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Performance and size: empirical evidence from Portuguese SMEs

Zélia Silva Serrasqueiro · Paulo Maçãs Nunes

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Abstract This article studies the relationship between company size and performance for small and medium-sized Portuguese companies. Using dynamic panel estimators, we conclude that performance is related positively to size. This relationship suggests the greater relevance of scale effects, diversification and the greater ability of larger companies to cope with market changes. Furthermore, our empirical results show that performance is persistent, not showing discontinuity, suggesting that small and medium-sized Portuguese companies are relatively successful in coping with possible scenarios of aggressive competition. Debt and level of fixed assets influence performance negatively, and separation of management and ownership influence performance positively. Liquidity, risk and ownership control are not relevant in explaining the performance of small and medium-sized Portuguese companies.

Keywords Dynamic estimators · Performance · Size · Small and medium-sized companies

Jel Classifications G31 · G32 · L26

Z. S. Serrasqueiro (✉) · P. Maçãs Nunes
Management and Economics Department, Beira Interior University, Pólo IV, Estrada do Sineiro, Covilhã 6200-209, Portugal
e-mail: zelia@ubi.pt

Z. S. Serrasqueiro · P. Maçãs Nunes
CEFAGE Research Center, Évora University, Évora, Portugal

1 Introduction

For researchers in the fields of finance and accounting, industrial economics and strategic management, size is considered to be a fundamental variable in explaining company performance. The conclusions of various studies indicate that the relationship between company size and performance can be positive or negative.

Greater company size can allow greater strategic diversification. Larger companies have a greater possibility of taking advantage of scale economies and greater possibility of renegotiating with clients and suppliers. Furthermore, larger companies have a greater ability to face competition, keeping prices above the competitive level. These factors conjointly may contribute to the positive influence of size on performance (Fiegenbaum and Karnani 1991).

However, increased size can also contribute to diminished company performance. Greater size can imply a greater need for formality in the relationships among the various agents participating in the company activity, meaning the possibility of less control of management action by owners (Pi and Timme 1993; Goddard et al. 2005).

In the context of deregulation initiated in the European Union in the field of the labour and goods and services markets, the study of the relationship between company size and performance is particularly

relevant, given the lowering of entry barriers and greater convergence concerning the technology used by companies.

Small and medium-sized companies (SMEs) take on special relevance in the context of the European Union in general and in the case of Portugal in particular. Portuguese SMEs represent 99.8% of businesses (National Institute of Statistics 2004), contributing greatly to job creation and to prosperity of the Portuguese economy. Considering the relevance of SMEs in the context of the Portuguese economy, the possible positive influence of size on performance can contribute towards sustained company growth, which will be advantageous for the country's economy. In this context, Russeeuw (1997), studying microcompanies, identifies a positive relationship between size and performance. However, it should be pointed out that the author concludes that the positive impact of size on performance becomes less as the size increases. The study by Yoon (2004) reinforces the conclusions by Russeeuw (1997), the former concluding that company growth beyond optimal level can contribute towards diminished performance.

Although there are various empirical studies (Russeeuw 1997; Wing and Yiu 1997; Meijaard et al. 2005; Beise-Zee and Rammer 2006; Chiao et al. 2006; Ooghe et al. 2006; Rickne 2006; Sels et al. 2006; Shin 2006; Andries and Debackere 2007) about the performance of SMEs, they do not analyse specifically the influence of size on performance, except for the studies by Russeeuw (1997) and Wing and Yiu (1997). However, the former does not take SMEs as its subject of study, only considering microcompanies. Wing and Yiu (1997) do not consider profitability as a measure of performance, considering rather companies' technical efficiency.

Given the state of the art concerning the study of the relationship between size and performance in the context of SMEs, this study makes four contributions. First, we extend the existing empirical investigation, studying the relationship between size and performance in SMEs, taking company profitability as a measure of performance. Second, we use various dynamic panel estimators (GMM, 1991; GMM system, 1998; LSDVC, 2005). This methodology, in the context of SMEs, is a first in the study of performance in general, and in the study of the relationship between size and performance in particular. Third, the test of the robustness of results is quite rigorous. For one thing, we use the three measures of business size usually considered in the literature (assets, sales and number of employees) to test if the relationship between size and performance is, or not, dependent on the measure of size used. Finally, this study is innovative in analysing the difference between results from SMEs and large companies concerning the relationship between size and performance.

The results obtained allow us to conclude that there is a positive, and statistically significant, relationship between size and performance in SMEs, whatever the measure of size used. This positive relationship suggests that the positive effects of the greater possibility for diversification and success, when facing the demands of a more competitive market, are greater than the possible negative effects of increased size, namely those arising from less control of managers' actions by company owners.

In this study, the relationship between size and performance for large Portuguese companies is not statistically significant. Comparing this result with that obtained for Portuguese SMEs, we may conclude that smaller companies are not necessarily less efficient in taking advantage of the greater possibility to diversify activities nor are less successful in facing up to market challenges.

The article is structured as follows, after this introduction: in Sect. 2 we present the literature review and establish hypotheses for investigation, concerning the relationship between performance and its possible explanatory variables; in Sect. 3 we present the methodology concerning the database, the variables used in this study and the econometric methods used; in Sect. 4 we present the results obtained; in Sect. 5 we go on to interpret and discuss the results; and finally, in Sect. 6 we present the conclusions of this study.

2 Literature review

Next we present the literature review concerning the relationship between performance and its possible explanatory variables, giving special relevance to the relationship between size and performance, the main aim of this study.

2.1 Company size

According to various studies, increased company size can contribute towards increased performance for the following reasons: larger companies are more able to take advantage of economies of scale, concerning operating costs and the costs of innovation (Hardwick 1997) and greater size means the possibility of more diversification of activities, allowing companies to cope more successfully with possible market changes, as well as with high-risk situations (Fiegenbaum and Karnani 1991; Winter 1994; Wyn 1998; Goddard et al. 2005).

Although we can find a positive relationship between size and performance, performance increases associated with size become less above a certain size (Russeeuw 1997). The conclusions by Yoon (2004) indicate that an increase in company size beyond the optimal level can mean diminished performance.

The lesser possibility of owners controlling managerial action, as a consequence of increased size, can contribute to finding a negative relationship between size and performance (Pi and Timme 1993; Goddard et al. 2005). One of the reasons why this occurs may be the propensity of managers, better informed than owners about companies' specific characteristics and investment opportunities, to invest in projects that make the scale of the company grow beyond the optimal level. In this way, the managers' investment options may give increased personal benefits, but can contribute to diminished company performance.

Smaller companies, given the lesser rigidity of their organizational structure, may find it easier to recognize growth opportunities. Also, smaller companies may have a greater ability to adjust to innovation processes and establish networks with others. Consequently, increased size does not necessarily contribute to increased performance (Rogers 2004).

Considering that this study focuses on SMEs, we assume that the positive effects of increased size are greater than the possible negative effects in performance, and so we formulate the following hypothesis:

H1 There is a positive relationship between size and performance in small and medium-sized companies.

2.2 Other variables

2.2.1 Relationship between performance in the previous and current periods

There is a tendency for persistence of company performance, given that small divergences that may occur from time to time will be covered by the entry and exit of companies to and from the market (Mueller 1986).

Larger companies can have higher levels of performance persistence over time than smaller companies (Dilling-Hansen 2005). Due to greater exposure to the effects of competition and the greater possibility of occasional periods of high growth, we may not find persistency of performance in SMEs (Picot and Dupuy 1998).

On the contrary, other studies (Hawawini et al. 2003; Schumacher and Boland 2005) show that performance persistency is a consequence of companies trying to find an optimal level of performance adjusted to the specific characteristics of each company and the market they belong to. The authors' conclusions also indicate that the greater or lesser persistency of performance is not influenced by the size of companies.

Based on the relevance of the last argument, we formulate the following hypothesis:

H2 There is persistence in the performance of small and medium-sized companies.

2.2.2 Debt

There are two relevant theoretical arguments for a greater level of company debt to be able to influence performance negatively: first, the effort to pay debt interest is reflected in the reduced ability to take advantage of good growth opportunities (Goddard et al. 2005); and second, managers wish to invest in profitable but high-risk projects. Based on that possibility, creditors attach more restrictive conditions to the granting of credit, contributing to diminished performance (Jensen and Meckling 1976).

Nevertheless, higher levels of debt may not contribute to diminished company performance. Debt forces managers to manage resources more efficiently, given the reduction in free cash flows, since

there is the need to pay off the debt interest periodically (Jensen 1986; Berger et al. 1995; Wells et al. 1995; Adams 1996).

Due to the importance of the level of risk associated with SMEs activity, problems of information asymmetry found in the relationship between owners and creditors take on special relevance. Creditors reduce the amount of credit granted and/or increase its cost. These obstacles in accessing credit contribute to diminished performance in SMEs (Fu et al. 2002).

Considering as relevant the arguments about the effort to pay debt interest and the greater difficulty in accessing credit for SMEs, we formulate the following hypothesis:

H3 There is a negative relationship between level of debt and performance in small and medium-sized companies.

2.2.3 *Liquidity*

A greater level of company liquidity contributes to increased conflicts between owners and managers, since it increases the possibility of managers investing in projects that do not maximize company value (Huberman 1984; Ang 1991; Myers and Rajan 1995). Companies with higher levels of liquidity tend to have lower levels of performance, due to investment by managers in projects with current negative net value, but that benefits them personally (Boose 1993; Adams 1996; Pottier 1998; Adams and Buckle 2003).

Various arguments point to higher levels of company liquidity contributing to increased performance: greater liquidity allows greater capacity to face changes of a competitive nature in the markets companies operate in (Goddard et al. 2005); companies with higher levels of liquidity will find it easier to meet short-term commitments (Deloof 2003) and a higher level of liquidity becomes more important when companies experience obstacles in getting credit (Fagiolo and Luzzi 2006).

Given SMEs' greater difficulty in accessing credit and the relevance of a greater level of liquidity to face changes in the environment and short-term commitments, we formulate the following hypothesis:

H4 There is a positive relationship between liquidity and performance in small and medium-sized companies.

2.2.4 *Risk*

A higher level of company risk is normally associated with situations of great competition and uncertainty. In these cases, managers may invest in projects that benefit their own personal interests, rather than focusing on projects that contribute to improved company performance. Realizing this less than optimal behaviour from the point of view of performance, creditors make access to credit difficult (Fama and Jensen 1983; Lamm-Tennant and Starks 1993; Oppenheimer and Schlarbaum 1983; Adams and Buckle 2003).

It is more difficult for SMEs to disclose to creditors the exact nature of their assets. Besides, it is easier for smaller companies to change their asset structure due to their greater flexibility. These characteristics of smaller companies may contribute to increased company risk (Pettit and Singer 1985). Consequently, creditors make the granting of credit difficult, preventing owners from affecting the risk of their assets to the detriment of creditors' wealth (Pettit and Singer 1985; Ghosh 2007).

However, Nemetz and Fry (1988) conclude that SMEs have a greater perception of business risk than large companies. Consequently, SMEs reduce investments, which have associated a potential high-risk business (Lensink et al. 2005).

Considering that level of risk can particularly affect SMEs, despite having a greater perception of risk than large companies, we formulate the following hypothesis:

H5 There is a negative relationship between level of risk and performance in small and medium-sized companies.

2.2.5 *Asset structure*

Several studies (Griliches and Lichtenberg 1984; Pusher 1995; Smith et al. 2004; Nucci et al. 2005) identified a positive relationship between the level of intangible assets and company performance. Companies most directed towards innovating activities have

a greater percentage of intangible assets in total assets as well as showing higher levels of performance. The importance of innovation, and corresponding change in strategy, in the context of SMEs, is confirmed in the study by Andries and Debackere (2007). For these authors, an innovative attitude in SMEs, through the adoption of new information technology, is fundamental in explaining the increased performance of small companies.

In this context, Beise-Zee and Rammer (2006) conclude that innovation is the greatest determinant of the exporting capacity of German SMEs. Moreover, several studies (Picot and Dupuy 1998; Yasuda 2005; Calvo 2006) evidence that expenditure on innovation influences the growth of SMEs positively. These results give empirical support to the arguments of Rogers (2004) that SMEs have the advantage of being more able to recognize growth opportunities and more able to implement suitable plans for innovation.

Other empirical studies also reinforce the relevance of innovative activities for SMEs: the adoption of new technology can be fundamental as a way of making relationships between companies easier (Shin 2006) and the adoption of new technology can contribute to establishing cooperation networks, generating improved performance (Rickne 2006).

Considering that companies most directed towards innovating activities have a greater percentage of intangible assets in total assets as well as showing higher levels of performance, we formulate the following hypothesis:

H6 There is a negative relationship between level of tangible assets and performance in small and medium-sized companies.

2.2.6 *Ownership of capital and management control*

There are several advantages of opening up company capital to foreigners: companies invest more efficiently, due to the greater experience in diversifying investment and obtaining good rates of profitability (Berger et al. 1992); companies are keener on innovative activities, and so they find it easier to diversify the product and investment (Joseph and Hewins 1997; Adams and Buckle 2003); it allows for the creation of growth dynamics (Markusen and Venables 1999) and in the context of SMEs, foreign investment can be crucial for solving difficulties of growth, a consequence of possible limited exporting capacity (Becchetti and Trovato 2002).

Nevertheless, the results of Gomes and Ramaswamy (1999) and Chiao et al. (2006) show that the effect of company internationalization on performance may not be linear, having the form of an upturned U. Up to a certain level of internationalization, taking advantage of initial scale economies, the effect is positive. However, beyond a certain level, given the possibility of the costs associated with increased internationalization cancelling out its benefits, the effect of internationalization may be negative.

Considering the advantages of opening up SMEs' capital to foreigners as relevant, we formulate the following hypothesis:

H7 Small and medium-sized companies where ownership control belongs to foreigners have higher performance.

The greater centralization of decision-making in owners avoids problems of information asymmetry between them and managers, contributing to greater company efficiency. Concentration of management and ownership on the same individual, due to the coinciding interests, may contribute to increased company performance (Alchian and Demsetz 1972).

On the contrary, the studies by Marschak and Radner (1972) and Lenox (2002) indicate that more decentralization of decision-making can contribute to increased company performance. In this context, Garicano (2000) evidences that decentralizing company decision-making, given the greater possibility of specialization of functions in the company, may lead to increased performance.

Based on the relevance of employee specialization, we formulate the following hypothesis:

H8 Small and medium-sized companies with a greater level of separation between ownership and management have greater performance.

3 Methodology

3.1 Database

In this study, we use the database from the Exame Journal, provided by a Portuguese branch of Dun &

Bradstreet Consultants, concerning the 500 biggest Portuguese companies. The companies making up the database are initially selected annually based on volume of sales. Following a first selection, companies are selected according to a set of criteria, such as: sales growth; growth of net results; profitability of sales determined by current results; gross-added value of sales; solvency and other economic and financial indicators.

The time period of the study covers the years between 1999 and 2003, due to the absence of information about previous years, namely about companies' capital and asset structure. Given the use of the dynamic estimators to analyse the influence of the dynamism of explanatory variables on small and medium-sized company performance, we choose a uniform panel.

Consideration of a non-uniform panel could make it impossible, for certain companies that were not present in every year, to analyse inter-temporal effects.[1] Arellano and Bond (1991) conclude that the total number of companies making up a sample to be considered in the econometric analysis and in the second order autocorrelation tests[2] must be present in the database for a certain number of consecutive years. Otherwise, the companies would be eliminated from the econometric analysis, and so we could be interpreting data for a certain number of companies. This number, however, is necessarily lower than the total as a consequence of not all being present for a determined number of consecutive years.

In a first phase, we choose the companies belonging to the database made up of the 500 companies selected by the Exame Journal. Doing so, we obtain a panel composed of 162 companies, all of them remaining on the database of the 500 companies of the Exame Journal for the entire period between 1999 and 2003.[3]

In a second phase, we move on to selection, considering the 162 companies initially chosen, of SMEs. For this selection, we consider the criteria established by the European Commission in 1996[4]: assets not above 27 million euros volume of sales or business not above 40 million euros; and finally, employees number not above 250 employees. After combining these three criteria, we select 51 SMEs that are present in the database for the entire period of analysis. The total number of observations is 255. The data concerning the number of companies, and respective percentage, by sector of activity, of all companies, and the sample used in this study of SMEs are presented in Appendix A (Tables A.1 and A.2). Concerning the representative nature of sub-sectors of activity, the sample used in this study (Table A.2) is not substantially different from the total of SMEs in Portugal according to data from the National Institute of Statistics (Table A.1), the wholesale and retail trade sub-sector predominating in both cases.

With the aim of carrying out comparison of the results between SMEs and large companies, in Appendix C we present the results of the relationship between performance and determinants for large Portuguese companies.

3.2 Variables

The main aim of this study is to analyse the relationship between size and performance in the context of SMEs. However, taking into account the literature, we consider the possibility of other variables having implications for small and medium-sized company

[1] For example, a company that only belonged to the analysis for the first two years would be eliminated from the analysis when applying the General Method of Moments (GMM) (1991) dynamic estimator, since the instruments used are the dependent and independent variables two lagged periods.

[2] The second order autocorrelation tests are essential to validate the robustness of results.

[3] It should be noted that the fact of companies belonging to the sample for all years considered is due to they meeting the requirement of minimum annual volume of sales imposed by the Exame Journal of the Portuguese branch of Dun & Bradstreet Consultants, to be considered as the biggest companies and therefore be included in the database. Therefore, we see companies leaving the database each year, not due to bankruptcy but due to being replaced by companies with greater volume of business. In this way, the sample chosen for this study appears not to be biased by matters related to company survival/bankruptcy.

[4] Recommendation 96/280/EC, April 3, 1996.

Table 1 Measurement of variables

Variables	Measurement
Dependent variables	
Performance ($PERF_{i,t}$)	Ratio between operating income and total assets
Independent variables	
Company Size1($SIZE1_{i,t}$)	Logarithm of total assets
Company Size2 ($SIZE2_{i,t}$)	Logarithm of sales
Company Size3 ($SIZE3_{i,t}$)	Logarithm of number of employees
Debt ($LEV_{i,t}$)	Ratio between total liabilities and total assets
Liquidity ($LIQ_{i,t}$)	Ratio between current assets and short-term liabilities
Risk ($EVOL_{i,t}$)	Absolute value of percentage change of operating income
Asset structure ($TANG_{i,t}$)	Ratio between fixed assets and total assets
Shareholder control ($OWNER_{i,t}$)	Dummy variable that assumes the value of 1 if shareholder control belongs to foreigners and the value 0 otherwise
Managerial control ($MAN_{i,t}$)	Dummy variable that assumes the value 1 if the principal manager is different from principal shareholder and the value 0 otherwise

performance, namely: debt; liquidity; risk; level of tangible assets and finally, company ownership and management control. In the following table, we present the variables and their corresponding measurement (Table 1).

3.3 Estimation method

To estimate results of the relationship between the performance of small and medium-sized Portuguese companies and its determinants, we use dynamic estimators. Using static panel models, we cannot understand the dynamism of the changes in performance of small and medium-sized Portuguese companies. Using dynamic estimators, we can check if performance in the current period is related to performance in the previous one.

Using dynamic estimators, we have:

$$\begin{aligned} PERF_{i,t} = {} & \beta_0 + \delta PERF_{i,t-1} + \beta_1 SIZE_{i,t} + \beta_2 LEV_{i,t} \\ & + \beta_3 LIQ_{i,t} + \beta_4 EVOL_{i,t} \\ & + \beta_5 TANG_{i,t} + \beta_6 OWNER_{i,t} \\ & + \beta_7 MAN_{i,t} + d_t + v_{i,t} + e_{i,t}, \end{aligned} \quad (1)$$

where i represents each of the companies; t represents the period of time; $PERF_{i,t}$ is performance; $PERF_{i,t-1}$ is performance in the previous period; $SIZE_{i,t}$ is size; $LEV_{i,t}$ is debt; $LIQ_{i,t}$ is liquidity; $EVOL_{i,t}$ is level of risk; $TANG_{i,t}$ is asset structure; $QWNER_{i,t}$ is a dummy variable with the value of 1 if ownership control lies with foreigners and the value of 0 if it is Portuguese owned; $MAN_{i,t}$ is a dummy variable with the value of 1 if ownership and management is different and the value 0 if ownership and management is the same; d_t is dummy time variable measuring the impact of possible macroeconomic changes on the performance of SMEs; $v_{i,t}$ are companies' non-observable individual effects and, $e_{i,t}$ correspond to the error, which is assumed to have normal distribution.

Besides the advantages mentioned already, the use of dynamic estimators allows for elimination of companies' non-observable individual effects and greater control of endogeny.

Estimating Eq. 1 using static panel models, admitting or not correlation between non-observable individual effects and performance determinants, we obtain biased and inconsistent estimates of the estimated parameters, since along with correlation between $v_{i,t}$ and $PERF_{i,t-1}$, there is also correlation between $e_{i,t}$ and $PERF_{i,t-1}$. The correlation of non-observable individual effects and the error with the previous period's performance have the consequence of bias and inconsistency of estimated parameters.

Arellano and Bond (1991) propose estimation of Eq. 1 with variables in first differences, and the use of lags of performance and its determinants, in levels as instruments. Estimation of Eq. 1 in first differences allows for elimination of non-observable individual effects, thereby eliminating the correlation between $v_{i,t}$ and $PERF_{i,t-1}$. Using lags of performance and its

Table 2 Dynamic estimators (SIZE1)

Dependent variable: $PERF_{i,t}$				
Independent variables	GMM (1991)	GMM system (1998)	LSDVC (2005) initial (AB)	LSDVC (2005) initial (BB)
$PERF_{i,t-1}$	−0.09453	0.56467***	0.41787***	0.57489***
	(0.20986)	(0.10237)	(0.08987)	(0.07112)
$SIZE1_{i,t}$	0.019035**	0.04321***	0.019012**	0.015927***
	(0.00903)	(0.00910)	(0.007906)	(0.00089)
$LEV_{i,t}$	−0.15098***	−0.18409***	−0.18780***	−0.16811***
	(0.03512)	(0.04824)	(0.03504)	(0.03620)
$LIQ_{i,t}$	−0.00492	−0.01081	−0.00627	−0.00719
	(0.00498)	(0.02813)	(0.00951)	(0.01482)
$EVOL_{i,t}$	0.00049	−0.00005	0.00086	0.00112
	(0.00047)	(0.00066)	(0.00122)	(0.00881)
$TANG_{i,t}$	−0.12172***	−0.07204**	−0.13512***	−0.12603***
	(0.02802)	(0.02892)	(0.026087)	(0.02804)
$OWNER_{i,t}$	−0.00351	0.02982	0.00129	0.00914
	(0.04082)	(0.03375)	(0.03593)	(0.03518)
$MAN_{i,t}$	0.02458**	0.02078**	0.02278***	0.02165***
	(0.010234)	(0.08678)	(0.00055)	(0.00043)
CONS	0.00180	−0.27198***		
	(0.00427)	(0.0867)		
Instruments	10	42		
Observations	153	204		
Wald (χ^2)	39.01***			
F(N(0,1))		14.04***		
Sargan (χ^2)	7.21			
Hansen (N(0,1))		28.05		
m1(0,1)	−0.82	−2.69***		
m2(0,1)	−0.93	−0.23		

Notes: (1) Column (2) adopts the one-step Arellano and Bond GMM (1991) estimation method, using instruments: ($PERF_{i,t-2}$, $\sum_{K=1}^{n} Z_{k,i,t-2}$). (2) Column (3) adopts the one-step Blundell and Bond GMM system (1998) estimation method, using instruments: ($PERF_{i,t-2}$, $\sum_{K=1}^{n} Z_{k,i,t-2}$) in differenced equations and ($\Delta PERF_{i,t-2}$, $\sum_{K=1}^{n} \Delta Z_{k,i,t-2}$) in the levels equations. (3) Z_K is a k performance determinant. (4) Heteroskedasticity consistent and asymptotic robust standard deviations are reported in brackets. (5) *** indicates significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level. (6) The Wald test has χ^2 distribution and tests the null hypothesis of non-significance as a whole of the parameters of the explanatory variables. (7) The F test has normal distribution N(0,1) and tests the null hypothesis of non-significance as a whole of the estimated parameters, against the alternative hypothesis of significance as a whole of the estimated parameters. (8) The Sargan test of over-identifying restrictions is distributed as χ^2 under the null hypothesis of instrument validity, used in one-step Arellano and Bond GMM (1991) estimation method. (9) The Hansen test of over-identifying restrictions is distributed as N(0,1) under the null hypothesis of instrument validity, used in one-step Blundell and Bond GMM system (1998). (10) The m1 test is a test for first order autocorrelation of residuals and is distributed as N(0,1), under null hypothesis of no first order autocorrelation. (11) The m2 test is a test for second order autocorrelation of residuals and is distributed as N(0,1), under null hypothesis of no second order autocorrelation

determinants as instruments, allows for creation of orthogonal conditions between $e_{i,t}$ and $PERF_{i,t-1}$, eliminating its correlation.

Nevertheless, Blundell and Bond (1998) conclude that when the dependent variable is persistent and the number of periods is not very high, the GMM (1991) dynamic estimator is inefficient, the instruments used being generally weak. In these circumstances, Blundell and Bond (1998) extend the GMM (1991) dynamic estimator, considering a system with

Table 3 Dynamic estimators (SIZE2)

Dependent variable: $PERF_{i,t}$				
Independent variables	GMM (1991)	GMM system (1998)	LSDVC (2005) initial (AB)	LSDVC (2005) initial (BB)
$PERF_{i,t-1}$	−0.07971	0.46501***	0.36890***	0.584331***
	(0.17280)	(0.12806)	(0.06934)	(0.06576)
$SIZE2_{i,t}$	0.06812***	0.11123***	0.06297***	0.05415***
	(0.02167)	(0.02810)	(0.01883)	(0.01798)
$LEV_{i,t}$	−0.16548***	−0.23460***	−0.20667***	−0.19238***
	(0.02876)	(0.05954)	(0.02897)	(0.03481)
$LIQ_{i,t}$	−0.00348	−0.00701	−0.00689	−0.00723
	(0.00389)	(0.00523)	(0.00801)	(0.01089)
$EVOL_{i,t}$	0.00042	−0.00009	0.00083	0.00112
	(0.00042)	(0.00072)	(0.00436)	(0.04563)
$TANG_{i,t}$	−0.07287**	−0.08295***	−0.09178***	−0.08817***
	(0.03210)	(0.00823)	(0.03127)	(0.02902)
$OWNER_{i,t}$	−0.00598	0.04978	0.00582	0.01295
	(0.04024)	(0.05198)	(0.03704)	(0.03689)
$MAN_{i,t}$	0.02587**	0.02296**	0.02187***	0.02142***
	(0.11786)	(0.0982)	(0.00046)	(0.00032)
CONS	−0.00018	−0.30178***		
	(0.00478)	(0.08937)		
Instruments	10	42		
Observations	153	204		
Wald (χ^2)	50.89***			
$F(N(0,1))$		14.76***		
Sargan (χ^2)	5.11			
Hansen ($N(0,1)$)		22.89		
m1(0,1)	−1.17	−2.74***		
m2(0,1)	−1.08	−0.30		

Notes: (1) Column (2) adopts the one-step Arellano and Bond GMM (1991) estimation method, using instruments: ($PERF_{i,t-2}$, $\sum_{K=1}^{n} Z_{k,i,t-2}$). (2) Column (3) adopts the one-step Blundell and Bond GMM system (1998) estimation method, using instruments: ($PERF_{i,t-2}$, $\sum_{K=1}^{n} Z_{k,i,t-2}$) in differenced equations and ($\Delta PERF_{i,t-2}$, $\sum_{K=1}^{n} \Delta Z_{k,i,t-2}$) in the levels equations. (3) Z_K is a k performance determinant. (4) Heteroskedasticity consistent and asymptotic robust standard deviations are reported in brackets. (5) *** indicates significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level. (6) The Wald test has χ^2 distribution and tests the null hypothesis of non-significance as a whole of the parameters of the explanatory variables. (7) The F test has normal distribution $N(0,1)$ and tests the null hypothesis of non-significance as a whole of the estimated parameters, against the alternative hypothesis of significance as a whole of the estimated parameters. (8) The Sargan test of over-identifying restrictions is distributed as χ^2 under the null hypothesis of instrument validity, used in one-step Arellano and Bond GMM (1991) estimation method. (9) The Hansen test of over-identifying restrictions is distributed as $N(0,1)$ under the null hypothesis of instrument validity, used in one-step Blundell and Bond GMM system (1998). (10) The m1 test is a test for first order autocorrelation of residuals and is distributed as $N(0,1)$, under null hypothesis of no first order autocorrelation. (11) The m2 test is a test for second order autocorrelation of residuals and is distributed as $N(0,1)$, under null hypothesis of no second order autocorrelation

variables in level and first differences. For variables in level in Eq. 1 the instruments are the lagged variables in first differences. In the case of the variables in first differences in Eq. 1, the instruments are those lagged variables in level.

However, the GMM (1991) and GMM system (1998) dynamic estimators can only be considered valid after checking two conditions: if the restrictions created, a consequence of instrument use, are valid and if there is no second order autocorrelation.

Table 4 Dynamic estimators (SIZE3)

Dependent variable: $PERF_{i,t}$				
Independent variables	GMM (1991)	GMM system (1998)	LSDVC (2005) initial (AB)	LSDVC (2005) initial (BB)
$PERF_{i,t-1}$	−0.07705	0.70546***	0.43768***	0.62494***
	(0.15594)	(0.1276)	(0.10873)	(0.06915)
$SIZE3_{i,t}$	0.05092***	0.07292***	0.04582***	0.05209**
	(0.01692)	(0.00137)	(0.00682)	(0.02017)
$LEV_{i,t}$	−0.11381***	−0.10651***	−0.14654***	−0.13701***
	(0.00789)	(0.00801)	(0.03001)	(0.03265)
$LIQ_{i,t}$	−0.00133	−0.00141	−0.00291	−0.00380
	(0.00287)	(0.00402)	(0.00396)	(0.00383)
$EVOL_{i,t}$	0.00041	0.00038	0.00077	0.00117
	(0.00040)	(0.00049)	(0.01098)	(0.00443)
$TANG_{i,t}$	−0.13404***	−0.05893***	−0.15031***	−0.13483***
	(0.04632)	(0.00880)	(0.02604)	(0.02504)
$OWNER_{i,t}$	−0.00809	0.04812	−0.00914	0.00192
	(0.00603)	(0.03743)	(0.03848)	(0.03506)
$MAN_{i,t}$	0.02378**	0.02156**	0.02387***	0.02296***
	(0.01023)	(0.09034)	(0.00038)	(0.00033)
CONS	0.00483	0.05804		
	(0.00423)	(0.05592)		
Instruments	10	42		
Observations	153	204		
Wald (χ^2)	36.18***			
F(N(0,1))		10.97***		
Sargan (χ^2)	3.53			
Hansen (N(0,1))		29.08		
m1(0,1)	−0.81	−3.17***		
m2(0,1)	−1.23	0.56		

Notes: (1) Column (2) adopts the one-step Arellano and Bond GMM (1991) estimation method, using instruments: ($PERF_{i,t-2}$, $\sum_{K=1}^{n} Z_{k,i,t-2}$). (2) Column (3) adopts the one-step Blundell and Bond GMM system (1998) estimation method, using instruments: ($PERF_{i,t-2}$, $\sum_{K=1}^{n} Z_{k,i,t-2}$) in differenced equations and ($\Delta PERF_{i,t-2}$, $\sum_{K=1}^{n} \Delta Z_{k,i,t-2}$) in the levels equations. (3) Z_K is a k performance determinant. (4) Heteroskedasticity consistent and asymptotic robust standard deviations are reported in brackets. (5) *** indicates significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level. (6) The Wald test has χ^2 distribution and tests the null hypothesis of non-significance as a whole of the parameters of the explanatory variables. (7) The F test has normal distribution N(0,1) and tests the null hypothesis of non-significance as a whole of the estimated parameters, against the alternative hypothesis of significance as a whole of the estimated parameters. (8) The Sargan test of over-identifying restrictions is distributed as χ^2 under the null hypothesis of instrument validity, used in one-step Arellano and Bond GMM (1991) estimation method. (9) The Hansen test of over-identifying restrictions is distributed as N(0,1) under the null hypothesis of instrument validity, used in one-step Blundell and Bond GMM system (1998). (10) The m1 test is a test for first order autocorrelation of residuals and is distributed as N(0,1), under null hypothesis of no first order autocorrelation. (11) The m2 test is a test for second order autocorrelation of residuals and is distributed as N(0,1), under null hypothesis of no second order autocorrelation

To test validity of the restrictions, we use the Sargan test in the case of the GMM (1991) dynamic estimator and the Hansen test in the case of the GMM system (1998) dynamic estimator. In both cases, the null hypothesis indicates the restrictions imposed by use of the instruments are valid, indicating the alternative hypothesis that the restrictions are not valid. Rejecting the null hypothesis, we conclude the estimators are not robust.

We test for the existence of first and second order autocorrelation. The null hypothesis is that there is no autocorrelation, the alternative hypothesis being existence of autocorrelation. Rejecting the null hypothesis of non-existence of second order autocorrelation, we conclude that the estimators are not robust.

Bruno (2005) concludes that when the number of cross sections is not very high, and consequently nor is the number of observations, the use of dynamic estimators, given the number of instruments generated, can lead to bias of the estimated parameters. Given the number of observations, we present the Bruno (2005) dynamic estimator, LSDVC (Least Squares Dummy Variable Corrected) fixed effect convergence regression, to test the robustness of the results obtained from applying the GMM (1991) and GMM system (1998) dynamic estimators.

4 Results

4.1 Descriptive statistics and correlation matrix

The results of the descriptive statistics (Tables B.1 and B.2) and the correlation matrix (Table B.3) are presented in Appendix B. Performance shows some volatility (Table B.1), since the standard deviation is above the mean, although the difference is not very pronounced. The proxy measuring level of risk is a variable showing great variation with standard deviation considerably above the mean, the maximum value being quite high. Observing the descriptive statistics of variables by year (Table B.2), we find that there is no substantial difference in the mean and median from one year to the next. However, concerning performance, asset value and sales, there is an increase throughout the period of analysis, with the rise in values in 2001 being especially noticeable.

We can see (Table B.3) that there is significant correlation between debt and the three proxies used to measure company size (SIZE1, SIZE2 and SIZE3). Correlations between debt and liquidity, and correlations between SIZE2 and level of tangible assets are also quite significant. So there is justification for the use of dynamic estimators, to reduce the possible presence of collinearity between explanatory variables.

4.2 Dynamic estimators

Next we present results of the dynamic estimators.[5] The results considering the relationship between explanatory variables[6] and performance are presented in the following tables (Tables 2–4).

As was already mentioned, in Appendix C, we present the results of the relationship between performance and determinants for large companies,[7] to see if there are differences between the results obtained for small and medium-sized companies and large companies.

First, the results of the Sargan tests, in the case of the GMM (1991) dynamic estimator, and Hansen test, in the case of the GMM system (1998) dynamic estimator, allow us to conclude that we cannot reject the null hypotheses. Thereby, the use of the instruments and consequent restrictions are not found to be unsuitable. This result testifies the validity of the instruments used.

Second, the results of the second order autocorrelation tests, both for the GMM (1991) dynamic estimator and for the GMM system (1998) dynamic estimator, allow us to conclude that we cannot reject the null hypotheses of absence of second order autocorrelation.

Based on the results of the Sargan/Hansen tests and on the second order autocorrelation tests, we can conclude that the results of the GMM (1991) and GMM system (1998) dynamic estimators are robust.

[5] We estimate the relationship between performance and size, using static panel models, considering all explanatory variables of performance and the different measurements of size. The results are very similar to those obtained from the use of dynamic estimators. The results are available from the authors upon request.

[6] We estimate the relationship between performance and size, considering only the relationship between the different measurements of size, using static panel models and dynamic estimators. Comparing the results when we consider the relationship between all explanatory variables and performance, with the results when we only estimate the relationship between size and performance, we find there are no significant changes concerning the magnitude and statistical significance of the estimated parameters. The results are available from the authors upon request.

[7] Concerning large Portuguese companies, we do not consider the separation of management and ownership as an explanatory variable of performance, since unlike what happens in the context of SMEs, this separation is common or usual.

The correlation coefficient between performance in the current period and performance in the previous period is 0.7507, indicating high persistence of the series measuring company performance. Given the rather low number of years, and persistence of the dependent variable, the GMM system (1998) dynamic estimator may show itself to be more suitable than the GMM (1991) dynamic estimator. This is because situations of reduced number of years, and persistence of the dependent variable, can lead to bias of the estimated parameters, particularly concerning the parameter measuring the relationship between performance in the previous period and the current one.

The results obtained from applying the LSDVC (2005) dynamic estimator corroborate the results obtained with the GMM (1991) and GMM system (1998) dynamic estimators. Therefore, given the similarity of results, there is no bias of the parameters estimated by application of the GMM (1991) and GMM system (1998) dynamic estimators, as a consequence of the number of instruments generated.

Based on the results, we can establish the following relationships:

- there is a positive, and statistically significant, relationship between the size of small and medium-sized Portuguese companies and their performance;
- there is a positive, and statistically significant, relationship, between the performance of small and medium-sized Portuguese companies in the previous period and the current one;
- there is a negative, and statistically significant, relationship between the level of debt of small and medium-sized Portuguese companies and their performance;
- there is no statistically significant relationship between the liquidity of small and medium-sized Portuguese companies and their performance;
- there is no statistically significant relationship between the risk level of small and medium-sized Portuguese companies and their performance;
- there is a negative, and statistically significant, relationship between the level of tangibility of small and medium-sized Portuguese companies and their performance;
- there is no statistically significant relationship between the dummy variable measuring shareholder control of small and medium-sized Portuguese companies and their performance;
- there is a positive, and statistically significant, relationship between the dummy variable measuring the managerial control of small and medium-sized Portuguese companies and their performance.

5 Interpretation and discussion of results

The positive relationship between the size and performance of small and medium-sized Portuguese companies allows us to accept hypothesis H1 of this study. This result corroborates the arguments of several studies (Fiegenbaum and Karnani 1991; Winter 1994; Hardwick 1997; Wyn 1998) that greater size allows companies greater benefit from scale economies, more efficient use of resources and greater ability to cope with possible changes in market conditions.

The empirical evidence concerning the relationship between size and performance has led to different results. Russeeuw (1997), for small US companies, obtains a positive relationship between size and performance, a result that corroborates what we obtained in this study. However, the author concludes that as the size of small companies increases, the performance increases, but at a decreasing rate. This result is identical to the one obtained by Wing and Yiu (1997) for small and medium-sized manufacturing companies in Shanghai. The conclusions point out that increased size is particularly relevant in explaining increases in technical efficiency in the context of small firms, this relevance diminishing in the group of medium-sized firms. These empirical results agree with the conclusions of Sutton (1997) that companies grow at a decreasing rate as their size increases.

Hart and Oulton (1996) and Geroski (2000) conclude that SMEs have higher growth rates than large companies. However, Becchetti and Trovato (2002) and Fagiolo and Luzzi (2006) evidence that the difficulties of SMEs in accessing external finance to finance good investment opportunities, can limit their growth, and therefore can mean reduced performance.

Several studies (Grace and Timme 1992; Cummins et al. 1999; Gschwandtner 2005) for the United

States, although not specifically about SMEs, confirm the existence of a positive relationship between size and performance. Adams and Buckle (2003) find a statistically insignificant relationship between size and performance for companies in Bermuda. Goddard et al. (2005), for Belgian, French, Italian, Spanish and UK companies, find a negative relationship between size and performance. The result of that study, although not specifically for SMEs, shows that increased size does not necessarily mean increased performance. Therefore, beyond a certain size, according to the arguments of Pi and Timme (1993), increased size can lead to a reduction of management efficiency, a consequence of less control of managers' action by owners.

When we consider large Portuguese companies, we find that there is a statistically insignificant relationship between size and performance. This result suggests that for large Portuguese companies, the possible positive effect of diversification and less risk of the activity can be cancelled out by the negative effects of reduced management efficiency, a consequence of less control by owners of managers' activity.

Furthermore, the positive impact of size on the performance of small and medium-sized Portuguese companies allows us to conclude that scale effects, the possibility of taking greater advantage of resources and greater diversification of products and activities, a consequence of greater size and outweigh the problems of possible inefficiency, a consequence of less control of management action by owners.

We found a positive relationship between performance in the previous period and performance in the current one. Therefore, we can conclude that small and medium-sized Portuguese companies manage to maintain their level of performance over time, coping successfully with possible changes in the competition.

This result corroborates hypothesis H2 of this study that the performance of small and medium-sized Portuguese companies is persistent. This performance persistence of Portuguese SMEs supports the result obtained by Fu et al. (2002) for small Thai companies. Goddard et al. (2005), although not specifically for SMEs, also found performance persistence for Belgian, French, Italian, Spanish and UK companies.

The persistence of performance of large Portuguese companies is not very different from the persistence of performance of small and medium-sized Portuguese companies. This result corroborates the arguments of Hawawini et al. (2003) and Schumacher and Boland (2005) that performance persistence is related to companies' attempts to find optimal performance, which does not depend significantly on size.

Nevertheless, the result obtained in the current study does not corroborate the arguments of Picot and Dupuy (1998) and of Dilling-Hansen (2005) that the performance of small companies tends not to be persistent, given the difficulties of continuous growth and lower scale.

The negative relationship between the level of debt of small and medium-sized Portuguese companies and their performance lets us accept hypothesis H3 as valid. This result suggests that companies with higher levels of debt, given the need to pay off the debt periodically, are less able to finance projects that would contribute to improved performance, corroborating the arguments of Jensen and Meckling (1976) and Goddard et al. (2005), respectively.

Fu et al. (2002), for small Thai companies, also obtain a negative relationship between debt and performance. Although not specifically about SMEs, the results obtained by Chevalier (1995) for the United States and by Goddard et al. (2005) for Belgium, France, Italy, Spain and the United Kingdom, show a negative relationship between debt and performance. The results of Goddard et al. (2005) suggest that agency problems between creditors and owners/managers and the effort to pay off the debt can have considerable implications for company performance. An identical relationship is obtained in the current study for large Portuguese companies. Thereby, whatever the size of Portuguese companies, the effort to pay debt interest, and the possible agency problems between owners/managers and creditors cancel out the possible positive effect of owners monitoring managers' action, as a consequence of recourse to debt.

The relationship between the liquidity of Portuguese SMEs and their performance is not significant statistically, and so we do not accept hypothesis H4 of this study as valid.

The result obtained in this study goes against those, although not referring specifically to SMEs, obtained by and Goddard et al. (2005) that identify a positive relationship between liquidity and performance for Belgian, French, Italian, Spanish and UK companies. Moreover, Adams and Buckle (2003) identify a negative relationship between liquidity and performance for companies in Bermuda.

Given the statistically insignificant relationship between liquidity and performance, on the one hand we cannot conclude that the greater liquidity of small and medium-sized Portuguese companies contributes to increased performance as a consequence of the lesser risk of not fulfilling short-term obligations (Deloof 2003) as well as the greater ability to face market changes (Goddard et al. 2005; Fagiolo and Luzzi 2006). On the other hand, nor can we conclude that the greater level of liquidity of small and medium-sized Portuguese companies contributes to diminished performance, as a consequence of the possible use of free cash flows for less than optimal investments (Huberman 1984; Ang 1991; Boose 1993; Myers and Rajan 1995; Adams 1996; Pottier 1998; Adams and Buckle 2003).

However, in this study, for large Portuguese companies we obtain a negative relationship between liquidity and performance. Although problems of free cash flows, and consequently less than optimal investment, are not relevant in diminishing small and medium-sized company performance, they influence large company performance negatively. This result finds support in the arguments of Jensen and Meckling (1976). According to these authors, cash flows can aggravate agency problems between managers and owners that are frequent in large companies due to the separation of capital ownership from management.

The empirical results obtained in this study suggest that agency problems between owners and managers are not sufficiently relevant to mean diminished performance in small and medium-sized Portuguese companies. However, in the context of large Portuguese companies, those problems seem to be sufficiently relevant to contribute to diminished performance. Therefore, we can conclude that agency problems between company owners and managers become more relevant as the size of Portuguese companies increases.

We do not find a statistically significant relationship between level of risk and performance in small and medium-sized Portuguese companies, and so we do not accept hypothesis H5 as valid.

The statistically insignificant relationship between risk and performance, identified in the current study, does not allow confirmation of the argument of several authors (Fama and Jensen 1983; Lamm-Tennant and Starks 1993; Oppenheimer and Schlarbaum 1983; Adams and Buckle 2003) that greater level of risk means diminished performance. Nevertheless, the result obtained in the current study seems to support, respectively, the arguments of Nemetz and Fry (1988) and Lensink et al. (2005) that small companies have better perception of business risk and reduce investment in high-risk situations.

Although not specifically about SMEs, Adams and Buckle (2003) point out a positive relationship between risk and performance for companies in Bermuda. Conversely, Gschwandtner (2005) identifies a negative relationship between risk and performance for US companies. Also in the case of large Portuguese companies, as with SMEs, we do not find a statistically significant relationship between risk and performance. Therefore, we can conclude that in the Portuguese case, the relationship between risk and performance is not dependent on company size.

We confirm the existence of a negative relationship between tangibility of assets and performance in small and medium-sized Portuguese companies, validating hypothesis H6 of this study.

A greater level of tangible assets means diminished performance in small and medium-sized Portuguese companies. This result seems to support the arguments of Griliches and Lichtenberg (1984) that companies with lower levels of tangible assets are more likely to innovate, which contributes to increased performance. Although not directly, we can conclude that SMEs with greater levels of intangible assets, possibly more prone to innovating activities, have higher performance than SMEs with a higher percentage of tangible assets. The importance of innovating activities in the context of SMEs is identified in the studies by Picot and Dupuy (1998), Yasuda (2005) and Calvo (2006) who show that innovation is fundamental for the growth of small firms. Rogers (2004) concludes that small companies may find it easier to implement innovation plans and recognize good growth opportunities. Furthermore, Beise-Zee and Rammer (2006) and Andries and Debackere (2007) confirm the relevance of innovative activities in explaining the performance of German and US SMEs, respectively.

The negative relationship between level of tangible assets and performance in small and medium-sized Portuguese companies suggests that a lower level of tangible assets and greater tendency to innovate seems to contribute to increased performance.

Although not specifically about SMEs, Griliches and Lichtenberg (1984) for the USA, Pusher (1995)

for Japan, Deloof (2003) for Belgium, Smith et al. (2004) for Denmark and Nucci et al. (2005) for Italy, show the existence of a negative relationship between level of tangible assets and performance.

The results obtained when we consider large Portuguese companies also indicate, just as in the case of SMEs, the existence of a negative relationship between level of tangible assets and performance.

We did not find a statistically significant relationship between foreign ownership control and the performance of small and medium-sized Portuguese companies, and so we cannot validate hypothesis H7 of this study.

Berger et al. (1992) for the United States, Joseph and Hewins (1997) for the United Kingdom and Adams and Buckle (2003) for Bermuda, although not specifically about SMEs, obtain a positive relationship between foreign ownership control and performance. The result obtained in this study does not support the arguments of Becchetti and Trovato (2002), and the empirical results of Berger et al. (1992), Joseph and Hewins (1997) and Adams and Buckle (2003), that foreign ownership of small companies can allow for increased exports, and consequent reduction of risk, contributing to increased performance.

The statistically insignificant relationship between foreign ownership and performance in small and medium-sized Portuguese companies appears to corroborate the arguments of Gomes and Ramaswamy (1999) and Chiao et al. (2006), that the effect of greater internationalization of activities on performance may not be linear, being dependent on the degree of company internationalization.

When we consider large Portuguese companies, we find that there is a positive, and statistically significant, relationship between foreign control of ownership and performance. Based on this result, we can conclude that the size of Portuguese companies is relevant in explaining the relationship between foreign ownership control and performance. Large Portuguese companies can take advantage of greater diversification of activities and product, and the reduced business risk, compared to SMEs, to face competition in foreign markets more successfully, this fact meaning improved performance.

We find that there is a positive, and statistically significant, relationship between separation of ownership control and management and the performance of Portuguese SMEs. Therefore, we can consider hypothesis H8 of this study to be valid.

The results obtained corroborate the arguments of Marschak and Radner (1972), Garicano (2000) and Lenox (2002), that decentralization of company decision-making can mean giving more responsibility to employees and consequently more motivation and specialization, contributing to improved performance. In opposition, the arguments presented by Alchian and Demsetz (1972), that centring decision-making on company owners avoids agency problems between managers and owners, contributing to improved company performance, find no empirical evidence in the case of Portuguese SMEs.

The results obtained suggest that the effects of giving more responsibility, motivation and specialization will be more relevant than agency problems between managers and owners. Consequently, the possible decentralization of decision-making in Portuguese SMEs may contribute to improved performance. Meijaard et al. (2005), for small German companies, show that a greater decentralization of companies' organizational structure does not mean diminished performance. Also, Sels et al. (2006), for small Belgian companies, conclude that greater decentralization of decision-making, with the consequent increase in employee responsibility, can contribute to improved performance.

6 Conclusions and implications

The main aim of this study was to determine the relationship between the size of small and medium-sized Portuguese companies and their performance. As a measure of performance, we consider asset profitability, given by the relationship between operational results and assets. As measures of size we use the variables of total assets, sales and number of employees.

We conclude that there is a positive, and statistically significant, relationship between the size and performance of SMEs. This relationship suggests that scale economies are a dominant factor for SMEs to attain higher levels of performance.

For large Portuguese companies we do not find a statistically significant relationship between size and performance. This result suggests that for large Portuguese companies, the possible positive effect of diversification and less risk of the activity can be cancelled out by the negative effects of reduced

management efficiency, a consequence of less control by owners of managers' activity. In the case of small and medium-sized Portuguese companies, the scale effect, diversification and lower risk appear to compensate for the possible negative effects of increased size caused by less control by owners of managers' activity.

The persistence of performance allows us to conclude that obtainment of relevant performance rates by small and medium-sized Portuguese companies is not a haphazard process, but is continuous over time. This suggests that the greater level of risk and possible negative effects of competition associated with small companies, do not mean pronounced changes in performance over time. The similarity of performance persistence in Portuguese SMEs to performance persistence in large Portuguese companies allows us to validate empirically the arguments that persistence of company performance is not very dependent on size. This suggests that the scale of companies does not take on special relevance in explaining persistency of performance.

The negative relationship between debt and performance shows the greater relevance of agency problems between owners and creditors. The greater level of risk and lower level of security associated with small companies imply greater efforts to pay off the debt and may contribute to diminished performance.

The statistically insignificant relationship between liquidity and performance prevents us from concluding that a higher level of liquidity in SMEs contributes to increased performance. This may be a consequence of lower risk of not fulfilling short-term obligations and the greater possibility of coping with market changes. On the other hand, for large Portuguese companies, we found a negative influence of the level of liquidity on performance, showing the possible existence of less than optimal investment in cases of high company liquidity. However, this kind of problem does not appear to be relevant in the context of Portuguese SMEs.

Despite the greater level of activity risk in the context of SMEs, the statistically insignificant relationship between risk and performance does not allow us to confirm that greater risk means diminished performance.

The negative relationship between level of tangible assets and performance suggests that small and medium-sized Portuguese companies with higher levels of intangible assets, and probably more prone to innovation, manage to achieve better performance than companies with higher levels of tangible assets.

Foreign ownership control is not associated with better performance in small and medium-sized Portuguese companies. Therefore, we do not find evidence for the argument that companies owned by foreigners have greater capacity for investment and product diversification or greater ability to internationalize, justifying their better performance. Also in these circumstances, the results referring to large Portuguese companies are different, finding a positive and statistically significant relationship between foreign control of ownership and performance. While the greater possibility of diversifying activities and the product, as a possible consequence of foreign ownership control, appears to be relevant in increasing the performance of large Portuguese companies, it does not appear to be relevant in the context of Portuguese SMEs.

Finally, we found a positive and statistically significant relationship between separation of ownership and management and the performance of Portuguese SMEs. This result is particularly relevant because it suggests the possibility of the greater importance of the effects of responsibility, motivation and professional management, a consequence of greater decentralization of decision-making, compared to the possible agency problems between owners and managers, a consequence of separating management from ownership.

To sum up, the results obtained in this study allow us to conclude that: the possible positive effects of increased scale and diversification of activities and the product are relevant for improved performance in Portuguese SMEs; the greater inclination to innovate also contributes to increased performance and the performance of Portuguese SMEs is also influenced by separation of ownership and management, which illustrates the possibility of more professional management of Portuguese SMEs being able to contribute to increased performance.

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Appendix A: Firm distribution by industries

Table A.1 Firm distribution by sub-sectors (total Portugal SMEs-2001)

Industry	Number of firms	Total firms (%)
Agriculture, forestry and mining	8,551	2.80
Manufacturing	43,425	14.22
Construction	37,524	12.28
Wholesale and retail trade	98,130	32.12
Hotels and restaurants	28,748	9.41
Transport and communications	18,856	6.17
Business services	48,726	15.95
Education, health, social work and others	21,521	7.05
Total	3,05,481	100

Source: INE (2004)

Table A.2 Firm distribution by sub-sectors (data base SMEs)

Industry	Number of firms	Total firms (%)
Agriculture, forestry and mining	3	5.88
Manufacturing	7	13.72
Construction	5	9.81
Wholesale and retail trade	22	43.14
Hotels and restaurants	3	5.88
Transport and communications	3	5.88
Business services	5	9.81
Education, health, social work and others	3	5.88
Total	51	100

Appendix B: Descriptive statistics and correlation matrix

Table B.1 Descriptive statistics

Variable	Obser.	Mean	Standard deviation	Minimum	25° Perc.	Median	75° Perc.	Maximum
$PERF_{i,t}$	255	0.052	0.057	−0.1188	0.0157	0.0414	0.0762	0.3628
$SIZE1_{i,t}$	255	17,209.3	6,407.75	2,362.95	1,2247.93	17,729.20	22,785.21	26,755.10
$SIZE2_{i,t}$	255	24,049.9	9,127.23	7,529.58	1,6901.55	25,095.56	31,353.93	39,763.11
$SIZE3_{i,t}$	255	126.44	69.668	5	58	130	186	242
$LEV_{i,t}$	255	0.5482	0.2127	0.0848	0.3727	0.5295	0.7329	1.0743
$LIQ_{i,t}$	255	1.7619	1.3331	0.2846	1.1585	1.4088	1.9220	11.646
$EVOL_{i,t}$	255	2.5427	6.45499	0.00216	0.33165	0.52661	2.0898	50.036
$TANG_{i,t}$	255	0.3887	0.24107	0.01598	0.15330	0.44350	0.56050	0.90043
$OWNER_{i,t}$	255	0.2862	0.4529	0	0	0	1	1
$MAN_{i,t}$	255	0.3014	0.5924	0	0	0	1	1

Table B.2 Descriptive statistics (mean and median per year)

Variable	1999	2000	2001	2002	2003
$PERF_{i,t}$	0.049	0.048	0.052	0.055	0.056
	(0.039)	(0.038)	(0.040)	(0.044)	(0.046)
$SIZE1_{i,t}$	15,080.2	15,510.5	18,791.9	18,072.8	18,590.8
	(14,083.4)	(14,913.4)	(18,127.6)	(18,622.5)	(19,117.5)
$SIZE2_{i,t}$	20,264.4	21,932.7	24,262.4	26,104.0	27,686.0
	(18,577.4)	(19,504.6)	(25,040.4)	(27,143.4)	(27,257.6)
$SIZE3_{i,t}$	125.2	126.7	127.8	127.0	125.3
	(124)	(123)	(136)	(133)	(136)

Table B.2 continued

Variable	1999	2000	2001	2002	2003
$LEV_{i,t}$	0.5172	0.5541	0.5371	0.5572	0.5754
	(0.4942)	(0.5671)	(0.5042)	(0.5431)	(0.5489)
$LIQ_{i,t}$	1.7119	1.6585	1.6944	1.8999	1.8448
	(1.342)	(1.5172)	(1.8944)	(1.4121)	(1.6791)
$EVOL_{i,t}$	1.9762	2.4259	3.4897	2.6654	2.1563
	(0.3192)	(0.5472)	(0.6941)	(0.5241)	(0.5072)
$TANG_{i,t}$	0.4034	0.4329	0.3648	0.3510	0.3914
	(0.4742)	(0.4817)	(0.4012)	(0.4172)	(0.4316)
$OWNER_{i,t}$	0.274	0.294	0.294	0.274	0.294
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$MAN_{i,t}$	0.294	0.352	0.254	0.313	0.294
	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)

Median in brackets

Table B.3 Correlation matrix

	$PERF_{i,t}$	$SIZE1_{i,t}$	$SIZE2_{i,t}$	$SIZE3_{i,t}$	$LEV_{i,t}$	$LIQ_{i,t}$	$EVOL_{i,t}$	$TANG_{i,t}$	$OWNER_{i,t}$	$MAN_{i,t}$
$PERF_{i,t}$	1									
$SIZE1_{i,t}$	0.092	1								
$SIZE2_{i,t}$	0.150***	0.750***	1							
$SIZE3_{i,t}$	0.184***	0.324***	0.376***	1						
$LEV_{i,t}$	−0.154***	0.410***	0.601***	0.204***	1					
$LIQ_{i,t}$	0.356***	0.095*	−0.071	0.024	−0.459***	1				
$EVOL_{i,t}$	−0.045	0.075	0.072	0.034	0.082	0.038	1			
$TANG_{i,t}$	−0.176***	−0.072	−0.420***	0.050	−0.327***	−0.194***	−0.047	1		
$OWNER_{i,t}$	0.152***	0.228***	0.072	−0.059	−0.098*	0.113**	0.023	0.043	1	
$MAN_{i,t}$	0.372***	0.200***	0.147**	0.307***	0.025	−0.130**	−0.066	−0.116*	0.182***	1

Notes: 1. *** indicates significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level

Appendix C: Results of large Portuguese companies

Table C.1 Dynamic estimators (SIZE1)

Dependent variable: $PERF_{i,t}$				
Independent variables	GMM (1991)	GMM system (1998)	LSDVC (2005) initial (AB)	LSDVC (2005) initial (BB)
$PERF_{i,t-1}$	0.50381***	0.60774***	0.58198***	0.59879***
	(0.20101)	(0.05115)	(0.09435)	(0.05774)
$SIZE1_{i,t}$	−0.01458	0.01052	−0.00990	−0.00937
	(0.01222)	(0.00834)	(0.00841)	(0.00751)

Table C.1 continued

Dependent variable: $PERF_{i,t}$				
Independent variables	GMM (1991)	GMM system (1998)	LSDVC (2005) initial (AB)	LSDVC (2005) initial (BB)
$LEV_{i,t}$	−0.24474***	−0.06865***	−0.22657***	−0.20357***
	(0.05603)	(0.02184)	(0.04764)	(0.04398)
$LIQ_{i,t}$	−0.01002***	−0.00369***	−0.01532***	−0.01355**
	(0.00072)	(0.00014)	(0.00584)	(0.00583)
$EVOL_{i,t}$	−0.00155	−0.00544	0.00146	0.00125
	(0.00549)	(0.00411)	(0.00453)	(0.00445)
$TANG_{i,t}$	−0.26721***	−0.08165***	−0.22726***	−0.19994***
	(0.05338)	(0.02516)	(0.04147)	(0.03713)
$OWNER_{i,t}$	0.02029***	0.01769***	0.01327***	0.01341***
	(0.000432)	(0.00451)	(0.00258)	(0.002503)
CONS	−0.00439	0.00629		
	(0.00417)	(0.07918)		
Instruments	9	91		
Observations	333	444		
Wald (χ^2)	35.97***			
F(N(0,1))		27.28***		
Sargan (χ^2)	1.44			
Hansen (N(0,1))		93.57		
m1(0,1)	−4.97***	−3.39***		
m2(0,1)	1.20	0.34		

Notes: (1) Column (2) adopts the one-step Arellano and Bond GMM (1991) estimation method, using instruments: ($PERF_{i,t-2}$, $\sum_{K=1}^{n} Z_{k,i,t-2}$). (2) Column (3) adopts the one-step Blundell and Bond GMM system (1998) estimation method, using instruments: ($PERF_{i,t-2}$, $\sum_{K=1}^{n} Z_{k,i,t-2}$) in differenced equations and ($\Delta PERF_{i,t-2}$, $\sum_{K=1}^{n} \Delta Z_{k,i,t-2}$) in the levels equations. (3) Z_K is a k performance determinant. (4) Heteroskedasticity consistent and asymptotic robust standard deviations are reported in brackets. (5) *** Indicates significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level. (6) The Wald test has χ^2 distribution and tests the null hypothesis of non-significance as a whole of the parameters of the explanatory variables. (7) The F test has normal distribution N(0,1) and tests the null hypothesis of non-significance as a whole of the estimated parameters, against the alternative hypothesis of significance as a whole of the estimated parameters. (8) The Sargan test of over-identifying restrictions is distributed as χ^2 under the null hypothesis of instrument validity, used in one-step Arellano and Bond GMM (1991) estimation method. (9) The Hansen test of over-identifying restrictions is distributed as N(0,1) under the null hypothesis of instrument validity, used in one-step Blundell and Bond GMM system (1998). (10) The m1 test is a test for first order autocorrelation of residuals and is distributed as N(0,1), under null hypothesis of no first order autocorrelation. (11) The m2 test is a test for second order autocorrelation of residuals and is distributed as N(0,1), under null hypothesis of no second order autocorrelation

Table C.2 Dynamic estimators (SIZE2)

Dependent variable: $PERF_{i,t}$				
Independent variables	GMM (1991)	GMM system (1998)	LSDVC (2005) initial (AB)	LSDVC (2005) initial (BB)
$PERF_{i,t-1}$	0.56870***	0.62327***	0.56412***	0.60712***
	(0.20814)	(0.08114)	(0.08568)	(0.05511)
$SIZE2_{i,t}$	0.00219	0.01857	0.00824	0.00923
	(0.01612)	(0.08912)	(0.01127)	(0.01026)
$LEV_{i,t}$	−0.23889***	−0.07149***	−0.20981***	−0.19044***
	(0.05719)	(0.02220)	(0.04720)	(0.04435)

Table C.2 continued

Dependent variable: $PERF_{i,t}$				
Independent variables	GMM (1991)	GMM system (1998)	LSDVC (2005) initial (AB)	LSDVC (2005) initial (BB)
$LIQ_{i,t}$	−0.01053***	−0.00254***	−0.01524***	−0.01324**
	(0.00075)	(0.00014)	(0.00577)	(0.00582)
$EVOL_{i,t}$	−0.00261	−0.00616	0.00150	0.00131
	(0.00561)	(0.00422)	(0.00458)	(0.00451)
$TANG_{i,t}$	−0.28507***	−0.07038***	−0.24087***	−0.21685***
	(0.05268)	(0.01754)	(0.04070)	(0.03671)
$OWNER_{i,t}$	0.02242***	0.00890***	0.01454***	0.01392***
	(0.001694)	(0.000474)	(0.00109)	(0.00268)
CONS	−0.00263	0.03025		
	(0.00407)	(0.05040)		
Instruments	9	91		
Observations	333	444		
Wald (χ^2)	34.90***			
$F(N(0,1))$		24.52***		
Sargan (χ^2)	1.27			
Hansen ($N(0,1)$)		92.07		
m1(0,1)	−5.00***	−3.45***		
m2(0,1)	1.40	0.32		

Notes: (1) Column (2) adopts the one-step Arellano and Bond GMM (1991) estimation method, using instruments: ($PERF_{i,t-2}$, $\sum_{K=1}^{n} Z_{k,i,t-2}$). (2) Column (3) adopts the one-step Blundell and Bond GMM system (1998) estimation method, using instruments: ($PERF_{i,t-2}$, $\sum_{K=1}^{n} Z_{k,i,t-2}$) in differenced equations and ($\Delta PERF_{i,t-2}$, $\sum_{K=1}^{n} \Delta Z_{k,i,t-2}$) in the levels equations. (3) Z_K is a k performance determinant. (4) Heteroskedasticity consistent and asymptotic robust standard deviations are reported in brackets. (5) *** Indicates significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level. (6) The Wald test has χ^2 distribution and tests the null hypothesis of non-significance as a whole of the parameters of the explanatory variables. (7) The F test has normal distribution $N(0,1)$ and tests the null hypothesis of non-significance as a whole of the estimated parameters, against the alternative hypothesis of significance as a whole of the estimated parameters. (8) The Sargan test of over-identifying restrictions is distributed as χ^2 under the null hypothesis of instrument validity, used in one-step Arellano and Bond GMM (1991) estimation method. (9) The Hansen test of over-identifying restrictions is distributed as $N(0,1)$ under the null hypothesis of instrument validity, used in one-step Blundell and Bond GMM system (1998). (10) The m1 test is a test for first order autocorrelation of residuals and is distributed as $N(0,1)$, under null hypothesis of no first order autocorrelation. (11). The m2 test is a test for second order autocorrelation of residuals and is distributed as $N(0,1)$, under null hypothesis of no second order autocorrelation

Table C.3 Dynamic estimators (SIZE3)

Dependent variable: $PERF_{i,t}$				
Independent variables	GMM (1991)	GMM System (1998)	LSDVC (2005) Initial (AB)	LSDVC (2005) Initial (BB)
$PERF_{i,t-1}$	0.55889***	0.65712***	0.57791***	0.56419***
	(0.21670)	(0.08456)	(0.08778)	(0.05534)
$SIZE3_{i,t}$	−0.03130	0.02483	−0.00128	0.00188
	(0.02549)	(0.08417)	(0.01712)	(0.01481)
$LEV_{i,t}$	−0.24514***	−0.10454***	−0.21890***	−0.19610***
	(0.05717)	(0.03236)	(0.04718)	(0.04313)
$LIQ_{i,t}$	−0.00981***	−0.00457***	−0.01540**	−0.01366**
	(0.00014)	(0.00027)	(0.00602)	(0.00585)

Table C.3 continued

Dependent variable: $PERF_{i,t}$				
Independent variables	GMM (1991)	GMM System (1998)	LSDVC (2005) Initial (AB)	LSDVC (2005) Initial (BB)
$EVOL_{i,t}$	−0.00198	−0.00560	0.00159	0.00126
	(0.00560)	(0.00426)	(0.00463)	(0.00441)
$TANG_{i,t}$	−0.29062***	−0.09998***	−0.24057***	−0.21490***
	(0.05337)	(0.03240)	(0.04124)	(0.03631)
$OWNER_{i,t}$	0.02322	0.01452***	0.01321***	0.01436***
	(0.001733)	(0.000264)	(0.00135)	(0.001853)
CONS	−0.00269	−0.01079		
	(0.00390)	(0.04791)		
Instruments	9	91		
Observations	333	444		
Wald (χ^2)	34.25***			
F(N(0.1))		20.99***		
Sargan (χ^2)	1.44			
Hansen ($N(0,1)$)		86.38		
m1(0,1)	−4.90***	−3.43***		
m2(0,1)	1.43	0.27		

Notes: (1) Column (2) adopts the one-step Arellano and Bond GMM (1991) estimation method, using instruments: ($PERF_{i,t-2}$, $\sum_{K=1}^{n} Z_{k,i,t-2}$). (2) Column (3) adopts the one-step Blundell and Bond GMM system (1998) estimation method, using instruments: ($PERF_{i,t-2}$, $\sum_{K=1}^{n} Z_{k,i,t-2}$) in differenced equations and ($\Delta PERF_{i,t-2}$, $\sum_{K=1}^{n} \Delta Z_{k,i,t-2}$) in the levels equations. (3) Z_K is a k performance determinant. (4) Heteroskedasticity consistent and asymptotic robust standard deviations are reported in brackets. (5) *** Indicates significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level. (6) The Wald test has χ^2 distribution and tests the null hypothesis of non-significance as a whole of the parameters of the explanatory variables. (7) The F test has normal distribution $N(0,1)$ and tests the null hypothesis of non-significance as a whole of the estimated parameters, against the alternative hypothesis of significance as a whole of the estimated parameters. (8) The Sargan test of over-identifying restrictions is distributed as χ^2 under the null hypothesis of instrument validity, used in one-step Arellano and Bond GMM (1991) estimation method. (9) The Hansen test of over-identifying restrictions is distributed as $N(0,1)$ under the null hypothesis of instrument validity, used in one-step Blundell and Bond GMM system (1998). (10) The m1 test is a test for first order autocorrelation of residuals and is distributed as $N(0,1)$, under null hypothesis of no first order autocorrelation. (11) The m2 test is a test for second order autocorrelation of residuals and is distributed as $N(0,1)$, under null hypothesis of no second order autocorrelation

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