Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.4, No.20, 2013

Application of Principal Components Analysis on Venture Capital Investment Decision Process in Ghana

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Abstract

In response to the numerous complaints by the business community of inadequate and high cost of capital to run their businesses, the Government of Ghana, in 2004 established the Venture Capital Trust Fund with a vision to provide low cost financing to businesses to enable them grow, create jobs and improve wealth creation towards poverty alleviation. The Trust Fund operates through institutional partnerships by means of joint venture arrangements that establish Venture Capital Financing Companies managed by Fund Managers, who are responsible for deal sourcing, selection, monitoring and exit of Fund investments. Small and Medium-Scale Enterprises seeking for funding submit a Business Proposal, among other documents, to the Venture Capital Financing Companies. The Business Proposal goes through an initial review, and if found to be viable a second round review is initiated. When all claims are verified and authenticated, due diligence follows. Considering the amount of time that due diligence and negotiation of terms may take, it is imperative that the Financing Companies minimize their efforts during screening so that only those ventures with the most potential proceed to the next stage. Yet, at the same time, the screening process should also be careful not to eliminate potentially viable Proposals prematurely. To achieve this, the use of statistical models will aid in the screening process. In this study, Principal Components Analysis have been applied to the several variables considered at the initial review stage. The implication of this study is that properly developed statistical models may be successful screening decision aides.

Keywords: Venture Capital, Small and Medium-Scale Enterprise, Business Proposals, Principal Components.

1. Introduction

Venture capital is a type of private equity capital typically provided to early-stage, high-potential for growth companies, in the interest of generating a return through an eventual realization event such as a trade sale of the company. In effect it is money used for investment in enterprises that involve high risk, but offer the possibility of large profits. A core skill within Venture Capital is the ability to identify novel technologies that have the potential to generate high commercial returns at an early stage. Venture Capitalists also take a role in managing entrepreneurial companies at an early stage, thus adding skills as well as capital (thereby differentiating Venture Capital from buy out private equity which typically invest in companies with proven revenue), and thereby potentially realizing much higher rates of returns.

In Ghana, funding has been the major problem for the entire private sector particularly for Small & Medium Enterprises (SMEs). About 90 percent of businesses in Ghana are made up of SMEs. To achieve the desired goal of middle income status by 2015, these SMEs and private sector enterprises should be empowered with both financial resources and the efficient Technical Assistance to ensure business expansion and job creation. To partly address the inaccessibility to low cost financing to businesses, the Government of Ghana established a venture capital fund to provide a vehicle for small and medium scale enterprises to raise capital. The aim of the Fund is to provide financial resources for the promotion of venture capital financing for small and medium scale enterprises in the economy and also to stimulate the emergence of a sustainable private owned venture capital industry in Ghana.

Since coming on stream, the fund has forged a number of collaborations with some financial institutions to decentralize the credit distribution mechanism in order to reach more clients. Out of these collaborations have emerged Venture Capital Finance Companies (VCFCs), who assess the business viability of the enterprises seeking venture funding, through the business proposals they submit. A business proposal which is submitted goes through three processes. It starts with the initial (or desktop) review, verification of claims and finally due diligence is made. SMEs seeking for funding initially submits a comprehensive Business Proposal, among other documents, which goes though these processes: Initial (Desktop) Review; which is a review of the Business Plan and other accompanying documentations. Second Round Review; which is a verification of claim, visit to

facility and authentication; and then the final stage: Due Diligence; which considers critically the Legal, Technical and Financial aspects.

Based on internationally accepted practice, at the initial review, the VCFCs in Ghana basically considers several variables which include the Company's History and Background, Corporate Governance, Legal Structure, Market Analysis, Competition, Product Concept, Human Resources and Organization, Economic Impact, Risk Identification & Mitigation Plan, Technical Viability of Project and Financial Viability. Generally, the main objective of this study is to perform a Principal Components Analysis on the variables outlined above to identify variables that are more significant in determining the viability of a Business Proposal, at the desktop review stage.

In a developing country like Ghana, the need to promote venture capital financing for small and medium scale enterprises to help boost the economy for rapid growth, to achieve the much touted middle income status by 2015 is primary. It therefore becomes imperative to explore and improve upon present day knowledge on venture capital investment decision making. This will be of great assistance to the VCFCs in their decision making process. The findings of this study will help entrepreneurs who seek venture funding to assess themselves first and build capacity to meet the rigorous criteria set by venture capitalists. Furthermore, the resulting models will make the initial review of the Business Proposals more scientific.

In a paper written by Zacharachis and Meyer, (Zacharachis and Meyer, 2000), titled 'The Potential of Actuarial Decision Models', they wanted to see how a statistical model can improve the Venture Capital Investment Decision. According to them, Venture Capitalists are considered experts in identifying high potential new ventures. Such ventures survive at a much higher rate than those ventures backed by other sources (Kunkel and Hofer, 1991; Sandberg, 1986; Timmons, 1994). Thus, the Venture Capital decision process has received tremendous attention within the entrepreneurship literature. Nonetheless, Venture Capital backed firms still fail at a surprisingly high rate. Therefore, there is room for improvement in the Venture Capital investment process.

In their article, they stated that the three staged investment process often begins with venture screening. Venture Capitalists screen the hundreds of proposals they receive to assess which deserves further consideration. Those ventures that survive the initial stage are then subjected to extensive due diligence. Finally, the Venture Capitalists and entrepreneur negotiate terms of the investment. Considering the amount of time that due diligence and negotiation of terms may take, it is imperative that Venture Capitalists minimize their efforts during screening so that only those ventures with the most potential proceed to the next stage. Yet, at the same time, the screening process should also be careful not to eliminate potentially viable proposals prematurely. Another actuarial model derived by Roure and Keeley (Roure and Keeley, 1990), best distinguished between success and failure in a study of 36 high-technology ventures. The implications of this study are that properly developed statistical models may be successful screening decision aides. The success of the statistical models may be attributed to their consistency across different proposals and time. Although there is a potential threat that the information included in the Business plan is inaccurate (which would carry over into the experiment), (Roure and Keeley, 1990) found that Venture Capitalists rarely need to make "intense" corrections. Thus, it is reasonable to assume that the business plans are accurate enough for this study. The model developed out of three different scenarios they considered was:

$$Z = (\text{market familiarity}) + (\text{leadership ability}) + (\text{proprietary protection}) + (\text{market size}) + (\text{market growth}) + (\text{start-up}) - (\text{competitors}) - (\text{competitor strength}),$$

(where: Z = standardized prediction of success).

Finally, (Tybejee and Bruno, 1984) in their paper describe the activities of venture capitalists as an orderly process involving five sequential steps, which include: Deal Origination, which is the processes by which deals enter into consideration as investment prospects; Deal Screening, which is a delineation of key policy variables which delimit investment prospects to a manageable few for in-depth evaluation; Deal Evaluation, which is the assessment of perceived risk and expected return on the basis of a weighting of several characteristics of the prospective venture and the decision whether or not to invest as determined by the relative levels of perceived risk and expected return; Deal Structuring, which is the negotiation of the price of the deal, namely the equity relinquished to the investor, and the covenants which limit the risk of the investor; and then Post-Investment Activities, which is the assistance to the venture in the areas of recruiting key executives, strategic planning, locating expansion financing, and orchestrating a merger, acquisition or public offering.

2. Methods and Analysis

A sample of Business Proposals received from the first quarter of 2009 to the first quarter of 2012, were considered for the study. Scores are obtained for each variable and weighted accordingly, which then constitute the actual data on which the Principal Component Analysis (PCA) models are run. PCA is a mathematical

procedure that transforms a number of possibly correlated variables into a smaller number of uncorrelated variables called principal components. The objective of PCA is to reduce the dimensionality (number of variables) of the dataset but retain most of the original variability in the data. The first principal component accounts for as much of the variability in the data as possible, and each succeeding component accounts for as much of the remaining variability as possible.

A PCA is concerned with explaining the variance - covariance structure of a high dimensional random vector through a few linear combinations of the original component variables. For a p-dimensional random vector $X = (X_1, X_2, ..., X_p)$, k principal components (k ϵ p) of X are k (univariate) random variables $Y = (Y_1, Y_2, ..., Y_k)$, which are defined as $Y_k = l_k' X = l_{k1} X_1 + l_{k2} X_2 + ... + l_{kp} X_p$.

Therefore: jth Principal Component = Linear combination lj'X that maximizes Var(lj'X) and || lj || =1 and Cov(lk'X , lj'X) = 0 for all k < j.

This means that the principal components are those linear combinations of the original variables which maximize the variance of the linear combination and which have zero covariance (and hence zero correlation) with the previous principal components. Indeed there is exactly p such linear combinations. However, typically, the first few of them explain most of the variance in the original data. Therefore, instead of working with all the original variables $X_1, X_2, ..., X_p$, it is better to first perform a PCA and then use only first two or three principal components, say Y_1 and Y_2, in subsequent analysis. PCA requires that the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy be greater than 0.50 for the set of variables used in the analysis. KMO Measure of Sampling Adequacy is an index for comparing the magnitudes of the observed correlation coefficients to the magnitudes of the partial correlation coefficients. Another relevant test for a PCA is the Bartlett's test of Sphericity. It is a test statistic used to examine the hypothesis that the variables are uncorrelated in the population.

The Hosmer and Lemeshow Test in table 1 provide a formal test for whether the predicted probabilities for a covariate, match the observed probabilities. For this test, a large p-value indicates there is a good match between the covariates and the response variable. In this study, our p-value of 1.000 indicates a good match. PCA requires that there be some correlations greater than 0.30 between the variables included in the analysis. For this set of variables, there are several correlations in the matrix greater than 0.30, satisfying this requirement. This is shown in the correlation matrix in table 2. Furthermore, the KMO measure was 0.602. This indicates that the degree of common variance among the eleven variables is bordering in the middle. We observe further that the Bartlett's test of sphericity is significant. This means that the correlation matrix is not an identity matrix. These are shown in table 3.

3. Discussion

From table 3, we observe that the first Principal Component contributes about 24.7% of the total variation of the data. The second Principal Component also contributes 20.2% whiles the third Principal Component contributes 18.0% of the total variation in the data. The fourth Principal Component contributes 9.4% of the total variation in the data. Therefore the four Principal Components contribute about 72.3% of the total variation. Furthermore, the fifth Principal Component accounts for about 9% of the total variation. The sixth Principal Component accounts for almost 8%, while the seventh Principal Component accounts for 2.7% of the total variation. Altogether the first seven Principal Components contribute about 92% of the total variation. This means that ideally only the first seven Principal Components will be used in the analysis. The seven equations for the seven Principal Components can easily be formed.

From the first Principal Component, among the variables, Economic Impact has the highest influence. This indicates that the first Principal Component measures the viability of a project in terms of Economic Impact. For the second Principal Component, the most influential variable is Financial Viability, followed by Technical Viability. This means that second Principal Component determines project viability only in terms of Financial Viability and Technical Viability. The third Principal Component also has the most influential variable as Financial Viability, followed by Technical Viability. This Principal Component also measures project viability only in terms of Financial Viability and Technical Viability. For the fourth Principal Component, the most significant variable is marketing strategy. This Principal Component also measures project viability only in terms of marketing strategy. The fifth Principal Component also has the most influential variables as Product Concept, Technical and Financial Viabilities. This Principal Component also introduces a new variable, which is Product

Concept. The sixth and seventh Principal Components also maintain Product Concept, Technical and Financial Viabilities. Relying on the fist four Principal Components, the four most influential variables are Economic Impact, Financial Viability, Technical Variability and Market Analysis.

4. Conclusion

To conclude, the factors that have impact on Business Proposals submitted by the SMEs seeking funding are Economic Impact, Financial Viability, Technical Viability and Market Analysis. These are the variables to consider at the initial (desktop) review of Business Proposals. It is recommended that investment analysts that review Business Proposals must further test the Models obtained. They must explore the predictive aspect, and refine it to suit the purpose of timely review of these Proposals. However, at the initial review stage, the most significant variables to consider are the four mentioned above.

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APPENDIX

Table 1: Hosmer and Lemeshow Test

Hosmer and Lemeshow Test			
Step	Chi-square	df	p-value
1	.000	2	1.000

Table 2: Correlation Matrix

1.000										
.112	1.000									
.394	.254	1.000								
-.292	.172	.204	1.000							
.000	-.213	-.164	.011	1.000						
.215	-.351	.451	-.084	-.284	1.000					
-.301	-.172	-.324	.184	-.135	.255	1.000				
.071	-.214	-.095	-.434	-.318	-.117	-.664	1.000			
.143	.462	.223	.241	-.072	-.524	.394	-.073	1.000		
-.524	-.085	.443	.364	.057	.000	.151	-.028	.184	1.00	
-.043	-.085	.054	.135	.057	-.086	.264	.242	.562	.543	1.000

Table 3: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.602
Bartlett's Test of Sphericity	Approx. Chi-Square	50.846
	df	55
	Sig.	0.000

Table 4: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.580	24.658	24.658	11.580	24.658	24.658
2	9.480	20.186	44.845	9.480	20.186	44.845
3	8.475	18.047	62.891	8.475	18.047	62.891
4	4.433	9.440	72.331	4.433	9.440	72.331
5	4.250	9.049	81.380	4.250	9.049	81.380
6	3.756	7.997	89.377	3.756	7.997	89.377
7	1.269	2.702	92.079	1.269	2.702	92.079
8	1.038	2.211	94.290			
9	0.992	2.113	96.403			
10	0.958	2.040	98.444			
11	0.731	1.556	100.000			