

Assessing and measuring the equity gap and the equity requirements for innovative SMEs

Valeria Venturelli and Elisabetta Gualandri

The attempts to quantify the scale of the equity gap at the international level have been limited by availability data. As a result, they have tended to be largely qualitative pointing to anecdotal conclusions. This paper sets out to critically review the different approaches developed for the assessment and measurement of the equity gap for firms, mainly innovative SMEs, extending the quantitative approaches for equity gap developing a demand-side model that allows to predict the future demand for equity in precise terms. Through the application of the model to a sample of Italian firms, we find that the amount of equity needed is on average tiny (147.3 K euro). One important new finding to emerge from the application of the estimation model is the direct, statistically significant relationship between additional equity requirement per unit of sales and the firm's size category and age; on the other hand, no significant differences were found with regard to firms' degrees of innovation.

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1. Introduction

This paper sets out to investigate the problem of assessing and measuring the equity gap for innovative SMEs. The contribution to the current debate is the development of an original demand-side model that allows to predict the future demand for equity (so-called equity requirement) in precise terms. Various authors (Berger and Udell, 1998) have reported that, due to market failures, equity is the form of finance best suited to providing the entrepreneur with the additional resources needed for the development of the innovative project. In continental Europe, the relative backwardness of financial systems (Rajan and Zingales, 2001; European Commission, 1998 and 2003b) aggravates the structural difficulties faced by SMEs in obtaining access to finance amplifying the problems related to the availability of equity. This contributes to create a lack of resources available for equity investments, known as the equity gap.

During the last few years there have been various attempts, at the international level, to estimate whether an equity gap exists, and if so to assess its significance. However, there is still a great deal of uncertainty with regard to the method to be used for estimating the phenomenon. Most of the approaches developed focus on the equity supply side, although the demand-side analysis which is currently the least used, it is the most interesting from the methodological point of view.

Dr. Valeria Venturelli, venturelli.valeria@unimore.it, University of Modena and Reggio Emilia and CEFIN – Centro Studi Banca e Finanza www.cefin.unimore.it
Prof. Elisabetta Gualandri, gualandri.elisabetta@unimore.it, University of Modena and Reggio Emilia and CEFIN – Centro Studi Banca e Finanza www.cefin.unimore.it

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Our intention here is to pursue the demand-side quantitative approach, with the main aim of measuring the future demand for equity on the part of firms, with a particular focus on firms in innovative sectors.

The paper consists of 4 sections. The first surveys the theoretical literature on the financial constraints limiting SMEs' growth and the main methods used and the thresholds identified in international studies on the equity gap. In the second part, we show the methodology used in order to compute the additional equity requirements. In section three, we study firms in Italy's Emilia Romagna region to identify the causes which generate financial needs to be covered by equity, and estimate the absolute and relative size of the investment required. Finally, the main conclusions of the study are presented.

2. Literature Review

Several authors have underlined the problem of access to finance for SMEs (Beck and Demirguc-Kunt, 2006) with a particular focus on firms in innovative sectors (Hall B. H., 2002 and 2005). Traditionally (Bank of England, 2001), the process which leads from the birth of an innovative idea to the sale of the relative product on an industrial scale consists of four main stages, which differ substantially in their relative levels of financial needs. In particular, for innovative firms debt capital financing is particularly difficult. The high operational and financial risks, the lack of a track record, their inability to offer guarantees, and the significant degree of moral hazard, all mean that, once we have accepted that capital markets are not perfect, innovative firms require different forms of finance to fund their innovation in the different stages of their life-cycles. According to the financial growth cycle (Berger and Udell, 1998) when an innovative idea is conceived the financial constraints are very tight, driving the entrepreneur to use informal sources of capital (his own and/or his relatives' savings, or equity provided by business angels). In the start-up phase, the moral hazard problem is particularly acute, and equity becomes necessary. Once the critical start-up and growth stages have passed and firms have achieved stability, they tend to diversify their sources of finance.

As a consequence, the role played by venture capital operators during the initial stages of the firm's growth cycle is crucial. However, some features of venture capital imply that it is not always suitable for financing any kind of investments. For example, it cannot be of assistance to investment schemes still in the embryonic (seed) stage, or on a too small economic scale. This problem, known as the small ticket problem (Berger and Udell, 1998 and Petrella, 2001), can be overcome through the involvement of business angels, who are willing to invest smaller amounts in projects still in the seed stage.

However, situations may arise in which the financial requirement is too small to be economically viable for venture capital operators, but too large for business angels to cover; this is the situation known as the equity gap, in which there is a shortage of equity investment during the initial stages of the firm's life-cycle. The term equity gap, as the broader concept of financing gap, describes a situation in which, due to market failures, deserving companies do not receive the volume of financing to which they would be entitled in an efficient market (European Commission, 2005).

Three approaches can be identified in order to ascertain whether such a gap exists¹. A first type of survey identifies the characteristics of the equity gap in a specific national context

by monitoring the distribution and the characteristics of private equity investments². A second survey method makes a qualitative analysis by means of interviews/questionnaires targeting experts on the supply side and/or on the demand side of the phenomenon³. The findings of these types of studies tend to be affected by the composition of the panel/sample, which may fatally influence replies and the resulting degree of representativeness, as well as by anecdotal convictions⁴. One third procedure, the least widely used at present but definitely the most interesting in methodology terms, concerns a quantitative approach, using empirical analyses of demand-side data sets. In our knowledge, the only study partially centred on this approach is the one developed by Harding and Cowling (2006). The investigation is based on both a qualitative analyses, with semi-structured interviews with experts in the sector, and an estimate of the demand-side equity gap starting from the 2003 GEM (Global Entrepreneurship Monitor) qualitative survey.

In terms of thresholds identified, the scenario studied in greatest depth is that of the United Kingdom, where a number of surveys in the early years of this century identified equity gaps for SMEs of between £250,000 and £1.5 million⁵. The European Commission also indirectly identifies intervals which are proxies for the equity gap. The authorisation for measures to assist in the provision of equity requires proof of market failures identified a priori as thresholds varying in amount depending on the type of area involved, less than 500,000 euro, 750,000 euro or one million euro as the case may be (European Commission, 2001b).

3. Methodology and Research Design

This study develops a quantitative approach, with the main aim not of producing a precise calculation of the equity gap, but of measuring the future equity requirement of the firms. We identify the underlying causes of an equity requirement, with the ultimate purpose of comparing the results with the thresholds reported in the main studies on the equity gap.

A firm's growth, measured by means of the rise in its turnover within a specific period, generates an increasing need for financing which will be covered partly by self-financing and current debts, and partly from external sources, consisting of equity and loan capital. The models generally adopted in empirical studies (Canovi, Grasso and Venturelli, 2007) differ in terms of the hypothesis adopted with regard to the role of financial debt; here, the model is based on the assumption of the maintenance of a constant ratio between financial debt and equity.

The equity requirement at constant leverage (FE_{LC}) is estimated as the amount outstanding after deduction of the amounts covered by the other forms of finance. It is assumed that the additional financial requirement generated by the growth in sales (FA) may be covered by self-financing (CA), an increase in current indebtedness (CDC) and the growth in financial indebtedness, provided the leverage (financial debt/equity) remains stable. Moreover, assuming that no significant changes in capital intensity, in the margin of self-financing and in the current indebtedness as a proportion of sales are expected, the following equations apply:

$$FA = X \cdot V_{t-1} \cdot K$$

X = Expected rate of growth in sales

V_{t-1} = Sales for the period previous to the one being analysed

K = Total assets/Sales = Capital intensity

$$\mathbf{CDC} = X \cdot V_{t-1} \cdot D_c$$

D_c = Current debts/Sales

$$\mathbf{CA} = X \cdot V_{t-1} \cdot A$$

A = Self-financing⁶/Sales

In order to measure the amount covered by new financial debts, two values have to be obtained. The first (CDF_1) derives from the fact that, since self-financing produces an increase in the firm's equity capital, financial debts increase by an amount equal to self-financing multiplied by leverage, without any change in the latter. Analytically:

$$\mathbf{CDF}_1 = \frac{D_f}{E} \cdot X \cdot V_{t-1} \cdot A$$

If the additional financing required exceeds the sources analysed so far (self-financing, current debts, first component of financial indebtedness), there is a shortfall that cannot be financed only by means of equity, since in this case the leverage ratio would fall. The part covered by additional new debts – in compliance with the constant leverage constraint – provides the second component of the growth in financial indebtedness (CDF_2) and is equal to:

$$\mathbf{CDF}_2 = X \cdot V_{t-1} \cdot \left[K - D_c - A \cdot \left(1 + \frac{D_f}{E} \right) \right] \cdot \frac{\frac{D_f}{E}}{1 + \frac{D_f}{E}}$$

The total coverage provided by financial indebtedness (CDF) is therefore the sum of the two components. The equation can be reduced to:

$$\mathbf{CDF} = \frac{X \cdot V_{t-1} \cdot \frac{D_f}{E} \cdot (K - D_c)}{1 + \frac{D_f}{E}}$$

Finally, the equity requirement at constant leverage (FE_{LC}) is obtained from subtracting all the forms of coverage examined so far from the additional financing requirement.

$$\mathbf{FE}_{LC} = X \cdot V_{t-1} \cdot \left[K - D_c - A \cdot \left(1 + \frac{D_f}{E} \right) \right] \cdot \frac{1}{1 + \frac{D_f}{E}}$$

4. Discussion of Findings

The sample studied was limited to companies having registered office in the Emilia Romagna region, operating in the manufacturing sector and in the service sector. The model is tested on SMEs located in Emilia Romagna region since these firms can be considered an adequate proxy of an "average" Italian SMEs; moreover the financial supply in this region is similar to the one in the rest of the country. The analysis was conducted only on share capital companies⁷ in a growth stage⁸ with financial statement data available in the period 2003-2005. A number of methodological decisions were then taken in order to obtain a sample in line with the purposes of the study. First of all, the analysis was restricted to SMEs only, meaning that large firms (i.e. those with 2005 sales in excess of 50 million euro) were excluded from the sample⁹. Moreover, constraints were set with reference to the size of the current debt/sales ratio (less than 100% in terms of annual average during 2003/2005) and the leverage ratio D_f/E (positive, but less than 10 in the

same period). The application of these selection criteria enabled us to identify a sample of 4508 firms of which almost 14% consists of high tech firms¹⁰.

Application of the Model allows identification of the causes which generate financial needs to be covered by equity, and estimation of the absolute and relative size of the investment required. In general, the average growth rate in sales of the firms in the sample is 13.8% (Tab. 1).

Tab. 1 – Model Inputs (annual average per firm 2003-2005)

	Mean	Median	Standard Dev.	Minimum	Maximum
Number			4508		
X - Rate of growth in sales (%)	13.8	9.8	13.7	0.0	98.6
A - Self-financing margin (%)	5.5	4.2	5.4	- 44.2	45.4
K - Capital intensity	0.79	0.74	0.30	0.10	3.63
D _c - Current debts/Sales (%)	44.0	39.8	19.1	5.2	100.0
D _f /E - Financial debts/Equity	0.76	0.00	1.66	0.00	5.2

Source: processing of AIDA Database data

The average annual self-financing margin for the three-year period is 5.5% (Tab. 1); overall the self-financing margins are not particularly high, and thus the resources generated by the company's own operations cannot be the main means of providing the financing needed¹¹.

The capital intensity value does not lead to the identification of any "capital intensive" firms, in line with the production organisation typical of the Emilia Romagna region.

The role of current debt is particularly important: on average, operating debt provides financial coverage for 44% of sales. This source of financing, already highly significant for the sample on average, is especially significant for micro and small enterprises less than five years old; therefore, as a company's size and age increase, the extent of its use of current debt decreases.

The leverage is fairly low (0.76), although the range is wide. In relative terms, the lowest indebtedness ratio is found in young firms and micro-enterprises. Overall, the sample group seem not to make particularly aggressive use of leverage, also testified by a median value of the ratio equal to zero; therefore, the firms studied should not find it too difficult to increase their level of financial indebtedness, especially within the limit needed to keep their leverage constant, as envisaged by the model.

Assuming a constant indebtedness ratio, the additional need for financing generated by the growth in sales is covered (Tab. 2), on average, by self financing (7.1%), by increasing current debts (59.5%), by new financial indebtedness (10.7%) and for the remainder (22.8%) by equity.

Tab. 2 – Application of the FE_{LC} Model (average per firm)

	Mean	Median	Standard Dev.	Min	Max
CA/FA - (%)	7.1	5.8	6.4	-52.1	60.1
CDC/FA - (%)	59.5	60.2	22.5	6.8	131.5
CDF/FA - (%)	10.7	0.0	17.3	0.0	74.7
FE _{LC} /FA - (%)	22.8	18.8	17.6	-28.2	87.2
CDF/XV _{t-1} - (%)	9.9	0.0	19.4	0.0	246.9
FE _{LC} /XV _{t-1} - (%)	19.1	13.3	19.3	-13.4	140.3
FE _{LC} - (000 Euros)	147.3	34.5	403.8	-207.5	9031.7

CA: Self-financing; **CDC:** Current Debt; **CDF:** Financial debt requirement; **FE_{LC}:** Equity requirement; **FA:** Additional financing requirement; **XV_{t-1}:** Expected variation in sales

Source: processing of AIDA Database data

The results once again confirm the essential role of current debt. It should be underlined that this form of cover is often ignored, with a few exceptions (Biais and Gollier, 1997), in theoretical studies, and is thus not picked up by analyses which focus on the relationship between equity and financial debt.

When we look at the ratio between equity capital requirement and expected sales (on average 19.1%) we find a direct relationship with the enterprise's size and age (Tab. 3). The results of the financial indebtedness are coherent with the size of the leverage – smaller for micro-enterprises (0.4) and higher for medium-sized firms (1.7) – on the one hand, while those related to the equity requirement are consistent with the current debt ratio, higher for micro-enterprises (47.2%) and lower for medium-sized firms (33.7%). Concerning the age, the direct relationship with additional equity requirement for unit of marginal sale is consistent with the degree of coverage offered by current debt; higher for younger enterprises (49.8%) than for more consolidated ones (40.7% for firms established by more than 10 years).

Moreover, manufacturing firms have a higher equity requirement than service firms; while the degree of innovation does not provide a statistical significant basis for a distinction between firms with different equity requirements.

Tab. 3 – The segmentation of the significant variables (average per firm)

	CA/FA - (%)	CDC/FA - (%)	CDF/FA - (%)	FE _{LC} /FA - (%)	CDF/XV _{t-1} - (%)	FE _{LC} /XV _{t-1} - (%)	FE _{LC} - (000 Euros)
Size							
Micro	7.3	65.6***	4.7***	22.4	4.2***	17.6***	28.0***
Small	7.0	60.7***	9.6***	22.7	8.7***	19.3	109.0***
Medium-sized	7.0	42.5***	26.7***	23.7	25.9***	21.8***	521.2***
Age of firm							
≤ 5 years	6.6	71.8***	6.8***	14.8***	6.2***	11.3***	128.8
Between 5 and 10 years	7.2	64.8***	8.4***	19.7***	7.4***	15.8***	106.5***
> 10 years	7.1	52.4***	13.4***	27.0***	12.8***	23.6***	185.6***
Degree of innovation							
High-Tech	7.8***	56.9***	10.6	24.7***	9.9	20.1	165.1
Non High-Tech	7.0	59.9	10.7	22.5	9.9	19.0	144.5
Business sector							
Manufacturing	6.9*	58.3***	11.8***	22.9	11.2***	19.8***	157.3
Services	7.6**	63.8***	6.4***	22.2	5.4***	16.7***	111.4***

CA: Self-financing; **CDC:** Current Debt; **CDF:** Financial debt requirement; **FE_{LC}:** Equity requirement; **FA:** Additional financing requirement; **XV_{t-1}:** Expected variation in sales

Source: processing of AIDA Database data

The Test T was calculated for every single group in relation to the overall average of the sample. H₀: Average = sample overall average. Statistical significance at the level of 10%, 5% and 1% indicated respectively by symbols *, **, and ***

With regard to the equity requirement expressed in monetary terms, the aggregate value of 147.3 thousand euros for the entire sample conceals a high degree of variation: the range is from a value of 28.0 thousand euros for micro-enterprises to 521.2 thousand euros for medium-sized firms, confirming that the equity requirement is correlated to business size, as expected.

5. Conclusion

The findings in the literature and economic policy publications report that innovative firms are fundamental to economic growth, but suffer from major barriers to access to external financing due to the imperfections of the capital markets and their own intrinsic characteristics. These factors encourage the use of equity as the form of financing best suited to support innovative projects. It is therefore particularly useful to estimate the potential need for equity of SMEs in order to ascertain whether they are affected by an equity gap.

During the last few years there have been various attempts, at the international level, to estimate whether an equity gap exists, and if so to assess its significance. However, there is still a great deal of uncertainty with regard to the method to be used for estimating the phenomenon. Most of the approaches developed focus on the equity supply side, although there have been a few attempts, still in the minority but potentially amongst the most interesting, to analyse the problem from the demand side with the aid of a quantitative approach.

This study adopts the quantitative approach, with the main aim not of producing a precise calculation of the equity gap, but of measuring the future equity requirement of the firms. We identify the underlying causes of an equity requirement, with the ultimate purpose of comparing the results with the thresholds reported in the main studies on the equity gap.

To achieve this, a sample of 4508 growing SMEs with registered office in the Emilia Romagna region was selected. An observation of the values used as input for the estimation model leads to the conclusion, first and foremost, that overall, investments per unit of sales are low, secondly, that the role of self-financing in fuelling growth is absolutely marginal, and thirdly, that it is essential for firms to be able to transfer a major proportion of their financing requirement to other non-financial enterprises. Assuming a constant indebtedness ratio throughout the period surveyed, for the sample as a whole, the additional need for financing generated by the growth in sales is covered, on average, by self financing (7.1%), by increasing current debts (59.5%), by new financial indebtedness (10.7%) and by new equity (22.8%).

One important new finding to emerge from the application of the estimation model is the direct, statistically significant relationship between additional equity requirement per unit of sales and the firm's size category and age; on the other hand, no significant differences were found with regard to firms' degrees of innovation.

The results of this study vary somewhat from the pointers given by current theory, according to which small, new, innovative enterprises should be the ones to make extensive, if not prevalent, use of equity as a source of financing. Our findings, which underline the importance of this source of financing for the firms which are most consolidated in terms of age and size class, do not however contradict the literature on the subject. It is important to remember that we explicitly considered the role of current debt, which appears to be important in general but especially so for micro-enterprises and for young firms, which are also the types of companies which show the lowest need for equity; the inclusion of this variable, not always considered in the literature, is essential if firms' financial problems are to be interpreted correctly.

Finally, the study estimates the equity requirement in monetary terms. It appears to be relatively low in all contexts and in the various sub-groups identified. Overall, assuming a constant indebtedness ratio, the equity requirement is assessed at 147.3 thousand Euros. As underlined on several occasions, although these values are not a specific estimate of the equity gap, overall the amount of equity required is in line with the thresholds identified by the main international studies, which could indirectly confirm the problem of a gap in the availability of risk capital.

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¹ See H. M. Treasury-SBS, 2003a; Harding R., 2002; Harding R., Cowling M., 2006; European Commission 2005, OECD 2006a

² See H. M. Treasury-SBS 2003a, OECD 2006a

³ See Harding R.2002; Harding R., Cowling M. 2006, H. M: Treasury-SBS, 2003a and 2003b, OECD, 2006a

⁴ See H. M. Treasury-SBS, 2003b; Harding and Cowling, 2006

⁵ See Harding R. 2002; Mason C. M., Harrison R. T., 2003; H. M. Treasury-SBS, 2003b

⁶ Self-financing = Net revenue + Amortisations – Profits distributed

⁷ All companies not registered as limited liability companies, single-shareholder limited liability companies and joint-stock companies were excluded

⁸ This implied the exclusion from the sample only of companies with negative growth in sales, while also requiring an average annual rate of growth in sales for the period of reference (2003-2005) not exceeding 100%

⁹ See European Commission, 2003a. In detail, companies with sales below the 2 million Euro threshold are defined as micro-enterprises and those between 2 and 10 million Euro as small enterprises, while medium-sized enterprises are defined as those having sales volumes between 10 and 50 million Euro

¹⁰ See Cavallo C., Lazzeroni M., Patrono A., Piccaluga A., 2002. In the intermediate industry and services census, a distinction is made between the high-tech sector with high technology content, the high-tech manufacturing sector with medium technology content, high-tech service sectors with high technology content and high-tech service sectors with medium technology content. In terms of classification of economic activities, the high tech manufacturing sector with high technology content corresponds to the following codes: 24.4 (Manufacture of pharmaceutical, medicinal chemicals and botanical products); 30 (Manufacture of office machinery and computers); 32 (Manufacture of radio, television and communication equipment and apparatus); 33 (Manufacture of medical, precision and optical instruments, watches and clocks); 35.3 (Manufacture of aircraft and spacecraft). The high tech service sectors with high technology content are the following: 72.2 (Software consultancy and supply); 72.60 (Other computer related activities); 73.1 (Research and experimental development on natural sciences and engineering)

¹¹ It should also be borne in mind that the self-financing margin was calculated without taking into consideration any distribution of profits. Although not particularly important for firms of this kind, this hypothesis should still be considered, because the distribution of profits would imply even lower self-financing margins than those recorded here