Risk Factors for SMEs Involved in Electric Power Feneration

Fluctuations in the discount rate (WACC)

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Abstract. The determination of the value of investment projects must take into account the risk-return trade-off present in the market.The fiscal, economic and monetary policies of the various international organizations have an impact upon the market and subsequently on the perception of risk. This study analyses the trend of one of the parameters for risk assessment in valuation processes, between 2011 to 2013, for the specific sector of small and medium-sized enterprises involved in generating electrical energy from alternative sources in Spain.

Keywords.WACC, capital structure, cost of debt, cost of equity, capital asset pricing model, return on equity, SMEs, power, beta, levered, unlevered

1. Introduction

Renewable energy sources are used across the planet to generate electricity, as has been widely recorded in the academic literature [1]. Technological advances in the capture of solar energy by photovoltaic (PV) panels have been such that they are now a particularly attractive option for those countrieswhich enjoy high levels of solar radiation, such as Spain[2]. Given that it is the aim of Spain's renewable energy policy (known as the *Plan de EnergíasRenovables*)for 20% of its primary energy needs to be met by renewable energy sources by 2020, Spain and PV panels would seem to be a match made in heaven.

The current state of photovoltaic technology is efficient from the technological point of view, allowing it to compete with the generation of energy through non-renewable sources[3].In order for the widespread installation of renewable energy facilities to become a reality, both a stable legal framework and a competitive rate of return are required. The Spanish legislative framework provides the necessary stability, and rates of return can be calculatedusing a discount rate, reflecting the potential risks and returns in the marketplace. Profitability can be calculated with different valuation methods. Menegaki[4] reviews the valuation methods used in renewable energy, namely: Stated preference techniques, revealed preference techniques, financial option theory or portfolio analysis, emeryanalysis and other economic approaches. For the proper implementation of all these methods that obtain a valuation in relative or absolute terms, a discount rate is needed to upload the values obtained in the years of lifespan of renewable energy.

The aim of this study is to analyse the parameters responsible for risk in Spain for small and medium-sized enterprises (SMEs) which generate energy from photovoltaic (PV) panels, using an estimated discount rate with which to place a value on these companies' electrical power generation activity. As the discount rate is crucial in assessment models, it seems engaging to study it. The discount rate is influenced by various parameters such as the cost of public debt, corporate profitability and market conditions among others. The evolution of these parameters is different in times of economic expansion or recession of the economy. This study will examine the different factors which influence the discount rate in order to determine how the latter behaves during an economic period[5]. To carry out this objective, in our study we consider the case of SMEs that made solar PV installations.

The discount rate is conditioned by the current economic situation and the behaviour of other financial assets such as public debt. During an economic recession, public debt is issued at higher rates of interest; conversely, the decrease in profits experienced by companies leads to lower financial returns[6]. All this leadsto discount rates tending to decrease, in turn leading to higher valuation figures (if cash flow is taken to be stable) or lower thresholds for decisions on the viability of potential projects. We search for a discount rate that meets the business reality and market conditions in which small and medium-sized companies investing in renewable energy are developed. Thus, the parameters used for calculation depends on the companies in the sector of renewable energies and indicators of this sector in the market.

We will examine the sector of SMEs dedicated to electrical power generation from alternative energy sources in Spain in 2011, 2012 and 2013,in order to observe the behaviour of the discount rate and returns, and to consider the implications of this.

This study seeks to make a contribution to theory and professional practiceby demonstrating that the discounted cash flow model of valuation is conditioned by the discount rate used [7] and that different methods used to determine the cost of equity can lead to very different results with regard to the trend in the discount rate, as the economic environment in which the valuation takes place plays a key role.

2. Conceptual Framework

Fernandez [8]defines the weighted average cost of capital (WACC) the rate at which the free cash flows must be discounted to obtain the same result as in the valuation using equity cash flows discounted at the required return to equity. The WACC is neither a cost nor a required return, is based on the cost of the company's equity(k_e)and on the cost of debt, (k_d)[9]. These costs must be weighted to reflect the company's,or the sector's, capital structure, taking tax effects into accountby incorporating the appropriate tax rate (t).

$$WACC = \frac{(E\,k_e) + (D\,k_d)(1-t)}{(E+D)} \quad (1)$$

Where:

k_d: cost of liabilities

K_e: cost of equity

D: percentage of debt to capital structure.

E: percentaje of equity to capital structure.

t: applicable corporate tax rate.

The cost of debt (k_d) is the cost to companies of all their sources of financing (D), including loans, insurance policies, bills of exchange, etc.

The capital structure of Spanish SMEstypically consists of equity, short term borrowing from banks and trade credit. Maroto [10]has reported that financial institutions limit the provision of credit to SMEs by means of increases to the interest rates applicable to furtherborrowing. This leads to SMEs being unable to accept such conditions, impacting upon investment decisions, limiting their growth and thereby blocking any possible expansion of the company structure. However, the extent of credit provided by financial institutions varies according to the sector in question (the extent of financial support to the construction sector is one example of this).

Financing by means of incurring debt leads to interest payments being made, which brings tax benefits for the company, as such expenses are tax-deductible. This beneficial effect of debt is known as the tax shield, and this is reflected in equation (1)for the WACC calculation by the term (1-t) [11].

Finally, the cost of equity (k_e), i.e. the rate of return demanded by the owners, can be defined as the sum of the risk-free rate (RFR) and the market risk premium (π):

$$k_e = RFR + \pi \quad (2)$$

A number of financial models appear in the literature for the evaluation of risk and asset performance[12], and they differ in the manner in which they measure the market risk. Two of the most popular models in the literature are the capital asset pricing model (CAPM) and the analysis of historical returns on equity.

2.1. Capital Asset Pricing Model (CAPM) - Model 1

The CAPM builds on the Markowitz mean-variance efficiency model in which risk-averse investors with a one-period horizon care only about expected returns and the variance of returns [13]. The CAPM has received significant criticism, in particular with regard to its difficulty in determiningthe individual risk of a particular asset, and also due to the fact that it looks to past performance when determining the future cost of capital [5, 14]. The model can be summarised by means of the following equation.

$$E(R_i) = k_e = RFR + E(R_m - RFR)\beta_i \quad (3)$$

where:

- E(ri): the expected returnfrom the asset, i.e. the cost of equity.
- RFR: the risk-free rate,or return that could be obtained from the market without running any risk of losing the investment or the interest arising from it.

- E(Rm-RFR): the market risk premium. This is the difference between the expected return from the market and the risk-free rate. In these cases, historical data are typically used.
- β_i: the parameter principally responsible for measuring the systematic market risk for the asset in question. Mathematically, it is defined as follows:

$$\beta_i = \left[\frac{cov(R_i R_m)}{\delta_m^2}\right] \quad (4)$$

where $\delta^2_m$is the variance of the market return.

The $\beta_i$coefficient enables an analysis of the sensitivity in the performance of a particularasset to market variations. If the value of β is higher than 1, this means that the asset is sensitive to market variations and that it suffers greater fluctuations in its performance than the market itself. On the other hand, if β is lower than 1, this implies that the asset demonstrates behaviour which is resistant to market fluctuations.

The β coefficients reported in the literaturetake into account the degree of financial leverage of the sectors in question. For this reason, they must, first of all, be unlevered in order to be able use them without taking into account the capital structures from which they derive, and then later they must belevered once more with the corresponding capital weights. Following Copeland et al [15], the calculation for this procedure is as follows:

$$\beta_L = \left[1 + (1-t)\frac{D}{E}\right]\beta_U \Rightarrow \beta_U = \frac{\beta_L}{(1+(1-t)\frac{D}{E}} \quad (5)$$

where:

- β_L: levered beta coefficient
- β_U: unleveredβcoefficient
- E: equity
- D: debt
- t: applicable corporate tax rate

2.2. Historical return on equity (ROE). Model 2

It is very common to use historical data to compare the return on equity in shares with the return of the risk-free rate. Some conclude that the difference between the historical return on equities and the historical return of the risk free rate is a good indicator of the market premium.

This methodology is to opt for an average of the return on investment of the sector for several years. A moving average is set at five years, and gets a return on investment-weighted and corrected the effects that may represent a specific fiscal year in the overall profitability of the sector.

Hence, although the equity gain above bonds in a particular year is not considered to be the market risk premium, the incremental return of stocks over bonds, over a number of years is considered to be a good estimator of the required market risk premium. After a bad year, the market risk premium will have fallen, even if there is no reason for this.

This method, sometimes called Ibbotson's method [16], "*assumes that the required return to equity in the past was equal to the return actually received, and that the market is all investors' efficient portfolio. As we will see further on, this method provides inconsistent results, and, at present, reducing the required market risk premium*".

In this case, the market risk premium has been defined as the difference between the ROEfor the sector and the mean risk free rate for the year.

Once this market risk premium has been determined, the risk free rate of the year to be evaluated can be added to it (using data from December), and thus the cost of equity can be calculated.

$$k_e = RFRn + \pi_h \quad (6)$$

where:

π_h: historical market risk premium

RFR_n: risk free rate (at the end of the year)

The main criticism of this model faces is that it is a pureaccounting approach and does not take other variables into account. Nevertheless,it can give a reasonable approximation of the returns that investors in this sector are seeking over the following years,[17].

3. Methods

The Spanish economic crisis,which began in 2007, haschanged the way in which the fluctuations in the parameters impacting upon the discount rate should be interpreted. The deterioration of the main macroeconomic indicators means that the calculationsneeded to determine them should be carried out more frequently.

3.1. Data gathering

We calculated the discount rateusing data from the specific sector of Spanish SMEs dedicated to the electric power generation using alternative energy sources, namelythe accounts available for the 2011-2013 period. Information from a total of 95 companies was used. These companies possessed a turnover of between 2 and 50 million euros, were currently active, were located in Spain, achieved a profit in each of the three years studied, and their economic activity was classified in category 3519 (the production of electrical energy of other types) of the Spanish classification of economic activities (CNAE).

For the estimation of the discount rate for this sector, we will briefly present the analysis of the trends during these three years for each of the factors which form part of the calculations described earlier.

3.2. Tax rate

In accordance with Royal Legislative Decree 4/2004 of 5th March enacted the Consolidated Text of the Corporate Income Tax Act, the general tax rate between 2008 and 1st January 2015 was 30%.

3.3. Capital structure

The aggregated capital structure of the sector was analysed and the results can be seen in Table 1.

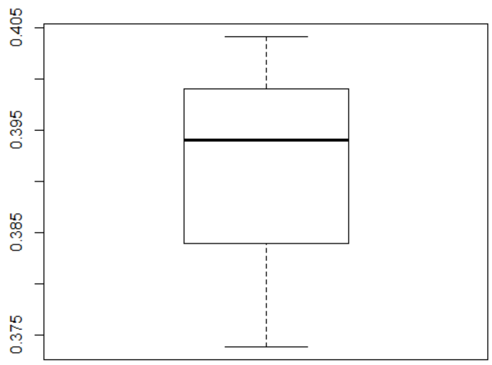
Table 1. Capital structure

	2011	2012	2013
Equity	1,247,725,364	1,310,492,858	1,329,314,051
Debt	2,089,859,984	2,015,435,423	1,959,764,196
Total	3,337,585,348	3,325,928,281	3,289,078,246

a. Amount in Euros. SME power generation sector in Spain

In order to determine whether the sector was tending towards higher capitalization or a more leveraged structure, a statistical analysis of the ratio of equity to total liabilities was undertaken. The results are shown in Figure 1.

Figure 1. Capital structure



During the 2011-2013 period, the ratio of equity to total debt ranged between 37.38% and 40.42%. The data were relatively consistent across different measures, with the 50th percentile (or median) being close to the mean (39.40% vs 39.07%). It can therefore be concluded that the capital structure of the sector is somewhat leveraged, although the trend in recent years points to a move towards higher capitalization.

3.4. Cost of debt (k_d)

This was determined on the basis of the headline interest rates offered for (non official) mortgages (not the official rate) and other interest rates: preferential rates offered by banks and savings banks and published by the Bank of Spain (*Banco de España*). From 2012 onwards these interest rates ceased to be published. Therefore, for 2012 onwards, k_d refers to the interest rates for new operations (the annual percentage rate or APR, and the restricted definition effective rate, or RDER, which is the same as the APR except for the fact that it does not include commission charges).

Table 2. Cost of debt. Headline interest rates for mortgages.

Year	Interest rates
2012	5.28%
2011	5.27%

Source: Banco de España

Table 3. Cost of debt. Interest rates (APR and RDER) for new loans to non-financial companies.

Year	APR
2013	5.18%

Source: Banco de España

3.5. Cost of equity (k_e)

There are different ways of determining the cost of equity. In this study, two approaches were used: the capital asset pricing model (based on the wider market situation) and a historical analysis of financial returns in this sector (based on accounting principles).

1) Capital asset pricing model. Model 1.

To apply this model, it is first necessary to take into account the return from a risk-free asset (RFA). Government bonds are taken to be such assets, as the issuers generally offer high credit ratings, good liquidity and good returns. In this study, the risk free-rate wastaken to be that for 10-year Spanish government bonds. This timeframewas taken based on experience in this sector and on typical valuation practices[18].

Table 4. Risk-free rate, based on 10-year Spanish government bonds

Year	Risk free rate
2011	5.51%
2012	5.67%
2013	4.74%

Source: Banco de España

Another factor to take into account is the market return. The Madrid Stock Exchange is the main stock exchange in Spain and its principal index is the Madrid Stock Exchange General Index (IGBM).

Table 5. Market returns, as measured by the IGBM.

Year	IGBM	Variation
2011	857.65	-14.55%
2012	824.7	-3.84%
2013	1011.98	22.71%

Source: Banco de España

With regard to this approach, the beta parameter isthe one which has received the most criticism. As was mentioned above, this parameter measures the sensitivity of an asset to market fluctuations or changes. We analysed the beta parameters for the European power generation sector, using unlevered betas in order for them to be re-levered later with the financial structure of the sector under study.

The Beta parameter [19] sed to determine the cost of equity is a critical factor because it provides a reference of how the industry has historically behaved studied in relation to market developments, showing the risk taken against developments a benchmark. Generally it used to estimate the expected return of an asset in relation to the general market return. So, it reflects the sensitivity of a sector to the general market changes.
The Beta parameter is ultimately a measure of volatility active on the market variability. So that: if Beta > 1 means the sector contains more volatility than the market, for Beta = 1, the sector is analogous to volatility sectors of the market., and finally, a Beta < 1 denote less volatility in the sector than in the market.
In the analyzed period 2011-2013 the increase of Beta unlevered (B_u) is 114%, going from 1.25 to 2.68 is observed. A Beta of 2.68 means that the energy sector is 168% more volatile than the market. Obtaining Betas for the Spanish energy market is conditional on sufficient number of data in data base and its adequate treatment for companies quoted on the Spanish stock exchange. In the absence of a strong and robust database, that accomplishes these conditions, on which to work to obtain the Beta of the energy sector, we opt for the use of betas calculated for the European market.The sector's betas for the years in question are shown in Table 6.

Table 6. Unlevered and levered beta variations.

Year	Beta u	Variation	Beta l	Variation
2011	1.253		2.721	
2012	1.540	22.91%	3.197	17.49%
2013	2.683	74.24%	5.451	70.50%

Source: Prepared by the authors

The weighting of debt to equity has a direct influence on the levering processof the beta parameter. For example, for the year 2012 theunlevered beta increased by 22.91% in comparison with the previous year, while the levered beta increased by only17.49%. This is a consequence of the trend towards capitalization in this sector.

Once all of the parameters had been defined, the cost of equity was calculated using the CAPM.

Table 7. Cost of equity. Model 1.

	2011	2012	2013
Risk free rate (Dec)	5.55%	4.67%	4.10%
$E(R_m\text{-}R_f)$	5.10%	4.52%	5.04%
Levered beta	2.72	3.20	5.45
k_e	19.44%	19.12%	31.56%

Source: Prepared by the authors

2) Historical return on equity. Model 2.

Information about companies was taken from the SABI (Iberian Balances Analyses System) database, which provides information on companies' financial status and allow, among other actions, companies to be grouped according to CNAE activity codes.

Using the target group taken from SABI to determine the weighting of the historical capital structure of the sector, we established the mean financial return of the sector for each year in question (2011–2013).

Equation (6) possesses a simpler structure than that used by the CAPM. It represents an accounting-based approach to determining the capacity of companies in the sector to generate profits for a particular level of equity.

The calculation of$k_e$for 2013 involved the addingtogether the RFR for December 2013 and the market risk premium, obtained earlieras the difference between the sector's financial return for 2013 and the mean RFR for 2013.

Table 8. Sector return on equity for 2011-2013

	2011	2012	2013
Net profit	221,145,691	243,892,591	189,563,074
Equity	1,247,725,364	1,310,492,858	1,329,314,051
ROE	17.72%	18.61%	14.26%

Prepared by the authors. Data in euros

Having established the parameters, we then calculated the cost of equity for the sector using the historical returns model.

Table 9. Cost of equity. Model 2.

	2011	2012	2013
Risk free rate (Dec)	5.55%	4.67%	4.10%
Meanrisk free rate	5.51%	5.67%	4.74%
Return on equity	17.72%	18.61%	14.26%
k_e	17.75%	17.61%	13.62%

Prepared by the authors

The cost of equity lies within the 13%-18% range when applying Model 2and the 19%-32% range when applying Model 1.

It can thus be seen thatthe CAPM demonstrates greater volatility than the historical returns model for the sector. The changes to the beta parameter are crucial in the former model, as it drives increases to the market risk premium. In 2013, the beta coefficientincreased considerably (70% in comparison with 2012),despite there being a trend towards capitalization in the capital structure of the sector as there was a D/E coefficient of 1.47 (4.14% lower than the previous year).

Furthermore, the cost of equity obtained using Model 2 shows a significant decrease in 2013: the value for $k_e$was 13.62% (22.7% lower than in 2012). This decrease was accompanied by lower returns for the sector, due to a decrease in profits: 189 million euros in 2013, falling from 243 million euros in 2012. For 2013, the two approaches differ in terms of the trend detected.

4. Results

Having established the different parameters required, WACC calculation was carried out and the resulting trend analysed.

Table 10.WACC for the SME electric power generation sector.

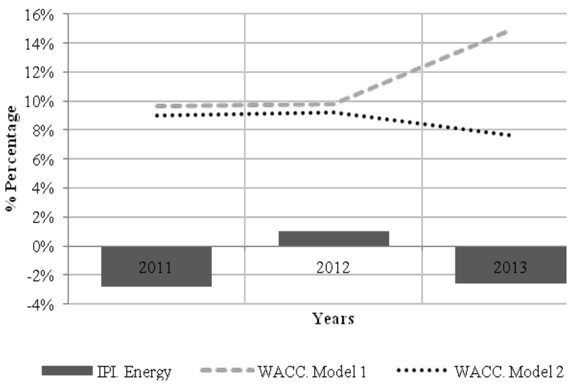
	2011	2012	2013
WACC Model 1	9.63%	9.80%	14.92%
WACC Model 2	9.00%	9.21%	7.66%

Prepared by the authors

The discount rate reflects the impact of the cost of equity trend, so that with Model 1 the trend is upward, with a notable increase in 2013, whereas, with Model 2, the discount rate for 2013 is lower than before.

The sensitivity of the WACC model to fluctuations in$k_e$andk_d can therefore be seen.

Figure 2. WACC fluctuations for Models 1 and 2 and the IPI



When the trends of these rates were compared with the annual variations of the Spanish Industrial Production Index (IPI) for energy generation between 2011 and 2013, it was found that:

- Model 1 incorporated the risk arising from the poor economic situation (with an IPI indicator of -2.61%) by means of an increase to the discount rate.
- Model 2 presented a lower rate, a result of the methodological approach involved [14]. The sector wasexperiencing a difficult period (with a decrease in profits), resulting in a lower equity cost, leading in turn to a lower discount rate.

It can therefore be stated that when faced with a historical situation involving cycles characterised by higher risk (with regard to the viability of projects, the generation of profits, etc.), Model 2 presents a lower discount rate, something which seems incoherent.

The discount rate obtained will be useful for the economic valuation of investments in photovoltaic installations in Spain, as has been done in India and Pakistan [20].

5. Conclusions

The cost of equity for the sector has been estimated by means of the CAPM and the historical return on equity for the sector. The first approach takes into account the systematic risk for a diversifying investor while the second is based on a consideration of the returns for shareholders. Interestingly, the cost of capital is higher with the first approach.

The cost of equity appears to be the most influential factor for changes to the cost of capital in the period studied for the electric powergeneration sector (although this conclusion depends on the weight given to equity and debt). In Model 2 the decline in profits entails a lower cost of equity and a lower cost of capital. A lower cost of capital leads to a higher company value (if cash flows remain constant).

Using the CAPM implies greater variability in the cost of capital (an increase of 52.16% from 2012 to 2013). This greater variability indicates that the risk factors related to cost equity markets outweigh the risk factors linked to the financial performance of companies

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