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# INVESTMENT IN AFRICA'S MANUFACTURING SECTOR: A FOUR COUNTRY PANEL DATA ANALYSIS

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## I. INTRODUCTION

This paper investigates manufacturing investment in four African countries – the Cameroon, Ghana, Kenya and Zimbabwe – in which financial markets have been heavily controlled. During the 1990s per capita GDP has declined in Africa generally at 1.8 percent p.a. whereas in other developing areas it has grown by 4.4 percent World Bank (1996). There is some evidence from growth regressions (King and Levine (1993) and Easterly and Levine (1995)) that financial markets are important in the growth process and that their weakness in Africa has contributed to these outcomes. One route by which financial markets might matter is through the level and efficiency of investment. To date, analyses of African investment have typically been based upon national aggregate investment rates, whether through time series of particular countries (for example Jenkins (1996) and Mlambo and Mhlophe (1995)) or international cross-sections (for example, Kumar and Mlambo (1995) and Hadjimichael *et al*. (1995)). Such datasets do not provide the information necessary to assess the links between financial performance and firm investment.

A positive relationship between profitability and investment has been widely found in both developed and developing countries (Fazzari *et al*. (1988), Hoshi *et al*. (1991), Bond and Meghir (1994), Tybout (1983), Athey

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and Laumas (1994) and Harris *et al*. (1994)). If firms have limited access to financial markets profitability affects the capacity to finance investment. The more financially constrained the firm the less able it is to adjust to its desired capital stock. Tybout (1983, p.600) argues that 'if the effect of credit rationing is essentially to increase the user cost of capital, rationed firms should exhibit relatively high marginal products of capital in the long run, and they should be relatively sluggish in adjusting their capital stocks to any given gap between actual and desired levels'. In a flexible accelerator specification of the investment function the ability of the firm to respond to changes in its desired capital stock is reflected in the positive effect on investment of the growth in value-added. Past firm borrowing may affect present investment adversely if such borrowing increase the probability of bankruptcy. Firm size and age may affect investment for several reasons. Both size and age may affect access to finance and thus be associated with firm specific capital costs. Indivisibilities in investment, if investment rates are low, may imply a different pattern in the timing of investment for firms of different size. The importance of all these factors in determining investment in plant and equipment in African manufacturing firms is investigated in this paper in the context of major changes in macroeconomic policies in the countries surveyed.

The structure of the paper is as follows. Section II describes the macroeconomic policy environments in the four countries. In Section III the data on which the results are based is described. Alterative specifications for the investment function are set out in Section IV and the estimation results presented in Section V. Section VI provides a comparative review of the findings in this paper for Africa and those for other countries. Section VII concludes.

## II. THE MACROECONOMIC BACKGROUND

All the countries included in this paper faced difficulties in their macroeconomic environment that had important implications for the performance of the manufacturing sector. The periods convered by the RPED surveys, on which the analysis in this paper is based, were for Kenya 1992 to 1994, for Ghana 1991 to 1993, for Zimbabwe 1992 to 1994 and for Cameroon 1992/93 to 1994/95.

Figure 1 shows the pattern of the changes in real per capita GDP for the four countries from 1980 to 1995 and in Table 1 the trend growth rates are presented for the period from 1971 to 1995. Ghana has seen a sustained reversal of poor economic performance. However this recovery is in the context of the largest fall in real per capita GDP since 1971 of any of the four countries. Economic performance in Cameroon deteriorated dramatically in the period from the mid 1980s. Kenya is the only country which has seen a long term sustained growth of per capita income. In Zimbabwe per capita GDP has fallen at a trend rate of 0.4 percent per annum over the

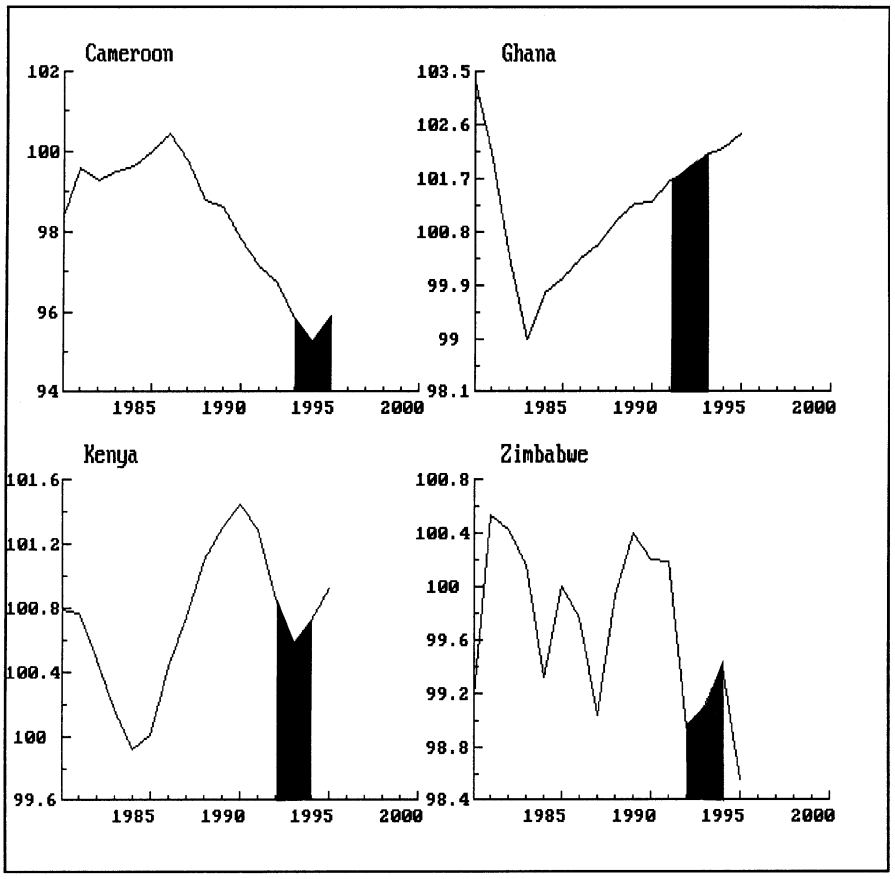


Figure 1. The Log of Real per Capita GDP for the Four Countries 1980–1995: Index 1985 = 100

TABLE 1
*Trend Growth Rates: Real per Capita GDP (% pa)*

| *Period* | *1971–1995* | *1971–83* | *1983–95* |
|---|---|---|---|
| Cameroon | 1.1 | 6.1 | −5.3 |
| Kenya | 0.7 | 1.4 | 0.6 |
| Ghana | −1.2 | −3.3 | 1.8 |
| Zimbabwe | −0.4 | −0.9 | −0.4 |

*Source* for Figure 1 and Table 1: World Bank Database.

period from 1971. The shaded areas in the figure indicate the period for which the surveys were conducted.

All the countries have adopted some measures of economic reform in the last decade. The structural adjustment programmes adopted by the Ghana government date from 1983. In the period from 1983 to 1991 the exchange rate had been liberalised so that, by the start of the survey period (1992), the premium on foreign exchange had been eliminated. In the late 1980s a reform of the financial system had removed a substantial number of non-performing loans from the banking system and had liberalised interest rates which were substantially positive in real terms over the survey period (see Table 2 below). There may have been a slow-down in growth in the years

TABLE 2
*Rates of Inflation, Real Exchange Rate Changes and Real Interest Rates*

| *Rates of Inflation (% per annum)* | *Cameroon* | *Ghana* | *Kenya* | *Zimbabwe* |
|---|---|---|---|---|
| 1990/91 | 0 | 18 | 20 | 23 |
| 1991/92 | 0 | 10 | 30 | 42 |
| 1992/93 | −3 | 25 | 46 | 28 |
| 1993/94 | 35.1 | 25 | 29 | 22 |
| 1994/95 | 13.9 | 60 | 1 | 23 |
| 1990/95 | 8 | 25 | 22 | 24 |
| Real Exchange Rate (% Change) | | | | |
| 1991/92 | 6 | −8 | 11 | 5 |
| 1992/93 | −9 | −16 | −19 | 3 |
| 1993/94 | −33 | −17 | 31 | −5 |
| 1994/95 | 21 | 21 | 5 | 10 |
| 1990/95 | −29 | −19 | 21 | −12 |
| Real Interest Rates (%) | | | | |
| 1991 | 11 | 2 | 1 | −4 |
| 1992 | 12 | 20 | −9 | −13 |
| 1993 | 15 | 10 | 0 | 1 |
| 1994 | −27 | 8 | −8 | 7 |
| 1995 | −5 | −15 | 24 | 7 |

*Source*: IMF Financial Statistics (various issues). The nominal exchange rate (Er) is the period average of the domestic currency relative to the US dollar (line rf). The real exchange rate is defined as the domestic CPI deflated by the US export price index (XPus) adjusted by the nominal exchange rate (CPI/Er*XPus). The nominal interest rate is the rate at which the monetary authorities lend or discount eligible paper for deposit money banks (line 60). The real interest rate is simply the nominal rate less the rate of inflation.

covered by the survey but, as can be seen from Table 1, the trend growth over the period 1983–94 was far higher than for any of the other countries.

In Kenya the donors temporarily withdrew their support in 1991. This initiated a serious economic crisis and there were falls in per capita GDP from 1991 to 1993 (Figure 1). Political turmoil and ethnic clashes before and after the elections in December 1992 also had serious repercussions on the economy. There was considerable uncertainty about government policies. Thus 1993, which is the year at the centre of the survey period, was one of the worst years in post-independence Kenya. By mid 1994 there had been some economic recovery and the per capita growth rate for 1994 was positive for the first time in four years (Figure 1).

In both Zimbabwe and Cameroon the period since 1983 has seen trend declines in their per capita GDP and, in the case of Zimbabwe this negative trend extends from the 1970s. Both countries adopted policies of substantial reform in the 1990s.

In Zimbabwe a structural adjustment programme was adopted in 1991. Policy changes initially focused on dismantling the highly restrictive system of import and foreign exchange controls. This involved substantial exchange rate adjustments, which quickly eliminated much of the parallel market premium, and the gradual movement of import categories to an Open General Import Licence (OGIL) list to which foreign exchange rationing did not apply. By the time of the first survey (June 1993) these reforms had eliminated most of the trade and exchange rate problems which firms had faced throughout the 1980s. Zimbabwe was hit by a very serious drought in 1991/92, which still affected the surveyed manufacturing firms in 1993, in that demand was still low. It subsequently recovered quickly. In the course of the survey period (1993–95) there were two important changes. First, competition increased, both from new domestic firms and from imports. Second, the combination of fincancial liberalisation and a large fiscal deficit led to sharp rises in nominal interest rates so that real interests rates changed from −13 percent in 1992 to 7 percent in 1994 and 1995 (Table 2).

Cameroon experienced by far the largest fall in per capita GDP, of the four countries, in the period 1983 to 1994, Table 1. Between 1986 and 1994 Cameroon's per capita income fell by nearly 50 percent, Figure 1. An adverse terms of trade shock in 1986, and declines in government revenue, led to the financing of the public deficit with increased external borrowing and arrears in the private sector. In 1988, an IMF-supported stabilisation package was accepted by the government, followed a year later by the implementation of a World Bank and bilateral donor-financed Structural Adjustment Programme (SAP). Given the CFA zone's fixed nominal exchange rate vis-a-vis the French franc, the government had to reply on policy instruments other than the exchange rate for adjustment. Despite some major reforms in the business environment (including price and labour deregulation, banking sector reform and tariff reductions), income

continued to fall, with little export growth. In early 1994, the CFAF was devalued by 50 percent against the French franc, and measures of trade and indirect tax reform section were implemented. Since this latest round of reforms, some positive signals have been registered at the macroeconomic level, in particular the first increase in per capita GDP since 1986, Figure 1.

Table 2 presents the rates of inflation, the rates of depreciation of the real exchange rate and real interest rates from 1991 to 1995 for all the countries in this study. While the largest nominal depreciation was in Ghana and the smallest in Cameroon, the largest real devaluation was in the Cameroon. All four countries have in common high, and highly variable, rates of inflation and exchange rate depreciation. In all four countries real interest rates, measured simply as the difference between nominal rates and the rate of inflation, have moved between substantial positive and negative numbers. The level of nominal interest rates has also been highly variable; in Kenya doubling, then halving, during the period of the surveys. It is clear that the macroeconomic environment in which the firms worked ensured the potential for substantial uncertainty. Uncertainty about the real interest rate they would face, uncertainty about the real exchange rate and uncertainty about the credibility of government policies to maintain incentives to export. It will be argued that such uncertainty plays a major role in explaining the poor investment performance of the firms.

## III. FIRM CHARACTERISTICS

The sample is drawn from a survey of firms in the manufacturing sectors of the Cameroon, Ghana, Kenya and Zimbabwe ranging in size from micro (less than five employees) to those employing over a thousand. For each of the four countries three rounds of interviews were conducted over the period 1992 to 1995. The sample was chosen by sampling from four sectors within manufacturing – textile and clothing, wood and furniture, metal working and machinery and foods – and stratifying by size and location. In the regressions reported below we control for, but do not report, sector, ownership and location effects. The average size of firms in the samples is smallest in Ghana, at 36 employees, and largest in Zimbabwe at 303 employees. In Ghana and Zimbabwe the average size of firms increased over the survey period, although for Zimbabwe the rise was very small, Appendix A Table 1. We wish to use lagged values of the variables, and to measure the growth rate of real value-added, so we lose one wave of the survey for each country. Initial inspection of the data led us to discard a few observations as being very sizable outliers leaving a sample size of 739 for which we have complete information. It is this sample which provides the basis of the regressions reported in this paper.

Table 3 presents the averages of the variables we wish to explain across all three rounds of the survey and across the four countries. Investment refers to purchases of plant and equipment, investment in building and land

TABLE 3
*The Pattern of Firm Investment across Countries and Firm Size*

| *Investment by country Means* | *Proportion of firms investing* | *Investment/ Value-added if firms invest* | *Investment/ Capital if firms invest* | *Investment/ Value-added* | *Investment/ Capital* |
|---|---|---|---|---|---|
| Cameroon | | | | | |
| 1992/93 | 0.21 | 0.49 | 0.45 | 0.08 | 0.08 |
| 1993/94 | 0.28 | 0.27 | 0.27 | 0.08 | 0.07 |
| 1994/95 | 0.33 | 0.39 | 0.31 | 0.11 | 0.08 |
| Ghana | | | | | |
| 1991 | 0.34 | 0.21 | 0.16 | 0.08 | 0.05 |
| 1992 | 0.52 | 0.23 | 0.25 | 0.12 | 0.13 |
| 1993 | 0.54 | 0.25 | 0.26 | 0.13 | 0.13 |
| Kenya | | | | | |
| 1992 | 0.45 | 0.23 | 0.15 | 0.12 | 0.09 |
| 1993 | 0.45 | 0.24 | 0.14 | 0.11 | 0.06 |
| 1994 | 0.45 | 0.33 | 0.16 | 0.13 | 0.05 |
| Zimbabwe | | | | | |
| 1992 | 0.69 | 0.18 | 0.14 | 0.13 | 0.09 |
| 1993 | 0.76 | 0.15 | 0.12 | 0.11 | 0.09 |
| 1994 | 0.71 | 0.11 | 0.10 | 0.08 | 0.07 |
| Investment by firm size (a) Means | | | | | |
| Large ($>=100$ employees) | 0.72 | 0.18 | 0.11 | 0.13 | 0.08 |
| Small ($<100$ employees) | 0.41 | 0.25 | 0.21 | 0.11 | 0.09 |
| All Firms | 0.50 | 0.22 | 0.18 | 0.11 | 0.09 |

*Note*: (a) Firm size is defined as the average size of the firm over the three rounds of the surveys.

is excluded from the analysis throughout this paper. Half the firms carry out no investment in any year. This problem also arose in the analysis of Harris, Schiantarelli and Siregar (1994, p. 43) who excluded all firms from their estimation which did not have four consecutive year of non-zero investments. It is clear from Table 3 that there is a pattern by which large firms, while more likely to invest, invest less than smaller firms when they do invest. The means of investments to capital of 9 percent are similar to those reported in studies for the UK (see Table 5). However such averages are misleading as can be seen by considering the distribution of the variables shown in Table 4.

It is well known that rates of investment, in general, in African countries have been low. Table 4 shows just how low has been investment in the manufacturing sector. The median value for investment to value-added (I/V), and for investment to the capital stock (I/K), in the four countries is close to zero. The average profit rate (C/K) shown in Table 4 is very high.

TABLE 4
*Descriptive Statistics Showing Distribution of Key Variables*

| | | *Cameroon* | *Ghana* | *Kenya* | *Zimbabwe* | *All* |
|---|---|---|---|---|---|---|
| *N* | | *130* | *199* | *177* | *233* | *739* |
| $I/K_{(-1)}$ | M25 | 0 | 0 | 0 | 0 | 0 |
| | M50 | 0 | 0.003 | 0 | 0.03 | 0.004 |
| | M75 | 0.02 | 0.09 | 0.07 | 0.13 | 0.10 |
| | Mean | 0.11 | 0.13 | 0.11 | 0.12 | 0.12 |
| I/V | M25 | 0 | 0 | 0 | 0 | 0 |
| | M50 | 0 | 0.002 | 0 | 0.04 | 0.007 |
| | M75 | 0.04 | 0.07 | 0.07 | 0.12 | 0.09 |
| | Mean | 0.10 | 0.12 | 0.12 | 0.09 | 0.11 |
| C/K | M25 | 0.05 | 0.19 | 0.09 | 0.14 | 0.12 |
| | M50 | 0.32 | 0.83 | 0.26 | 0.37 | 0.38 |
| | M75 | 1.29 | 3.45 | 1.09 | 0.80 | 1.34 |
| | Mean | 1.36 | 3.63 | 1.82 | 0.85 | 1.92 |
| V/K | M25 | 0.23 | 0.35 | 0.19 | 0.36 | 0.29 |
| | M50 | 0.52 | 1.53 | 0.52 | 0.68 | 0.72 |
| | M75 | 1.58 | 5.33 | 1.76 | 1.42 | 2.17 |
| | Mean | 1.80 | 5.05 | 2.49 | 1.49 | 2.74 |
| B/K | M25 | 0 | 0 | 0 | 0 | 0 |
| | M50 | 0.01 | 0 | 0 | 0 | 0 |
| | M75 | 0.22 | 0 | 0.02 | 0.08 | 0.03 |
| | Mean | 0.21 | 0.02 | 0.06 | 0.15 | 0.10 |
| $\Delta V_c/K_{(-1)}$ | M25 | −0.59 | −0.40 | −0.37 | −0.27 | −0.36 |
| | M50 | −0.13 | 0.03 | −0.02 | −0.02 | −0.03 |
| | M75 | 0.06 | 0.78 | 0.27 | 0.17 | 0.25 |
| | Mean | −0.35 | 0.28 | −0.25 | −0.26 | −0.12 |

*Notes*: Mi is the ith percentile, N is the number of observations.
Variable definitions: $I/K_{(-1)}$ is investment in plant and equipment to the lagged capital stock, I/V is investment to value-added, C/K is the profit rate, V/K is value-added to capital, $\Delta V_c/K_{(-1)}$ is the change in real value-added deflated by lagged capital, K/V is the capital to value-added ratio and B/K is indebtedbess (defined as past formal borrowing) to capital.

This is true for all the countries in the sample. It is also the case that this variable too has a highly asymmetric distribution in that the mean in 192 percent and the median is 38 percent. The asymmetry of the distribution of the variables implies that the median is a better measure than the mean of central tendency. Table 4 also shows a median value of the value-added to capital ratio (V/K) of 0.72. It is far higher for Ghana than for the other countries. Formal debts to the banking system (B/K) are negligible for the majority of firms and the data is wholly consistent with a severely financially constrained regime operating in all the countries in the survey.

TABLE 5
*Comparative Data for the Europe and India (a)*

| | | *Belgium (1981–1989)* | *France* | *Germany* | *UK* | *UK (1983–1986)* | *India Small* | *Large* |
|---|---|---|---|---|---|---|---|---|
| I/K | Mean | 0.13 | 0.11 | 0.12 | 0.12 | 0.09 | na | na |
| | Median | na | na | na | na | 0.07 | 0.08 | 0.12 |
| C/K | Mean | 0.18 | 0.12 | 0.16 | 0.13 | 0.16 | na | na |
| | Median | na | na | na | na | 0.14 | 0.07 | 0.10 |
| B/K | Mean | na | na | na | na | 0.12 | na | na |
| | Median | na | na | na | na | 0.09 | na | na |

*Note*: (a) The source for the first four columns is Bond, Elston, Mairesse and Mulkay (1997, Table 2). The source for the UK data from 1983–1986 is Bond and Meghir (1994). The Indian data is taken from Athey and Laumas (1994). Size for the Indian firms refers to a measure of market capitalization so is not directly comparable to the employment definition used in this, and other papers, to investigate the size issue.

Finally, the growth in value added at the median is negative at $-3$ percent per annum. Only in Ghana is the median growth rate positive.

Table 5 provides comparative data for some European countries and India. Compared to all these countries the median values of investments to capital in all the African countries is low while the profit rate is high. In the literature the possibility that own finance is used to fund investment has been linked to the existence of financial constraints and capital market segmentation.

The extent to which capital markets are segmented and how this segmentation can be modelled has been extensively investigated in the literature. Athey and Laumas (1994) use panel data on firms listed on the Indian stock exchange, summarised in Table 5, and find that net profits were most important for larger firms where size is defined in terms of capital value. Harris, Schiantarelli and Siregar (1994) have panel data for Indonesian firms, and they find that small firms, defined in terms of employment ($< 100$ workers), appear to rely more on internal funds than larger firms. This is also the finding in Tybout (1983). The specifications used in these papers are very close. A similar result, derived by a different route, can be found in Nabi (1989) who uses an endogenous switching model to show that firms excluded from the formal capital market rely more on profits for investment. It is this implication that small firms are more likely to be financially constrained that will be considered in the regressions reported below.

## IV. ALTERNATIVE SPECIFICATIONS FOR THE INVESTMENT FUNCTION

In the analyses of investment discussed in the last section all the papers assume that the firm's objective is to maximise profits. They differ in the specification chosen, essentially choosing either a flexible accelerator or

proceeding by the use of an Euler equation. In empirical implementation the latter uses a more general cost of adjustment function than is implied by the flexible accelerator model. The papers have in common a valuation function of the form:

$$V_t(K_{t-1}) = \max\{\Pi(K_t, L_t, I_t) + \beta^t_{t+1} E_t[V_{t+1}(K_t)]\} \quad (1)$$

$\Pi(\cdot)$ is the net revenue function, $K_t$ is the capital stock, $L_t$ is labour and $I_t$ is investment. The expectations operator $E_t[\cdot]$ is conditional on information available at the start of period t.

The Euler equation approach is adopted by Bond and Meghir (1994) using UK data and by Jaramillo *et al*. (1996) for Ecuadorian firms. They write a net revenue function of the form:

$$\Pi = [p_t F(K_t, L_t) - w_t L_t - G(I_t, K_t) - p^I_t I_t] \quad (2)$$

where F (K, L) is the production function, w is the wage rate, r the discount rate used by the firm and G ($I_t$, $K_t$) is the cost of adjusting the capital stock, p is the output price and $p^I$ is the price of capital goods. The Euler equation specified in discrete time can be written as:

$$-(1-\delta)\beta^t_{t+1} E_t[\Pi_I(K, I)_{t+1}] = -\Pi_I(K, I)_t - \Pi_K(K, I)_t \quad (3)$$

where $\delta$ is the depreciation rate and $\beta^t_{t+1} = 1/(1 + r_t)$ is the firms' discount factor.

This equation, when extended to allow for imperfect competition and the possibility of debt financing of the firm, leads to an estimating equation of the form:

$$(I/K)_t = \alpha_0 + \alpha_1 (I/K)_{t-1} - \alpha_2 (I/K)^2_{t-1} - \alpha_3 (C/K)_{t-1} + \alpha_4 (V/K)_{t-1} + \alpha_5 (B/K)^2_{t-1} \quad (4)$$

where $C/K = [p(F - G) - wL]/pK$.

In this equation the term $V/K$ controls for imperfect competition and is eliminated from the Euler equation under perfect competition; otherwise the coefficient on the term is positive. The debt term in the equation $(B/K)^2$ controls for non-separability between investment and borrowing and is eliminated under Modigliani-Miller debt irrelevance.

The specification in equation [3] specialises to the flexible accelerator form if the cost function depends only on investment, it can be shown that

$$\Pi_K = rG_I(I) - G_{II}(I)\, dI/dt \quad (5)$$

and that such a specification leads directly to the accelerator model of investment

$$I_t = \beta[K^* - K_t] \quad (6)$$

where $K^*$ is the desired capital stock.

This formulation of the flexible accelerator model was originally due to Eisner and Strotz (1963). If this model is extended to allow for liquidity constraints and the effects of past borrowing then the specification is of the following form:

$$I/K_{(t-1)} = \alpha_0 + \alpha_1 \Delta V/K_{(t-1)} + \alpha_2 (C/K)_{(t-1)} + \alpha_3 (B/K)_{t-1} \qquad (7)$$

Bond, Elston, Mairesse and Mulkay (1997) provide a comparison of the effects of functional form by using specifications based both on the Euler equation and the flexible accelerator form for four European countries: Belgium, France, Germany and the UK. They note that the interpretation of cash flow or profit terms in equations like [7] is ambiguous. 'Whilst a significant cash flow effect could reflect the presence of financial constraints on investment, it is also possible that such terms could be significant in the absence of financial constraints. In the presence of adjustment costs, for example, current investment depends not only on current but also on expected future changes in the desired stock of capital. It is possible that information on cash flow helps to forecast output, for example, in which case such information on cash flow would help to explain investment spending in such a reduced form model.' (p.4)

In the next section we report estimates based on both the accelerator and an Euler equation. We allow for the fact that many African manufacturing firms do not invest by means of a logit which allows us to test whether sample selectivity is affecting the size of the profit coefficient in the accelerator specification. The fact of zero investment may reflect either a wish to disinvest, analysed in Nickell (1978, pp.55ff), or the effects of uncertainty and irreversibility in ensuring that delaying investment is optimal, Dixit and Pindyck (1994). The firms in our sample are small so allied to such effects may be the indivisibilities in investment that ensure that small firms invest less often than large ones.

In this paper we seek to go some way in disentangling these alternative explanations for zero investment by means of two variables which may influence the costs of capital to the firm. The first is the size of firm measured by its number of employees. If indivisibilities are important then larger firms will be more likely to invest. If the cost of capital is being proxied by the size of the firm, larger firms having more access to the formal capital market might be expected to face lower firm specific capital costs, then size should affect both the propensity to invest and the amount of investment undertaken. The second variable we consider is the age of the firm. Longer established firms could arguably be thought to have access to lower cost capital and greater experience. If age is proxying cost it should affect both the decision to invest and the amount of investment undertaken.

In the approaches to modelling investment summarised above it is assumed that the firm faces an exogenously given cost of capital, r and any difference in firm costs are allowed for by using a panel estimation method.

The general form of the equations which have been used in the literature can now be summarized:

$$(I/K_{t-1}) = \alpha_0 + \alpha_1 \Delta V/K_{(-1)} + \alpha_2 (C/K)_{t-1} + \alpha_3 (B/K)_{t-1} + d_t + \eta_i + v_{it} \quad (10)$$

$$(I/K)_t = \alpha_0 + \alpha_1 (I/K)_{t-1} - \alpha_2 (I/K)^2_{t-1} - \alpha_3 (C/K)_{t-1} + \alpha_4 (V/K)_{t-1} + \alpha_6 (B/K)^2_{t-1} + d_t + \eta_i + v_{it} \quad (11)$$

where $d_t$ is a time dummy, $\eta_i$ is an unobserved firm-specific effect and $v_{it}$ is an error term. Bond, Elston, Mairesse and Mulkay (1997) provide a comparison of the effects of alternative functional forms by using both these equations on a common set of data. We will draw on their findings in the comparison between the results for this paper and others in section VI below.

The importance of the factors discussed above – profitability, the growth of value-added, borrowing, firm size and age – in the determination of investment is taken up in the next section. We present first a levels specification of the decision to invest and the amount of investment using the accelerator specification in [10] which includes both a linear and non-linear term in borrowing. We then adopt three specifications using fixed effects to test the robustness of the profit term in the determination of investment. The first of these specifications again adopts the flexible accelerator. The second is based on the Euler specification as in [11], extended to include a linear term in borrowing to ensure comparability with the accelerator equation. The third specification then adds the term in the growth of value-added to the specification based on the Euler equation. Such a simple generalisation allows the data to choose the form of the adjustment. The length of the panel, three years, is short, and the problems of bias identified by Nickell (1981) are likely to be serious so, in the case of the Euler equation and its generalisation, we use instruments. Our objective is to see if the findings regarding the effects of profitability of investment are sensitive to the specification chosen and how the size of the effect compares with other studies.

## V. THE EVIDENCE

In this section we examine how far the alternative variables in the investment function can explain both the decision to invest and the amount of investment undertaken in the four countries. We begin with the levels specification. In Table 6 column [1] a logit for the decision to invest is presented. The argument presented in the last section is that both firm size and firm age may influence the decision to invest, insofar as they reflect indivisibilities, uncertainty and firm specific capital costs. All the variables,

TABLE 6
*Investment Equations*

| | *Logit INVDUM = 0 if no investment, 1 if investment [1]* | *Investment/ Capital$_{(t-1)}$ No allowance for selectivity [2]* | *Investment Capital$_{(t-1)}$ Allowing for selectivity [3]* |
|---|---|---|---|
| Constant | −0.36 | 0.33 | 0.18 |
| | [0.8] | [3.0] | [0.5] |
| Δ Value-added/ | 0.01 | 0.008 | 0.008 |
| Capital$_{(t-1)}$ | [0.9] | [1.8] | [1.7] |
| Profit | 0.04 | 0.03 | 0.03 |
| Rate$_{(t-1)}$ | [2.1]* | [6.8]** | [4.7]** |
| Ln (Size)$_{(t-1)}$ | 0.04 | −0.03 | −0.01 |
| | [5.5]** | [1.6] | [0.2] |
| Firm Age$_{(t-1)}$ | −0.02 | −0.002 | −0.003 |
| | [3.4]** | [0.9] | [0.9] |
| (Borrowing/ | −0.42 | 0.02 | 0.26 |
| Capital)$_{(t-1)}$ | [0.7] | [0.3] | [1.6] |
| (Borrowing/ | −0.006 | 0.003 | −0.10 |
| Capital)$^2_{(t-1)}$ | [0.02] | [1.0] | [1.7] |
| Ghana | −0.74 | −0.04 | −0.08 |
| | [3.0]** | [0.7] | [0.8] |
| Kenya | −1.03 | 0.04 | −0.02 |
| | [4.2]** | [0.7] | [0.1] |
| Cameroon | −1.94 | 0.11 | −0.04 |
| | [6.7]** | [1.5] | [0.1] |
| Lamda (a) | | | 0.18 |
| | | | [0.5] |
| N | 739 | 391 | 391 |
| Adjusted $R^2$ | | 0.16 | 0.15 |

*Notes*: The figures in [] are for the Logit the z values of the ratio of the coefficient to its standard error, for equations [2] and [3] they are White (1980) corrected standard errors. * indicates significance at the 5% level, ** at the 1% level.
(a) We report the lamda from the logit using the same set of variables for both equations. We also ran equation [3] excluding the Ln (size) variable but this made no difference to any of the coefficients or the significance of lambda.

except the change in value-added enter the specification with a lag. Table 6 columns [2] and [3] report the equation for the amount of investment undertaken, if a firm invests. Column [2] makes no allowance for selectivity while column [3] does.

As Table 6, column [1] shows both the size of firm and its age are highly significant determinants of the decision whether to invest. Larger firms are much more likely to invest and older firms less likely. However neither of these factors determine the amount of investment. In terms of the discussion in the previous section these results suggest that it is indivisibilities and

uncertainty, rather than the cost of capital to the firm, that are being proxied by these variables. The profit rate variable enters significantly both the decision to invest and the amount of investment undertaken. There are significant differences across the countries in the propensity to invest but, conditioned on investment, the country dummies are not significant.

Tables 7 to 9 report fixed effects estimates where firm fixed effects have been removed by differencing the variables. The dependent variable is the investment to capital ratio and the sample is confined to those firms which carried out some investment over the second and third rounds of the survey. Table 7 reports the accelerator specification. The results of this table are

TABLE 7

*The Accelerator Specification: Fixed Effects Estimates All Variables, Except Country Dummies, are Differenced. Dependent Variable* $(\Delta I/K_{(t-1)})$

| | *All Firms [1]* | *Large Firms [2]* | *Small Firms [3]* |
|---|---|---|---|
| Constant | −0.05 | −0.04 | −0.07 |
| | [1.3] | [0.8] | [1.0] |
| Δ Value-added/ | 0.01 | −0.003 | 0.01 |
| $\text{Capital}_{(t-1)}$ | [1.6] | [0.4] | [1.9] |
| Profit | 0.06 | 0.04 | 0.06 |
| $\text{Rates}_{(t-1)}$ | [3.5]** | [0.6] | [4.0]** |
| Ln $(\text{Size})_{(t-1)}$ | 0.04 | −0.2 | 0.03 |
| | [0.3] | [0.1] | [0.2] |
| (Borrowing/ | 0.34 | 0.24 | 0.30 |
| $\text{Capital})_{(t-1)}$ | [1.7] | [0.7] | [1.2] |
| (Borrowing/ | −0.14 | −0.09 | −0.13 |
| $\text{Capital})^2_{(t-1)}$ | [1.8] | [0.5] | [1.6] |
| Ghana | 0.07 | −0.27 | 0.12 |
| | [0.8] | [1.0] | [1.1] |
| Kenya | 0.04 | −0.05 | 0.08 |
| | [0.6] | [0.7] | [0.7] |
| Cameroon | 0.09 | 0.10 | 0.09 |
| | [0.9] | [0.6] | [0.8] |
| N | 223 | 73 | 150 |
| Adjusted $R^2$ | 0.18 | −0.2 | 0.21 |
| White's $\chi^2$ [DF} | 32 [39] | 62 [36] | 23 [39] |
| Wald test (1) $\chi^2$ | 5.7 (2) | Wald test (2) $\chi^2$ | 6.4 (3) |
| [p value](a) | [0.06] | [p value](b) | [0.09] |

*Notes*:
The figures in [] parentheses are the robust one-step t statistics reported in the DPD programme, Arellano and Bond (1988). (a) The Wald test (1) is a test for the joint significance of the two variables. One is the growth of real value-added interacted with the log of size, the second is the profit rate interacted with the log of size. (b) The Wald test (2) is a test for the joint significance of the profit term interacted with the country dummies. * indicates significance at the 5% level, ** at the 1% level.

directly comparable with those of Table 6 columns [2] and [3]. Table 7 also presents the results separately for large and small firms. Firms are defined as large if their average number of employees over the three rounds of the survey was greater than 100. In Table 7 column [1] the coefficient on the profit rate term is double in size that obtained in Table 6 column [3] while the coefficient on the growth in real value-added is unchanged. The result for the profit term would seem to confirm the importance of firm fixed effects which are biasing down this coefficient. In comparing the results for large and small firms, Table 7 columns [2] and [3], both the profit term and the coefficient on growth of value added become insignificantly different from zero for large firms. However in the case of the profit term the point estimates are very close. To test if there was a size effect on these coefficients we interacted the log of the average employment size with both coefficients. The result was that these interactive terms were not significantly different from zero. This suggests that for both these coefficients there is no difference based on firm size. We also report a test for the pooling of the coefficients on the profit term over the four countries, (Wald test (2) at the bottom of Table 7). There is no evidence for different profit effects across the four countries.

In Table 8 we report the results of the differenced estimator based on the Euler equation specification, equation [11] above. In this specification the interpretation of the V/K term arises from the possibility that the firms operate in non-competitive markets. In Table 8 it is not significantly different from zero. The profit rate term is similar to that obtained for the accelerator specification. In this equation we have instrumented the lagged dependent term and its square by the initial levels of the other variables in the equation. As for the accelerator specification we also report tests for the null hypothesis that the profit coefficient is the same across the four countries. For this specification this hypothesis is rejected at the one percent significance level.

Finally in Table 9 we present a general specification which includes both the lag structure suggested by the Euler equation specification and the growth rate of real value-added. One problem with the specification presented in Table 6 is that this variable is clearly endogenous, so in this final run we instrument it by its lagged value. The result of presenting this more general specification is to increase the short-run profit coefficient to 0.10 and now the hypothesis of pooling across countries is accepted, (Wald test (2) at the bottom of Table 9). The rejection of this hypothesis for the Euler specification appears to be due to the specification of the lags in that equation. As in Table 8 the point estimates for the profit coefficient for large firms is negative and not significantly different from zero in contrast to the well specified results for small firms. However a test of interacting size with both the growth of value-added and profit, Wald test (1) at the bottom of Table 9, shows that these effects across size are not significant.

The specification reported in Tables 6 and 7 is similar to that chosen by

TABLE 8

*The Euler Equation Specification: Fixed Effects and Instruments (a) All Variables, Except Country Dummies, are Differenced. Dependent Variable* ($\Delta I/K$)

| | *All Firms [1]* | *Large Firms [2]* | *Small Firms [3]* |
|---|---|---|---|
| Constant | −0.07 | 0.03 | −0.09 |
| | [1.3] | [0.8] | [1.1] |
| $(I/K)_{(t-1)}$ | 0.11 | 0.86 | 0.17 |
| | [0.1] | [1.1] | [0.14] |
| $(I/K)^2_{(t-1)}$ | 0.38 | −1.16 | 0.35 |
| | [0.5] | [2.3]* | [0.5] |
| $(V/K)_{(t-1)}$ | −0.001 | 0.06 | −0.01 |
| | [0.03] | [0.6] | [0.2] |
| Profit | 0.07 | −0.02 | 0.07 |
| $\text{Rate}_{(t-1)}$ | [1.8] | [0.3] | [1.9] |
| (Borrowing/ | 0.23 | 0.01 | 0.15 |
| $\text{Capital})_{(t-1)}$ | [1.0] | [0.1] | [0.5] |
| (Borrowing/ | −0.09 | 0.003 | −0.07 |
| $\text{Capital})^2_{(t-1)}$ | [1.3] | [0.04] | [0.7] |
| Ghana | 0.001 | −0.15 | 0.05 |
| | [0.01] | [1.7] | [0.4] |
| Kenya | 0.07 | −0.08 | 0.15 |
| | [0.9] | [1.3] | [1.3] |
| Cameroon | 0.26 | 0.05 | 0.29 |
| | [1.2] | [0.3] | [1.2] |
| N | 221 | 72 | 149 |
| Adjusted $R^2$ | 0.10 | 0.15 | 0.11 |
| Sargan $\chi^2$ (df) | 2.9 (2) | 3.1 (3) | 1.96 (3) |
| [p value](b) | [0.24] | [0.38] | [0.6] |
| Wald test $\chi^2$ | 12.4 (3) | | |
| [p value](c) | [0.006] | | |

*Notes*: (a) The variables in this equation which are instrumented are the lagged dependent variable and its square. The additional instruments are the first period levels of the other explanatory variables. (b) The Sagan test is for the validity of the instruments as reported in the DPD programme. (c) The Wald test is a test for the joint significance of the profit term interacted with the country dummies. * indicates significance at the 5% level, ** at the 1% level.

Tybout (1983), Harris, Schiantarelli and Siregar (1994) and Athey and Laumas (1994) while that reported in Table 8 is similar to that of Bond and Meghir (1994) and by Jaramillo *et al*. (1996). The results reported show that similar effects to those observed in other datasets can be found in this African study. However it is not simply the existence of a profit effect that is of importance but its size, both across firms of different size and across countries. How the results reported in Tables 7 to 9 compare with other studies is shown in Table 10 and discussed in the next section.

TABLE 9

*A General Specification: Fixed Effects and Instruments (a) All Variables, Except Country Dummies, are Differenced. Dependent Variable* ($\Delta I/K$)

| | *All Firms [1]* | *Large Firms [2]* | *Small Firms [3]* |
|---|---|---|---|
| Constant | −0.06 | 0.02 | −0.11 |
| | [0.9] | [0.8] | [1.1] |
| $(I/K)_{(t-1)}$ | 1.42 | 0.54 | 1.40 |
| | [1.2] | [1.4] | [1.1] |
| $(I/K)^2_{(t-1)}$ | −0.14 | −1.03 | −0.11 |
| | [0.2] | [2.9] | [0.1] |
| Δ Valued-added/ | 0.04 | 0.03 | 0.04 |
| $Capital_{(t-1)}$ | [1.5] | [1.1] | [1.5] |
| $(V/K)_{(t-1)}$ | 0.01 | 0.15 | 0.01 |
| | [0.4] | [1.3] | [0.3] |
| Profit | 0.10 | −0.02 | 0.10 |
| $Rate_{(t-1)}$ | [2.2]* | [0.2] | [2.2]* |
| (Borrowing/ | 0.45 | −0.03 | 0.12 |
| $Capital)_{(t-1)}$ | [1.3] | [0.2] | [0.2] |
| (Borrowing/ | −0.14 | 0.07 | −0.06 |
| $Capital)^2_{(t-1)}$ | [1.4] | [0.8] | [0.4] |
| Ghana | −0.09 | −0.11 | −0.02 |
| | [0.7] | [1.6] | [0.1] |
| Kenya | 0.08 | −0.02 | 0.19 |
| | [0.7] | [0.4] | [1.3] |
| Cameroon | 0.23 | 0.04 | 0.28 |
| | [0.9] | [0.4] | [1.0] |
| N | 221 | 72 | 149 |
| Adjusted $R^2$ | 0.07 | 0.17 | 0.07 |
| Sargan $\chi^2$ (df) | | 1.93 | 0.83 (3) |
| [p value](b) | | [0.6] | [0.84] |
| Wald test (1) $\chi^2$ | 0.71 (2) | Wald test (2) $\chi^2$ | 4.6 (3) |
| [p value](c) | [0.67] | [p value](d) | [0.21] |

*Notes*: (a) The variables in this equation which are instrumented are the lagged dependent variable and its square and the growth in value added. The additional instruments used are the first period levels of the other explanatory variables. (b) The Sagan test is for the validity of the instruments as reported in the DPD programme. (c) The Wald test (1) is a test for the joint significance of the two variables. One is the growth of real value-added interacted with the log size, the second is the profit rate interacted with the log of size. (d) The Wald test (2) is a test for the joint significance of the profit term interacted with the country dummies. * indicates significance at the 5% level, ** at the 1% level.

## VI. IMPLICATIONS OF THE FINDINGS

In section II the macroeconomic background of the countries used in the sample in this paper was presented. The country that has experienced the largest sustained rise in per capita income in the recent past is Ghana. This

TABLE 10

*Profits and Investment: An International Comparison*
*The Coefficient Reported in this Table Shows the Effect on Investment of a $US 1 Increase in Profits* (a)

| *Study* | *All Firms* | *Large Firms* | *Small Firms* |
|---|---|---|---|
| Bond and Meghir (1994, Table 2, column (ii)) | 0.18 | na | na |
| Athey and Laumas (1994, Table 3) (b) | 0.12 | na | na |
| Tybout (1983, Table 1) (c) | na | 0 | 0.43 |
| Harris, Schiantarelli and Siregar (1994, Table 9, column (2)) (d) | na | 0.056 | 0.65 |
| Bond, Elston, Mairesse and Mulkay (1997) (e) | | | |
| *Accelerator Model* | | | |
| Belgium | 0.13 | | |
| France | 0.14 | | |
| Germany | 0.38 | | |
| UK | 0.61 | | |
| *Euler Equation* | | | |
| Belgium | 0.01 | | |
| France | 0.07 | | |
| Germany | 0.04 | | |
| UK | 0.29 | | |
| This study | | | |
| Accelerator (Table 7) | 0.06 | 0.04 | 0.06 |
| Euler equation (Table 8) | 0.09 | −0.03 | 0.09 |
| General specification (Table 9) | 0.10 | −0.02 | 0.10 |

*Notes*: (a) The dependent variable in the Euler specification is I/K and there are linear and non-linear lagged dependent terms. For the Euler equation specifications the long run result calculated at the means is shown. For Table 9 the result is for the short run.
(b) Athey and Laumas reported results for large and small firms but these are defined in terms of capitalisation and are thus not directly comparable with the other studies. Large firms as defined in their sample have larger profit effects than small firms.
(c) Small firms are those with between 10 and 199 employees, large firms are those with at least 200 employees (p.603)
(d) Harris, Schiantarelli and Siregar defined small firms as those employing fewer than 100 workers, large firms employ more than 100, (p.37)
(e) Bond, Elston, Mairesse and Mulkay report comparative results for the flexible accelerator and Euler Equations using a method of moments first differenced estimator in which the instruments used are lagged two periods. The data summarised is taken from their tables 4 and 6.
(e) Small is firms with less than 100, large is firms with more than 100 employees. A finer division was tried identifying firms with from 20–100 employees separately but there was no difference between such firms and those employing less than 20.

may be an important factor in explaining the relative success of Ghana in the sample. Only in Ghana was the median growth in value added positive for the manufacturing sector. In Ghana the average size of firms, measured in terms of employment, increased by 15 percent over the three rounds of the survey, while it fell in the Cameroon and Kenya. The propensity for firms to invest in Ghana is also significantly higher than in Kenya and Cameroon (see Table 6). While the relatively favourable macroeconomic environment in Ghana may have helped smaller firms to carry out some investment the gain was limited. In terms of median rates of investment Zimbabwe is, at 3.3 percent, far higher than any of the other countries. It is this very poor performance of the best performer which is indicative of the magnitude of the problems faced by firms in Africa's manufacturing sector. Why are these investment rates so low?

A common factor across all the four African countries in our sample is a poor macroeconomic policy environment. High and variables rates of inflation, rapid and variable rates of exchange rate depreciation in the cases of Kenya, Ghana and Zimbabwe. A large devaluation in Cameroon that was widely anticipated and contentious as a policy option. In cross-section studies there is evidence that the quality of the macroeconomic environment is of importance for growth. The evidence presented here is indirect, but entirely consistent with this cross-section evidence. The most persuasive factor suggesting that high risk plays a very important part in the problems facing firms in Africa manufacturing sector is the very high profit rates shown across all the countries. It is important to stress these are average rates of return and marginal rates are likely to be much lower. The high rate of return required on investment in Africa suggests that the costs of capital, in terms of the firm specific discount rate required to justify investment, is very high. This micro finding is consistent with other evidence. Bhattacharya, Montiel and Sharma (1996) find that the return on foreign investment in Africa over the period 1990 to 1994 is around 60 percent higher than in other developing countries, in the range of 24–30 percent, as against 16–18 percent. They also find that these high returns do not generate high rates of investment: in 1995 flows to Africa (excluding South Africa) were only US$2 billion, less than 2 percent of all flows to developing countries and less than half those to the next lowest region, the Middle East.

The most common reason advanced for low levels of investment, particularly among small firms, is that they are financially constrained. We noted above that most studies have found that smaller firms respond more to profits than do larger firms. It seems useful, as the average size of firms in the sample is so small, to compare the results for this study with others. Table 10, which presents such a comparison, shows that the profit effect is much less for the firms in our sample than that found in most comparable studies. The profit coefficient for all firms is below that found by Bond and Meghir (1994) and by Athey and Laumas (1994). Considering small firms, where small is defined as those employing less than 100, the coefficient in

this study ranges from 0.06 for the accelerator specification to 0.10 for the most general specification. This compares with 0.429 in Tybout (1983) and 0.65 in Harris, Schiantarelli and Siregar (1994). The paper by Bond, Elston, Mairesse and Mulkay (1997) is particularly relevant as it compares the accelerator and Euler equation approaches on the same data. Their findings are reproduced in the lower part of Table 10. For all four of the European countries in their study the Euler equation approach produced a lower coefficient on the profit term than the accelerator model. We find that the Euler specification provides a slightly higher estimate of the profit effect. For the accelerator specification the coefficient is far higher for the European countries than it is for the African countries.

## VII. SUMMARY AND CONCLUSIONS

The low levels of investment in sub-Saharan Africa have been widely recognised to be an important policy problem. In this paper firm-level evidence has been reported for investment in plant and equipment in the manufacturing sector for four countries: Cameroon, Ghana, Kenya and Zimbabwe. The median rate of investment across the four countries is close to zero. These low investment rates are associated with high profit rates and low rates of growth of value-added.

The low rate of value-added growth from the micro data reflects the poor macroeconomic performances of the economics. Only Kenya has seen a long run, sustained per capita income growth over the last twenty years and that has been modest. All the countries have experienced high, and variable, rates of inflation and large changes in nominal and real interest, and exchange, rates. There is evidence from macroeconomic studies that such instability has adverse effects on growth and investment.

In order to understand the reasons for the low investment rates in the firms in the countries surveyed a model has been estimated of both the decision to invest and the amount of investment undertaken. In doing so we have been able to use the panel dimension of the data to allow for firm fixed effects. The results reported in Tables 7 to 9 allow for firm fixed effects and show a highly significant positive profit effect onto investment for small firms, which is about twice the coefficient found in the cross-section data. The most robust result to emerge from the fixed effects estimates is that firm profits play a significant part in investment decisions and the coefficient ranges for 0.06 to 0.10, depending on the specification. In the most general specification tested the hypothesis of a common coefficient on the profit term across countries was accepted.

We have compared these results with those available for other countries. Where a direct comparison for small firms is possible the coefficient found in this study is substantially lower than that in comparable studies. Research using data from European countries finds that a Euler equation approach produces a much smaller coefficient on the profit term in investment

equations than the use of the flexible accelerator specification. In this paper we find for the African data that the two specifications produce similar identical results. The African data reported in this paper differ radically from all the comparable studies in the combination of very low levels of investment and high profit rates.

The conclusion we would draw is that, while the evidence is consistent with firms being financially constrained, the most important factor adversely affecting investment is the high capital costs facing the firms which are reflected in their high profit rates. Macroeconomic studies report an adverse effect of instability on investment. The micro evidence presented here is entirely consistent with such findings.

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## APPENDIX A

TABLE 1
*Average Employment Size of Firms across the Three Rounds of the Survey*

| | | *Cameroon* | *Ghana* | *Kenya* | *Zimbabwe* | *All* |
|---|---|---|---|---|---|---|
| N | | 60 | 98 | 75 | 109 | 342 |
| Round 1 | Mean | 87 | 33 | 90 | 299 | 140 |
| | Std | 200 | 66 | 218 | 491 | 327 |
| Round 2 | Mean | 83 | 36 | 73 | 306 | 138 |
| | Std | 198 | 62 | 104 | 483 | 312 |
| Round 3 | Mean | 83 | 38 | 75 | 305 | 139 |
| | Std | 207 | 67 | 108 | 488 | 316 |

*Notes*: N is the number of observations, Std is the standard deviation.

## APPENDIX B

### *Variable Definitions*

I/K is investment to capital.

Investment in this paper refers to investment in plant and equipment. Investments in land and building are excluded. The capital stock takes the reported value of the capital stock in the first round of the survey as a base. The capital stock for rounds two and three is then calculated by revaluing the stock by the CPI and adding the value of investment.

We experimented with a variety of deprecation rates and also with using the reported values of the capital stock. The use of alternative depreciation rates made no difference to the results. There is some evidence that the reported values perform better than the calculated values in the levels specification. However in the differenced specification, which are central for the method we have chosen to allow for firm fixed effects, it is clear that measuring the change in the capital stock by the level of investment produces much better defined statistical results than using the changes in the reported values of the capital stock.

I/V is investment to value-added.

The measure of output in this paper is value-added. Value-added was calculated from data on output, sales, material costs, defined as the raw materials input used in producing output and indirect costs. A detailed list of indirect costs was specified in the questionnaire.

C/K is the profit rate.

Profits are measured as value-added less wages less interest payments. This differs slightly from the discussion in section 4 above. The exclusion of interest payments from the definition of the profit rate made no difference to the results.

V/K is value-added to capital.

This is the ratio of value-added to capital as already defined.

$\Delta V_c/K_{(-1)}$ is real value-added deflated by lagged capital.

This variable is the change in the real value of value-added, defined as value-added deflated by the consumer price index, divided by the real value of capital of the previous period, defined as capital stock deflated by the consumer price index. The rationale for this procedure is as follows. The rate of inflation has varied widely across both countries and time. This means that changes in the real value of value-added cannot be simply picked up by the dummy terms in the regressions. We have limited price information common across all four countries so we have attempted to allow at least for differential aggregative changes in the price level by deflating both value-added and the capital stock by the CPI.

B/K is indebtedness (measured by past formal borrowing) to the value of the capital stock.

Formal borrowing were identified separately in the questionnaire and include borrowing from banks and other formal institutions.

Employment is defined to be the total number of employees in the firm. There is no distinction between casuals or part-time workers. The number of part time workers identified in the surveys is small.