chemicals industry. I multiply this by the coefficient estimate for this sector, apply the resulting fraction to the exponential of the constant term and add the result to net TFP.

[13] Please refer to Bond et al (2003) for a discussion of different specifications.

[14] The data does not allow me to calculate the real capital stock from its initial level and I thus rely on the broad measure introduced in section 3.3.

[15] It is beyond the scope of this thesis to provide a fuller theoretical treatment of difference and system GMM. Bond (2002) and Rodman(2006) provide a pedagogic introduction.

[16] For example, refer to the IMF's (2008:3) Regional Economic Outlook for a discussion of the "broadly positive" macroeconomic developments in 2007.