TRUNCATED DISTRIBUTIONS OF VALUATION MULTIPLES. AN APPLICATION TO EUROPEAN FOOD FIRMS

1. Introduction and objectives

Over recent years in Spain, there has been a change in the focus and information that the market gives to company valuation. This new trend is directed towards the financial objective of giving a true reflection of a company's value according to its current profits and the factors (internal and external) which will have an effect on company growth and profits in the future.

In view of this, both within companies and in the area of financial theory, instruments which assist in transferring the concept of company valuation across the different areas of the organisation must be found. Based on this trend, efforts have been made to find variables and indicators which facilitate obtaining company value for the market.

The commonly accepted methodology for company valuation is discounted cash flow, corroborated by the empirical study carried out by Rojo and García (2006) which shows that this technique is the one most widely used by all types of company valuation enterprises and which differs significantly from other methodologies. For Jennergren (2008), the discounted cash flow (DCF) model is one member of a whole family of related models of company valuation, among the members of this family, the DCF model has traditionally been a dominant one in practice. Imam *et al. (2008)* find that analysts perceive the discounted cash flow to have become significantly more important than prior survey evidence suggests, although they also find the continued importance of valuation multiples.

Valuation by multiples is often used as a contrast methodology, and it is most frequently used as the main valuation methodology when valuing large companies. Estimating valuation multiples relies on stock market listings as its main source of information, based on which a simple calculation gives the relation between balance sheet and share price. Extending valuation multiples to small and medium-sized enterprises is a questionable practice, since the differences in size, organisation and management between stock market listed companies and small and medium-sized enterprises (SMEs[11]) are considerable.

The Spanish food industry is affected by this problem given the high number of SMEs and the small number of stock market listed companies. Thus, according to the 2003 Agri-food Statistical Yearbook prepared by the Ministry of Agriculture, Fisheries and Food, 96.97% of food sector companies employed less than 50 workers. The percentage increases to 99.36% if we consider companies employing up to 200 workers. As regards food companies listed on the secondary market[22], their number is very low and this increases the difficulty of using valuation multiples due to poor suitability.

Among other works on the valuation of food sector companies are studies by Caballer and Moya (1998) and Adelaja *et al.* (1999). The first study, using economic and financial information, obtains equations to explain the stock market value of agri-food companies, employing techniques such as factorial analysis and multiple regression. The second study examines whether diverse areas such as liquidity, financial leverage, profitability, sales

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[1] In its Recommendation 2003/361/CE, the European Commission defines an SME as a company employing less than 250 persons and with an annual turnover of not more than 50 million Euros or an annual balance sheet of not more than 43 million Euros.

[2] Current data from the Madrid Stock Exchange indicate that there are 10 companies from the food and drinks sectors (Barón de Ley, S.A., Bodegas Riojanas, S.A., Compañía Vinícola del Norte de España, S.A., Campofrío, S.A, Ebro Puleva, S.A, Natra, S.A., Paternina, S.A., Pescanova, S.A, Sos Cuétara, S.A. and Viscofan, S.A), 4 of which are wine producers and one, Viscofan, manufactures artificial casings for the meat industry.

growth, stock, performance capacity, percentage of ordinary shares sold on the stock market and book ratio are statistically significant in explaining the mergers and acquisitions between agri-food companies which took place in the American market from 1985-1994.

Declerck (1997) showed that the wave of mergers and acquisitions which took place in the American food industry during the eighties was motivated by the gain in efficiency and profits that results from a powerful market position.

In the French food sector, another study by Declerck (2003) examined the valuation multiples (EV/Sales and EV/EBITDA) in companies that were sold within merger and acquisition processes over the period 1996-2001.

In this context, a mass valuation model is constructed and applied to obtain diverse valuation multiples for small and medium-sized enterprises in the Spanish food sector. The multiples obtained in this way will be compared with the multiples of European food sector companies listed on the stock market. However, the asymmetry of the different distributions obtained makes the arithmetic mean questionable as an indicator of typical multiples, and hinders determining statistically significant differences between distributions. To prevent biases generated by distribution asymmetry, an algorithm to eliminate outliers has been designed.

2. Valuation model

As state above, estimating valuation multiples relies on stock market listings as its main source of information, based on which a simple calculation gives the relation between balance sheet and share price. However, in the case of SMEs, to obtain valuation multiples a prerequisite is to estimate their market value, since their shares are not market listed. Consequently this work requires the application of a valuation methodology, since obtaining multiples for SMEs presupposes knowing their market value and equity value.

To calculate market value, a discounted free cash flow model is used. Discounted cash flow models consider the potential value of the company and not merely the value of its tangible assets. This type of model assumes that the value of a company for an investor is equivalent to the series of annual cash flows that the company can generate in the future, transposed to the present by means of a discount rate.

2.1. General model

The most widely used model is usually broken down into two stages, a first stage of explicit cash flows and a second stage which calculates a residual value using the Gordon formula [1] (Jennergren, 2008).

$$V = \frac{FC_1}{(1+k)} + \frac{FC_2}{(1+k)^2} + ... + \frac{FC_t}{(1+k)^t} + \frac{FC_t \cdot (1+h)/(k-h)}{(1+k)^t} \qquad [1]$$

In an approach to mass valuation, it is not possible to fix explicit cash flows for each company by year, given that their growth and investment policies are not known. Therefore, a two stage model is used, replacing the explicit cash flows stage with a constant growth stage based on company history (Damodaran, 2002) [2].

$$V = FC \cdot \left(\frac{1+g}{k-g}\right) \cdot \left[1 - \frac{(1+g)^t}{(1+k)^t}\right] + FC \cdot \left[\frac{(1+g)^t \cdot (1+h)}{(k-h) \cdot (1+k)^t}\right] \qquad [2]$$

Where:

FC: expected free cash flow for the first year of projection (year 1)

t: duration of the first stage

t: duration of the first stage

g: expected constant growth during the first stage

h: expected constant growth during the second stage

Model [1] is equivalent to model [2] if the free cash flows grow at a constant annual rate *g.*

The definition of free cash flow used is the one most widely used in the business environment (Rojo and García, 2006).

EBIT (1-*t*)

+Depreciation (DA)

- Variation in working capital

-Investment in fixed assets

Free cash flow

Where EBIT is Earnings before Interest and Taxes, taken to be operating profit and not therefore considering extraordinary profits. This variable is corrected by (1-*t*) where *t* is the tax rate, thus an adjusted companies tax since neither financial profits nor extraordinary profits have been included. This approach is equivalent to the Copeland *et al.* (2004) approach using the NOPLAT (Net Operating Profit Less Adjusted Taxes) variable.

This approach may appear to be far from the practical reality in the valuation of a company. However, future growth and investment policies are not usually very clear in small companies, principally due to the absence of a strategic plan. For this reason, the analyst tends to rely more on historical and sectorial data.

Consequently, it is a model to be applied to historical accounting data that attempts to mimic the valuation models used by analysts and valuation professionals on specific companies.

2.2. Specific parameters

Applying discounted cash flow valuation models presupposes setting out a series of hypotheses. If this model is to be applied to a large number of companies, then the same premises must be used for all the companies in order to give coherence to the mass model. That is to say, calculation methods for parameters such as growth, discount rate etc., will be the same for all the companies, but not the values for these parameters which will be specific to each company.

The discount rate chosen is the weighted average cost of capital, which involves quantifying k_e (cost of equity), k_d (cost of liabilities), likewise the financial structure of the company determined by E/(E+D) (percentage of equity to capital structure) and D/(D+E) (percentage of debt to capital structure).

$$K = WACC = \frac{E \cdot k_e + D \cdot k_d \cdot (1-t)}{E+D} \qquad [3]$$

The cost of equity (k_e) is set through CAPM (Capital Asset Pricing Model). The sector average unlevered beta is used. For this, stock market beta will be used that will require unlevering using the financial structure of each listed company.

The approximate cost of liabilities can be calculated using each company's accounting information, such as the quotient between financial expenditure and the mean balance of liabilities.

Capital structure presents the problem of circularity. To determine the weighted average cost of capital we must know the weightings based on market value, but to determine market value free cash flows must be discounted from the weighted cost of capital. One way of solving this problem is to set a capital structure target for the company, another way is to carry out an iterative calculation (Copeland *et al,* 2004). In this latter solution, in addition to fixing the costs of equity and of external financing, the value of equity is determined in such a way that the total of these and of company debt is equal to the value obtained by discounted cash flows. Given that the target financial structure is not known, and that the book structure is not very reliable, we chose to solve the problem of capital structure circularity using iterative calculations.

Using the two stage constant growth model means that two specific growth rates for each stage must be calculated.

In the first stage growth (*g*) will be calculated following Damodaran (2002), and increases will be calculated according to return on capital (ROC) and the reinvestment rate. In the second stage, in the longer term, growth will be close to some measure of growth of the economy (GDP) or of prices (CPI), it being understood that in mature sectors with a large number of companies, annual growth in the long term will not be very high. Morris (1994) warns of the common error of forever using unsustainable growth rates.

Following Morris (1994) the explicit timeframe of the valuation depends on the reliability of the estimate of future operations, the usual periods being 3 to 10 years, longer periods being possible for highly stable companies. An explicit timeframe of 5 years has been chosen for the application, subsequently considering a residual value using the Gordon model. This explicit duration is probably shorter than the one which would be used if there were more specific information about each company.

It has been considered that during the projection period, there will be no distribution of dividends to shareholders.

The model proposed does not have a direct comparison since there is no transparency in company stocks and shares transfer operations. Similarly, selling stocks is not easy for the company owners due to this absence of transparency and information, and some studies indicate that this lack of liquidity could involve a downwards correction of the value obtained. This downwards correction could be reflected in a higher weighted cost of capital.

Once the value of the company (EV) has been obtained, the value of equity or value of shares (P) must be obtained, calculated as:

Value of equity (P) = Price = EV – Debt +Accounts receivable + Liquidity position [5]

3. Information source

Applying the model requires accounting information from various financial years for a large number of companies. A database of company economic and financial information has been used; specifically the SABI[3] database on small and medium-sized enterprises[4] with a turnover of less than 50 million euros in 2006. The food sector was chosen, segmented by the National Code of Economic Activities, code 15 food and drink products industries, excluding drinks manufacturing companies, and following the same criteria as used in the majority of stock market classifications. To avoid problems of poor data quality, the lower limit for turnover has been set at 1 million euros. Furthermore, companies with a negative cash flow in 2006 have been excluded from the analysis.

In this way, information has been obtained on a total of 920 companies which meet the criteria specified above and for which accounting information for the entire 2002-2006 period is available.

For each of the NCEA sub-codes, Table 1 shows the number of companies and the percentage they represent of the total.

The most recent information that could be obtained on the aforementioned companies is from 2006, so the reference is taken as the valuation of companies in June 2007[5], and the parameters for calculating value are those available at that date.

4. Main results from the mass valuation model

By applying the mass valuation model to the group of companies selected, the company value (EV) and equity value (P) are obtained for each one of the companies.

Subsequently the multiples are calculated from the results of the model and from the corresponding accounting variables for 2006. The most usual multiples shown in Table 2 have been taken.

Table 3 shows the descriptive statistics for each one of the multiples selected for the study.

The descriptive statistics values show the high variability that exists in results for sector companies.

Both the PER and the EV/EBIT show very high maximum values, causing high standard deviation and variation coefficient values. These results match usual management practices in small companies, excessively people-centric and asset preserving, where the impact of companies tax leads to the attempt to minimise net profit.

The PCF multiple uses cash flows for its calculation and thus eliminates the effect of different policies for amortization of non-current assets, obtaining more homogenous results and much lower dispersion than that of the PER, as demonstrated by the standard deviation for both multiples.

Declerck (2003) obtains higher multiples calculated on real transactions carried out by French food sector companies for the period 1996-2001, where the average values of the multiples were EV/Sales = 1.05 and EV/EBITDA = 11.83.

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[3] SABI: Iberian Balance Sheet Analysis System, a database which contains the annual accounts of over 800,000 Spanish companies.

[4] In its Recommendation 2003/361/CE, the European Commission defines a small enterprise as one with less than 50 employees and whose annual turnover is no more than 50 million euros or whose balance sheet is no more than 10 million euros.

[5] The definitive data from 2006 are considered in 2007 with the legalisation of books in the Companies Register.

The large dispersions of some of the multiples and the elimination of negative values give rise to asymmetric distributions with large tails to the right.

5. Algorithm for eliminating outliers

The non-normality of the distributions obtained and their asymmetry makes it helpful to eliminate companies with excessive multiples (very low or very high values) which can cause a major bias both in central trend and position statistics. The problem of asymmetry and poor representativeness of the average as typical multiple is not exclusive to the multiples obtained using the mass model of valuation. Indeed, stock market valuation multiples usually present asymmetric distributions.

Marazzi and Ruffieux (1999) refer to some common methods for estimating a truncated mean, a frequent solution for estimating a representative mean where there are asymmetric distributions, and put forward their own alternative.

Meiri and Zahavi (2006) carry out a simpler elimination of outliers, the variable values which are more than six standard deviations away from the variable's mean, are truncated by setting their value to 6*σ, where σ is the standard deviation.

Grosot and Ganugi (2007) also use truncated distributions; they model the firm size distribution (FSD) of Italian manufacturing firms, by a continuous and a discrete distribution: the Pareto IV distribution on total assets and the Yule distribution on number of employees.

In our work, we put forward an algorithm based on truncating the distribution obtained for a given multiple in such a way as to keep the size of the truncated range to a minimum. The algorithm seeks the highest concentration of multiples.

The steps in the algorithm are as follows:

1. Establishing sample size (*M*): n
2. Arranging the sample in growing order (*M*)
3. Fixing the outliers elimination factor: α[0,1]
4. Establishing the size (*q*) of the solution sub-sample: *q*=integer[(1- α)*n*]
5. Min (e_{i+q} - e_i) *i*=1,2,…*n* where e_i is the *i*-th element of the ordered sample *M*
6. Test sub-sample m[e_i,e_{i+q}]

Positing an outliers elimination factor of 20%, the algorithm will provide the interval extremes that, containing 80% of the values, present a smaller size or range.

Within this same structure the algorithm would be useable varying the function to be minimised. Thus, and especially in this application, it is useful to minimise the quotient between the two extremes of the interval, since this would indicate a smaller ratio between the highest value and the lowest value of the company providing the multiple.

Figure 1 shows the different 50% interval bands of the values using percentiles (25 and 75), minimisation of range and minimisation of the relation between the interval extremes for a variable, specifically the PER multiple.

The intervals established by the algorithm detect the position of the mode or most likely value in a more reliable manner. In this respect it is superior to other measurements such as the truncated mean or using the interquartile interval, since for equal values in the truncated distribution the range is minimum, which means a higher concentration of values.

For a sample of 50% and 80% of values, figure 2 shows the range and the range relation between the central ranges and the ranges obtained using the algorithm with the two proposed options (minimising range and minimising relation of range extremes).

The greater gains, in the sense of obtaining a higher concentration using the algorithm, are presented in the multiples with a higher initial variability, PER and EV/EBIT.

Using the algorithm leads to lower dispersion among the central position statistics as mean, median and harmonic mean.

6. Comparison with stock market multiples

The multiples obtained can be compared with the multiples of food sector companies listed on the stock market in order statistically to determine their similarity. Given the low number of Spanish companies that meet this criterion, the sample has been widened to include European food sector companies[6].

Table 4 shows the descriptive statistics for the multiples of the aforementioned companies. In this case, variability is lower in the PER and EV/EBIT multiples than in the case of Spanish food sector small enterprises, which corroborates the hypothesis of profit minimisation for tax purposes.

As regards the descriptive statistics for position, harmonic means present greater similarity between both groups of companies (tables 1 and 4) than do means or medians, which are more affected by anomalous values and the asymmetry imposed in the model.

Given the non-normality of the available data for both stock market multiples and SMEs multiples, a permutation test has been used (table 5). The null hypothesis, that distributions are not different, is refuted in four of the multiples both for whole samples and 80% and 50% data samples following application of the algorithm for eliminating outliers minimising the range.

The average stock market multiples observed are higher than SMEs multiples in almost all instances. If the accounting variable applied is the same, the greater the multiple applied, the higher the value obtained will be.

In the PCF ratio, the null hypothesis is rejected for both the whole sample and the truncated sample. However, it is not clearly established whether this multiple is greater for listed companies or for SMEs, according to the size of the sample of companies. This fact means that the differences encountered cannot be considered reliable.

The PER ratio does not present statistically significant differences for any of the three samples studied. The absence of statistically significant differences implies that equity cost is similar for investors, there being no differences between these two types of company. The mass valuation model has used an equity cost from listed companies, which makes this result coherent.

The EV/Sales ratio is statistically higher for listed companies, which means that the operating margins are larger and relative financial costs smaller; for each euro sold the value of the company is higher in the case of a listed company than in the case of an SME.

The EV/EBITDA ratio is also statistically higher for listed companies. Additionally, the EV/EBIT ratio does show some evidence of significant difference for the 80% of minimum range sub-sample and refutes the null hypothesis for the 50% of minimum range sub-sample. The higher value of the listed company per euro generated implicitly means lower risk. Given that equity cost is similar, lower risk is determined by the more favourable financial conditions that listed companies obtain.

As is to be expected, the Tobin's *q* ratio is also statistically greater for listed companies. Indeed, the existence of other intangibles in addition to the brand, such as distribution networks, know-how, and human and intellectual capital should generate a larger *q* ratio,

[6] From Bloomberg information at the end of 2006, the multiples for listed food sector companies from various European countries (Germany, Austria, Belgium, Denmark, Spain, Norway, Finland, France, Greece, Italy, Ireland, United Kingdom, Switzerland, Sweden,…)

Teece *et al. (1994)* suggest that the *q* ratio could be used as an indicator of organisational or technical skills.

7. Conclusions

It is difficult to use valuation multiples for small and medium-sized enterprises given the lack of market data on transfer of stocks in this type of company, and for this reason the method of valuation by multiples involves comparing SMEs with listed companies unsuited for the purpose. Using a mass model of valuation which emulates the valuation process carried out by professionals in the field eliminates the problems associated with valuation by multiples. This model provides quantitative information on the usual multiples of a sector.

The high variability in the values of some of the multiples obtained, with very high maximums for some of them, along with the fact that negative values are not considered, leads to high average multiples. Furthermore, the asymmetry of the different distributions obtained makes using the arithmetic mean as an indicator of typical multiples somewhat questionable, and hinders determining statistically significant differences between distributions.

To prevent these problems from producing biases in determining multiples, an algorithm for eliminating outliers has been designed. This algorithm uses a process of interval size minimisation to obtain a higher concentration of intervals of multiples. The algorithm permits better calculation of the most likely values and allows the use of multiples with high variation coefficients, which otherwise would have to be discarded.

The presence of a high variation coefficient occurs both with the PER multiple and the EV/EBIT multiple. These results match usual management practices in small companies, excessively people-centric and asset preserving, where the impact of companies tax leads to the attempt to minimise net profit. With these multiples, commonly used by analysts and managers, applying the algorithm for eliminating outliers allows the previously mentioned problems to be avoided.

Once the results have been treated with the algorithm for eliminating outliers, the proposed model can be used for various purposes. Thus, to the classic uses of valuation and comparative valuation (comparison with valuations carried out using other methodologies), can be added others such as analysis of the range of values of a company according to diverse accounting variables, calculation of premiums due to lack of liquidity in SMEs valuation, measuring the likely existence of purchased goodwill, and determining auxiliary ratios for the valuation of intangible assets, etc.

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Table 1. Number of companies used.

NCEA	Description	Number	Percentage
151	Meat industry	273	29.7%
152	Manufacture and conservation of fish and fish-based products	51	5.5%
153	Preparation and conservation of fruit and vegetables	64	7.0%
154	Manufacture of fats and oils (vegetable and animal)	42	4.6%
155	Dairy	55	6.0%
156	Manufacture of milling products, starches and starch products	30	3.3%
157	Manufacture of animal feed	63	6.8%
158	Manufacture of other food products	342	37.2%
TOTAL		920	100.0%

Table 2. Valuation multiples selected.

Valuation multiple	
PCF	Price/Cash-Flow
PER	Price/Earnings
EV/SALES	Company Value/Sales
EV/EBITDA	Company Value/Earnings before Interest, Taxes, Depreciation and Amortization
EV/EBIT	Company Value/Earnings before Interest and Taxes
q	Tobin's q: Company Value/ Assets Value

Table 3. Descriptive statistics of the multiples selected for the study.

Multiple	n	Mean	Median	H Mean	St. Dv	cv	Min	Max	P25	P75
PCF	920	9.35	8.89	7.53	4.21	0.45	0.72	52.30	5.05	13.70
PER	868	99.37	20.74	18.69	1152.2	11.60	1.57	29553.46	11.16	72.50
EV/SALES	920	0.82	0.63	0.51	1.25	1.52	0.05	34.19	0.28	1.43
EV/EBITDA	919	8.71	8.53	7.99	3.47	0.40	0.81	82.43	6.27	10.85
EV/EBIT	855	36.57	15.19	13.95	191.08	5.22	1.18	4031.78	8.26	45.09
q	920	1.01	0.92	0.79	0.53	0.53	0.07	7.85	0.53	1.55

Missing data indicates elimination of the company in the calculation of certain multiples

Table 4. Descriptive statistics of the multiples of stock market listed European food sector companies

Multiple	N	Mean	Median	H mean	St. Dv	cv	Min	Max	P25	P75
PCF	90	16.77	11.24	8.69	28.39	1.69	0.64	200.00	7.36	15.68
PER	88	28.98	21.15	14.03	32.19	1.11	0.65	200.00	14.45	31.82
EV/SALES	99	1.42	0.91	0.81	2.11	1.48	0.14	20.00	0.65	1.61
EV/EBITDA	97	16.19	10.49	9.94	20.78	1.28	3.08	127.34	7.68	14.04
EV/EBIT	94	27.92	15.06	15.29	38.98	1.40	4.59	200.00	12.35	24.42
Q	98	2.25	1.91	1.75	1.39	0.62	0.52	10.04	1.32	2.57

Source: in-house based on Bloomberg as at 31/12/2006

Table 5. Permutation test for listed v. SME multiples

Stock market listed companies	**Mean n=100%**	**Mean n=80%**	**Mean n=50%**
PCF	16.77	9.94	8.14
PER	28.98	20.27	16.16
EV/SALES	1.42	0.92	0.65
EV/EBITDA	16.19	9.67	8.83
EV/EBIT	27.92	16.22	13.04
Q	2.25	1.81	1.64
SMEs	**Mean n=100%**	**Mean n=80%**	**Mean n=50%**
PCF	9.35	8.64	8.78
PER	99.37	20.23	16.19
EV/SALES	0.82	0.59	0.50
EV/EBITDA	8.71	8.51	8.62
EV/EBIT	36.57	14.96	11.51
Q	1.01	0.91	0.89
ASL*. Permutation test	**n=100%**	**n=80%**	**n=50%**
PCF	0%	0%	2%
PER	23.40%	99%	87.30%
EV/SALES	0%	0%	0%
EV/EBITDA	0%	0%	8%
EV/EBIT	69.80%	5.40%	0%
Q	0%	0%	0%

**ASL: Achieved Significance Level.*

Figure 1. Intervals of 50% of data for the multiple PER

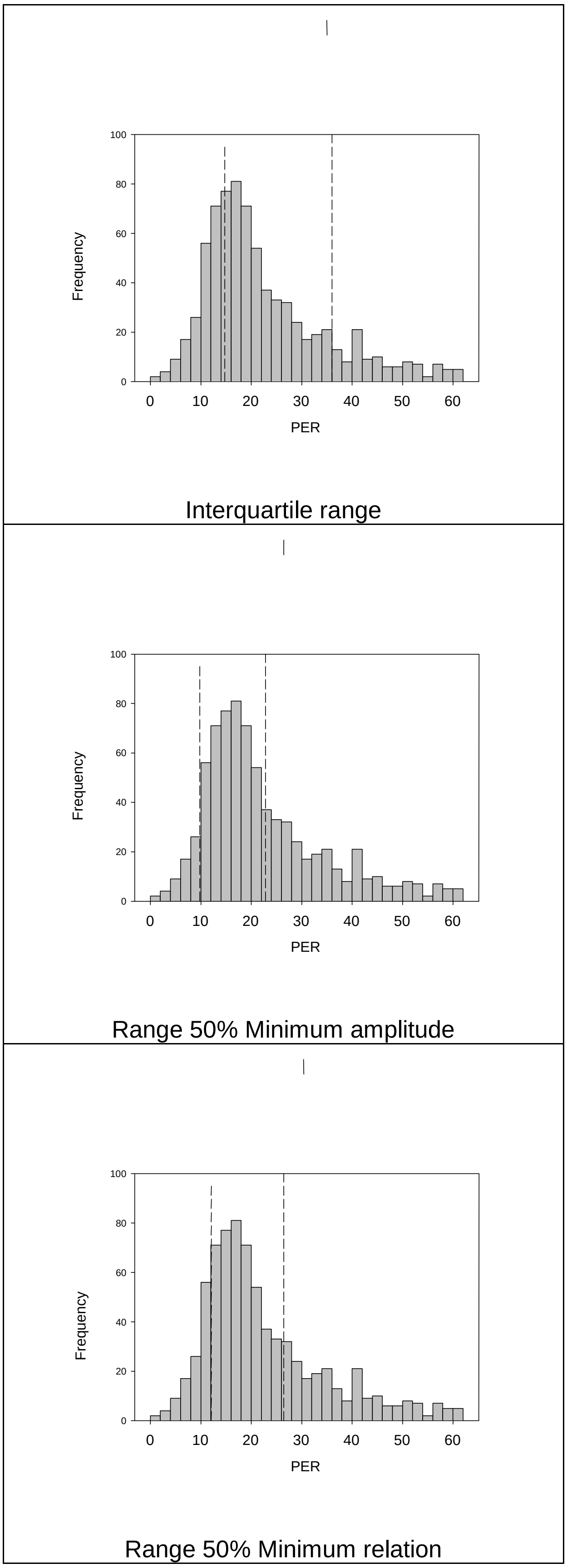

Figure 2. Comparison between the central ranges and the ranges obtained using the algorithm for eliminating outliers.