

A proposal to estimate the valuation of small and medium size companies using geographically comparable information

Propuesta para estimar la valoración de pequeñas y medianas empresas mediante el uso de información geográficamente comparable

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Abstract

A common prerequisite in valuation analysis is the availability of temporal information on financial variables. Nevertheless, reduced size companies- representing more than 98% on current productive systems- fail to have available temporal information to estimate valuations. In this paper, we offer a procedure for estimating reduced size companies' values under the hypothesis that spatial behaviour matters for valuations. With this aim, we present the theoretical background for this hypothesis and introduce a spatial proposal with a case study of industrial companies where the significant role of space on firms' valuations is previously tested. This analysis shows the relevance of spatial information in firms' valuation confirming the predictive capability of our approach applying the out of sample methodology

Keywords: location; company valuation; geographically comparable companies; discounting cash flows model; SMEs

JEL Classification: G12; R12; R51

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Resumen

Un requisito previo en cualquier análisis de valoración es la disponibilidad de información temporal para determinada variables financieras. Las pequeñas y medianas empresas, aunque representan más del 98% en los sistemas productivos actuales, no disponen de información temporal para estimar las valoraciones. En este documento, ofrecemos un procedimiento para estimar los valores de las empresas de tamaño reducido bajo la hipótesis de que el comportamiento espacial afecta a las valoraciones. Con este objetivo, presentamos los antecedentes teóricos para esta hipótesis e introducimos una propuesta espacial con un estudio de caso de empresas industriales, donde el papel significativo del espacio en las valoraciones de las empresas se ha probado previamente. Este análisis muestra la relevancia de la información espacial en la valoración de las empresas confirmando la capacidad predictiva de nuestro enfoque aplicando la metodología fuera de muestra

Palabras clave: localización; valoración de empresas; empresas geográficamente comparables; modelo de descuento de flujos de efectivo; PYMES

Clasificación JEL: G12; R12; R51

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1. Introduction

When companies are aware of their financial results, they take into account their peers' financial practices as reference values. Graham and Harvey (2001) examine this behaviour through a comprehensive corporate survey. They show that firms are concerned about their peers' financial behaviours. In particular, their results indicate that peers' debt average value impact by 23,40% on how the company choose the appropriate amount of debt. This percentage turns to 22.93% when the company considers issuing common stock. In a more recent study, Leary and Roberts (2014) show that peer actions play an important role in determining firms' financial decisions. In fact, this effect is more important for capital structure determination than mostly of the previously identified determinants. This is explained by the indirect peer effect that amplify the impact of changes in exogenous factors on leverage by over 70%. In this context, we state that geographical proximity between companies plays a significant role strengthening this peer effect. In this sense, space intensify interconnections between companies facilitating the mimicking of financial practices between geographically close companies (Maté-Sánchez-Val et al., 2017).

Thus, we argue that financial information of geographically close peers may be a useful source of information to approach companies' valuation. This proposal has far-reaching implications on firms' valuation processes when temporal information is not available. In particular, this proposal is ideal for reduced size companies that present simplified financial statements (Damodaran, 2009; Plenborg and Pimentel, 2016; Vidal and Sanchis, 2017) and could be an useful tool to solve the problem of the estimation of news companies' economic values (Miloud et al., 2012; Dusatkova and Zinecker, 2016). Financial literature presents several procedures to compute valuations for listed companies, but these methods have limitations for non-listed reduced-size companies. In order to overcome this barrier, further valuation procedures consider the specific risks of these companies (Marquez-Perez et al., 2017). A well-known procedure is presented in the studies of Rojo and García (2005 and 2006). These authors present a three-component proposal to determine the small companies' valuations. This method is based on the widely used Discounted Cash Flow (DCF) model by adding a specific risk premium for small companies. Nevertheless, to apply this procedure, temporal information is required to estimate future data from firms' financial statements. But, one of the main limitations of applying traditional methods is the absence or unrepresentativeness of firms' historical data (Damodaran, 2009). In order to overcome this limitation, financial information of geographically close peers could play a relevant role to estimate reduced size firms' valuations. In this sense, in a recent study, Occhino and Mate (2017) identify the existence of spatial concentration areas of small companies with similar valuations. They further examine the causal relationship finding that average valuations of geographically close peer companies have a significant effect on firms' values.

Thus, given the relevance of peer effect on firms' valuations when geographically close environments are examined, we proposed a method to estimate the valuations of those companies with scarce temporal information by including spatial data. The procedure starts by defining spatially comparable companies as those companies acting in the same sector and with similar characteristics and a geographically close distance between them. The suggested classification is derived from a known underlying theoretical foundation (e.g. profit maximization, economies of scale) following financial literature on valuation methods of multiples. Then, we identified spatial clusters of companies whose valuations are interconnected and proposed a spatial valuation approach based on firms' internal characteristics and spatially comparable' valuations. To make our point, we presented a study case on a sample of industrial small and medium size (SME) companies located in Madrid, Spain. We further estimated differences from our spatial proposal and traditional methods with promising results.

We were able to find a spatial valuation approach taking into account that geographically close firms are financially linked between them. We believe that our approach offers a complementary perspective in the valuation methodology that may constitute a proper contribution for estimate the value of firms without available temporal information, as reduced size companies. Our main claim is that geographical proximities induce the existence of networks between companies causing a financial contagion effect and mimic actions which should be considered in the valuation process. This reasoning will be particularly exposed in the next section.

The rest of the paper is organized as follows; the Section 2 shows theoretical background. Section 3 gives basic definitions and formal concepts, and describes the procedure. In section 4 a case study for industrial SMEs is presented. We conclude and discuss several implications and limitations of our method in the last section.

2. Background

Recent studies highlight social managers' networks as a significant element in their financial decisions (Shue, 2013). In this sense, empirical analysis find that available information about peers is considered when financial practices-such as capital structure and/or capital budgeting-are adopted. This is known as peer effect. Peer effect refers to a situation where a company reacts in response to its peers actions (Maquieira et al., 2012). This effect is different from common or correlated effects derived from the fact that companies present similar characteristics or are located in common environments (Grennan, 2017). Financial literature identifies the peer effect from different theoretical perspectives (Park et al., 2017). From the herd behaviour model, the peer effect is caused by the fact that companies mimic other companies independently from their available internal information. From the strategic intentions model, companies consider peer effect to adopt strategies affecting the financial results of other companies in the market (Rajan, 1994). Another theory related to peer effects comes from the learning behavior model. This model states that firms use information as an instrument for adopting rational decisions (Chevalier and Scharfstein, 1996). For example, financial literature of trade off indicates that there is an optimal capital structure. Thus, managers should adjust their financial variables towards this target. Nevertheless, a rational decision maker would value financial practices of their peers to make their own decisions instead of determining the optimal capital structure, which would be more complicated (Bikhchandani et al., 1992). Finally, behavioral preferences model indicates that managers act following irrational anticipations. Thus, peer effect could be used to identify anticipations of future financial situations and therefore, would be imitated (Malmendier and Tate, 2005).

Financial studies tend to omit previous theoretical arguments about the significant role of peer effects (Zaighum, 2019). Nevertheless, Leary and Roberts (2014) in a recent study, considers peers' interactions finding a positive correlation between the increase in the peers' average leverage and the increase in a firm's leverage value. Francis et al. (2016) propose an international analysis, concluding that companies in both developed and developing countries, decide their leverage values based on their peers' information. Grennan (2017) finds that managers take into consideration peers dividend policies when deciding their own firms' dividend policies. Finally, Fairhurst and Nam (2018) show that the U.S. firms that have weak external corporate governance are more prone to mimic their peers' capital structure choices.

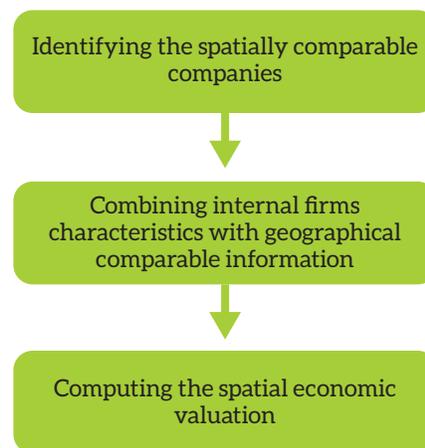
In this context, recent studies states that the geographical proximity between companies play a significant effect strengthening the peer effect in firms' financial decisions. In this sense, Maté et al. (2012) identify a spatial concentration area constituted by companies with similar values for their financial ratios. They propose a model to estimate the causal relationship of peers financial ratios on firms' financial ratios with significant results. They conclude that the impact is more intense when the distance between geographical companies is reduced. In addition, reduced size companies are more affected by this effect. Mate et al. (2017) provide a

similar analysis with a sample of industrial reduced size companies corroborating that space plays a relevant role on peer effects intensifying interactions in financial decisions between geographically close companies. The theoretical explanation of the accelerator effect of space is based on the economic arguments of transportation costs and external economies (Fujita and Thisse, 1996). On the one hand, the theory is based on the hypothesis that geographically close companies have easy access to external resources minimizing transportation costs. Therefore, geographically close companies tend to establish commercial relationships which at the end will provide additional information about the financial practices of their geographically close peers. In this sense, Selan and Kalatzis's study (2017) indicate that there is a positive and statistically significant spatial dependence between stock return from peers companies. Occhino and Mate (2019) provide evidence about the significant role of geographical proximity when financial results from commercial interrelationships are examined. On the other hand, the external economies theory states that companies' location triggers different forms of interaction between firms and between firms and their environment (Marshall, 1920). From this perspective, there are knowledge spillovers cause a flow of information between agents working in the same geographical area. Geographical proximity facilitates the formation and transmission of social capital, enhancing trust and the ability to share vital information (Karlsson et al., 2015). Managers working in the same environment normally have the opportunity to build face-to-face relationships, exchange ideas and learn from one another's experience. As a result, positive network externalities will ensue and companies will be able to learn from the failure and success of other firms sooner than they would if no direct contact between was possible (Maskell, 2001).

3. Methodology: The spatial valuation proposal

Our spatial valuation proposal is based on the steps showed in the following Figure 1.

Figure 1. Steps to estimate firms' valuation with geographical information



Source: authors.

3.1 Identifying the spatially comparable companies

The first stage of our proposal is to identify spatially comparable companies. This definition is based on the financial literature on valuation methods of multiples. In particular, on one of the most basic concepts in economics: *perfect substitutes should be sold for the same price* (Kudsen et al., 2017); Thus, the fact of identifying companies that are truly comparable (a perfect substitute) is indispensable when using multiples as a valuation technique. When the comparable companies are more similar to the firm being valued, the degree of comparability is greater, and they provide more valuable information (Eberhart, 2001). Theoretically,

using the multiple method, we could estimate the value of a firm knowing the value of its exactly identical firms (theoretically in terms of profitability, growth, and risk). Geographical speaking, Schreiner (2009) recommends, especially for Small and Medium size companies (SMEs), choosing comparable companies from the same country or region. The reasoning behind this idea is that the main competitors of small firms are typically other regional players. Furthermore, smaller firms are subject to the economic characteristics of the territory in which they operate. Following this reasoning, in order to consider spatially comparable companies, we took into account both firms' valuation similarities and geographical proximity between companies. The fact of selecting the optimum number of comparable companies is not a simple task. Benninga and Sarig (1997) state that since each firm has its own peculiarities, the peer group must consist of a large enough sample so that peculiarities can be smoothed out when estimating the peer group multiple. On the contrary, Schreiner (2009) suggests that the peer group should be composed by a number between two and ten comparable companies. Thus, there is not a general opinion about the optimal number of comparable to compute firms' valuations. In order to show additional understanding on this question, we suggested the application of a non-parametric clustering process to identify the number of comparable companies. In particular, we applied a Ward-like hierarchical clustering algorithm developed by Chavent et al. (2017).

3.2 Estimating the impact of comparable information

In order to estimate the impact of valuations' comparable companies on each company in the cluster, we proposed a spatial model which considers both firms' particular characteristics and spatially comparable firms' valuations. With this aim, we defined a $M \times M$ weight matrix W which connected comparable companies. In particular, the elements of this matrix w_{ij} valued 1 if companies i and j were comparable (they were in the same cluster) and zero otherwise. The weight matrix W was row-standardized. Based on this information, we proposed a Spatial Auroregressive (SAR) model (1) (Le Sage and Pace, 2010):

$$y = X\beta + \rho Wy + \varepsilon \quad (1)$$

The parameter ρ evaluated the peer geographical valuation effect among comparable companies. A positive and significant coefficient ρ represents the existence of significant interrelationships in these firms' valuations. X represented firms' characteristics and β the corresponding coefficients of these variables. ε evaluated the residual term normally distributed with mean zero and standard deviation (σ^2). In order to contrast the significance of the spatial model, we computed the Lagrange Multiplier (LM_LAG and LM_ERR) tests (Florax and Folmer, 1995) whose null hypotheses is the absence of peer geographical effects ($\rho = 0$).

3.3. Computing the spatial economic value

Previous model (1) provides the elasticities of each explanatory variable on firms' valuation. Thus, based on this estimation, we proposed a Spatial Economic Value (SEV) for a company i as follows (2)

$$\widehat{SEV}_i = \widehat{\beta}X_i + \frac{\widehat{\rho} [\sum_{j=1}^N EV_j]}{N} \quad (2)$$

where SEV_i is the Spatial Economic Value of the target firm i ; EV_j is the Economic Value of spatially peer comparable firms j ($j=1, \dots, N$) to the company i ; X_i represents firm i ' particular characteristics with $\widehat{\beta}$ the estimated coefficients of these variables. N is the number of spatially comparable firms of the company i ; $\widehat{\rho}$ the coefficient of the impact of the spatial peer effect for the company i .

4. Empirical Application

In order to test our proposal, we undertook an empirical application with a sample composed by industrial reduced size firms located in Madrid, Spain.

4.1. Database and sample

Firms' financial information comes from SABI database (Iberian Balance Analysis System), which offers information from the official financial registers in Spain. Based on this dataset, we selected a sample of industrial reduced size companies according with the National Classification of Economic Activities (NACE, 2009). In addition, with the aim of controlling for the correlation effect, the sample was composed by companies whose headquarter were located in Madrid, Spain. The territory of Madrid is an adequate environment for our analysis given the prominent weight of the industrial sector in this region (Official Spanish Statistical Institute, www.ine.es). After this selection process, we got a sample of 639 companies. Finally, we dropped those companies without available financial information to estimate their values or with mistakes in their financial registers (for example, companies with unbalanced balance-sheets). In addition, we selected those companies whose main activity was classified in the two digit NACE codes: 11, 18 and 25. Then, we got a sample of 360 companies with available information over the period from 2010 to 2018. Table 1 shows the sample distribution for different sizes, sectors and ages.

SIZE	Variable	Cases (%)	Definition
	Micro	250(69.44%)	Less than 10 employers
	Small	73(20.22%)	From 10 to 50 employers
	Medium	18(5%)	From 51 to 250 employers
	TOTAL	360	-
NACE codes	10	77(21.38%)	Manufacture of food products
	18	215(59.72%)	Printing and reproduction of recorded media
	25	68(18.88%)	Manufacture of fabricated metal products, except machinery and equipment
Age	Midle Age	161(44.72%)	From 5 to 24 years
	Old	199(55.27%)	More than 24 years

(¹) Small and Medium Size companies definition from the European Commission on 6 May 2003.

(²)NACE-2009 represents the Statistical classification of economic activities in the European Community (<http://ec.europa.eu/eurostat>). (³) Based on the study of Berger & Udell (1998), we defined two categories in function of firms' age: middle-aged firms and old firms. There were not available information for those companies with less than five years and therefore were eliminated from the sample.

Source: authors.

4.2 Variables

Dependent Variable: Economic valuation based on the DCF model

Many scientists consider the Discounted Cash Flow (DCF) valuation as the most accurate valuation method (Fernández, 2013; French, 2013; Dönbak and Ukav, 2016). Based on DCF, the Economic Value () was computed discounting the future free cash flows that the firm will create in the subsequent years using the weight average cost of capital as the discount rate¹.

Explanatory variables

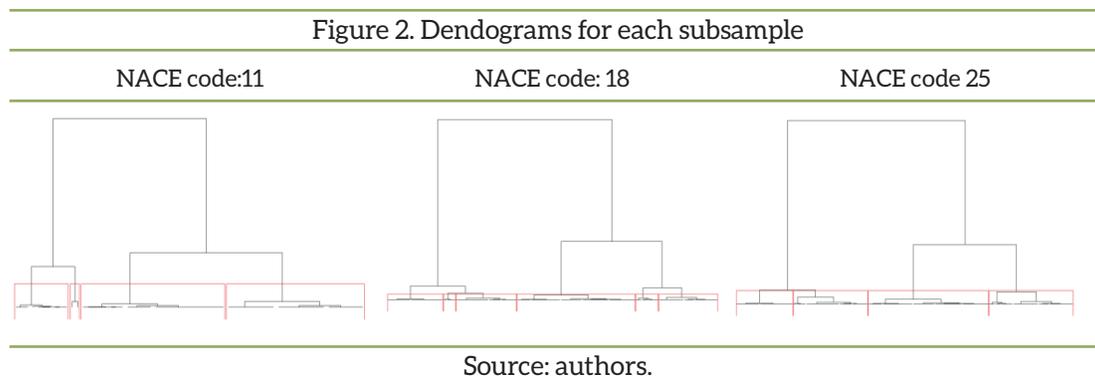
Regarding previous literature, we considered as firms characteristics the age, size and sales growth. In this sense, we find that small and young firms present informational asymmetries that make them riskier and therefore, the values of these companies should be lower (Dietsch and Petey, 2004; Chen, 2010; Mayr et al. 2017). Furthermore, empirical literature (Gill et al., 2009) argues that larger firms have more stable cash flows and more possibilities to diversify

1. See Annex for further details about the application of these methodologies

thus, is universally accepted a negative relationship between firm size and risk (Pettit and Singer, 1985). Arcuri and Levratto (2018) demonstrate that new firms have limited cash flows and low profits and rely more heavily on short-term debt finance and consequently, are most likely to be subject to financial distress. On the valuation models (especially in the DCF model) the high bankrupt's risk is reflected in a higher discount rate (WACC) influencing negatively on firms' valuations. In addition, average growth sales is included as a proxy of firms' performance where a positive relationship with values is expected (Clout and Willett, 2016). We defined the *size* (S) as the logarithm of total assets, *age* (A) as the logarithm of the number of years of the company since its constitution and *sales growth* (Sg) as the average value of sales growth over the last three years.

4.3 Step 1: Identification the spatially comparable companies

In order to identify spatially comparable companies, we applied Ward hierarchical clustering with the function `hclustgeo` from the package `ClustGeo` in R (Chavent et al., 2017). Peers' valuations and geographical proximity between the M companies in the sample are included through two dissimilarity matrices: D_0 evaluates the Euclidean distance matrix between companies' valuations and D_1 measures geographical proximity between companies. In addition, all companies in the sample i ($i = 1, \dots, M$) have similar weights. Based on this information, we included a mixing parameter $\alpha \in [0,1]$ to provide the relevance of each dissimilarity matrix to define comparable companies. In order to select the optimal α value, we followed Chavent et al. (2017) procedure which is based on the number of K clusters (K sets of comparable companies) selecting the value that best reduces the balanced losses from valuation and physical proximity homogeneities. Applied to our proposal, the parameter α should increase the homogeneity from physical proximity, given the partition in K clusters, minimizing the increase in the heterogeneity of firms' valuations in each cluster. In order to measure clusters' homogeneity pseudo within-cluster inertias are computed. In addition, the pre-selection of the optimum number K of clusters is necessary. According with Chavent et al. (2017), we represented the Dendrogram of the hierarchically-nested set of possible partitions based on firms' valuations. The following Figure 2 shows the Dendrograms for the different subsamples based on NACE codes.



This result suggests a number of peer comparable companies for different subsectors. In particular, the subsample with companies producing in the activity with NACE code 11 could be classified into five sets of comparable companies. The second subsample, corresponding with the productive activity with NACE code 18 was divided into six groups of comparable companies and the last subsample related to NACE code 25 could be separated into four groups of comparable companies. Nevertheless, these groups are defined based on firms' valuation without considering geographical proximity and, therefore, we could find some territorial dispersion in the distribution. In order to get more geographically compact clusters, we also included the matrix D_1 for considering physical distances between companies. With this purpose, we included a mixing parameter $\alpha \in [0,1]$ to increase the geographical cohesion of the companies in each cluster without reducing the homogeneity from

firms' valuations. In this sense, when $\alpha=0$ then geographical dispersion is not considered whereas when $\alpha=1$ homogeneity in firms' valuations are not considered. In order to select the adequate α , we performed an iterative procedure based on different α values given the number of K clusters for each subsample. For each value, we computed the pseudo within-cluster inertia to evaluate the homogeneity corresponding with each different group of proposed clusters. The following Figure 3 (next page) shows the graphical representation of pseudo within-cluster inertia obtained with different alpha values. In each case, we selected those alpha value which minimizes the loss of homogeneity from firms' valuation and improve homogeneity from geographical distribution homogeneity.

Figure 3.A provides a percentage equal to 93% of explained pseudo-inertia with firms' valuation distances (D_v) and geographical distances are not considered ($\alpha=0$). This proportion is reduced when geographical proximity is included ($\alpha>0$). On the opposite, the amount of pseudo-inertia when geographical distances (D_g) are exclusively considered is equal to 64% ($\alpha=1$). The balanced between the highest increasing in the homogeneity from geographical distances minimizing the dropping in the homogeneity from firms' valuations occurs when $\alpha=0.3$. At that α value, there is a loss of 10% of firms' valuation homogeneity and an increase of 56% in physical proximity homogeneity. Thus, this result suggest to select $\alpha=0.3$ to define comparable companies for the subsector with NACE code=11. Following the similar procedure, we obtained $\alpha=0.1$ for the subsample of companies producing with NACE code= 18 and $\alpha=0.5$ for defining comparable companies in the subsector with NACE codes equal to 25.

Based on this information, we test the significance of the spatial peer effect computing the spatial autorregressive Moran's I test. The null hypothesis of this test is the absence of significant spatial interactions between geographically close companies. In order to compute this statistic, we use previously defined weight matrix W . Table 2 shows these results.

Table 2. Moran's I test of spatial autocorrelation

Normalized test	NACE 11	NACE 18	NACE 25
(p-value)	13.6751***	25.2037***	8.7881***
	(0.000)	(0.000)	(0.000)

(***) significant 1% (**) significant at 5% (*) significant at 10%

Source: authors.

We found that spatial peer effect was significant in all cases. Firms' valuations of geographically close companies was significant as additional information to compute firms' valuations.

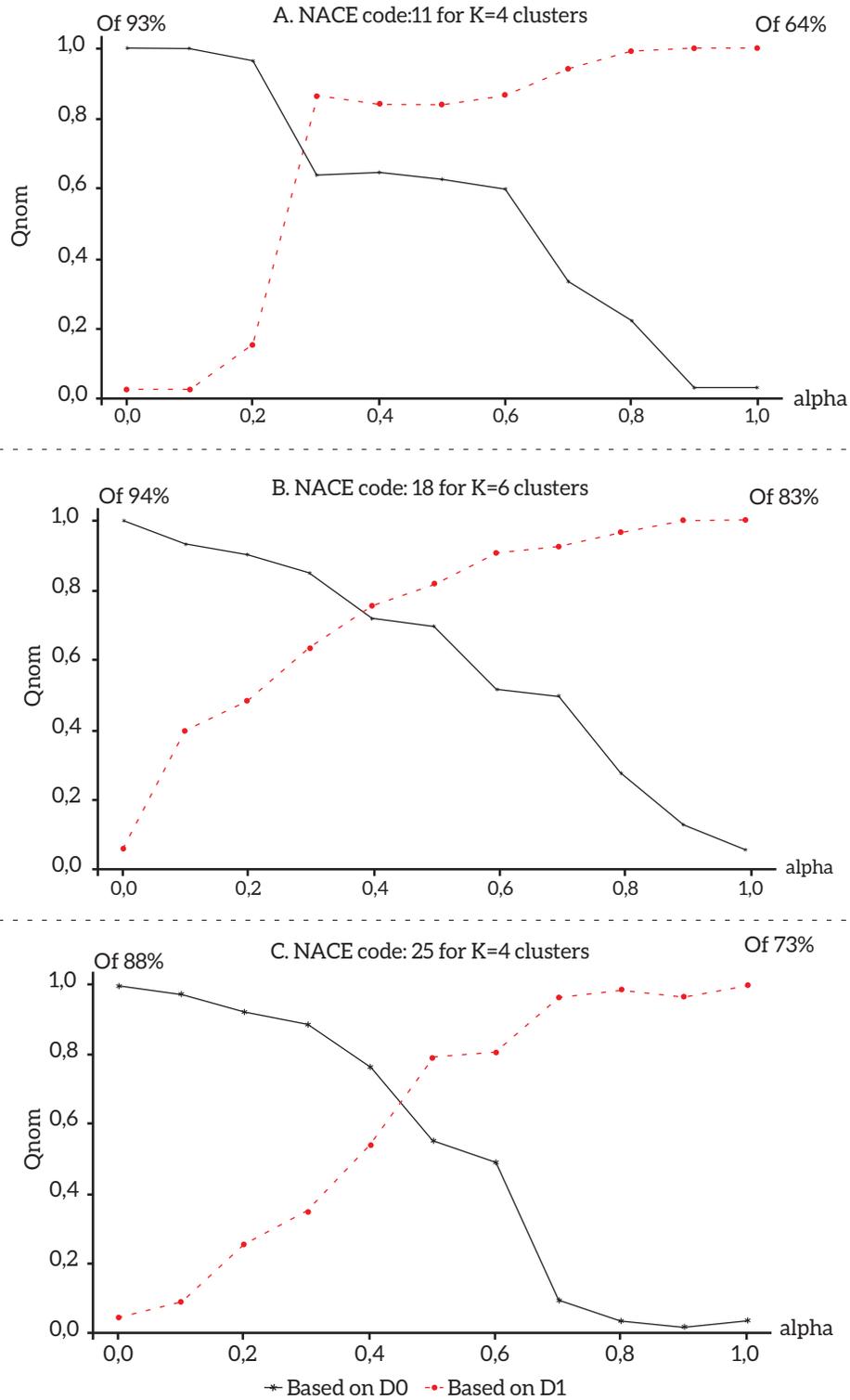
4.4 Step 2. Combining internal firms' characteristics with comparable information

Once we have identified spatial comparable companies, we proposed the estimation model (3) to evaluate elasticities of firms' particular characteristics and peers comparable valuations on firms' valuations.

$$SEV = \beta_1 S + \beta_2 A + \beta_3 Sg + \frac{\hat{\rho} [\sum_{j=1}^N EV_j]}{N} + \varepsilon \quad (3)$$

This specification is the spatial first-order autoregressive model (1) where SEV represents a ($M \times 1$) vector of the economic valuations (EV_{CAPM}). S , A and Sg represent the Size, Age and Sales Growth with β_i ($i=1,2,3$), the elasticities of each variable to changes in firms' valuations. The sensibility of spatially comparable companies is evaluated with the coefficient ρ . To estimate this model, we applied the Maximum Likelihood (ML) estimation (Elhorst, 2010). In addition, we computed Lagrange multipliers (LM-LAG and LM-ERR) tests to contrast the significance of spatial peer effects in the model. The null hypothesis of LM tests indicates absence of this effect.

Figure 3: Pseudo-within inertia values for each α value



Black lines represent the proportion of explained pseudo-within inertias from firms' valuation homogeneity whereas the red lines evaluate the percentage of explained pseudo-within inertias from physical distances between companies.

Source: authors.

LM-LAG contrasts the significant role of the spatial comparable companies in the model, whereas LM-ERR test indicates whether there is some residual spatial effect that has been omitted from this analysis. Table 4 shows the estimation results.

Table 3. Estimation results. Dependent variable: Firms' Economic Value (EV_{CAPM})			
Coefficients	NACE 10	NACE 18	NACE 25
Size	0.2465*** (0.003)	0.3005*** (0.010)	0.2717*** (0.008)
Age	0.0163** (0.017)	0.0168** (0.025)	0.0130*** (0.000)
Sales Growth	0.8129*** (0.000)	1.1425** (0.032)	1.8279** (0.043)
Spatially comparable valuation (ρ)	0.8402*** (0.000)	0.8329*** (0.000)	0.8564*** (0.000)
Post-Estimation proofs			
LM-LAG (p-value)	51.873*** (0.000)	34.217*** (0.000)	44.1889*** (0.000)
LM-ERR (p-value)	0.4320 (0.811)	1.6689 (0.317)	0.2389 (0.865)
Wald statistic (p-value)	12.9181** (0.037)	17.7681*** (0.000)	11.2709* (0.059)
Log likelihood	-152.27	-348.5271	-126.763
RMSE-out of sample	0.3020	0.6289	0.9699
Corr VDam, EBITDA	0.9391	0.9261	0.9501
RMSE VE	2.7784	3.2355	3.2985
(***) significant 1% (**) significant at 5% (*) significant at 10%			
Source: authors.			

In all the cases, we obtained significant values for the spatially comparable firms' valuations coefficients (ρ) in all subsectors. In addition, we found a positive and significant sign for the explanatory variables representative of Size, Age and Sales Growth. This was expected according to the previous literature (Arcuri and Levratto, 2018). About, the LM tests: the LM-LAG test was positive and significant confirming the existence of significant spatial interrelations in firms' valuations of spatially comparable companies. In addition, the LM-ERR was not significant and therefore, there is not any residual spatial structure omitted in the model.

4.5 Computing the spatial economic valuation from previous results

From the coefficients of the Table 4, we could estimate the value of a company without temporal information located in the same territory and whose main activity corresponds with any of the analysed subsamples. Thus, by combining the spatial peers and firms' information we are able to estimate the value of any company. In particular, for a company i , in the subsector 10, we would apply the following equation (4) to obtain the spatial-firm economic value (SEV).

$$\widehat{SEV}_i = 0.2465 \cdot (\widehat{SG}_i) + 0.0163 \cdot \widehat{A}_i + 0.8129 \cdot \widehat{S}_i + 0.8402 \cdot \sum_{j=1}^N \frac{\widehat{EV}_j}{N} \quad (4)$$

4.6 Analysing the adjustment of the SEV proposal: Out of sample test

In order to evaluate the goodness of adjustment of our proposal, we undertook an out of sample test. In particular, we considered an iterative procedure in which one of the companies i in the

analysed subsample is extracted from the sample in each interaction. Then, we re-estimate the parameters of the SEV proposal (3) and compute its value. Once we got all firms' SEV through this procedure then we computed the root-mean-square error (RMSE²) to evaluate the differences between predicted values with our proposal and the values estimated by DFC method. An RMSE value of 0 would represent a perfect adjustment between predicted and observed data. Thus, a lower RMSE indicates a better fit. Table 4 shows these results.

Table 4. RMSE of out of sample test

	N	RMSE
NACE 10	77	0.0188
NACE 18	218	0.7078
NACE 25	68	0.0152

Source: authors.

These results shows good results for the goodness of adjustment of our proposal with the exception of the subsample of companies with NACE 18. In particular, this subsample is composed by the largest number of companies. Thus, these result could be motivated by the wider heterogeneity of this subsample and therefore, the complexity of defining homogeneous clusters in this subsample. Nevertheless, further analysis should be considered in order to determine the number of spatially comparable companies when large subsamples of companies are examined to control for firms' heterogeneity.

4.7 Approaching a spatial valuation through available peers information

Given the difficulties to know the values of the spatially comparable firms, we proposed an alternative version to find the Spatial Economic Value of a company i where the average value of the valuations of spatially comparable companies (EV_j) is substituted by the average value of $EBITDA_j$ (Earnings Before Interests, Taxes, Depreciations and Amortizations) for these spatially comparable companies. Previous literature support this result. In this sense, Kaplan and Ruback (1995) compare the valuation performance of DCF against relative valuation. They conclude that both DCF valuation and EBITDA supply similar estimations. Kantšukov and Sander (2016) demonstrate that $EV/EBITDA$ multiples are the most popular valuation methods among analysts. Vidal-Garcia and Ribal (2019) argue that the stock market $EV/EBITDA$ multiple may be used to determine the terminal value (the most consistent part of the firm's value) in the valuation process of unlisted small and medium-sized food companies in Spain. Another studies (Fernandez, 2017) state that the most used multiples are the Price-Earnings (PER) and the Enterprise Value-EBITDA ($EV/EBITDA$). At this regard, some authors (Koller et al., 2010) have expressed a preference for the second one, since PER is highly affected by the capital structure and is based on earnings, which can be easily manipulated. Thus, applying this alternative procedure, the spatial valuation proposal present the following specification (5):

$$SEV_i = \alpha_1 SG_i + \alpha_2 A_i + \alpha_3 S_i + \alpha_4 \left(\sum_{j=1}^N \frac{EBITDA_j}{N} \right) \quad (5)$$

In order to provide additional consistency to this approach (5), we computed correlation coefficients between average value of the valuations of spatially comparable companies applying DCF and the average value applying EBITDA. These values were above 95%. Furthermore, out of sample tests perform similar as when we applied (4). Therefore, according with this results a good approach of firms' values could be proposed with firms' characteristics and spatially comparable information.

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2. The RMSE is computed as the square root of the quadratic mean of the difference between predicted and observed values.

5. Discussion and conclusions

The aim of this study were to propose a method to estimate firms' economic valuations that have short term temporal histories of available data or for reduced size companies that present simplified financial statements. In contrast with previous studies, we considered both firms' internal characteristics and geographical information. This procedure is based on the financial hypothesis that financial practices between reduced size peer companies tend to present certain similarities. We tested our proposal finding good results. In this sense, we tested that companies in the analysed sectors tend to have similar values when grouped in small areas; consequently, it is possible to use the EVs of peer firms as a reference in order to value a company without possessing all the necessary information. Based on previous literature, we combine external information with firm's intrinsic characteristics (age, size and sales growth). This spatial proposal is based on the vast literature on multiple methods, which recommends extrapolating information using a group of similar companies as a reference (Eberhart, 2001). It is based on the implicit assumption that identical firms should have identical value. For SMEs, in order to obtain a more precise estimation, it is advisable to consider firms in the same sector and same region given that small firms are heavily dependent on the economic situation in which they operate (Schreiner, 2009). Our test provided a positive result, and want give an ulterior input on the analysis of the key value drivers for SMEs valuations. The aim of the study is to open up a new field for further investigation. Using this spatial perspective, would be possible to obtain valuations for new SMEs characterized by the lack of available data. Our results provided good adjustments for those subsamples composed by a reduce number of companies whereas the adjustmet was weaker for those subsample with a larger number of companies. This result could be motivated by the higher firms' hereterogeneity for this group. Thus, further research could analyse this aspect in order to solve this particular issue. Moreover, the present study is first step so need to be tested in other scenarios and subsectors.

6. Appendix

Many scientists consider the Discounted Cash Flow (DCF) valuation as the most accurate valuation method (Fernández, 2013; French, 2013; Dönbak and Ukav, 2016). Based on DCF, the Economic Value (EV) is computed discounting the future free cash flows (FFCF) that the firm will create in the subsequent years using a discount rate (k). k is usually assumed to be the weight average cost of capital (WACC). Thus, the EV for each company for the year t is calculated as in (A.1):

$$EV_t = \sum_{i=1+t}^l \frac{FFCF}{(1+k)^t} + \frac{RV}{(1+k)^l} \quad (\text{A.1})$$

This is a two-step method. In the first step the earning of the next five years (Damodaran, 2002) have to be estimated and discounted at the valuation year. In the second step a Residual Value have to be computed. This happen because a firm have an infinite life and forecast valuations should be calculated for the same period. It is obviously difficult and therefore, we need to limit the period of valuation by targeting a particular year that is why Residual Value, which is the last value in the last year were targeted. This value is usually a very important part of the total value; thus, its estimation is a key activity in the valuation process (Esteban, 2018). Residual Value was determined applying the Gordon model that assumes that FCF will grow at a constant rate (g) after the estimation period (A.2) (Copeland et al., 2010):

$$RV = FCF_{t+1} \frac{(1+g)}{(k-g)} \quad (\text{A.2})$$

This work estimated (A.2) after the projection period there will be a 1.5% of growth. In order to estimate the free cash flow (FCF) (A.3) we used the one most widely formula used in the business environment (Damodaran, 2007; Fernandez, 2013).

$$FCF = EBIT(1 - t) + D\&A + Imp - \Delta WC - I \quad (A.3)$$

Where *EBIT* is the earnings before interests and taxes, *D&A* represents the depreciation and amortization, *Imp* represents impairments, ΔWC evaluates the changes in working capital, and *I* measures the investments in non-current assets. In order to estimate *FFCF* for the next five years (2017-2022) we had to assume the evolution of the main components of *FCF*. In this regard, we followed the traditional literature (Alekneviene et al., 2013) fitting a linear regression based on data on each company's historical sales and extrapolating future sales based on the linear model fitted. Once future sales were estimated, we projected the rest of the components of *FCF* assuming the mean of the ratios among each *FCF* component and the historical sales remain constant (Gentry & Reilly, 2007). The *FCF* are discounted by using the *WACC*, (A.4)

$$WACC = K_e \frac{E}{(E + D)} + K_d(1 - t) \frac{D}{(E + D)} \quad (A.4)$$

The cost of debt is calculated as an approximation using the financial expenses and the current debt of the company, (A.5).

$$K_d = \frac{FE}{D} \quad (A.5)$$

The capital structure is taken from the company's books given that many studies use the book value of debt and equity in order to estimate the capital structure in a DCF method (Woolley; 2009).

One of the main problems in business valuation when we apply the DCF Model is how to include risk from the uncertainty associated with future cash flows (CFs) (Cañadas and Rojo; 2011). Usually risk is included in the discount rate (k_e) and represent the risk assumed by the company. This method is known as "discount rate method with risk" or "traditional approach." According to Bruner et al. (1998) and Graham and Harvey (2001), the most commonly used method in practice to estimate the risk for an investor is the CAPM (Sharpe 1964). Following the traditional literature, discount rate of a firm (k_e) is the sum of the risk-free rate (R_f) and the risk premium (P_M) given to the difference between the R_f and the sectorial premium rate (R_m) (A.6).

$$k_e = R_f + \beta_i(R_m - R_f) \quad (A.6)$$

The individual beta of each company is obtained by unlevering each food firm beta using the Modigliani and Miller's (1958) beta formula (Vidal and Sanchis; 2017). The unlevered beta, in the valuation of privately-held firms, is usually estimate using the formula, Eq. (A.7) (Petersen et al.; 2006).

$$\beta_u = \frac{\beta_t}{[1 + (1 - t) \frac{D}{E}]} \quad (A.7)$$

Then, industry beta is levered by using the capital structure of the individual company, following Eq. (A.8).

$$\beta_l = [1 + (1 - t) \frac{D}{E}] \beta_u \quad (A.8)$$

It is possible to get the necessary information from Damodaran's webpage which provides market risk premiums by industries and countries. However, we found different specifications

from this model in order to face particular characteristics of non-listed firms. In this sense, an interesting specification is proposed by Rojo and García (2005, 2006). The difference between Rojo and García (2005, 2006)'s approach and that commonly used based on the Capital Asset Pricing Model (CAPM) is the addition of a specific risk premium in order to take into account the higher risk faced by non-listed companies when compared to their listed counterparts (Occhino and Maté, 2017). Rojo and García (2005, 2006) compute the k_e adding a specific risk P_e . The argumentation to this proposal is that the valuation of privately-held firms often involves investors who are not well-diversified. Thus, an investor that cannot diversify his investment need to have a higher premium risk that reflect also the specific risk of the firm (Rojo, 2013).

$$k_e = R_f + P_M + P_e \quad (\text{A.9})$$

Rojo- Ramírez et al. (2011) demonstrated that P_e can be calculated how showed in eq (A.10):

$$P_e = P_M \frac{\sigma_e}{\sigma_M} \quad (\text{A.10})$$

Where σ_e is the standard deviation of the profitability of the company and σ_M is the standard deviation of the profitability of market. Finally, we determined the RV by applying the Gordon model that assumes that FCF will grow at a constant rate (g) after the estimation period.

6. References

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