Determinants of Private Investment Behaviour in Ugandan Manufacturing Firms

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1. Introduction

Overview

This study investigated the determinants of private investment behaviour in Ugandan manufacturing firms. The low level of investment in Sub-Saharan Africa has been widely recognized as an important policy problem. What is more intriguing is the combination of relatively low investment rates, high profit rates, but small profit effects on investment in Sub-Saharan Africa (Bigsten et al., 1997). Bhattacharya et al. (1996) find that the return on foreign investment in Africa over the period 1990 to 1994 is around 60% higher than in other developing countries, in the range of 24-30%. The existence of high profit rates in Africa is consistent with neoclassical theory, which predicts higher marginal returns to the factor that is relatively scarce. However, a low level of investment is inconsistent with neoclassical theory predictions. This co-existence of low investment despite high returns poses a puzzle that has come to be referred to as the "Lucas paradox" (see Lucas, 1990 and Montiel, 2006). In Uganda, for example, the average profit margin from a sample of manufacturing firms is 29% compared to only 4% of the sales that the same firms invest (Table 1). This suggests that there could be obstacles causing disequilibrium between low levels of investment and high profits observed in Ugandan manufacturing firms.

Table 1: Investment and profit as a percentage of total sales from manufactured goods, 2002

	Investment/Total Sales				Profit/Total Sales			
	Mean	Median	Standard deviation	No. of firms	Mean	Median	Standard deviation	No. of firms
Large (100+)	6.1	3.5	8.7	14	28.3	29	14	9
Medium (50-99)	2.0	1.6	2.4	11	33	26	24	10
Small (<49)	4.6	0	12.9	127	29.7	21	27	97

Source: Investment Climate Survey (2003)

It is imperative for manufacturing firms in Uganda to invest and grow over time to play a predominant role in economic growth, and thus facilitate poverty reduction. However, there is controversy on why investment rates are so low and on what policies would be appropriate to raise investments. Moreover, the determinants of investment in Ugandan manufacturing firms are not yet well understood. While recent research by, for instance, Bigsten et al. (1997), Teal (1997), and Grenier et al. (1998), has shed new light

on determinants of investment in manufacturing firms in Sub-Saharan Africa, most of these studies utilize data that was collected before 1999. Besides, these studies investigate only a few variables, yet other factors besides the traditional ones may also be important in explaining investment behaviour in manufacturing firms in Sub-Saharan Africa.

The idea that the manufacturing sector is a dynamic engine of growth can be traced to contributions by Lewis (1954), Kaldor (1966) and others. For instance, in the short period beginning in the early 1960s, Taiwan, Korea and Singapore raised their shares of manufacturing in gross domestic product (GDP) by more than 15% and their per capita incomes nearly quadrupled. The same has been true of countries such as Malaysia, Thailand and Indonesia, where manufacturing shares increased and living standards have grown rapidly. These newly industrialized countries were almost at the same level of development as Uganda in the early 1960s.

Since 1987, the Government of Uganda has implemented a number of trade and fiscal reforms that were partly intended to encourage investment by manufacturing firms. Subsequently, Uganda registered an increase in investment in manufacturing projects and consequent increase in manufactured output (Table 2) (World Bank, 2004).

Table 2: Industrial production index of five major industrial groups (1997=100)

Group	1999	2000	2001	2002	2003	2004	2005
Food processing	123.6	118.2	131.9	135.3	136.4	141.6	123.8
Tobacco and beverages	112.3	116	119	122.5	137.3	153.9	179.2
Textiles and clothing	185.4	178.9	166.3	168.4	208.2	267.1	249
Timber, paper and printing	134.1	163.5	183.8	156.7	196.2	189.4	182.8
Chemicals, paint and soap	125.3	124.8	138.2	132	150	149.1	183.1
Index of all items	127.5	127.5	141.4	145.5	150.5	169.2	175.3
Manufactured output as a ratio of GDP	9.4	9.3	9.5	9.4	9.1	8.9	8.3
Growth rate of manufactured output	9.3	3.7	9.7	3.0	6.5	11.1	-1.6

Source: Uganda Bureau of Statistics (2006)

However, the manufacturing share in GDP in Uganda has remained below 10.0% and stagnant since independence. In 2007, manufacturing output as a percentage of GDP was only 8.8%, only a few percentage points above her independence levels. In contrast, Thailand, Malaysia and Indonesia, which had comparable shares of manufacturing output in GDP in the 1960s, have increased their shares to 34.5%, 29.8%, and 27.0%, respectively (Table 3).

Table 3: Manufacturing output as a percentage of GDP

	1987	1997	2007
Kenya	11.6	12.7	11.8
Tanzania	.	6.9	6.9
Uganda	5.9	8.6	8.8
Thailand	24.3	30.2	34.5
Indonesia	16.9	26.8	27

Source: World Bank (2008), World Development Indicators

The implications of stagnation in manufacturing for economic transformation and

modernization, and ultimately for Ugandan standards of living, are serious. Why do most African manufacturing firms invest so little? Why do actually observed returns to investment in Africa not act as a signal to investment? Can these outcomes be explained in terms of industrial policies, markets, risk, poor infrastructure, information deficiency, coordination failure, high transaction costs or deficiencies in financial markets? The most common reason advanced for low levels of investment, particularly among small firms, is that they are financially constrained. However, strong evidence by Bigsten et al. (1997) suggests that the reasons for the low levels of investment in Africa are not to be sought in the financial constraints that firms face. Most firms in the sample could invest more, by the use of internal funds, than they do. The other reason advanced recently by Warnholz (2008) is that there is an information deficit on African markets. This Lucas paradox explanation may not be valid because evidence shows that firms operating in Africa, including Uganda, also invest less yet they are more informed about the African market. The Lucas paradox, therefore, largely remains unexplained.

This study fills this research gap by investigating the factors that may explain low investments in Ugandan manufacturing firms. There is need to investigate other factors that may affect investment besides the traditional factors that have been examined by previous studies. Besides, the investment environments may differ among countries and over time. To increase Ugandan manufacturing firms' competitiveness, there is need to increase investment levels of manufacturing firms. The main thrust of this study was empirical, contributing to limited evidence on determinants of investments in Ugandan manufacturing firms.

Statement of the problem

The results from the Regional Programme on Enterprise Development (RPED) surveys have shown that in Africa, macroeconomic reform is a necessary but not a sufficient condition for private sector growth. There are enterprise-level constraints that inhibit the growth of existing firms and impede the entry of new ones. Foremost among these constraints are low levels of investment in equipment and machinery, which in turn leads to lower competitiveness and exports of manufactures from Africa (see, for example, Serven, 1997; Teal, 1999; Naude, 2000). However, what is puzzling is the evidence that shows a combination of relatively low investment rates, high profit rates, but small profit effects on investment in Sub-Saharan Africa (Bigsten et al., 1997). Given the low levels of investment in the manufacturing sector in Africa, there is need to understand which factors determine investments in African manufacturing firms. However, little is known about the determinants of investment in the Ugandan manufacturing firms. A common explanation for low levels of investment is financial constraint. However, evidence by Bigsten et al. (1997), Fafchamps and Oostendorp (1999), Soderbom (2002), and Mazummdan and Mazaheri (2003) suggests that the reasons for the low levels of investment in Africa are not to be sought in the financial constraints that firms face.

Objectives

The general motivation of the study is to investigate the determinants of private investment behaviour in Ugandan manufacturing firms.

The specific objectives of the study are to:

- investigate the significant factors influencing private investment behaviour in Ugandan manufacturing firms; and
- draw policy conclusions and recommendations for increasing private investment in Ugandan manufacturing firms.

Hypotheses

On the basis of the specific objectives of the study, the following null hypotheses were tested:

a) there is a large positive profit effect on investment among smaller firms and lower profit effect on investment among large manufacturing firms;
b) export participation has a positive influence on the propensity to invest among manufacturing firms;
c) capacity utilization is positively associated with the propensity to invest among manufacturing firms; and
d) firm age is positively associated with the propensity to invest among manufacturing firms.

Significance of the study

In the last decade, most countries have shifted their development strategies towards a greater reliance on private firms. This underlines the importance of research on the investment behaviour of manufacturing firms in a different range of institutional environments. To understand how manufacturing firms in Uganda make investment decisions, it is necessary to examine the determinants of their investment decisions. A study on the determinants of investment in Uganda manufacturing firms is an important research area that needs to be explored. This study is relevant in the Ugandan context given the central role the private manufacturing sector is expected to play as the engine of economic growth and poverty reduction. It is expected that the findings of this study will have important policy implications for Ugandan manufacturing firms. Identification of factors determining low investment amid high profit rates may change policies as a result of the identification of factors explaining the Lucas paradox.

Investment decisions of manufacturing firms involve a wide range of policy issues. At the macro level, they have implications for capital market development, interest rates and regulation. At the micro level, such decisions affect capital structure and firm growth. For Ugandan manufacturing firms wishing to be competitive in a more open economic environment, investment in plant and equipment is necessary. In this light, an identification of the firm-level determinants of investment and, consequently, policy recommendations to raise the levels of investment in Ugandan manufacturing firms is crucial.

The rest of the paper is organized as follows: section two presents the literature review, section three describes the methodology, section four presents the results, and section five is the conclusion.

2. Literature review

This section reviews some of the existing evidence on the determinants of investments of manufacturing enterprises in Africa, and identifies a number of hypotheses to assess against our study evidence, and also establish emerging stylized facts. One of the first studies to analyze whether investment among African firms is hampered by lack of external finance is that by Bigsten et al. (1997). These authors test if investment is sensitive to changes in cash flow among firms in four African countries. The evidence indicates that there is a significant profit effect on investment, which suggests that credit constraints are present. Subsequent research based on RPED data confirms that investment is not particularly sensitive to changes in profits. In an in-depth analysis of the manufacturing sector in Zimbabwe between 1992 and 1994, Fafchamps and Oostendorp (1999) show that the cash-flow sensitivity of investment is low, even among small firms.

Teal (1995) uses a survey of manufacturing firms in Ghana to estimate a probit model of the decision to invest. He finds that profits and exports are the variables that explain investment. Bigsten et al. (1997) also find a positive and significant profit effect in their estimation of a logit model of the decision to invest for four African countries. After controlling for firm size, they found that the impact of profits on the decision to invest for small firms is less in the African countries than observed in other countries. Grenier et al. (1998) in a study on manufacturing firms in Tanzania show evidence that firms with sustained investment are more likely to export. Sustained investment is also related to size, as larger firms in Tanzania are the most likely to sustain their investments.

Bigsten et al. (1997), using both the accelerator and Euler equation specifications, find a profit effect on investment for Cameroon, Ghana, and Kenya of roughly the same size (between 0.06 and 0.10). They also compare the size of the profit effect with those found in other studies, and find that for small firms, the effect is much smaller in Africa than for other countries. Soderbom (2002) obtains a similar result for Kenya. Mazumdar and Mazaheri (2003) use a sample of six countries (adding Côte d'Ivoire and Zambia to the set of countries considered by Bigsten et al., 1997) and report an estimated profit coefficient of 0.08, thus very similar to that of Bigsten et al. (1997). Mazumdar and Mazaheri (2003) also split the sample according to firm size, and obtain a profit coefficient equal to 0.09 in the sub-sample of small firms. They interpret the larger profit coefficient among small firms as evidence that small firms are more credit constrained than large ones. Reinikka and Svensson (2001) obtain a profit coefficient equal to 0.08 based on a sample from 1996-1997 of Ugandan manufacturing firms. The point estimate of the coefficient on profits among small firms is 0.11, and therefore, the effect is not quantitatively large even for small firms compared to what has been reported in other regions.

Two studies have been carried out in Uganda to establish the determinants of private investment in manufacturing firms. Reinikka and Svensson (2001) used data for the period from 1996-1997 collected from a sample of Ugandan manufacturing firms and found a larger profit effect among smaller firms, which is in agreement with the notion that credit access is more of a problem for small firms. They confirm the effect of size on investment in Uganda in addition to determining the effects of other factors such as age, location and sector. In the case of age, there was a negative significant effect, while regional and sector location effects were not significant in determining investment.

Abuka et al. (2006) carried out an analysis of firm level investment, its determinants and constraints using the Uganda Business Inquiry (UBI) Survey conducted by the Uganda Bureau of Statistics and private sector investment surveys conducted by the Bank of Uganda for 2001/2002 and 2002/2003 periods. The study found that turnover, profit and credit are significant determinants of firm-level investment. However, contrary to expectation, credit was not a significant factor on investment for small and medium-sized firms. Firms located outside the central region were more likely to invest. Large firms were also more inclined to reinvest over time as opposed to small and medium-sized enterprises. Higher profitability tended to be associated with higher levels of investment.

Warnholz (2008) carried out a 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. He found returns to invested capital in Sub-Saharan Africa to be high compared to select Asian and South American markets, and that investment remains low outside the mining industry. He also found that the link between past profitability and current investment is weak in Africa. After allowing for risk premium and other factors, he shows that the temporary disequilibrium between low investments and high profits observed is largely due to information deficit on African markets. While foreign investors may not be aware of lucrative opportunities in Africa, we should expect firms already operating in Africa to invest more, but evidence shows that this is not the case. Gollin (2009) also argues that if returns to capital are, indeed, very high in developing countries, then it is hard to understand why investors would fail to figure this out over a period of half a century.

Another explanation of the Lucas paradox has been advanced by Gunning and Mengistae (2001) and Collier and Patillo (2000) who 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 on the required return on capital, and Serven (1997) finds that this severely depresses investment in Africa. However, if one assumes that the firms that are operating in Africa are risk lovers, based on the latter explanation, then how come these risk-loving firms invest little despite the high returns? These arguments suggest that the Lucas paradox remains largely unexplained.

Some analyses of African investment have typically been based upon national aggregate investment rates, whether through time series of particular countries (for example, Fielding, 1999; Jenkins, 1998; Mlambo and Mhlophe, 1995; and Asante, 2000) or international cross sections (for example, Kumar and Mlambo, 1995 and Hadjimichael et al., 1995). Such data sets do not provide the information necessary to assess the determinants of firm investment. This study used an RPED panel data set. Besides, this study investigated many factors compared to previous studies that mainly concentrated on the traditional factors.

3. Methodology

The model

In the literature, two types of approaches are frequently used, namely, flexible accelerator approach or Euler approach. Most studies 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. In the flexible accelerator and Euler approaches to modelling investment, it is assumed that the firm faces an exogenously given cost of capital, and any differences in firm costs are allowed for by using a panel estimation method. It is also possible to embed the flexible accelerator specification in a general dynamic framework as is done, for example, for the flexible accelerator specification by Tybout (1983). The general form of the equations, which have been used in the literature, can now be summarized whereby equation (1) represents Euler's model and equation (2) represents flexible accelerator model:

$$(I/K)t = \lambda_0 + \lambda_1(I/K)_{t-1} - \lambda_2(I/K)^2_{t-1} - \lambda_3(C/K)_{t-1} + \lambda_4(V/K)_{t-1} + \lambda_5(B/K)^2_{t-1} + d_t + \mu_i + \nu_{it} \quad (1)$$

$$(I/K_{t-1}) = \lambda_0 + \lambda_1(I/K_{t-1})_{t-1} + \lambda_2 \Delta V/K_{(t-1)} + \lambda_3(C/K)_{t-1} + \lambda_4(B/K)_{t-1} + d_t + \mu_i + \nu_{it} \quad (2)$$

Where the subscript i denotes the cross-sectional dimension and t represents the time series dimension, λ_0 is the constant and λ represents the coefficients. K_t is capital stock, I_t is investment, V is value added, B is debt, C is profit, d_t is a time dummy, μ_i is an unobserved firm-specific effect, and v_{it} is an error term.

We adopted a flexible accelerator approach to modelling investment as the length of the panel, three years, is short, and the problems of bias identified by Nickell (1981) would likely be very serious if we sought to obtain panel estimates of equation (1). Given the short period of the panel data set, we decided to estimate directly the flexible accelerator model without the lagged dependent variable. However, this is a limitation to this study because investment at the firm level is largely a lumpy activity (see Cooper et al., 1999 and Cooper and Haltiwanger, 2000) and once an investment is undertaken it is costly to reverse (see Dixit, 1989), which means that investments in the past periods would have an influence on the current investment. We extended the flexible accelerator equation

by including control variables that have been found to influence the decision to invest in previous studies. The modified flexible accelerator equation estimated was as follows:

$$(I/K_{t-1}) = \lambda_0 + \lambda_1(I/K_{t-1})_{t-1} + \lambda_2 \Delta V/K_{(t-1)} + \lambda_3(C/K)_{t-1} + \lambda_4(B/K)_{t-1} + \lambda_5 Xt + d_t + \mu_i + \nu_{it} \quad (3)$$

Where λ_5 is a vector of coefficients and X is a vector of control variables that include: power outages, monopoly power, foreign ownership, crime, corruption, foreign competition, sector effects, gender, education of the manager, sharpe ratios, technical efficiency, location, firm size, capacity utilization, exporting participation, and firm age.

Discussion of variables

Dependent variables

Our first dependent variable was a dummy indicating whether or not a firm invests, lending itself to a probit analysis. The second dependent variable was the rate of investment (*investment capital ratio*) and since it is continuous but likely to be bounded between zero and one, we used a tobit regression model for this analysis. Investment in this study refers to investment in plant and equipment only. Investments in land and buildings were excluded.

Independent variables

The *profit capital ratio* controls for liquidity constraints. A positive relationship between profitability and investment has been widely found in both developed and developing countries (Tybout, 1983 and Harris et al., 1994). If firms have limited access to financial markets, profitability affects the capacity to finance investment. If liquidity constraints are binding, the effects of the cash flow variable were expected to be positive as well. Profits are measured as value added, less wages and interest payments. The capital stock takes the reported value of the capital stock in the first period of the survey and aggregates by the value of investment to create the capital stock for period 2 and 3. There is some evidence that the reported values perform better than the calculated values in the levels specification (see Bigsten et al., 1997). *Change in value added capital ratio* controls for imperfect competition. 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. Change in value added was entered in the specification with no lag. 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. Value added was calculated from data on sales less material costs, defined as the raw material inputs used in producing output and indirect costs.

In addition, basic economic theory informs us that *monopolies* will prefer to restrict output in order to earn supernormal profits. We used a dummy variable indicating if any of three main product lines have more than 60% of the market share. Furthermore, to proxy for foreign competition, we used a dummy equal to one if a firm indicated that it faces "intense competition" from foreign firms, either through imports or Foreign Direct Investment (FDI). *Debt capital ratio* controls for the effects of past borrowing or indebtedness. Past firm borrowing may adversely affect present investment if such borrowing increases the probability of bankruptcy. The borrowing term was assumed to have a negative impact on the investment rate, reflecting increasing costs of borrowing.

The *technical efficiency* level of the firm is also included as one of the control variables. It may be expected that more efficient firms will be better able to compete in the newly deregulated market and will therefore be more likely to invest in future production capacity. *Percentage of capacity utilization* was assumed to be positively associated with propensity to invest. Firstly, firms with less spare capacity are more likely to be experiencing sales growth, and therefore have a greater need to expand the capital base to fill a growing order book. Secondly, such firms are likely to be looking to expand capacity as they approach their production limits. Finally, firms that are producing nearer to their capacity are likely to have a higher ability to invest. Capacity utilization was proxied by the percentage of a firm's output capacity used.

The *education of the manager* is believed to be positively related to debt, implying that better educated managers have greater possibilities of borrowing. Better educated managers would find it easier to present a plausible case for a loan to an outside body (Abor, 2008). Overall, the level of education appears to have an important positive impact on micro and small enterprises' debt-raising capacities (Green et al., 2002). The level of education of the most senior manager was constructed as a binary with a dummy equal to one if the manager completed education above secondary education, and zero otherwise. *Sharpe ratio* was proposed by Sharpe (1994). It adjusts for risk and gives the return achieved per unit of risk. It is calculated by dividing the average net return by the standard deviation of excess returns. Excess returns refer to the difference between the return achieved by a firm in a given period and the risk-free opportunity cost of capital, for example, Treasury Bills (T-Bills).

Firm age may affect access to finance, and thus be associated with firm-specific capital costs. Longer-established firms could arguably be thought to have access to lower-cost capital and greater experience. If age is a proxying cost, it should affect both the decision to invest and the amount of investment undertaken. *Firms participating in export* tend to be more diversified and, as such, are capable of accommodating more debt capital (Abor, 2004). Thus, as firms engage more exporting activities, they tend to employ more debt and are therefore likely to invest more. Grenier et al. (1998) show that firms that sustain investment are more likely to export than those that do not sustain investment. Export status was constructed as a binary that was equal to one if a manufacturing firm is engaged in exports, and zero otherwise.

Firm size proxied by the average number of permanent and temporary employees may affect access to finance, and thus be associated with firm-specific capital costs. If the cost of capital is being proxied by the size of a 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.

Firm size may influence the decision to invest in so far as it reflects indivisibilities, and uncertainty. Large firms may have better information, but if they wish to undertake larger investments, the irreversibility of the investment may be a greater problem for them. The relationship, therefore, between firm size and investment is not clear cut. Besides the use of the continuous firm size variable, we used dummies to represent the three groups of firm sizes (that is, small if 5<50 employees, medium if 50-100 employees, and large if 100+ employees) to detect variations in sensitivity of investment to profits in the different size groups.

The literature is not very clear on the effect of *location* on investment. Public sector investment (in roads, schools, hospitals, public utilities and other business support services) facilitates a better business environment. More public sector investment in infrastructure would, therefore, attract more private investment. In addition, manufacturing firms close to the capital city would have easier access to debt finance than those located outside the capital city. Location was measured by a dummy variable equal to one for manufacturing firms located in the capital city, and zero otherwise. *Gender* of the manufacturing firm owner may affect the investment decisions of the firm. It is argued that women-owned businesses are less likely to use debt for a variety of reasons, including discrimination and greater risk aversion (Riding and Swift, 1990; Brush, 1992; Scherr et al., 1993). Gender was constructed as a binary, which was equal to one if the major owner of the manufacturing firm is male, and zero otherwise. There were no publicly listed firms in the sample.

The literature on sector effects, foreign ownership, power outages, bribery and crime is not clear. *Sector effects* will be captured by sector dummies, with the agro-based sector as our base category. *Foreign ownership* was captured by a dummy of one for a firm whose foreign ownership was over 50%. We also controlled for the case of foreign ownership of a European extraction and Asian or Middle Eastern extraction. *Power outage* was measured by the number of power outages or surges suffered from the national grid. Corruption was proxied by the percentage of total sales revenue used for unofficial payments to government bureaucrats. Inadequate infrastructure, crime and theft, inadequate demand, competition from imports, access to credit and skilled labour shortages were proxied by a dummy of one if a firm reported the problem among the three major obstacles of doing business in Uganda.

Estimation technique

In order to understand the reasons for the low investment rates in Ugandan manufacturing firms, a model of both the decision to invest and the amount of investment undertaken was estimated. If the factors that determine the decision to invest and the amount of investment are the same, then the correct specification is the tobit in the case where the dependent variable is continuous but bounded between zero and one. The tobit model assumes that any variable that increases the probability of positive investments must also increase the average rate of investment of firms. The tobit model incorporates the decision of whether or not to invest and the rate of investment in one model; that is, it imposes the same coefficients on the explanatory factors for the two decisions. The tobit model is also appropriate for censored data.

Since one of the dependent variables was a dummy indicating whether or not a firm invests, a probit regression model was used in the analysis.

Econometric issues such as endogeneity and measurement errors were addressed. The question of the causality, for example, from firm efficiency to investment was addressed. Are firms, for example, investing because they are more efficient, or are investing firms becoming more efficient? Probably both explanations hold to some degree, and may be able to explain why some firms are unwilling to invest. The same applies to other endogenous variables. The endogeneity issues were addressed by using lags of variables that are endogenous to reflect the manager's information set at time *t*. On measurement errors, observations with extreme values were deleted.

Data

The data was obtained from survey data that was collected from an interview during 2002-2003 as part of the World Bank's RPED, in collaboration with the Uganda Manufacturers' Association Consulting Services (UMACIS). The sample frame consisted of all manufacturing firms with 10 or more employees in the 2001/02 Census of Business Establishments (Uganda Bureau of Statistics, 2002). A stratified random sample was drawn from this frame with location, size and sector as the stratification dimensions. The stratification yielded 56 populated clusters. The sampled firms represent a sampling rate of 41% and account for about 70% of employment of the sampling frame. The data is reliable and of reasonably good quality.

The survey collected information on perceptions about infrastructure, skill of workers, access to finance, corruption, and demand conditions, among others. It also asked about the firm's sales, exports, plant age, employment, investment, and education levels of top managers, among other details. Although the data is not strictly comparable to surveys in other countries, useful comparisons were made between the results obtained from the survey data and those obtained in other African countries.

4. Results and discussion

Descriptive results

Summary statistics of major variables used in the analysis are presented in Tables 4 and 5 for 2002 and 2001, respectively. The tables provide the summary statistics of the dependent and explanatory variables. It reports the overall mean, standard deviations, minimum and maximum values as well as the number of observations. The standard deviations of most variables are larger than the means, indicating a wide spread around the means. Size and age variables are expressed as natural logarithms. Correlation matrices for all variables used in the regression analysis are reported in Appendix 1. The largest correlation (between capacity utilization and corruption) is 0.489.

All the 300 firms can be classified into one of five sectors, with 122 firms in the agricultural sector, 54 in the furniture and wood sector, 40 in the construction and wood sector, 25 in the chemical and plastics sector and 59 under other sectors (metals, textile and leather, and paper, printing and publication). It is interesting to note that there was an increase in leverage of firms whereby debt capital ratio increased from an average of 5% in 2001 to 6% in 2002. Similarly, value added capital ratio increased from an average of 31% in 2001 to 52% in 2002 compared to profit capital ratio that increased from 20% in 2001 to 33% in 2002.

Table 4: Summary statistics for 2001

Variable	Observation	Mean	Std. Dev.	Min	Max
Investment rate	284	0.082500	0.251000	0	1.420000
Chemical dummy	300	0.083333	0.276847	0	1
Construction dummy	300	0.133333	0.340503	0	1
Furniture dummy	300	0.180000	0.384829	0	1
Other sectors	300	0.196667	0.398142	0	1
City dummy	300	0.680000	0.467256	0	1
Export dummy	300	0.163333	0.370287	0	1
Ln (size)	294	1.158770	0.682576	0	3.546419
Ln (age)	294	0.884826	0.424313	0	1.963788
Gender	241	0.946058	0.226373	0	1
Power outage	228	0.649250	0.494648	-0.52288	2.225309
Monopoly dummy	179	0.162011	0.369495	0	1
Education manager dummy	298	0.687920	0.464122	0	1
African dummy	242	0.739669	0.439724	0	1
Corruption	146	1.028700	2.306000	0	10

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Table 4 Continued

Variable	Observation	Mean	Std. Dev.	Min	Max
Theft dummy	299	0.317726	0.466373	0	1
Foreign ownership	300	0.226667	0.419375	0	1
Credit financing	300	9.206667	24.698260	0	100
Capacity	279	56.53871	22.612430	1.60000	100
Skill problem	300	0.153333	0.360911	0	1
Infrastructure problem	300	0.250000	0.433736	0	1
Credit problem	300	0.313333	0.464624	0	1
Demand problem	300	0.080000	0.271747	0	1
Competing imports problem	300	0.20000	0.400668	0	1
Debt/K	274	0.051700	0.166000	0	1.152000
Profit/K	274	0.196000	1.837000	-8.47600	9.138000
Value added/K	262	0.310319	0.882900	-3.88890	5.12713
Efficiency	241	0.472133	0.336568	0.00500	1
Sharpe ratio	300	0.002372	0.406534	-1.91556	2.920752
Inflation	300	5.900000	0	5.90000	5.9

Source: Author's own calculation from Investment Climate Survey data, 2003

Table 5: Summary statistics for 2002

Variable	Observation	Mean	Std. Dev.	Min	Max
Investment rate	266	0.098200	0.289000	0	1.87
Chemical dummy	300	0.083333	0.276847	0	1
Construction dummy	300	0.133333	0.340503	0	1
Furniture dummy	300	0.180000	0.384829	0	1
Other sectors	300	0.196667	0.398142	0	1
City dummy	300	0.680000	0.467256	0	1
Export dummy	300	0.146667	0.354364	0	1
Ln (size)	279	1.141588	0.682556	0	3.778151
Ln (age)	281	0.840093	0.456147	0	1.959041
Gender	241	0.946058	0.226373	0	1
Power outage	228	0.649250	0.494648	0	2.225309
Monopoly dummy	179	0.1620110	0.369495	0	1
Education manager dummy	298	0.687920	0.464122	0	1
African dummy	242	0.739669	0.439724	0	1
Corruption	146	1.029000	2.306000	0	10
Theft dummy	299	0.317726	0.466373	0	1
Foreign ownership	300	0.226667	0.419375	0	1
Credit financing	300	9.206667	24.698260	0	100
Capacity	265	55.789810	23.167600	1	100
Skill problem	300	0.153333	0.360911	0	1
Infrastructure problem	300	0.250000	0.433736	0	1
Credit problem	300	0.313333	0.464624	0	1
Demand problem	300	0.200000	0.400668	0	1
Competing imports problem	300	0.080000	0.271747	0	1
Debt/K	274	0.064403	0.221596	0	1.742400
Profit/K	251	0.334000	1.196000	-2.865000	7.853000
Value added/K	262	0.523230	1.073380	-3.115000	4.576000
Efficiency	241	0.444817	0.332852	0	1
Sharpe ratio	300	-0.0291200	0.054318	-4.841150	3.808812
Inflation	300	4.6	0	4.600000	4.600000

Source: Author's own calculation from Investment Climate Survey data, 2003

Ugandan manufacturing firms in the sample were utilizing 56% of installed capacity. The average percentage of annual revenue used for unofficial payments constitutes 1%. The average level of education by the top manager of manufacturing firms in Uganda is vocational training. The average age of the manufacturing firms is 13.2 years, not far from the median age of 14.4 years, implying that most of the firms are young. In addition, the average firm size is 78 employees.

Exporting is less common, as only 16% of the manufacturing firms in Uganda participate in export markets. The average value of lost production due to power outages or surges as a percentage of total annual sales was 6%. As regards financing of new investment in machinery and equipment, only 9% of new investments are financed with credit from banks.

Regarding the three biggest obstacles to doing business in Uganda, crime and theft was reported by 32% of the firms, compared to 31% of the firms for inadequate access to credit. Insufficient demand for products was also reported by 20% of the firms compared to 25% for inadequate infrastructure. Skilled labour shortage was rated by 15% of the firms as among the three major obstacles to operations. Competition from imports was also reported by 8% of the manufacturing firms as one of the three biggest obstacles of doing business in Uganda.

On average, 95% of the manufacturing firms are owned by males as majority shareholders. In terms of ethnicity of the firm owner, 74% of the firms were owned by Africans. When compared with 23% of manufacturing firms that are foreign-owned, it implies that only 3% of the firms are owned by Africans of non-Ugandan origin. The majority of the firms (68%) are located in the major city. On average, 16% of firms interviewed can be described as having at least one local monopoly market; that is, at least one of their three main product lines possesses at least 60% of the Ugandan market.

Tables 6 and 7 present the distribution of the firms that invest in the sample according to sector, size, and gender, education of the manager, export status, location, ethnicity, foreign involvement and year. It is important to note that there was a reduction in the frequency of the proportion of firms investing from 45% in 2001 to 39% in 2002. However, there was no major change in the average rate of investment. The fact that the proportion of firms that report any investment is decreasing over time may reflect a genuine decrease in investment as well as a recollection bias – the 2000 and 2001 figures were asked retroactively.

The investment frequency and intensity for the present sample of firms are generally low, but do not show much variation among most groups. There are, for example, no significant differences between the frequency and intensity of exporting and non-exporting firms, firms owned by females and males, firms located in the main city and those located outside the city, and firms with managers whose education is above secondary or those whose education is below secondary education level.

However, firms in sectors other than agriculture are more likely to invest compared to agricultural sector firms. However, once they invest, their investment rates are likely to be less than agricultural manufacturing firms. On average, the frequency of African-owned firms investing is less than those of non-Africans, but there is no major difference between average investment rates. Large firms are also shown to be more likely to invest than medium firms. These descriptive statistics are consistent with what has been found for manufacturing firms in other Sub-Saharan countries. We proceed next by analyzing these mechanisms using econometric methods.

Table 6: Descriptive statistics for 2001

Variable	Number of firms investing	Proportion of firms investing	Average rate of investment if firms invest
Foreign-owned firms	33	0.49	0.13
Non-foreign owned firms	102	0.44	0.20
Firms located in main city	101	0.50	0.17
Firms located outside main city	35	0.36	0.20
Firms owned by Africans	75	0.42	0.20
Firms owned by non-Africans	35	0.56	0.15
Firms exporting	26	0.53	0.15
Firms not exporting	109	0.43	0.19
Firms owned by males	104	0.46	0.19
Firms owned by females	6	0.46	0.20
Managers with education above secondary	91	0.44	0.18
Managers with education equal and below secondary	42	0.45	0.19
Agriculture sector	49	0.40	0.22
Chemical and plastics sector	14	0.56	0.18
Construction sector	18	0.45	0.28
Furniture and woods sector	31	0.57	0.12
Other sectors	28	0.57	0.11
Small size firms (<50 workers)	106	0.45	0.20
Medium firms (50-100 workers)	10	0.4	0.13
Large firms (100+ workers)	18	0.53	0.14

Source: Author's own calculation from Investment Climate Survey data, 2003

Table 7: Descriptive statistics for 2002

Variable	Number of firms investing	Proportion of firms investing	Average rate of investment if firms invest
Foreign-owned firms	36	0.53	0.08
Non-foreign owned firms	92	0.40	0.20
Firms located in main city	89	0.44	0.17
Firms located outside main city	39	0.41	0.17
Firms-owned by Africans	70	0.39	0.18
Firms-owned by non-Africans	31	0.49	0.16
Firms exporting	19	0.43	0.17
Firms not exporting	109	0.43	0.17
Firms owned by males	94	0.41	0.18
Firms owned by females	6	0.46	0.37
Managers with education above secondary	89	0.43	0.14
Managers with education equal and below secondary	38	0.41	0.25
Agriculture sector	44	0.36	0.28
Chemical and plastics sector	14	0.56	0.11
Construction sector	18	0.45	0.04
Furniture and woods sector	28	0.52	0.11
Other sectors	24	0.41	0.08
Small size firms (<50 workers)	101	0.42	0.20
Medium firms (50-100 workers)	12	0.57	0.06
Large firms (100+ workers)	13	0.41	0.13

Source: Author's own calculation from Investment Climate Survey data, 2003

Regression results

Table 8 presents marginal effects of variables that determine the propensity to invest among Uganda manufacturing firms. We used step-wise regression analysis on a sample of firms, adding one more explanatory variable to the flexible accelerator equation to identify the primary determinants of investments. In each equation, we run the model with the traditional variables. The inclusion of control variables does not change the sign and statistical significance of the traditional variables (see Table 8 and Appendixes 2 and 3). The model is correctly specified, as indicated by the p-values. To facilitate interpretation, we report marginal effects for continuous variables (value added capital ratio, debt capital ratio, profit capital ratio, firm size, firm age, capacity utilization, credit financing, Sharpe ratio, corruption, lost output as a result of power outages, efficiency, foreign ownership) and for sectors, foreign ownership, monopoly, export status, gender, location, infrastructure problem, theft and crime, demand problem, credit problem, skills problem, education of the manager and ethnic origin of major shareholder dummy variables, the discrete change in estimated propensities to invest as the dummy changes from 0 to 1.

Table 8: Determinants of investment: Tobit estimates for equations 1-8 dependent variables, investment rate

Variable	1	2	3	4	5	6
Constant	-8.368 (-5.4)***	-4.243 (-2.64)***	-6.757 (-8.0)***	-10.688 (-5.4)***	-4.864 (-5.35)***	-5.857 (-6.87)***
ΔValue added/Capital$_{t-1}$	-0.147 (-0.31)	-0.0994 (-0.19)	-0.0601 (-0.14)	-1.480 (-1.3)	-0.0114 (-0.03)	-0.163 (-0.37)
(Debt/Capital)$_{t-1}$	-39.069 (-2.79)***	-36.617 (-2.55)***	-43.152 (-3.17)***	-52.628 (-2.08)**	-34.837 (-2.82)***	-30.644 (-2.58)***
(Profit/Capital) $_{t-1}$	-0.839 (-1.11)	-0.334 (-0.4)	-0.255 (-0.38)	-0.721 (-0.52)	-0.533 (-0.77)	-0.290 (-0.42)
Ln (firm size)	1.873 (1.66)*					
Ethnicity (African)		-3.152 (-1.79)*				
Credit financing			0.0915 (3.17)***			
Corruption				1.516 (2.57)***		
Credit problem					-4.599 (-3.08)***	
Skill problem						-4.38 (-2.58)***

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Table 8 Continued

Variable	1	2	3	4	5	6
Competition from imports						
Log likelihood	-780.613	-707.178	-810.02	-403.638	-809.853	-812.639
Wald chi^2	10.12	8.57	16.27	13.17	16.98	12.36
Prob>chi^2	0.04	0.07	0.002	0.01	0.0019	0.015
No. of observations	466[1]	407	488	236	488	488

Note: Reported values are marginal effects and the values in parentheses are the Z-statistics. ***, **, and * indicates statistical significance at the 1%, 5%, and 10% levels, respectively.

Financing factors emerge as important determinants of propensity to invest compared to industrial policies, markets, risk, business environment, information deficiency, and firm-specific factors. Debt capital ratio, financing of new investment with credit, and access to credit problem were found to be consistently associated with the propensity to invest. Other factors found to be associated with the propensity to invest include ethnicity, firm size, corruption, shortage of skilled workers and competition from imports.

Debt capital ratio is shown to be an important determinant of propensity to invest, suggesting that past firm borrowing or indebtedness adversely affects present investment if such borrowing increases the probability of bankruptcy. The negative sign of the debt capital ratio is consistent with the results obtained for samples of Latin American countries (Cardoso, in Serven and Solimano, 1993), East Asian countries (Larrain and Vergara, in Serven and Solimano, 1993) and a number of other developing countries (Serven and Solimano, 1993) in which the variable was significant and negatively related to investment.

Our results show that availability of bank credit to finance new investment in capital was positively associated with the rate of investments. This evidence indicates that financial constraints faced by firms may explain the very low rates of investment. The growth regression literature gives some support for the thesis that finance is important for growth (King and Levine, 1993). One key aspect discussed in the specific investment decision literature is whether or not firms are financially restricted. A firm is considered to be financially restricted if the cost or availability of external financing prevents it from realizing new projects that it would have selected if internal financing had been available (Kaplan and Zingales, 1997).

Firm size is shown to be an important determinant of propensity to invest, a finding that is consistent with Grenier et al. (1998) in a study on manufacturing firms in Tanzania, which shows evidence that larger firms in Tanzania are the most likely to sustain their investments. Large firms' fixed asset possession gives them strong bargaining power. However, the association between firm size and propensity to invest is weak, as firm size loses its significance under different model specifications. When firm size was interacted with access to credit, the relationship between propensity to invest and the interaction term was not different from zero (see Appendix 3).

Ethnic ownership of firms is weakly associated with the propensity to invest, with non-African-owned firms more likely to invest than African-owned firms. This finding is not surprising because foreign-owned firms are more likely to have more overseas connections. Corruption, measured by the percentage of sales revenue spent on unofficial

payments, is positively associated with the propensity to invest. This may be due to the fact that the survey respondents over-report the official payments they are making. It might also be that investing firms are more likely to encounter government officials than non-investing firms.

Shortage of skilled labour is reported by some firms as one of the three major obstacles of doing business in Uganda, and is shown to be negatively associated with the rate of investment. Low skill levels can keep the marginal product of capital low even in countries with low capital (see Faini, 1996). The demand for new investments can be choked off by limitations on skills (Putnam, 1995). Low marginal products of capital and low marginal products of labour can co-exist, provided the firm lacks skilled workers. It is argued that a country's skill endowment may play an important role in its ability to adapt and implement new and more productive technologies. But the productivity of capital using existing technologies may also depend on the skills of the labour force as broadly understood; that is, involving not just literacy and other aspects of formal education, but also industrial experience.

Firms that reported that they face intense competition from imports as one of the major obstacles to doing business showed a positive association with propensity to invest. This might suggest that to compete in the newly deregulated market, firms facing intense competition were more likely to invest in future production capacity.

The profit effect on investment in a sample of manufacturing firms is negative but insignificant. This result is consistent with the results obtained by Naude et al. (2000) in a study on South African manufacturing firms. A non-significant cash flow-capital ratio on a Belgian panel was also obtained by Bond et al. (2003) and Butzen et al. (2003). Warnholz (2008) found that the link between past profitability and current investment is weak in Africa. In an in-depth analysis of the manufacturing sector in Zimbabwe between 1992 and 1994, Fafchamps and Oostendorp (1999) show that the cash-flow sensitivity of investment is low even among small firms. Indeed, if firms were liquidity constrained, then changes in profits would have a powerful effect on investment, as has been found out by previous studies (Teal, 1995; Bigsten et al., 1997; and Reinikka and Svensson, 2001), but this is not borne by our data. This may suggest that, as stressed by Dixit and Pindyck (1994) and Serven (1997), in the presence of irreversibility, the potential investor has an incentive to remain liquid until risk is resolved. The value of waiting is that the investor avoids costly mistakes. The literature on the effect of risk on investment is not clear because of the crudeness of the risk measures used. This is not inevitable, but simply reflects the fact that existing survey instruments were not designed to measure the risks faced. The use of Sharpe ratio and inflation, for example, to measure risk in our analysis, may not be appropriate since they mainly measure volatility. The effect of Sharpe ratio and inflation rates on rate of investment is not significantly different from zero.

The positive effect, although not significant, for firm efficiency suggests that efficient firms are indeed more likely to invest than less efficient firms. The monopoly dummy is positive but insignificant. This is unsurprising, as basic economic theory informs us that monopolies will prefer to restrict output in order to earn supernormal profits. The regression results also show that the level of education of the top manager in a firm does not have any significant relationship with the rate of investment. The change in value added sales variable is insignificant, implying that firms are not likely to invest if they

have experienced an increase in their sales. Capacity is negatively but not significantly associated with the rate of investment. Theft and crime is also not significantly associated with the rate of investment. Variables such as age, gender, sector effects, export participation, inadequate provision of infrastructure, inadequate demand for produced products, location in the city, and loss of output due to power outages had the expected signs but the coefficients are not significantly different from zero.

To establish the determinants that influence the decision whether to invest or not, we estimated an additional model. Following Teal (1995), the factors explaining this decision using probit regression were analyzed. A number of regressions were made for the probit equation, some of which have been reported in Table 9 and the rest are reported in Appendixes 4 and 5. The regression results show that sector effects are important. All sectors invest significantly more than the baseline agricultural sector category. Apparently, sector effects matter for the decision to invest but not for the rate of investment. This suggests that sector effects may explain why some firms invest and others do not, but not by how much. Sector dummies used to capture differences in sector effects indicate that there are significant differences between other sectors and the agricultural sector. This is important information for sector development policy, for different mechanisms should be used in different sectors in order to foster private investments.

The majority of explanatory variables that influence the decision to invest or not to invest that were analyzed had the expected signs. These include debt capital ratio, firm size, firm age, location in the main city, loss of output due to power outages, monopoly, ownership of firms by Africans, credit financing, capacity utilization, infrastructural problems, access to credit problem, competition from imports, and technical efficiency (see Table 9 and Appendixes 4 and 5). However, the coefficients of these variables are not significantly different from zero.

Table 9: Determinants of investment: Probit estimates for equations 9-15
Dependent variable: Investment dummy

Variable	9	10	11	12	13	14	15
Constant	-0.681 (-2.99)***	-0.497 (-1.71)	0.241 (.77)	-0.192 (-1.26)	-0.145 (-0.55)	-0.105 (-0.6)	-0.174 (-1.15)
ΔValue added/ $Capital_{t-1}$	-0.0853 (-1.22)	-0.0871 (-0.18)	-0.0909 (-1.14)	-0.0763 (-1.09)	-0.106 (-1.08)	-0.0788 (-1.36)	-0.0792 (-1.13)
$(Debt/Capital)_{t-1}$	289 (.44)	-0.233 (-0.32)	-0.00264 (-0.01)	-0.424 (-0.58)	-0.887 (-0.90)	-0.0340 (-0.06)	-0.0770 (-0.11)
$(Profit/Capital)_{t-1}$	-0.145 (-1.26)	-0.180 (-1.47)	-0.229 (-1.58)	-0.149 (-1.29)	0.0643 (-0.39)	-0.158 (-1.36) -0.153 (-1.32)	
Chemical dummy	0.871 (1.85)*						

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Table 9 Continued

Variable	9	10	11	12	13	14	15
Construction dummy	0.858 (2.02)**						
Furniture dummy	1.131 (3.0)***						
Other sectors dummy	0.697 (1.97)**						
Ln (firm size)		0.341 (1.56)					
Ethnicity (African)			-0.513 (-1.44)				
Credit financing				0.00931 (1.57)			
Corruption					0.0371 (0.38)		
Credit problem						-0.0664 (-0.24)	
Competition from imports							0.608 (1.24)
Log likelihood	-293.516	-282.834	-243.621	-298.578	-142.45	-299.83	-299.069
Wald chi^2	13.64	4.99	5.00	5.00	2.14	2.61	4.07
Prob>chi^2	0.058	0.290	0.290	0.290	0.710	0.630	0.400
No. of observations	484	462	403	484	236	484	484

Note: Reported values are marginal effects and the values in parentheses are the Z-statistics. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

5. Conclusion and policy implications

The aim of this study was to establish the determinants of investment by Ugandan manufacturing firms. The study was based on descriptive and econometric analyses. It was deemed necessary to identify the determinants of investment in manufacturing, as this sector is vital for growth and job creation, and needs higher levels of investment than in the past.

The tobit regression results showed that financing factors emerge as important determinants of the propensity to invest compared to markets, risk, business environment, information deficiency, and firm-specific factors. Debt capital ratio, financing of new investment with credit, and the problem of access to credit were found to be consistently associated with the propensity to invest. Other factors found to be associated with the propensity to invest include ethnicity, firm size, corruption, skill problem, and competition from imports. Most of the variables that were analyzed, such as firm age, gender, sector effects, export participation, inadequate provision of infrastructure, inadequate demand for produced products, location in the city, and loss of output due to power outages had the expected signs but the coefficients are not significantly different from zero. In general, the results are consistent with comparable studies.

The probit regression results show that sector effects influence the decision to invest or not. All sectors invest significantly more than the baseline agricultural sector category. This suggests that sector effects may explain why some firms invest and others do not, but not by how much. This is an important result for sector development policy, for different mechanisms should be used in different sectors to foster private investments.

It is also clear from the results that access to credit and shortage of skilled workers are hindrances to private investment. If the private sector is to be the "engine of growth" in the economy, then these constraints, among others, need to be given serious attention. To remove the obstacles to investment in Uganda, the critical target of reform would seem to be in the area of public sector governance and financial sector. An appropriate financial environment (for example, an efficient credit bureau) would increase access to credit. In addition, a well-functioning and efficient public sector would undertake investments in human capital, for example, by focusing on vocational training to increase the skills of workers.

Note

1. The number of observations used in the regression is not equal to rest of the regressions because some firms did not have all the data.

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Appendix

Appendix 1: Correlation matrix

Variable	Value added/K	Debt/K	Profit/K	Chemical	Construction	Furniture	Other sectors
Value added/K	1						
Debt/K	-0.0382	1					
Profit/K	-0.0483	-0.0019	1				
Chemical	-0.0975	-0.0271	0.1475	1			
Construction	-0.0520	-0.0593	-0.1077	-0.1240	1		
Furniture	-0.0583	-0.0705	-0.2680	-0.0789	-0.0646	1	
Other sectors	-0.0244	-0.2117	0.0122	-0.2564	-0.2098	-0.1335	1
City	-0.1826	-0.1245	0.0543	0.2644	-0.1752	0.1377	-0.0454
Export	-0.1538	0.0941	0.1975	0.4745	0.0163	-0.1211	-0.2636
Size	-0.0756	0.1468	0.1840	0.2918	0.0891	-0.0652	-0.1847
Age	0.0136	-0.0192	-0.0290	0.2812	-0.1170	-0.1946	0.3615
Gender	0.0051	0.0572	-0.1359	0.0640	0.0524	0.0333	0.1083
Power outage	-0.0377	0.3057	-0.0179	-0.2697	-0.0314	-0.0043	0.1077
Monopoly	-0.0293	-0.0154	-0.0930	0.0826	0.1287	-0.0478	-0.1553
Manager educ	-0.0899	0.0190	0.2299	0.2089	-0.0474	0.1088	0.1474
African	0.1151	0.1081	-0.1745	-0.2988	0.0873	0.1729	-0.0183
Corruption	0.0632	0.0304	-0.0680	-0.0890	0.0414	-0.1100	-0.0653
Theft	0.1836	0.2088	-0.0487	0.0622	-0.0873	-0.1729	-0.2717
Foreign owner	-0.0543	0.1576	-0.0618	0.0326	-0.0870	-0.1211	0.2567
Capacity	-0.1270	0.0323	0.0993	0.1734	-0.2301	-0.0926	0.1454
Skill problem	-0.0866	-0.0954	0.1791	0.1809	0.0587	0.2268	-0.0592
Infra problem	0.1290	0.1733	-0.0886	0.4449	-0.1710	-0.1088	-0.0787
Credit problem	0.1282	-0.2708	0.0447	-0.2815	0.1622	0.2194	0.4257
Demand problem	-0.0774	0.3362	0.0295	-0.0449	-0.1839	0.3511	0.0165
Import competition	-0.0315	0.0297	0.0562	-0.1427	-0.1167	-0.0743	-0.0642
Efficiency	0.1276	0.1231	-0.1540	-0.2528	0.0270	0.0936	-0.0354
Sharpe ratio	0.0205	0.0387	-0.0175	0.0474	-0.3603	0.0238	0.0729

continued next page

Appendix 1 Continued

Variable	Value added/K	Debt/K	Profit/K	Chemical	Construction	Furniture	Other sectors
City	1						
Export	0.1489	1					
Size	0.1410	0.2625	1				
Age	0.0896	0.1021	0.2964	1			
Gender	-0.1117	-0.2751	-0.0549	0.0919	1		
Power outage	-0.4564	0.1172	-0.3989	-0.0676	0.0097	1	
Monopoly	0.1601	-0.1409	0.0748	0.1092	0.0387	-0.1747	1
Manager educ	-0.0930	0.3208	0.2981	0.1737	-0.0882	0.2140	-0.1563
African	-0.1207	-0.4587	-0.4859	-0.2385	-0.1402	0.2307	0.2010
Corruption	-0.3299	0.1177	0.0926	-0.0240	-0.1688	0.0489	-0.0354
Theft	0.1780	0.2166	-0.0357	0.0955	-0.1928	-0.0109	0.0377
Foreign owner	0.2774	-0.0179	0.0395	0.1325	0.0982	-0.0604	0.1268
Capacity	0.0733	0.1515	-0.0466	0.0373	0.0369	0.1704	-0.1488
Skill problem	0.2120	0.2777	0.1652	0.0981	0.0849	-0.2132	0.1674
Infra problem	-0.3146	0.1812	-0.0375	0.0945	0.0882	0.1156	-0.1265
Credit problem	-0.1106	-0.1925	-0.1253	-0.0365	-0.1779	0.0042	-0.0996
Demand problem	0.1307	-0.138	-0.1346	-0.2277	0.0949	0.0267	-0.1361
Import competition	0.1614	-0.0341	0.3842	0.0234	-0.4486	-0.1686	-0.0864
Efficiency	-0.1894	0.1262	-0.0762	-0.0222	-0.0239	0.1802	-0.1474
Sharpe ratio	-0.0741	-0.1905	-0.0925	-0.0850	-0.0193	0.0026	0.0374

continued next page

Appendix 1 Continued

Variable	Manager Educ	African	Corruption	Theft	Foreign owner	Capacity	Skill problem
Manager educ	1						
African	-0.3299	1					
Corruption	-0.0184	-0.1291	1				
Theft	-0.2457	0.1875	0.0780	1			
Foreign owner	0.0340	-0.0956	-0.2223	0.0956	1		
Capacity	0.1600	-0.1824	-0.4890	-0.1020	0.1426	1	
Skill problem	0.1223	-0.0826	-0.2144	0.0826	-0.1620	0.1799	1
Infrasructure problem	0.1366	-0.0539	-0.1860	0.1178	-0.0340	0.2453	-0.1223
Credit problem	0.1159	0.1463	-0.0932	-0.2533	0.1073	0.0777	0.0409
Demand problem	-0.1276	0.3693	-0.1524	0.1231	0.2070	-0.0023	0.1491
Import competition	0.0013	-0.1823	0.1047	-0.1476	-0.0341	-0.0235	-0.1893
Efficiency	-0.1309	0.0818	0.1186	0.1219	-0.0436	0.0137	-0.0255
Sharpe ratio	-0.0646	0.1337	0.0631	-0.1335	0.0670	-0.0565	-0.2207
Infrastructure problem	1						
Credit problem	-0.1792	1					
Demand problem	-0.1641	0.0152	1				
Import competition	-0.1967	0.0699	-0.2116	1			
Efficiency	-0.0477	0.0953	0.1275	-0.0518	1		
Sharpe ratio	0.0612	-0.1287	0.0596	0.0422	-0.1831	1	
Inflation	-0.0457	0.0549	-0.0456	0.0311	-0.0344	0.1185	1

Appendix 2: Determinants of Investment: Tobit estimates for equations 16-23

Dependent variable: Investment rate

Variable	16	17	18	19	20	21	22	23
Constant	-5.46 (-4.59)***	-6.0414 (-1.17)	-8.451 (-2.42)***	-6.566 (-5.06)***	-6.789 (-5.08)***	-6.627 (-7.47)***	-7.317 (-4.56)***	-5.0717 (-4.06)***
ΔValue added/ Capital$_{t-1}$	-0.146 (-0.32)	-0.155 (0.24)	-0.180 (-0.35)	-0.236 (-0.36)	-0.121 (-0.27)	-0.132 (-29)	-0.206 (-0.44)	-0.171 (-0.38)
(Debt/ Capital)$_{t-1}$	-34.099 (-2.74)***	-48.497 (-2.45)***	-31.808 (-2.38)***	-35.518 (-2.37)**	-33.62 (-2.72)***	-36.634 (-2.78)***	-34..822 (-2.72)***	-5.0717 (-4.06)***
(Profit/ Capital)$_{t-1}$	-0.44 (-.63)	-0.184 (-0.19)	-0.333 (-0.39)	-0.701 (-0.71)	-0.419 (-0.60)	-0.506 (-0.72)	-7.742 (-0.99)	-0.465 (-0.66)
Chemical dummy	-1.343 (-0.53)							
Construction dummy	-2.732 (-1.22)							
Furniture dummy	-1.639 (-0.89)							
Other sectors dummy	-0.232 (-0.13)							
Power outages		-2.211 (-1.17)						
Gender			1.865 (0.53)					

continued next page

Appendix 2 Continued

Dependent variable: Investment rate

Variable	16	17	18	19	20	21	22	23
Monopoly dummy				0.800 (0.31)				
City location dummy					0.694 (.48)			
Export dummy						2.584 (1.36)		
Ln (firm age)							1.124 (0.71)	
Education of top manager dummy								-1.982 (-1.39)
log likelihood	-813.738	-637.424	-704.669	-548.155	-814.66	-813.843	-782.15	-802.963
Wald chi^2	9.97	7.95	6.4	6.44	8.25	9.12	8.81	10.21
Prob>chi^2	0.19	0.093	0.17	0.17	0.08	0.058	0.066	0.037
No. of obser-vations	488	379	405	292	488	488	468	407

Appendix 3: Determinants of Investment: Tobit estimates for equations 24-32

Dependent variable: Investment rate

Variable	24	25	26	27	28	29	30	31	32
Constant	-6.488 (-1.37)	-6.821 (-6.87)***	-6.821 (-6.87)***	-4.81 (-2.48)***	-5.847 (-7.15)***	-5.902 (-6.61)***	-8.441 (-5.56)***	-6.344 (-7.49)***	-3.51 (-1.86)*
ΔValue added/ Capital$_{t-1}$	-0.141 (-0.31)	-0.126 (-0.28)	-0.154 (-0.34)	-0.240 (-0.48)	-0.0601 (-0.15)	-0.147 (-0.38)	-0.230 (-0.45)	-0.139 (-0.31)	-0.130 (1.2)
(Debt/ Capital)$_{t-1}$	-33.29 (-2.71)***	-33.26 (-2.7)***	-33.197 (-2.71)***	-36.124 (-2.68)***	-31.582 (-2.80)***	-33.739 (-2.76)***	-37.515 (-2.57)***	-33.092 (-2.7)***	32.021 (.28)
(Profit/ Capital)$_{t-1}$	-0.438 (-0.63)	-0.426 (-0.61)	-0.450 (-0.65)	-.741 (-0.94)	-0.416 (-0.62)	-0.433 (-0.62)	-.730 (-0.86)	-0.447 (-0.64)	-0.186 (-0.46)
Corruption									
Theft and crime dummy		1.487 (1.06)							
Foreign ownership			-0.762 (-0.48)						
Capacity utilization				-0.0279 (-0.87)					
Infrastructure dummy					-0.924 (-0.64)				
Demand problem dummy						-2.032 (-1.19)			
Efficiency							3.0004 (1.29)		

continued next page

Appendix 3 Continued

Dependent variable: Investment rate

Variable	24	25	26	27	28	29	30	31	32
Corruption									
Sharpe ratio								-0.0533	
								(-.87)	
Ln (firm size) *Credit financing									0.036
									(-0.10)
Log likelihood		-814.214	-814.656	-752.49	-817.223	-814.058	-672.576	-814.392	-157.6
Wald chi^2		9.21	8.38	9.5	9.45	9.55	9.47	8.89	1.90
Prob>chi^2		0.056	0.079	0.049	0.05	0.049	0.05	0.064	0.075
No. of observations		488	488	443	488	488	406	406	446

Appendix 4: Determinants of investment: Probit estimates for equations 33-39

Dependent variable: Investment dummy

Variable	33	34	35	36	37	38	39
Constant	-0.0976 (-0.61)	-0.105 (-0.60)	-0.163 (-1.40)	-0.174 (-1.15)	-0.276 (-1.2)	-0.130 (-0.89)	-0.588 (-0.89)
(Profit/ Capital)$_{t-1}$	-0.150 (-0.47)	-0.158 (-1.36)	-0.0805 (-1.15)	-1.153 (-1.32)	-0.0764 (-.62)	-0.158 (-1.37)	-0.143 (-1.21)
ΔValue added/ Capital$_{t-1}$	-0.0789 (-1.13)	-0.0788 (-1.13)	-0.0568 (-.09)	-0.0792 (-1.13)	-0.0559 (-.78)	-0.0802 (-1.15)	-0.0750 (-1.07)
(Debt/ Capital)$_{t-1}$	0.0174 (.03)	-0.0340 (-0.06)	-0.184 (-1.15)	-0.0770 (-0.11)	0.0678 (0.09)	0.0173 (-0.03)	-0.0128 (-0.02)
Infrastructure problem	-0.145 (-0.45)						
Credit problem dummy		-0.0664 (-0.24)					
Demand problem dummy			0.299 (0.91)				
Competition from imports dummy				-0.608 (1.24)			
Efficiency					0.133 (.39)		

continued next page

Appendix 4 Continued

Dependent variable: Investment dummy

Variable	33	34	35	36	37	38	39
Sharpe ratio						-0.00881	
						(-0.52)	
Inflation rate							0.086
							(0.72)
Log likelihood	-299.745	-299.828	-299.434	-299.069	-249.557	-299.675	-299.596
Wald chi^2	2.77	2.61	3.35	4.07	.99	2.83	3.07
Prob>chi^2	0.597	0.63	0.50	0.40	0.91	0.59	0.55
No. of observations	484	484	484	484	404	484	484

Note: Reported values are marginal effects and the values in parentheses are the Z-statistics. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Appendix 5: Determinants of investment: Probit estimates for equations 40-46

Dependent variable: Investment dummy

Variable	40	41	42	43	44	45	46
Constant	-0.401 (-1.19)	0.274 (.42)	0.0205 (0.09)	-0.154 (-0.63)	-0.0509 (-0.21)	-0.160 (-0.94)	-0.178 (-1.09)
(Profit/ Capital)$_{t-1}$	-0.142 (-1.22)	-0.216 (1.50)	-0.170 (-1.22)	-0.116 (-0.75)	-0.168 (-1.43)	-0.158 (-1.36)	-0.155 (-1.34)
ΔValue added/ Capital$_{t-1}$	-0.0963 (-1.29)	-0.0937 (-1.18)	-0.110 (-1.20)	-0.109 (-1.22)	-0.079 (-1.13)	-0.0799 (-.14)	-0.0782 (-1.11)
(Debt/ Capital)$_{t-1}$	0.0199 (.03)	0.0953 (.13)	0.175 (.25)	0.22 (0.26)	-0.0223 (-0.03)	-0.0588 (-0.09)	-0.0821 (-0.12)
Capacity utilisation	0.00534 (0.96)						
Gender dummy		-0.454 (-0.68)					
Power outages			-0.290 (-0.97)				
Monopoly dummy				-0.141 (-0.25)			
Education manager dummy					-0.129 (-0.45)		

continued next page

Appendix 5 Continued

Dependent variable: Investment dummy

Variable	40	41	42	43	44	45	46
Theft and crime dummy						0.105 (0.37)	
Foreign ownership							0.221 (0.71)
Log likelihood	-276.310	-243.433	-233.569	-173.0849	-296.445	-299.786	-299.601
Wald chi^2	3.20	3.40	3.40	1.82	2.93	2.69	3.05
Prob>chi^2	0.510	0.490	0.490	0.770	0.570	0.610	0.550
No. of observations	441	494	376	289	480	484	484

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Abstract

This study investigated the determinants of private investment behaviour using panel data. Evidence shows a combination of relatively low investment rates, high profit rates, but small profit effects on investment in Sub-Saharan Africa. Little was previously known about the determinants of investment in Ugandan manufacturing firms. This study adopted the flexible accelerator model with some modifications. The probit and tobit regression models were used in the analysis. The tobit regression results showed that debt capital ratio, financing of new investments with credit, and access to credit problems were consistently associated with the propensity to invest. Other factors found to be associated with the propensity to invest include ethnicity, firm size, corruption, skill problems and competition from imports. Sector effects also influence the decision to invest or not. It is clear from the results that low access to credit and inadequate skills are hindrances to manufacturing firms' investments in Uganda. If the private sector is to be the "engine of growth" in the economy, then these constraints, among others, need to be given serious attention.

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