

Determinants of Venture Capital in Africa: Cross Section Evidence

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Abstract

This paper identifies the determinants of venture capital activity using a cross-sectional data set covering 36 African countries in a semi-logarithmic model. It finds that rule of law, R&D expenditure as a percentage of GDP and better information between investors and potential investees are positively and significantly related to venture capital activity in Africa. It also finds that capital gains tax rates are negatively and significantly related to venture capital activity on the continent.

Key words: Venture capital; enterprise policy, Africa

JEL classification: G24, L53, O55

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1. Introduction

The private sector in Africa, which is important for economic growth (Organization for Economic Co-operation and Development, OECD, 2004), is dominated by micro, small and medium-scale enterprises (MSMEs). MSMEs represent 90% of businesses and account for about 63% of employment on the continent (United Nations Environment Programme Finance Initiative, UNEP FI, 2008). The topography of this MSME spectrum is skewed towards micro enterprises that operate alongside a few large firms, with a scarcity of small and medium-scale enterprises (SMEs). This leads to what is termed the “missing middle” (Harvard, 2010). For private sector development strategies on the continent to have the highest impact on economic growth, this missing middle needs to be reduced by increasing the number of growth-oriented SMEs that are more likely to become competitive in domestic and international markets, as opposed to their “lifestyle” counterparts that are content to remain small, supporting the livelihoods of their owners and a few additional employees (Hallberg, 1999). Such strategies require linking SMEs to sources of financing and providing appropriate business support (Christy and Fine, 2004). One financing instrument that can fulfill this task, in a single institution, is venture capital.

Venture capital is defined as “[medium] term, direct equity or equity-linked investments with a well-defined exit strategy in young, privately held companies [or investees], where the investor is a financial intermediary who raises and professionally manages a pool of money and is typically active [...] as a director, an advisor, or even the manager of a firm” (Kortum and Lerner, 1998). By matching financing to entrepreneurs with good projects and certifying companies to other investors, which increases their ability to exit (Megginson and Weiss, 1991), venture capital firms contribute to the success of investees. This results in several positive effects including commercializing innovation (Landskroner and Paroush, 1995); increasing overall innovation at the macroeconomic level (Kortum and Lerner, 1998), firm growth (Engel, 2002); professionalization of start-up firms (Hellman and Puri, 2002), and productivity (Romain and Potterie, 2003a). Investees’ success leads to economic growth and the creation of jobs.

Venture capital firms have been active in Africa since, starting with the Capital Development Corporation’s (formerly the Colonial and then the Commonwealth Development Corporation, or CDC) first investment in Chilanga Cement Plant in Zambia, which was Northern Rhodesia at that time (CDC, 2010). In 2007, these firms supported a total of 1,708 investees on the continent. This paper was motivated by the desire to provide a first step in exploring and understanding this venture capital activity. The findings contribute to the relatively under-explored research area of venture capital and provide insight into the factors that influence venture capital activity in Africa where limited, if any, empirical work on the continent level exists.

The main hypothesis in this paper is that macroeconomic, financial and regulatory factors can explain differences in venture capital activity in Africa. This paper will identify the determinants of venture capital activity on the continent, which is represented by the number of investees per capita. Overall, the paper finds that the institutional environment that affects financial factors and regulatory factors explain venture capital activity in Africa.

The rest of the paper is organized as follows: Section 2 summarizes previous studies that have investigated determinants of venture capital. Section 3 discusses the data, model, hypotheses and methodology that was adopted to achieve the paper's objective. Section 4 presents the results of the methodological application and then discusses the findings, and finally, Section 5 concludes.

2. Literature review

Porteba (1989) introduced the conceptual framework to analyse determinants of venture capital. He argued that venture capital activity depends on the supply of, or demand for, venture capital. The former is defined as investors' willingness to place money into venture capital funds (or investees' enterprises) while the latter is defined as the desire by entrepreneurs to attract venture capital investment to their firms (Gompers and Lerner, 1998). The interaction of the desires of investors and entrepreneurs results in an equilibrium in venture capital activity. This conceptual framework has been used by various empirical studies to identify the determinants of venture capital.

Achs and Audretsch (1994) found that macroeconomic factors can affect venture capital by influencing start-up activity. Jeng and Wells (1998) argue that differences in venture capital across countries can be further explained by financial and regulatory factors that affect technological opportunities and the entrepreneurial environment.

Macroeconomic factors include gross domestic product (GDP) growth, interest rates, the unemployment rate and stock market growth. Financial factors include risk, returns on initial public offerings (IPOs), trade sales and write-offs, performance, price ratios and book ratios as well as the institutional framework that affects financial factors such as legal and shareholder rights, financial reporting standards, and pension fund regulations. Regulatory factors affecting technological opportunities include innovation, and research and development (R&D) expenditures. Factors affecting the entrepreneurial environment include entrepreneurship levels, capital gains tax rates, labour market rigidity and corruption.

Various studies have been done on the determinants of venture capital activity. These include Porteba (1989); Gompers and Lerner (1998); Jeng and Wells (1998); Jagwani (2000); Romain and Potterie (2003b); Félix, Gulamhussen and Pires (2007); and Bonini and Alkan (2009). The rest of this section will summarize these studies and their findings and then position this paper among those studies.

Porteba (1989) descriptively investigated the link between capital gains taxation and venture capital activity in the United States of America from 1969 to 1987. He found that these taxes did not affect the supply of venture capital as most investors were tax-exempt. However, he argued that capital gains taxes negatively influenced the demand for venture capital.

Gompers and Lerner (1998) examined the determinants of venture capital fundraising for limited partnerships in the USA from 1972 to 1994. They focused on the aggregate industry level to determine if macroeconomic, regulatory or performance factors affect venture capital activity using overall venture capital commitments (due to the difficulty in obtaining firm-specific fundraising data) and the number of investees at the state level

(due to the difficulty in assigning aggregate commitments to each state). They found that an easing in pension fund restrictions and R&D expenditures had a positive impact on state-level venture capital fundraising. These authors also found that decreases in capital gains tax rates increase the demand for venture capital as more workers are motivated to become entrepreneurs.

Jeng and Wells (1998) examined the determinants of venture capital for limited partnerships in 15 OECD countries in North America, Europe and Asia between 1986 and 1995. They examined between regressions using the average of their selected variables over time to determine the difference in venture capital investments across countries due to the differences in the characteristics of the countries. Although they considered capital gains tax rates and the efficiency of bankruptcy procedures to be important, they did not include these variables as they did not find good measures for them. The authors found that civil law, accounting standards for public firms, which they adopted as a proxy for accounting standards for private firms; and skilled labour market rigidities, which they argue best represents the class of individuals who are likely to start a new enterprise, were negatively and significantly related to early stage venture capital investment.

Jeng and Wells (1998) also found that initial public offerings (IPOs) were a positive and significant determinant of later stage investment. To control for endogeneity, they included legal and shareholder rights, which capture the institutional framework that affect efficiency of financial markets and factors underlying IPOs that are not related to venture capital, as instruments. After controlling for this potential source of bias, they found that GDP growth, stock market capitalization growth, IPOs on early stage venture capital, rule-of-law, shareholder rights, anti-director rights, private pension fund levels, individual capital gains tax rates, and skilled labour market rigidities on overall venture capital investment, which combines the early and later stages of investment, were not significant.

Kortum and Lerner (1998) tested the link between venture capital and innovation across 20 industries in the USA over three decades. They found that venture capital significantly increases the rate of patenting and accounted for about 15% of industrial innovation.

Jagwani (2000) analysed the determinants of venture capital in the USA by applying ordinary least squares (OLS) to time series data. This author argued that as the decision to invest is based on past performance, the interest rate variable should be lagged one period in analysis.

Romain and Potterie (2003b) analysed the determinants of venture capital for a panel data set of 16 OECD countries between 1990 and 1998, using the generalized least squares technique. They first introduced each variable separately in their empirical equation and then simultaneously to determine if any difference could be observed. The results remained unchanged. These authors found that contemporaneous and not lagged GDP growth, short and long-term interest rates, number of triadic patents, growth rate of business R&D outlays - which represent the research dynamics of a country, and capital stock of business R&D - which represents the stock of knowledge of the cumulated value of innovative efforts, were positively and significantly related to venture capital. They also found that risk and the corporate income tax rate were negatively and significantly related to venture capital.

Romain and Potterie (2003b) also found that when they introduced the interest rates simultaneously with other variables, the long-term interest rate was no longer significant

and they argued that this insignificance was probably due to the impact of GDP growth. These authors also found that a total entrepreneurship activity index obtained from the Global Entrepreneurship Monitor, which was used to capture entrepreneurship level, increased the potency of their R&D expenditure variables when introduced as an interaction term. However, a minimum level of entrepreneurship was required before it positively influenced the effect of the stock of R&D on venture capital intensity. They also found that labour market rigidity, introduced as an interaction term, reduces the influence of GDP growth and the growth rate and stock of R&D expenditure on venture capital intensity.

Félix, Gulamhussen and Pires (2007) analysed the determinants of venture capital in Europe using a panel data set and included unemployment and trade sale divestment as additional variables. They found that long-term interest rates, IPOs and trade sales were positively and significantly related to venture capital. Although also positively significant, the influence of the stock market return was close to zero. In addition, these authors found that the unemployment rate and write-offs were negatively and significantly related to venture capital. Finally, they found that GDP growth was not significant.

Bonini and Alkan (2009) analysed the determinants of venture capital using a panel data set of 16 countries from Europe, North America and Australia between 1995 and 2002. These authors found a significantly positive relationship for control of corruption, a proxy for lower political risk, but acknowledged that the relationship was not robust.

By investigating venture capital activity in Africa, this paper contributes findings from a region that has not been explored in any of the previous, multi-country, empirical studies that have focused on analysing the determinants of venture capital activity.

In this paper, venture capital activity is measured as the number of investees funded each year by venture capital firms as opposed to the dollar amount that these firms invested in each country. This was an issue tackled by Kortum and Lerner (1998), and the choice conforms to Gompers and Lerner (1998). These authors determined equilibrium in the venture capital framework by examining the quantity of venture capital due to their inability to measure the anticipated rate of return in the venture capital market. They justified their choice by arguing that as supply curves for venture capital tend to be fairly elastic, changes in equilibrium have a bigger effect on quantity than on price.

Overall, not all macroeconomic, financial or regulatory factors tested in previous empirical studies were found to determine venture capital activity, which is the focus of this paper. However, the paper attempts to include all the variables in these studies for which data were available. In addition, the paper includes the cost to start a business and the efficiency of bankruptcy procedures as two additional variables. The potential importance of these variables for venture capital activity was recognized by Jeng and Wells (1998), but were not included in previous studies. Furthermore, this paper includes general labour market rigidity, which best captures the flexibility of all individuals to leave their current position to join a start-up, as opposed to skilled labour market rigidity, to ensure that its latent effect on the unemployment rate is not captured (Jeng and Wells, 1998).

The paper does not analyse the effect of long-term interest rates due to the relative scarcity of long-term bonds, i.e., with tenure of 10 years or more, in financial markets in Africa. It also does not include returns from venture-backed IPOs; trade sales or write-offs; pension fund levels, growth or regulations; price/book ratios and total entrepreneurial levels, due to difficulty in obtaining the requisite data.

3. Methodology

This section begins with a discussion of the data that this paper used to identify the determinants of venture capital activity in Africa. It then proceeds to discuss the adopted model and its hypotheses. Finally, it outlines the methodology applied in the paper to achieve its objective.

Data

Various sources of data were used to identify venture capital activity in Africa by country. The primary source was the African Venture Capital Association (AVCA) directory (AVCA, 2004) and presentations at the annual AVCA conferences. Other sources included Hannig and Joubert (2003), the Venture Capital Funds Index 2005 (NCDO & Adappt Foundation, 2005), the KPMG-South African Venture Capital Association (SAVCA) survey (KPMG, 2003), the SAVCA 2005 and 2008 *Yearbooks* (SAVCA, 2005; Mthombothi, 2008) and three infoDev publications (Zavatta, Economisti Associati SRL, Zernike Group and Meta Group, 2008a, 2008b and 2008c). The information from these sources was updated and verified using content, press releases and annual reports obtained from the identified venture capital firms' websites.

In current literature, the scope of venture capital financing differs depending on whether the American or European perspective is adopted. From the American perspective only seed, early stage and expansion financing constitute venture capital.¹ From the European perspective, besides these three, venture capital includes management buyouts (MBOs), management buy-ins (MBIs) and buy-in, management buy-outs (BIMBOs), i.e., what is considered private equity in America. Primarily because of a lack of data that differentiate investees or the amount of financing in Africa by stage of investment, this paper included investee information from only 134 of 287 venture capital or private equity firms identified from the sources in the preceding paragraph. These firms explicitly stated that they provided early stage venture capital financing regardless of whether they undertook MBO, MBI or BIMBO financing. This was done in an effort to capture the relative experience of venture capital firms providing seed or start-up financing, which is “the most challenging for policy makers to understand, and financiers – whether commercial or donor – to serve” (Patricof and Sunderland, 2005). Therefore, it can be argued that this paper conforms to the European definition of venture capital, but excludes those firms that state that they do not provide early stage financing.

To identify potential determinants of venture capital in Africa, the paper applied the country of destination paradigm that is used to record where funds are invested, i.e.,

which countries they go to (EVCA, 2001). This is contrary to the country of management paradigm, which is used to record funds raised, i.e., the country where the venture capital firm is based.

The potential macroeconomic, financial and regulatory determinants were also obtained from a variety of sources. These sources included the World Bank's African Development Indicators, Doing Business and Governance Indicators on-line databases. The International Monetary Fund's International Financial Statistics database was also used. Other sources of information were the Central Intelligence Agency *Factbook* (CIA, 2008), United Nations Economic Commission for Africa (UNECA, 2008), World Intellectual Property Organization – (WIPO, 2008), PriceWaterhouseCoopers (PWC, 2008) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute of Statistics on-line database.

The nature of the data was cross-sectional. An attempt to select a sample using different regions in Africa as strata was abandoned after statistical formulae suggested that to obtain results at the 10% confidence level, all the countries needed to be included. The initial dataset included 38 African countries. Using the model in Equation 1, the *dfbeta* measure was applied to an initial regression of this dataset to identify outliers that could bias the results. Based on this measure, Seychelles and Zimbabwe caused significant outlier effects. These two countries were excluded to avoid spurious regression results. The rest of the countries included in the data set are listed by region in Table 1.

Table 1: Countries in data set by region

North	East	South	Central	West
Algeria	Comoros	Angola	Cameroon	Benin
Egypt	Eritrea	Botswana	Democratic	Burkina Faso
Libya	Kenya	Malawi	Republic of	Côte d'Ivoire
Morocco	Sudan	Mozambique	Congo	Ghana
Tunisia	Tanzania	Namibia		Liberia
	Uganda	Rwanda		Mali
		Zambia		Niger
		Madagascar		Nigeria
		Mauritius		Senegal
		South Africa		Togo
				Mauritania
				Cape Verde
				Sierra Leone

Source: Author

A summary of the data is presented in Table 2. The initial data indicated a number of missing observations in some of the independent variables. The resulting list-wise deletion in regression could cause sample selection issues that could bias the results. To further avoid spurious results arising from list-wise deletion, this paper applied a multiple imputation technique used to address non-response in surveys to correct for the missing data (Rubin, 1987).

Table 2: Summary statistics

Variable	Description	Mean	Standard deviation	Max	Min	Missing observations before imputation (%)
<i>vc</i>	No. of investees per capita	2.349	5.774	27.8	0.0259	0
<i>yg</i>	Per capita GDP growth rate	0.992	2.224	13.094	0.044	0
<i>str</i>	Real interest rate	5.07	6.242	16.639	-6.467	36.1
<i>unmp</i>	Unemployment rate	28.04	21.644	85	1.90	2.7
<i>lstdc</i>	Per capita no. of listed domestic companies on stock exchange	3.78	5.47	32.539	0.089	25
<i>rxp</i>	Risk premium on lending	7.91	5.219	33.16	2.647	44.4
<i>rlw</i>	Rule-of-law indicator	33.83	20.464	75	1	0
<i>ssi</i>	Ease of shareholder suits index	4.944	2.203	10	1	2.7
<i>di</i>	Extent of disclosure index	4.639	2.03	8	0	2.7
<i>cgt</i>	Capital gains tax rate paid by business	21.33	13.203	40	0	0
<i>rdx</i>	Expenditure on R&D as % of GDP	0.356	0.303	1.03	0.03	58.3
<i>pat</i>	Per capita no. of patent filings by country of origin	2.688	5.392	18.365	0.016	41.6
<i>rgemp</i>	Composite rigidity of employment index	46.28	17.499	78	7	5.5
<i>csb</i>	Cost as % of per capita GNI involved in launching a business	147.4	215.947	1181	5	2.7
<i>incv</i>	Cost to resolve insolvency as % of estate value	18.03	9.299	43	7	19.4
<i>contcor</i>	Control of corruption indicator	36.94	21.009	78	4	0

Note: 36 observations

Model

The empirical model adopted in this paper is specified in Equation 1 below. It has a semi-logarithmic functional form. The variables with an asterisk (*) are normalized by population in millions of inhabitants in each country to control for size effects – heterogeneity² (Jeng and Wells, 1998).

$$\ln vc_i^* = \alpha_0 + \alpha_1 yg_i^* + \alpha_2 str_i + \alpha_3 unmp_i + \alpha_4 lstdc_i^* + \alpha_5 rpx_i + \alpha_6 rlw_i + \alpha_7 ssi_i + \alpha_8 di_i + \alpha_9 cgt_i + \alpha_{10} rdx_i + \alpha_{11} pat_i^* + \alpha_{12} rgemp_i + \alpha_{13} csb_i + \alpha_{14} insv_i + \alpha_{15} contcor_i + \varepsilon_i \quad (1)$$

where:³

- vc* is the total number of venture capital investments in 2007;
- yg* is the growth rate in real GDP in 2007. It is expected to have a positive effect on venture capital;
- str* is the real interest rate in 2006, which is the nominal lending rate minus the GDP deflator and represents the short-term interest rate in the previous year. Its expected relationship to venture capital is ambiguous and depends on whether the supply or demand effect dominates;
- unmp* is the total unemployment rate in 2007. It is expected to be positively related to venture capital because it is associated with a larger pool of potential entrepreneurs;⁴
- lstdc* is the number of listed domestic companies on the stock exchange in 2006, which is a proxy for the health of the stock market. It is expected to be positively related to venture capital;
- rxp* is the risk premium on lending in 2007, which is the prime rate minus the 91-day Treasury bill rate. It is expected to be negatively related to venture capital;
- rlw* is a rule-of-law index for 2007 ranging from 0 (weak performance) to 100 (strong performance) that measures the extent to which agents have confidence in and abide by the rules of society, in particular the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence.⁵ It is expected to be positively related to venture capital if it complements debt financing or negatively related if it substitutes for debt financing;
- ssi* is the ease of shareholder suits index in 2007, which is an indicator ranging from 0 (least desirable) to 10 (most desirable). It represents the shareholders' ability to sue officers and directors of a firm for misconducts, reflecting anti-director rights. It is expected to be positively related to venture capital;
- di* is an extent of disclosure index in 2007. It is an indicator ranging from 0 (least desirable) to 10 (most desirable) and represents the transparency of transactions by capturing the extent to which ownership and financial information is disclosed. It is expected to be positively related to venture capital;
- cgt* is the rate of capital gains tax rate paid by business in 2007. It is expected to be negatively related to venture capital;
- rdx* is the expenditure on R&D as a percentage of GDP in 2005. It is expected to be positively related to venture capital;
- pat* is the number of patent filings by country of origin in 2006. It is expected to be positively related to venture capital;⁶
- rgemp* is a composite rigidity of employment index in 2006, which is an unweighted average of the difficulty of hiring, difficulty of firing and rigidity of hours sub-indexes. It ranges from 0 (least rigid) to 100 (most rigid). It is expected to be negatively related to venture capital;
- csb* is the cost as a percentage of a country's income per capita involved in launching a commercial or industrial firm with at least 10 and up to 50 employees and start-up capital of 10 times the economy's income per capita. It is expected to be negatively related to venture capital;

- insv* is cost of bankruptcy or insolvency proceedings as a percentage of the estate's value in 2007. It is expected to be negatively related to venture capital if venture capital complements debt financing or positively related if venture capital substitutes for debt financing;
- contcor* is a control of corruption indicator, which measures the extent to which there is control of the public power exercised for private gain, including petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. It is expected to be positively related to venture capital; and,
- ε is a residual that captures random, unexplained factors; and i represents each individual country and ranges from 1 to 36.

Methodology

The paper used the ordinary least squares (OLS) regression technique to test the empirical model presented in Equation 1 using R version 2.9.2, a free statistical software. Although other studies used panel regression techniques, testing for both fixed and random effects, the decision to use a cross-sectional approach was primarily due to data paucity. A precedent for the approach adopted in this paper can be found in Gompers and Lerner (1998), when analysing the venture capital experience in the USA at the state level, and Jeng and Wells (1998), who applied between regressions to control for differences in the various countries included in their study using the average of their variables over time.

The results presented are the average of five regression replications based on Rubin's (1987) recommendation that 3 to 5 replications is enough to obtain unbiased estimates. The Shapiro-Wilk (SW) method was used to test for the normality of residuals. The Ramsey RESET test was used to test for any model misspecification. The F-test was used to determine the overall significance of the model and the importance of insignificant variables in an unrestricted regression consisting of all the variables from previous studies that were excluded in a restricted regression that explained venture capital activity better. To test for multicollinearity, variance inflation factors (VIFs) were measured. Although the Breusch-Pagan test was used to test for heteroscedasticity, we report White's adjusted standard error coefficients anyway. The Chow test was used to test if regional differences explained venture capital in Africa.⁷ Finally, an R^2 decomposition technique was used to determine the relative influence of each independent variable on the dependent variable in the restricted model.

4. Results and discussion

Using the data and methods described, the regression results are presented in Table 3.

With a Ramsey RESET test p-value of 0.3548, the null hypothesis that the model is appropriately specified cannot be rejected. With a SW p-value of 0.6024, the null hypothesis that the regression's residuals are normally distributed cannot be rejected either. In addition, the F-test for the regression has a p-value of 0.0000042, thus the null hypothesis that its coefficients are equal to zero is rejected. Furthermore, with an F-statistic on the restrictions having a p-value of 0.85 the null hypothesis that the omitted, unrestricted model's variables are not important for explaining venture capital activity cannot be rejected. With all its VIFs below 10, the regression seems to have no multicollinearity problems. Also, with its Breusch-Pagan test statistic with a p-value of 0.871, the null hypothesis that the model has no heteroscedasticity cannot be rejected. Finally, R^2 indicates that the variables explain 61.6% of the variation in the log of investees per capita.

Table 3: OLS regression results

Variable	Coefficient	Variance inflation factor
<i>rlw</i>	0.033** (0.013)	1.443
<i>di</i>	0.242* (0.134)	1.39
<i>cgt</i>	-0.04** (0.017)	1.148
<i>rdx</i>	2.141** (0.927)	1.567
Constant	-2.527*** (0.87)	
Multiple R-squared:	0.6155	
Adjusted R-squared:	0.5659	
F-statistic:	12.428 on 4 and 31 DF, p-value: 4.23e-06	
Breusch-Pagan:	0.871	
RESET:	F-stat 0.8758; df 1429.234; p-value 0.3548	
F on restrictions:	F-stat 0.023;df 806.5352;p-value 0.85	
Shapiro-Wilk:	F-stat 0.292, df 257.2814, p-value 0.6024	
Number of observations:	36	

Notes: Significance codes: 0.01 '***', 0.05 '**', 0.1 '*'; Numbers in parentheses represent White's adjusted standard error coefficients; dependent variable is log of investees per capita

The regression results indicate that the rule of law indicator, which is a proxy for the institutional environment underlying IPOs, efficiency of financial markets and level of uncertainty, is positively and significantly related to venture capital activity in Africa at the 5% level. This suggests that venture capital complements debt finance on the continent. Although the positive relationship conforms to Jeng and Wells (1998), the significance is contrary to the study because they found the rule of law indicator to be insignificant. This is not surprising because the variables differ. The Jeng and Wells rule of law indicator is obtained from the International Country Risk Guide in 1998 and does not include African countries. This paper's variable is obtained from the World Bank's Governance Indicators Database in 2007 and only includes African countries. The paper's findings suggest that an increase in the degree that agents in a country have confidence in and abide by the rules of society (Kaufmann, Kraay and Mastruzzi, 2009) is important for venture capital activity in Africa. Specifying a 95% confidence interval where, with degrees of freedom $(n-k-1) = 31$, the critical value is 2.04, an increase in the rule of law indicator score by 1 point should increase per capita venture capital activity in Africa by between 0.7% and 5.9%.

Also, the regression results indicate that the transparency of transactions represented by a disclosure index is positively and significantly related to venture capital activity at the 10% level. This finding corrects for the surprisingly and significant but negative finding in Jeng and Wells (1998), who used the accounting standards of public firms to capture the transparency of transactions, which they admitted was not the best proxy variable. The model's results indicate that good information between investors and potential investees is important for venture capital activity in Africa. Specifying a 90% confidence interval where, with degrees of freedom $(n-k-1) = 31$, the critical value is 1.6957, an increase in the disclosure index score by one point should increase per capita venture capital activity in Africa by between 1.4% and 46.9%.

In addition, the regression results indicate that the capital gains tax rate is negatively and significantly related to venture capital activity at the 5% level. This finding conforms to the prediction by Porteba (1989) that capital gains tax rates affect the demand for venture capital by investees. Specifying a 95% confidence interval, a decrease in capital gains tax rates by one percentage point should increase per capita venture capital activity in Africa by between 0.5% and 7.5%.

Finally, the regression results indicate that expenditure on R&D as a percentage of GDP is positively and significantly related to venture capital activity at the 5% level. Although these results conform to the findings by Romain and Potterie (2003b) on the capital stock of business R&D, this paper's finding refers to overall R&D expenditure. Specifying a 95% confidence interval, an increase in R&D expenditure as a percentage of GDP by one percentage point should increase per capita venture capital activity in Africa by between 24.9% and 403.2%.

Using a measure that decomposes R^2 into the portion accounted for by each independent variable, Table 4 illustrates that rlw , with a relative importance of 0.27, has the most influence on venture capital activity in Africa. This is followed by rdx , cgt and di , respectively. The findings suggest that in 2007 the rule of law was the most important determinant of venture capital activity in Africa.

Table 4: Relative importance of significant variables

Variable	Relative importance
<i>rlw</i>	0.273
<i>rdx</i>	0.153
<i>cgt</i>	0.104
<i>di</i>	0.091

Source: Author

After categorizing the countries according to the regions illustrated in Table 1, a Chow test was conducted to test for regional differences in the regression's results. The resulting F-statistic of 1.839 with a p-value of 0.146 suggests that the null hypothesis that the results are the same for subsets of regional data cannot be rejected.

Finally the paper found that the variables included to capture the effect of efficient bankruptcy procedures and the cost to start a small business were not important in explaining venture capital activity in Africa.

5. Summary and conclusion

This paper tested the hypothesis that macroeconomic, financial and regulatory factors cannot explain venture capital activity in Africa. The paper identified the determinants of venture capital activity in Africa by applying the OLS regression technique to a semi-logarithmic model consisting of a cross-sectional data set for 36 African countries. Overall, the paper's findings indicate that institutional environment affecting financial factors and regulatory factors explain venture capital activity in Africa. Based on its results, this paper argues that if private sector development actors wish to increase the potency of the venture capital instrument in a "missing middle" reduction toolkit, they should focus on these factors to stimulate venture capital activity on the continent.

This paper focuses on venture capital financing. Future research could focus on how the findings in this paper differ from those of private equity financing in the spirit of Kumar and Orleck (2002), who investigated the determinants of private equity in the USA and eight countries in Europe between 1986 and 1999. In addition, panel analysis techniques can be applied as more venture capital and private equity data become available. Also, as R&D expenditure is found to be an important factor determining venture capital activity in Africa, further research could investigate the channel through which venture capital activity affects GDP growth in Africa in the spirit of Hirukawa and Ueda (2008), who determine the direction of causality between innovation and venture capital investment.

Notes

1. Early stage venture capital refers to seed and start-up financing, while later stage venture capital refers to expansion financing (Jeng and Wells, 1998).
2. For panel data, Félix, Gulamhussen and Pires (2007) argue that normalizing by GDP also controls for inflation effects.
3. Except for (NOT PROVIDED) which is interpreted as being lagged one period (as proposed by Jagwani, 2000), the rest of the data were the latest available at the time the data were collected.
4. Entrepreneurs typically choose to be self-employed by choice rather than as a last option (Rissman, 2003). Due to the absence of wide enough set of data on overall entrepreneurship levels we assume that the unemployed are equally likely to start innovative, high-growth enterprises.
5. This paper did not include separate data on each country's legal origins as legal traditions were already captured in this indicator.
6. The country of origin is the country of residence of the first-named applicant or assignee of a patent application and is used to determine the origin of the patent application.
7. Regions are geographically defined and illustrated in Table 1.

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