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Hurdle Rate Analysis for Indian Power Projects

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Abstract

Hurdle rate is the minimum rate of return required by the investor. It has generally been observed that setting up of a hurdle rate in power generation projects is done arbitrarily purely on the basis of rules of thumb in Indian scenario. The present study is an effort to empirically link various variables utilised for making judgements on values of hurdle rate and the hurdle rate itself. The various variables used in the study are project's Weighted Average Cost of Capital (WACC), project default premium, project's unconventional risk factor, project's strategic discount factor, project's tenure and expected inflation rate. Various tests were conducted to check suitability of application of ordinary multiple regression. Finally, robust regression was found suitable to be applied depending on the test results. In addition, stepwise ordinary multiple regression was applied to find the relative significance of each applied independent variable. Suggestions are also provided on establishing a robust system of identification of unconventional risk factors as well as strategic discount factor. Lastly, a model has been developed and the relative significance and ways of application of various independent variables have been discussed.

JEL Codes: G31, G32

Keywords: Hurdle, Budgeting, Robust, Regression, Heteroskedasticity, WACC

Introduction

Concerns have been raised about financial performance of public sector undertakings or PSUs in India. It is believed that sound capital budgeting practices can have a sound effect on improving the performance of PSUs in India. It is also widely assumed that private sector enterprises usually perform better when it comes to making capital budgeting decisions. The present study ascertains the hurdle rate estimation of power projects and then identifies loopholes in the procedures. Conventionally, power generation projects have used certain thumb rules to estimate hurdle rates. These thumb rules are often easy to measure but lead to various inaccuracies. Overinvestment or underinvestment problems are often reported from power projects. Reports from other industries have suggested that they have started using more theoretically correct models. These models have been studied to provide comparatively more accurate measurements of hurdle rates given the assumption that input data is of high quality. Improvement in methods of data capture has led to better quality and quantity of input data for these models. Trends have been identified to move away from traditional models to more accurate models.

Considerable empirical findings have suggested that there is something unusual about capital budgeting methods and the very process of setting up of discount rates for projects. Firstly, a large number of firms still use unsophisticated evaluation methods of capital budgeting. Different reasons for the non-application of sophisticated capital budgeting methods and general overuse of 'rules of thumb' in investment evaluation have been suggested by many authors. These include limiting the tendency of excess optimism among CEOs and agency problems which is associated with project approval and limited availability of managerial and organisational capital. In addition, few other reasons have been listed as non-explicit inclusion of elements derived from valuation of real option, political risk considerations and rationality bounded by practical limitations. Other papers have even related the education of the CFO to the use of sophisticated capital budgeting methods.

Literature Review

Driver and Temple (2002) studied the relationship between hurdle rate and discount rate so that inference can be made on investment behaviour of different firm characteristics. Existence of strategic options led to the

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lowering of hurdle rate as compared to discount rate. Risk enhances hurdle rate to some extent. Brigham (1975) emphasized the significance of frequent hurdle rate revisions. In addition, it was identified that different projects of the same firm has different riskiness measures and hence, a firm should use more than one hurdle rate for different projects and scenarios. Antle and Eppen (1985) found out that companies generally keep hurdle rates strictly in excess of WACC. Through this policy certain level of capital rationing is also performed. Meier and Tarhan (2007) showed that the self-proclaimed WACC that financial managers in reputed firms use to discount cash flows exceeds computed WACC by 5.3% to 7.5%, which depends on the equity premium assumption. It was also found that the hurdle rate premium is positively correlated with high growth opportunities and the financial soundness and health of firms, and negatively correlated with the goodness of fit of the beta estimation models. Finally, they justified the excess value of hurdle rate over and above the WACC utilised by them. Brunzell, Liljeblom and Vaihekoski (2013) studied application of capital budgeting methods and hurdle rate determination among Nordic companies. They observed empirically that the hurdle rate used by the firms tend to be higher than those suggested by economic theory. If companies used less sophisticated methods of capital budgeting, they tend to use higher hurdle rate premiums.

Calandro, Gates, Madampath and Ramette (2015) highlighted how strategic factors impact upon the hurdle rates and that how finance executives are ruing the fact that no readily accepted models are available to estimate hurdle rates. Chen and Jiang (2004) showed that hurdle rates should be higher if project scales are larger and the project is riskier. In addition, more information collection effort from manager requires setting a higher hurdle rate.Block (2005) showed that there exists a somewhat unanimity among industries in using WACC as a hurdle rate. Public utility industries are the major exception where preference is given to using return on stockholder's equity as the primary metric. Lofgren, Millock and Nauges (2007) highlighted the lack of hurdle rate estimates for pollution abatement investments although sufficient data is available. Hence, they have called for development of models based on econometric approaches applied on observed data. In addition, uncertainty has been observed to increase hurdle rates. Kruger, Landier and Thesmar (2015) identified the fallacy in using the same WACC discount rate for all projects by a firm. Also, the costs involved in using multiple discount rates may not purely cognitive or computational. Use of multiple discount rates might increase the scope of politicking and gaming of the capital budgeting process. Jagannathan, Meier and Tarhan (2011) found that managers involved in capital budgeting systematically add a hurdle premium to their CAPM based cost of capital. The size of this premium was also found to be substantial. A model of hurdle rates was developed which used nonlinear WACC and other linear variables that proxy for the option to wait. It was determined through a zero intercept that managers do not use higher hurdle rates to compensate for optimistic cash flow projections. While, both cost and capital and hurdle premium components were found to be significant, cost of capital can only explain only 10% of the variation in hurdle rates whereas proxies for the option to wait explain 35%. It was also found that since hurdle premium varies substantially more than the cost of capital across firms, it actually hides the relationship between hurdle rate and CAPM beta.

Research Methodology

In the present study, an attempt has been made to develop a model by which we can constructively determine hurdle rate in a scientific way which is free from biases encountered in practical life. Effort has been made to collect data from higher level managers involved in making investment decisions of power generations projects. Firstly, efforts have been made to understand the practical approaches followed by power generation firms in estimating hurdle rates. Then, information is sought about the practical suitability and ease of applying these approaches.Thereafter, an attempt has been made to develop a model which provides a fairly accurate value of hurdle rate while not compromising on information of project default, project strategic importance, expected inflation and risk, size and tenure of the project. Primary data are collected from power generation firms on all these parameters. Hurdle rate is chosen as our dependent variable whose values are collected from experts from these power generation firms as well as other experts from banks and consulting industry so as to remove general biases. Getting accurate values of hurdle rates is the most basic essence of our model. Finally, regression is applied and a model is generated which is as shown below:

Hurdle Rate = a*Project WACC + b*Project Default Premium + c*Project Unconventional Risk Factor+

d*Project Strategic Importance Factor + e*Project Tenure + f*Expected Inflation Rate (1)

Hurdle rate is defined as "the minimum rate of return on a project or investment required by the investor". It may or may not be equal to the project's WACC as the former is the return expected by shareholders and long term creditors. Firms typically want a higher return to compensate for other factors such as unconventional risk.

Project's WACC (Weighted Average Cost of Capital) is defined as "the rate of return that a company is expected to pay on average to all its security holders and long term creditors to finance its assets.

Project default premium is additional return expected by a power project as a safety factor.

Project unconventional risk is the ordinal value of unconventional risk inherent in the project expressed on a scale of 0 to 10.

Project strategic importance discount is the ordinal value of strategic importance acknowledged by the power project expressed on a scale of 0 to 10.

Project tenure is the expected duration of successful and profitable operation of the power project. "Useful life" is another term which may be used for the variable. It is expressed in number of decades.

Expected inflation rate is the expected average rate of inflation over the project tenure or its "useful life". It is expressed as a fraction and not as a percentage.

Effort has been made to identify different independent variables of ratio or ordinal nature which can be used to arrive at a hurdle rate.

Hypothesis

Various hypotheses have been analysed for the study which are as mentioned under:-

(a) Project's WACC has no correlation with hurdle rate.

(b) Project default premium has no correlation with hurdle rate.

(c) Project unconventional risk has no correlation with hurdle rate.

(d) Project strategic importance discount has no correlation with hurdle rate.

(e) Project tenure has no correlation with hurdle rate.

(f) Expected inflation rate has no correlation with hurdle rate.

Data Analysis

Appropriate values of all discussed variables were collected beforehand. Care is taken such that the value of each variable is as close as possible to the actual value. As we can see the nature of our variables, records of actual values of these variables is not even diligently maintained by the industry experts. Hence, first information is sought by industry experts and the same is confirmed by banks and consulting firms. Data have been collected and confirmed for 123 power generation projects. Data for other power projects which were unreliable and unconfirmed were not included in our study. Linear multiple regression was first sought to be applied for the study.

Before applying multiple linear regression, several assumptions have to be checked in which are as mentioned below:-

1. Independence of errors (residuals)
2. A linear relationship between predictors and dependent variable.
3. Homoscedasticity of residuals (Equal Error Variance)
4. No Multicollinearity.
5. No significant outliers or influential points.
6. Errors (Residuals) are normally distributed.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.994[a]	.988	.987	.00235	1.968

a. Predictors: (Constant), Inflation, DefaultPremium, RiskFactor, WACC, Tenure, ImportanceDiscount

b. Dependent Variable: HurdleRate

Fig. 1: Durbin Watson Statistic of Multiple Linear Regression

As we can see in Fig.1, Durban-Watson statistic is 1.968 which is very close to 2. Hence, we can safely assume that there is independence of residuals and they are not auto correlated.

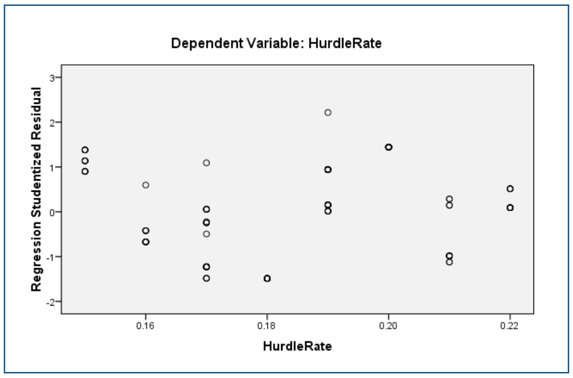

Fig. 2: Plot of Studentised Residual versus Unstandardised Hurdle Rate

As we can see in Fig.2, we have a horizontal band. Hence, it can be safely assumed that the relationship between the dependent and independent variables is likely to be linear. The partial regression plots are also drawn between each independent variable and the dependent variable. These are as presented in Fig. 3.

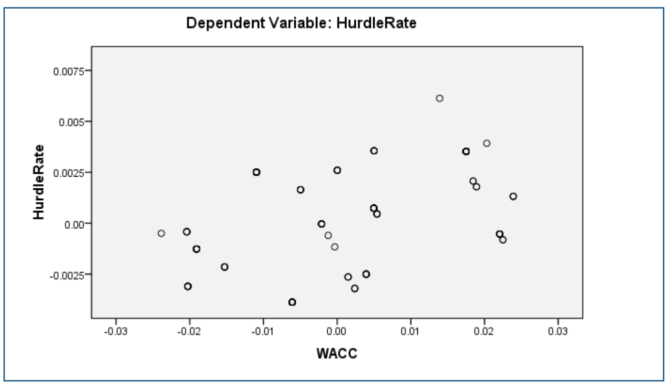

Fig. 3: Plot of Hurdle Rate versus WACC

As we can see from Fig.3, there appears to be a somewhat linear relationship between hurdle rate and WACC. The approximation line doesn't appear to tend upwards or downwards.

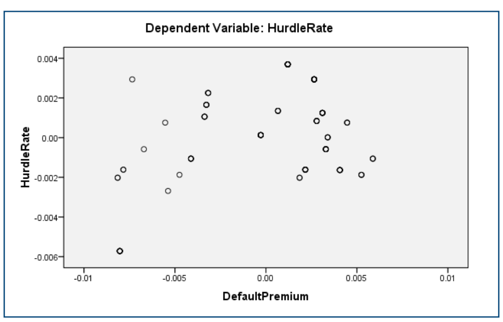

Fig. 4: Plot of Hurdle Rate versus Default Premium

As we can see from Fig.4, there appears to be a somewhat linear relationship between hurdle rate and default premium. The approximation line ignoring one outlier in the bottom doesn't appear to tend steely upwards or downwards.

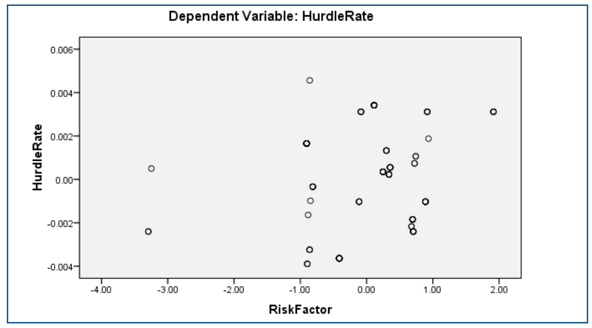

Fig. 5: Plot of Hurdle Rate versus Risk Factor

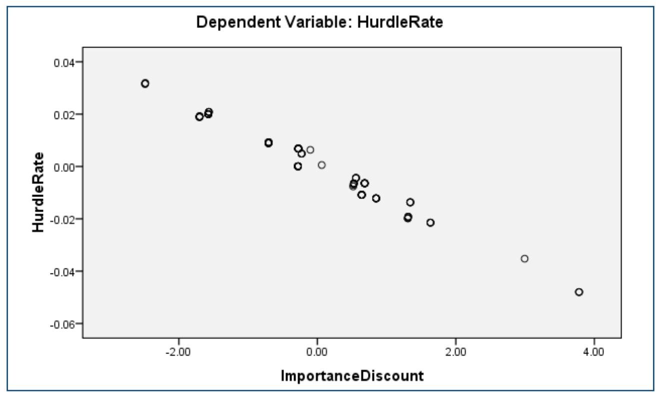

Fig. 6: Plot of Hurdle Rate versus Importance Discount

As we can see from Fig.6, there appears to be a clear linear relationship between hurdle rate and importance discount. Importance discount appears to be negatively correlated with hurdle rate. As importance discount increases, hurdle rate decreases linearly.

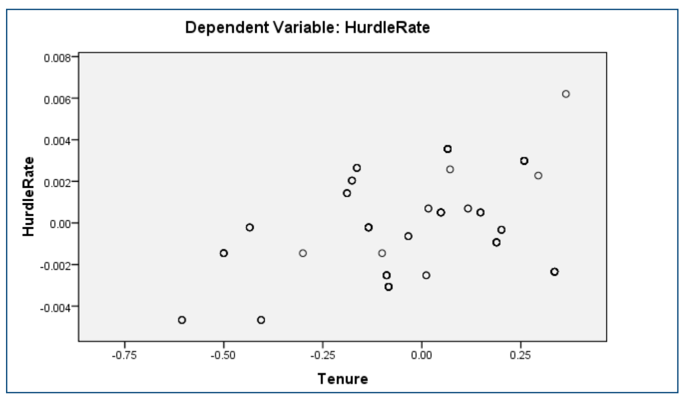

Fig. 7: Plot of Hurdle Rate versus Tenure

As we can see from Fig.7, there appears to be a somewhat linear relationship between hurdle rate and tenure. There appears to be a positive relationship between the two variables. The approximation line tends to uniformly rise slightly upwards and doesn't tend to bend upwards or downwards.

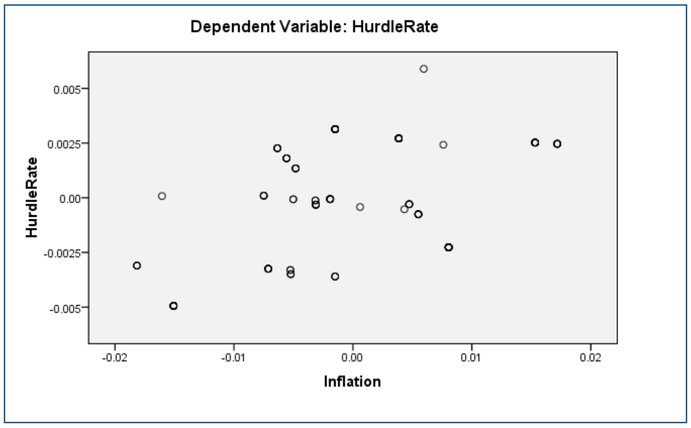

Fig. 8: Plot of Hurdle Rate versus Inflation

As we can see from Fig.8, there appears to be a somewhat linear relationship between hurdle rate and inflation. There appears to be a positive relationship between the two variables. The approximation line tends to uniformly rise slightly upwards and doesn't tend to steeply bend upwards or downwards.

Hence, we can safely proceed towards the analysis of tests of heteroskedasticity. Applying Breusch Pagan Test and Koenker Test on the available data yielded the following results as shown in Fig.9.

```
Sample size (N)
  123

Number of predictors (P)
    6

Breusch-Pagan test for Heteroscedasticity (CHI-SQUARE df=P)
    9.751

Significance level of Chi-square df=P (H0:homoscedasticity)
    .1355

Koenker test for Heteroscedasticity (CHI-SQUARE df=P)
   23.698

Significance level of Chi-square df=P (H0:homoscedasticity)
    .0006
```

Fig. 9: Breusch Pagan and Koenker Test Results

As we can see in Fig.9, we fail to reject heteroskedasticity in case of Breusch Pagan Test but reject it in the case of Koenker Test. Hence, for safety reasons we should not proceed ahead with application of multiple linear regression as such. Robust regression might be a better alternative to use. Checking for multicollinearity, we have the information as displayed in Fig.10.

As seen in Fig.10, the VIF values are less than 2. Hence, we can safely assume that there is no multicollinearity. Checking for normality of residuals yielded the results as shown in Fig.11.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	.198	.004		49.807	.000	.191	.206		
	WACC	.077	.016	.057	4.981	.000	.047	.108	.782	1.279
	DefaultPremium	.288	.050	.064	5.724	.000	.188	.388	.830	1.205
	RiskFactor	.001	.000	.034	2.448	.016	.000	.001	.541	1.848
	ImportanceDiscount	-.013	.000	-1.012	-72.339	.000	-.013	-.012	.527	1.899
	Tenure	.003	.001	.046	3.642	.000	.001	.005	.644	1.553
	Inflation	.142	.025	.074	5.722	.000	.093	.191	.620	1.613

a. Dependent Variable: HurdleRate

Fig. 10: Collinearity Statistics

Descriptives

			Statistic	Std. Error
Studentized Residual	Mean		-2.887E-3	...
	95% Confidence Interval for Mean	Lower Bound	-1.813E-1	
		Upper Bound	...	
	5% Trimmed Mean		-7.721E-3	
	Median		...	
	Variance		1.000	
	Std. Deviation		...	
	Minimum		-1.48686	
	Maximum		2.21482	
	Range		3.70168	
	Interquartile Range		1.92478	
	Skewness		-.011	.218
	Kurtosis		-1.183	.433

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Studentized Residual	.126	123	.000	.930	123	.000

a. Lilliefors Significance Correction

Descriptives

			Statistic	Std. Error
Standardized Residual	Mean		-9.03E-14	...
	95% Confidence Interval for Mean	Lower Bound	-1.740E-1	
		Upper Bound	...	
	5% Trimmed Mean		-5.288E-3	
	Median		...	
	Variance		.951	
	Std. Deviation		...	
	Minimum		-1.44869	
	Maximum		2.15019	
	Range		3.59888	
	Interquartile Range		1.87706	
	Skewness		-.003	.218
	Kurtosis		-1.176	.433

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual	.121	123	.000	.932	123	.000

a. Lilliefors Significance Correction

Fig. 11: Normality Tests of Standardised and Studentised Residuals

As we see from Fig.11, both the standardised and studentised residuals fail in the normality tests with p values very much less than 0.01. Hence, we cannot apply multiple linear regression. Instead we can proceed towards application of robust regression which is robust to violations of assumptions of homoscedasticity and normality. It will also take care of any outliers. Applying robust regression and using default 'bisquare' weighting function in MATLAB, we get the results as displayed in Fig. 12.

```
b =

    0.1985
    0.0774
    0.2838
    0.0006
   -0.0126
    0.0032
    0.1429
```

Fig.12: Robust Regression Output from MATLAB using 'bisquare' weighting function

```
mdl =


Linear regression model (robust fit):
    y ~ 1 + x1 + x2 + x3 + x4 + x5 + x6

Estimated Coefficients:
                    Estimate        SE         tStat       pValue
                   __________    __________    _______    __________

    (Intercept)       0.19854      0.004262     46.584    6.1851e-77
    x1               0.077433       0.01661     4.6618    8.4416e-06
    x2                0.28381      0.053807     5.2746    6.2528e-07
    x3             0.00056314    0.00024855     2.2657      0.025326
    x4              -0.012563    0.00018567    -67.661    4.6015e-95
    x5              0.0031563    0.00092847     3.3995    0.00092636
    x6                0.14292      0.026463      5.401    3.5752e-07


Number of observations: 123, Error degrees of freedom: 116
Root Mean Squared Error: 0.00251
R-squared: 0.986,  Adjusted R-Squared 0.986
F-statistic vs. constant model: 1.4e+03, p-value = 1.17e-105
```

Fig.13: Robust Regression Statistics of applied model

As we see from Fig.13, Adjusted R squared value is 0.986 which means 98.6% of the variance of hurdle rate is explained by our independent variables. Also, p value of F Statistic is 1.17e-105 which is very much smaller than 0.05. Hence, the fit of our overall model is good. This means that there is a very less chance of all the coefficients to be zero at the same time. In case of robust regression, due consideration has to be given to t and p values of coefficients. All coefficients with t values closer to 2 and p values closer to 0.02 imply insignificance of that particular coefficient. Hence in this case coefficient of x3 or 'risk factor' is insignificant. Rest all coefficients are significant.

```
P =

    0.1643


DW =

    1.9771
```

Fig.14: Durbin-Watson Statistic

As seen in Fig.14, the Durbin-Watson statistic is 1.9771 which is close to 2. Hence, we can assume that residuals for robust regression are not auto correlated. Even if the picture is clearer now, few other details need to be determined. The relative significance of each independent variable and the total information provided by them for estimating hurdle rate is still not known. Running stepwise regression will help us to know the relative importance of each individual independent variable. Running stepwise linear regression on SPSS yielded the results as shown in Figs. 15 and 16.

Model Summary[g]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.988[a]	.976	.976	.00328	
2	.990[b]	.980	.979	.00301	
3	.992[c]	.984	.984	.00267	
4	.993[d]	.986	.985	.00252	
5	.994[e]	.987	.987	.00240	
6	.994[f]	.988	.987	.00235	1.968

a. Predictors: (Constant), ImportanceDiscount
b. Predictors: (Constant), ImportanceDiscount, WACC
c. Predictors: (Constant), ImportanceDiscount, WACC, DefaultPremium
d. Predictors: (Constant), ImportanceDiscount, WACC, DefaultPremium, Inflation
e. Predictors: (Constant), ImportanceDiscount, WACC, DefaultPremium, Inflation, Tenure
f. Predictors: (Constant), ImportanceDiscount, WACC, DefaultPremium, Inflation, Tenure, RiskFactor
g. Dependent Variable: HurdleRate

Fig.15: Stepwise Regression Results detailing relative significance of independent variables

Studying information contained in Fig.15and 16leads us to believe that most significant information is contained in importance discount which explains 97.6% of the variance in hurdle rate. Hence we can easily comprehend that hurdle rate is more or less decided once its importance has been determined. WACC is the next most significant variable. Default premium, expected inflation, tenure, and risk factor follow WACC in that order of significance. Risk factor is the least important variable as observed previously also.

Findings

The various findings of the study are as listed under:-

1. Importance discount is the most important independent variable included in our study. It carries the most significant information required to develop a hurdle rate. It is negatively correlated with hurdle rate. It means when a project is thought to be strategically more important, the hurdle rate is reduced accordingly to accommodate the project.
2. WACC is the second most important independent variable in our study. Actually, it should be theoretically called the most important variable which roughly decides the hurdle rate. Importance discount only helps in fine tuning the hurdle rate.
3. Default premium is the third most important variable in our study. Taking a look at the values for de-

Excluded Variables[f]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics: Tolerance	VIF	Minimum Tolerance
1	WACC	.065[a]	4.842	.000	.404	.944	1.060	.944
	DefaultPremium	.063[a]	4.431	.000	.375	.873	1.145	.873
	RiskFactor	.053[a]	3.027	.003	.266	.611	1.638	.611
	Tenure	.007[a]	.489	.626	.045	.964	1.037	.964
	Inflation	.058[a]	4.179	.000	.356	.921	1.086	.921
2	DefaultPremium	.072[b]	5.808	.000	.470	.859	1.164	.845
	RiskFactor	.031[b]	1.788	.076	.162	.551	1.813	.551
	Tenure	.020[b]	1.516	.132	.138	.927	1.078	.908
	Inflation	.046[b]	3.425	.001	.300	.876	1.141	.876
3	RiskFactor	.028[c]	1.844	.068	.167	.551	1.815	.551
	Tenure	.010[c]	.821	.413	.075	.906	1.104	.838
	Inflation	.045[c]	3.887	.000	.337	.876	1.141	.803
4	RiskFactor	.036[d]	2.492	.014	.225	.542	1.844	.527
	Tenure	.048[d]	3.682	.000	.322	.645	1.550	.624
5	RiskFactor	.034[e]	2.448	.016	.222	.541	1.848	.527

a. Predictors in the Model: (Constant), ImportanceDiscount
b. Predictors in the Model: (Constant), ImportanceDiscount, WACC
c. Predictors in the Model: (Constant), ImportanceDiscount, WACC, DefaultPremium
d. Predictors in the Model: (Constant), ImportanceDiscount, WACC, DefaultPremium, Inflation
e. Predictors in the Model: (Constant), ImportanceDiscount, WACC, DefaultPremium, Inflation, Tenure
f. Dependent Variable: HurdleRate

Fig.16: Excluded Variables Study in Stepwise Linear Regression

fault premium, we see that only values of 2% or 3% are utilised. Hence, these almost standardised values provide enough safety cushions for the probable error in setting of the hurdle rate.

4. Expected inflation is our next significant variable. The probable reason, why it is placed lower in the significance list is that it is already factored while preparing power sale agreements. Once, it is accepted that inflation could be an issue; sufficient incorporations are made in the power sale agreement.
5. Tenure appears next on our list. It is placed lower in significance list because like expected inflation, it is already factored while preparing power sale agreement. Another factor is that while a long tenure implies uncertainty, it always provides you with a chance to incorporate some new technology to reduce costs and earn higher income.
6. Unconventional risk comes lowest in our significance list. While all of the systematic risk is factored in a project's WACC, unconventional risk is an unsystematic risk which doesn't provide you with a chance to earn enhanced incomes. Hence, having a higher unconventional risk reduces a project's importance discount and even factored in debt part in WACC as well as in slightly increased default premium, e.g. banks would usually charge a higher interest rate for a project with higher unconventional risk. Finally, Unconventional risk values carry little separate valuable information and hence the result.

Recommendations

The various recommendations for the power projects are as listed under:-

1. Strategic importance of a power project should be carefully studied before analyzing WACC and hurdle rate. Any similar power project with equal configurations should be studied carefully. Several factors should be developed for assessing strategic importance of a project. Ratings should be done on each of these factors and finally comprehensive report with strategic importance value should be utilised for arriving at a hurdle rate.
2. Special consideration should be given to WACC of strategically important projects. Effort should be made to reduce cost of debt burden of these projects as cost of equity is more or less fixed. Better risk handling measures, large size, reliable third party, fuel supplies, and other factors should be utilised to better work out interest charges from banks.
3. Default premium is more or less fixed in arriving at hurdle rates. It should be ideally set at 3% if there are no serious issues of concern. If issues do crop up or are estimated to be present, then default premium should be fixed at 4%. It should be set higher than 4% as this may lead to rejection of few profitable projects.
4. Expected inflation shouldn't be factored much in arriving at a hurdle rate. Instead efforts should be made to hedge the adverse effects of inflation on future cash flows. This can be done by incorporating suitable arrangements in power sale agreements.
5. Similar to expected inflation, tenure also shouldn't be factored much in arriving at a hurdle rate. Instead efforts should be made to work up against the negative fallouts and uncertainties of a long tenure by incorporating suitable arrangements in power sale agreements. In addition, suitable arrangements for incorporating newer technology of producing power should be made in these agreements. This will provide projects with a new tool to reduce cost in future as well as protect against closure of power projects using old technology and fuel due to international norms.
6. Unconventional risk seems to convey the least valuable information and hence shouldn't be factored much in arriving at a hurdle rate. Nevertheless, it should be studied carefully for avoiding possible losses. As bearing unconventional risk doesn't lead to greater returns, hence suitable ratings should be carefully done on each of the strategic importance factors as discussed previously in strategic importance discount section. In addition, certain other provisions should be made so as to bear the least possible interest payments.

Limitations

The various limitations of the study are as listed under:-

1. The number of power generation projects involved in the study is limited as their number is limited and all projects did not reveal all information.
2. Only selected variables were considered for the study.

3. Tax rate is assumed to be same for all the power projects and hence its effect on WACC is considered same.
4. Effect of government aids available to any project has been ignored.
5. Hurdle rate values have been arrived at by values expected by higher level directors, independent analysts, and other experts.
6. Weights applied to each observation for their inclusion is assumed to be known before hand.

Conclusion

Hurdle rates have been generally placed closer to WACC values. Moreover, few organisations even relate the two terms to mean the same thing or as interchangeable. This has led to application of inappropriate values of hurdle rates in the past. Hurdle rates have been arbitrarily applied based on certain rules of thumb by higher level directors in consensus with banks and other consulting experts. Application of regression has developed a cognizable relationship among the variables. The final equation to be applied to arrive at a hurdle rate is as given below:-

Hurdle Rate = 0.1985 + 0.0774*WACC + 0.2838*Default Premium + 0.0006*Unconventional Risk Factor – 0.0126*Strategic Importance Discount + 0.0032*Tenure + 0.1429*Expected Inflation (2)

where

WACC is expressed as an annual percentage,

Default Premium is expressed as a percentage added to WACC,

Unconventional Risk Factor is expressed as ordinal values denoting severity of unconventional risk on scale of 0 to 10 where 10 denotes maximum risk,

Strategic Importance Discount is expressed as ordinal values denoting relative strategic importance of the project on a scale of 0 to 10 where 10 denotes maximum importance,

Tenure is expressed as number of decades,

Expected Inflation is expressed as a fraction and not as a percentage

Strategic importance discount should be used most carefully and its value scientifically determined. Same should be the case with WACC. Maximum flexibility should be taken in fixing the value of unconventional risk factor which is of lowest significance in our study. In fact, its value can be slightly increased to be doubly sure of including all risk factors. Values of expected inflation should be taken from reliable government sources. Default premium values should be kept in the band of 2% to 3% depending on the situation as described before. Flexibility can be practiced in fixing of tenure due to the low value of coefficient as well as comparatively lower significance of this variable.

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