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Evidence on Competitive Advantage and Superior Stock Market Performance

Øystein Gjerde, Kjell Knivsflå* and Frode Sættem

Norwegian School of Economics and Business Administration, Bergen, Norway

This article analyzes the value-relevance of industry-based and resource-based competitive advantage in a large sample of firms listed on the Oslo Stock Exchange. We measure competitive advantage by a single variable and perform a new decomposition into its underlying sources. In 1986–2005, the industry-based and the resource-based competitive advantage explain more than 20% of abnormal stock market returns, accumulated over 5 years. The resource-based advantage is almost 4 times more important than the industry-based advantage. Differences in both the return and the risk capability of firms' net assets relative to their industry peers are significant parts of the resource-based advantage, estimated at 60 and 40%, respectively. Copyright © 2009 John Wiley & Sons, Ltd.

INTRODUCTION

The question of whether firm performance is driven primarily by industry-specific or firm-specific factors has been intensively debated in the strategic management literature. This literature is dominated by two models of competitive advantage; the industrial organization model and the resource-based model (see e.g. Barney, 2007). Most empirical studies rely on some sort of variance decomposition procedure to measure the effects of industry-specific and firm-specific factors on the variability of firm performance. This article expands previous empirical strategic management research in several directions. We focus on performance in terms of abnormal stock market performance instead of plain stock market performance or accounting-based firm performance. We measure competitive advantage by a single variable and introduce a new and intuitive decomposition of this variable into an industry-based competitive advantage and a resource-based competitive advantage. The resource-based advantage is further decomposed into a return and a risk difference. The importance of these three sources of competitive advantage is evaluated empirically by their ability to explain abnormal stock market performance over short and long periods. In this sense, we are inspired by value-based management and concerned with the value-relevance of competitive advantage for equity investors.

According to the industrial organization model of competitive advantage, the industry in which a firm chooses to compete has a stronger influence on firm performance than the choices managers make inside their own organization (Porter, 1980, 1985). Performance is believed to be determined primarily by economy-wide and industry-specific factors, including the intensity of competition among the firms within an industry. The resource-based model of competitive advantage assumes that each firm is a collection of resources and capabilities. They provide the basis for the firm's competitive strategy and are the primary source of the firm's return (Wernerfelt, 1984;

*Correspondence to: Norwegian School of Economics and Business Administration, NHH, 5045 Bergen, Norway. E-mail: kjell.knivsfla@nhh.no

Barney, 1991, 2001). Thus, according to this model, differences in firms' performance across time are primarily due to unique resources and capabilities rather than to the industry's structural characteristics. A resource-based competitive advantage could stem from both the corporate- and the single business-level within a firm.

On the basis of empirical work, the debate on the relative importance of industry-specific versus firm-specific effects on firm performance goes back at least to the work of Schmalensee (1985). He finds that industry-specific effects are the dominant explanatory factors of variation in profitability, measured by return on assets, while firm-specific effects in terms of both corporate and business-level effects are small. Rumelt (1991), on the other hand, finds that firm-specific effects explain the largest portion of profitability, followed by much smaller industry-specific effects.[1] His ratio of firm-specific to industry-specific effects is almost 10:1. Later research confirms Rumelt's finding, but at a somewhat smaller level (McGahan and Porter, 1997; McGahan, 1999; Bowman and Helfat, 2001; Spanos and Lioukas, 2001; Hawawini *et al.*, 2003, 2005; Villalonga, 2004; McNamara *et al.*, 2005; Tong and Reuer, 2006; Misangyi *et al.*, 2006). The majority of empirical studies employ return on assets or other accounting-based profitability measures to represent firm performance. Overall, empirical studies give strong support to the conclusion that firm-specific effects dominate industry-specific effects in explaining firm performance and that this result is not sensitive to type of performance metric. Thus, the empirical findings offer strong support to the importance of resource-based competitive advantage. Furthermore, industry-based effects also have a significant influence on firm performance, although their impact is smaller.

Our study differs from previous studies in several ways. First, we focus on superior, or equivalently, abnormal stock market performance, and do not investigate stock market performance *per se* (Spanos and Lioukas, 2001), superior accounting-based firm performance (Hawawini *et al.*, 2003) or Tobin's *q* (McGahan, 1999; Villalonga, 2004). By replacing accounting-based firm return by stock market return, the connection between main sources of competitive advantage and factors that create value for firm owners in the equity market may be examined more directly. This is in line with the increased awareness on investor value creation through the growth of value-based management (see e.g. Haspeslagh *et al.*, 2001; Young and O'Byrne, 2001).

Second, we introduce a technique for measuring industry-based and resource-based competitive advantage as single variables. In turn, the resource-based advantage is split into two components, acknowledging the distinction between resources as return generators and risk accumulators reflected in the cost of capital. Next, we regress the industry-specific effect and the two firm-specific effects on abnormal stock market return to learn what is the impact of competitive advantage and its underlying components, when we simultaneously control for conventional risk factors. Our two sources of competitive advantage are: (i) A firm is said to have an industry-based competitive advantage if its industry on average is able to earn a return on equity capital that is larger than the average cost of equity capital determined by the capital market. (ii) A firm has a resource-based competitive advantage if it is able to earn a return on its resources that is larger than the industry's average return or/and if the firm has a cost of equity capital below the industry's average cost of equity capital. The difference in return is related to net assets as strategic resources, while the difference in risk is related to funding abilities.

Our sample consists of 3051 firm-year observations over the 20-year period 1986–2005 of companies listed on the Oslo Stock Exchange in Norway. We find that the industry-based competitive advantage has a minor significant impact on the variability of superior stock market performance. On the other hand, the resource-based competitive advantage has a large impact, even after removing potentially extreme observations and checking for potential instability and lack of robustness. The ratio of resource-based to industry-based competitive advantage is 3.7 when it is estimated over 5-year periods and considerably higher when measured on an annual basis. Thus, our new approach confirms Rumelt's (1991) findings and the results of subsequent studies on the drivers of firm performance, and thus strongly supports the resource-based model of competitive advantage. Furthermore, we find that the resource advantage is driven both by unique return and risk capabilities of the firms' net assets relative to the average of their industry

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peers. We estimate the importance of these two parts of the resource-based advantage at 61 and 39%, respectively.

Our article is organized as follows. First, we develop our hypotheses and outline the test methodology. Second, we present the data, select the sample and give some descriptive statistics. Third, we present our correlation and regression results, and analyze their implications, including tests for time stability and specification robustness. Finally, we give some concluding remarks.

HYPOTHESES AND TEST METHODOLOGY

A competitive advantage results in superior value creation for the firm and for its shareholders. Since superior value creation may be measured by the firm's ability to deliver a return on capital that exceeds its cost of capital, the *outcome* from a competitive advantage may be calculated by the margin

$$\mathrm{CA} = i - k, \tag{1}$$

where i is the internal rate of return on invested capital and k is the corresponding cost of capital, i.e. the risk-adjusted required rate of return on invested capital determined by the capital market.[2] Using this approach, a firm has a competitive or strategic advantage when it is able to earn a return on capital greater than the risk-adjusted required cost of capital (value creation). A firm has a competitive disadvantage when i is less than k (value destruction). If i equals k, the firm earns its 'equilibrium rate of return' (value conservation). This definition of competitive advantage is much in line with the definition used in standard textbooks, for instance Barney (2007, pp. 17–19). Competitive Advantage is also closely related to performance measures such as residual income, and thereby to Stern Stewart & Co's Economic Value Added (EVA); see e.g. Young and O'Byrne (2001). While these measures focus on the amount of money, our measure is the percentage return above the cost of capital. Competitive advantage may also be aggregated over several periods $t = 1,\ldots,T$, such that a sustainable advantage over T periods may be represented by $(1+\mathrm{CA}_1)\cdot(1+\mathrm{CA}_2)\cdot\ldots\cdot(1+\mathrm{CA}_T)-1$, or, by using logarithmic abnormal returns, by $\Sigma_t\,\mathrm{CA}_t$.[3]

To evaluate the sources of a firm's competitive advantage, CA, we utilize the following decomposition of (1):

$$\mathrm{CA} = \underbrace{i_\mathrm{I} - k_\mathrm{I}}_{\substack{\text{Industry-Based}\\ \text{Competitive Advantage,}\\ \mathrm{CA_{IB}}}} + \underbrace{\underbrace{i - i_\mathrm{I}}_{\substack{\text{Return}\\ \text{Difference}\\ \mathrm{RED_{RB}}}} + \underbrace{k_\mathrm{I} - k}_{\substack{\text{Risk}\\ \text{Difference}\\ \mathrm{RID_{RB}}}}}_{\substack{\text{Resource-Based}\\ \text{Competitive Advantage}\\ \mathrm{CA_{RB}}}} \tag{2}$$

where i_I is the industry's average internal rate of return on equity and k_I is its average equity cost of capital. The first part, $\mathrm{CA_{IB}} = i_\mathrm{I} - k_\mathrm{I}$, is the industry-based competitive advantage. When the whole industry on average is able to earn a return, i_I, greater than its average cost of capital, k_I, it has a competitive advantage, e.g. due to entry barriers leading to imperfect competition. The second part, CA_RB is the resource-based competitive advantage, which is the part of CA not related to industry (i.e. the residual).

$\mathrm{CA_{RB}}$ is split into two components. The first one, $\mathrm{RED_{RB}} = i - i_\mathrm{I}$, represents the return difference between firm and industry caused by the firm's assets or resources. When a firm is able to generate a return, i, greater than the average return in its industry, i_I, this firm has a return advantage over an average firm. This component may stem from some resource or capability belonging to this firm alone, or, at least, it may have a larger quantity or quality of such assets than does an average firm, e.g. superior technology or competence to employ human resources more effectively than its competitors. The second component, $\mathrm{RID_{RB}} = k_\mathrm{I} - k$, emphasizes that a valuable strategic resource may stem from financial funding through the market-based risk premium relative to an average firm. We may regard this as a risk-based advantage caused by the risk built into the firm's resources, since risk in general accounts for the difference between the two costs of capital.

It is necessary to take both components, $\mathrm{RED_{RB}}$ and $\mathrm{RID_{RB}}$, into consideration when computing the resource-based competitive advantage, $\mathrm{CA_{RB}}$. Generally, return and risk are not separable. A return difference may be positive simply because the firm has more risky assets than the average industry or higher leverage, which in turn would imply that the risk difference becomes negative. The two effects may outbalance each other and will in that case show up in a high negative correlation between the variables (Modigliani-Miller's irrelevance theorem of capital structure and hence financial risk; see e.g.

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Berk and DeMarzo, 2006). Thus, a low correlation between the return and the risk difference will be required to make our decomposition of the resource-based competitive advantage meaningful with respect to separate return and risk advantages.[4]

Equations (1) and (2) are intuitive and quite powerful quantitative measures of the proceeds of having a competitive advantage, which may stem from a number of underlying factors.[5] For example, the industry-based competitive advantage is likely to be influenced by structural factors in that industry, while the resource-based competitive advantage would be influenced by management skills and other capabilities of the firm. A supplementary approach to understanding each source of competitive advantage is thus to regress abnormal returns on various underlying explanatory factors (see the conclusion for future research proposals).

In line with the growing importance of value-based management, we evaluate how superior stock market return is affected by our measure of competitive advantage (1). Consequently, we estimate the following regression model:

$$AR = \alpha + \beta \cdot CA + \varepsilon, \tag{3}$$

where AR is abnormal stock market return, α and β are the associated regression coefficients, CA is the competitive advantage given by (1), and ε is the error term.[6,7] Competitive advantage is relevant in explaining abnormal stock market performance, or simply value-relevant, if the response coefficient β, or the R^2, is different from zero at the desired level of statistical significance.

The abnormal stock market return of a firm, AR, equals $r-k$, i.e. the difference between the observed stock market return, r, and the expected stock market return, k, conditioned on conventional risk factors such as systematic risk (Capital Asset Pricing Model) and on proxy risk factors such as firm size and the book-to-price ratio (Fama and French, 1992, 1993). The expected stock market return, k, is not observable and has to be estimated on the basis of stock market data, for example by employing the market model on the time series of returns and adjusting for size and book-to-price effects on the cross-section of firms (see e.g. Berk and DeMarzo, 2006).

Furthermore, the value-relevance of the three sources of competitive advantage in (2) may be tested by running the regression:

$$AR = \alpha + \beta_1 \cdot CA_{IB} + \beta_2 \cdot RED_{RB} + \beta_3 \cdot RID_{RB} + \varepsilon, \tag{4}$$

where CA_{IB} is the industry-based competitive advantage, while RED_{RB} and RID_{RB} are the firm-specific return and the risk difference, as specified in (2).[8] If β_1 is significantly different from zero, the industry-based competitive advantage is value-relevant; if β_2 is significant, the return difference is value-relevant; and if β_3 is significant, the risk difference is value-relevant. Finally, if $\beta_2+\beta_3$ is significantly different from zero, the resource-based competitive advantage is value-relevant. Since RED_{RB} is expected to be negatively correlated with RID_{RB}, the estimation of β_2 and β_3 may be biased due to collinearity. However, neither the estimation of $\beta_2+\beta_3$ nor the evaluation of the relative importance of industry versus resources will be affected.

The relative importance of the three sources CA_{IB}, RED_{RB} and RID_{RB} may be calculated in several ways. One approach is to focus on the estimated coefficients and compute $\beta_1/(\beta_1+\beta_2+\beta_3)$, $\beta_2/(\beta_1+\beta_2+\beta_3)$ and $\beta_3/(\beta_1+\beta_2+\beta_3)$, respectively; i.e. the relative effect in abnormal stock market return of a change of one percentage point in each of the associated variables.[9] The ratio of resource-based to industry-based competitive advantage may then be defined as $(\beta_2+\beta_3)/\beta_1$.[10] An alternative procedure is to measure the contribution of each source of competitive advantage by the marginal increase in explained variance, represented by adjusted R^2, by loading all three sources of competitive advantages in (4) relative to a corresponding regression with only two of them included.

The abnormal stock market return regression (3) and (4) may be specified for different time periods. If competitive advantage and abnormal stock market return are measured by logarithms on an annual basis, (3) may be expanded over time simply by making year-by-year accumulations, $\Sigma_t AR = \alpha + \beta \cdot \Sigma_t CA + \varepsilon$. Similarly, (4) may be expanded to $\Sigma_t AR = \alpha + \beta_1 \cdot \Sigma_t CA_{IB} + \beta_2 \cdot \Sigma_t RED_{RB} + \beta_3 \cdot \Sigma_t RID_{RB} + \varepsilon$. The value-relevance of CA and its three sources, CA_{IB}, RED_{RB} and RID_{RB}, may therefore be examined over longer periods such as 5 or 10 years.[11]

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To sum up, our alternative hypotheses (to their nulls) may be specified as:

(1) Competitive advantage is a relevant factor in explaining abnormal stock market performance.
(2) Industry-based competitive advantage, the return difference and the risk difference, and hence the resource-based competitive advantage, are all relevant factors in explaining abnormal stock market performance.
(3) The importance of the industry-based competitive advantage differs from the importance of resource-based competitive advantages, i.e. the ratio of resource-based to industry-based competitive advantage, $(\beta_2+\beta_3)/\beta_1$, is different from 1.

Observations of superior stock market returns and sources of competitive advantage are usually panel or longitudinal data, with cross-sectional observations over time. The appropriate regression models (3) and (4) should therefore allow for unobserved effects in terms of fixed, random or mixed effects across time, industries and firms (Wooldridge, 2002; Greene, 2007). However, if pooled OLS regressions are chosen because they yield similar findings, their results should be accompanied by robust standard deviations and followed by a discussion on how unobserved effects influence on the results.[12]

DATA, SAMPLE SELECTION AND DESCRIPTIVE STATISTICS

In order to test the hypothesis whether competitive advantage and its underlying components are relevant factors in explaining superior stock market performance, a large sample of data on firms listed on the Oslo Stock Exchange (OSE) is employed. Over the 20 years 1986–2005, we have access to 3284 firm-year observations from 511 individual firms.[13] For each observation, we have accounting-based return on equity, stock market return and estimates of market-based cost of equity capital. Since we have no data dividing accounting return, stock market return and required return into different business segments within firms, all firms are by assumption considered to operate within one industry group. This implies that we are not able to calculate competitive advantages at the business-level. We only compare the firm-, or corporate-level, with the industry-level, as suggested by (2).

If financial statements are recorded according to the historical cost principle, the accounting return on equity will be an estimate of the underlying internal rate of return on equity with noise due to measurement errors. If financial statements are recorded at fair value, the equity return will be a noisy estimate of the required rate of return on equity or the internal rate of return in alternative use. Therefore, using the accounting rate of return as a proxy for the internal rate of return of each firm's equity capital is only valid when the financial statements are recorded according to transactional cost or when transactional cost is the dominant principle of bookkeeping, which implies that a Norwegian sample is eminently suitable for our purpose. Over the years 1986–2004, most firms listed on the OSE used Norwegian Generally Accepted Accounting Principles, NGAAP, as the basis for preparing their financial statements, while some used USGAAP or other accounting standards. The main principle of NGAAP is transaction-based historical cost, with fair value for liquid financial instruments in recent years. From 2005, firms listed on European exchanges were required by the European Union to report consolidated financial statements according to the International Financial Reporting Standards, IFRS, in which measurement according to fair value is more prominent than according to NGAAP. Nevertheless, cost is the alternative basis for measurement according to IFRS when fair value cannot be measured reliably. In practice, cost is used for nearly all assets other than liquid financial instruments, as their fair values are hard to measure reliably.[14] This suggests that the accounting rate of return on equity may function as a noisy measure of the internal rate of return on equity, which is required to compute competitive advantage in (1).

The annual accounting return on equity (our proxy for i) is simply the recorded earnings in a given year divided by the previous year's book-value of equity. If this book-value is negative, no meaningful return may be calculated and consequently, the observation is dropped. The required return on equity, k, i.e. the market-based risk-adjusted cost of equity, is estimated on the basis of annual stock market data. The firms'

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annual stock returns, including dividends and measured by logarithms, are divided into 10 size portfolios. Size is measured by the logarithm of the stock market value. Abnormal returns for each year are calculated as the realized annual stock return, r, minus the average annual stock return in the corresponding size portfolio (Fama and MacBeth, 1973). In addition, we adjust for another well-documented proxy risk factor, the book-to-price ratio (Fama and French, 1992, 1993). We run a cross-sectional regression each year, where the size-adjusted abnormal stock returns are explained by the book-to-price ratio. The excess return after this adjustment is our measure of abnormal return, $AR = r - k$.[15] A firm's competitive advantage for a given year equals its accounting return on equity minus its required return on equity, $CA = i - k$, and is split into its three underlying sources according to (2).

The 511 firms are divided into 11 industries according to the official OSE classification for most of the period 1986–2005. These industries are property (17 firms; 103 firm-year observations), banking and insurance (42; 245), retailing (17; 112), manufacturing (157; 994), information technology and communications (93; 449), media (10; 87), offshore (47; 247), shipping (78; 534), other transportation (13; 109), others services (28; 184) and savings banks (23; 220) issuing primary capital certificates.[16,17,18] The average return on equity and the average cost of equity are calculated for each of these industries. In accordance with (2), the industry-based competitive advantage is the average return on equity in an industry for a given measurement period minus the average equity cost of capital in that industry for that period. The resource-based competitive advantage is the firm's return on equity for a given period minus the average return on equity in that firm's industry for that period plus the average equity cost of capital in a firm's industry for a given period minus the firm's own equity cost of capital for that period.

Initially, we had 3284 observations available for the annual abnormal stock return variable, AR, and for the competitive advantage variable, CA, which in turn was split into its three underlying components, CA_{IB}, RED_{RB} and RID_{RB}. In order to reduce the possible impact of extreme observations, i.e. strategic leaders and losers, the full sample has been reduced by removing the 1% upper and the 1% lower observations in each of the four competitive advantage variables on an annual basis.[19] Table 1 shows that the selected sample includes 3051 firm-year observations, a reduction of 7.1% ($\neq 4$ variables $\cdot$ 2 tails $\cdot$ 1%, due to the removal of overlapping observations). In all, 504 individual firms are represented.

Table 2 presents descriptive statistics when the competitive advantage and abnormal stock market return are measured on an annual basis. The mean abnormal return for the selected sample is 1.2%. Since the average abnormal return for all observations on the OSE over the period by construction equals zero, the firms excluded from the sample, either because of lacking accounting data or because they are extreme firm-year observations, typically produce negative abnormal returns.

Table 1. Sample

	Number of observations	Percentage
All estimates of the required rate of return 1986–2005	3762	
Lacking accounting data to compute return on equity	468	
All firm-year observations with complete data	3284	100.0%
1% highest and lowest of CA, CA_{IB}, RED_{RB} and RID_{RB}	233	7.1%
Sample	3051	92.9%

CA is the competitive advantage, CA_{IB} is the industry-based competitive advantage, RED_{RB} is the return difference and RID_{RB} is the risk difference relative to industry. The resource-based strategic advantage $CA_{RB} = RED_{RB} + RID_{RB}$, as suggested by (2).

Table 2. Descriptive Statistics

	Obs.	Mean	St. dev.	Q_1	Median	Q_3
AR	3762	0.000	0.572	−0.256	0.032	0.289
AR	3284	0.003	0.562	−0.254	0.034	0.287
CA	3284	0.039	0.644	−0.252	0.020	0.315
CA_{IB}	3284	0.041	0.358	−0.223	0.073	0.264
RED_{RB}	3284	0.000	0.512	−0.113	0.008	0.121
RID_{RB}	3284	−0.002	0.185	−0.106	0.001	0.107
AR	3051	0.012	0.532	−0.246	0.034	0.277
CA	3051	0.040	0.407	−0.234	0.020	0.294
CA_{IB}	3051	0.041	0.312	−0.223	0.070	0.254
RED_{RB}	3051	−0.001	0.249	−0.101	0.010	0.117
RID_{RB}	3051	−0.000	0.154	−0.104	0.001	0.104

AR is abnormal stock market return, CA is the competitive advantage, CA_{IB} is the industry-based competitive advantage, RED_{RB} is the return difference and RID_{RB} is the risk difference relative to industry. The resource-based strategic advantage $CA_{RB} = RED_{RB} + RID_{RB}$. St. dev. is the abbreviation for standard deviation, Q_1 is lower quartile, and Q_3 is upper quartile.

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We learn that the mean competitive advantage is 4.0% in the selected sample of 3051 firm-year observations, implying that firms on average earn an accounting return on equity four percentage points above their estimated cost of capital. This represents the industry-based competitive advantage, since the average resource-based advantage by construction must be approximately zero. As we shall see, this does not necessarily imply that the industry-based competitive advantage dominates the resource-based one in explaining superior stock market performance.

TEST RESULTS AND ANALYSES

To test whether abnormal stock market performance is related to competitive advantage and its underlying drivers, we analyze binary correlation coefficients and perform multiple ordinary least-square regressions in Stata. Our regression results will be tested for time stability and robustness against alternative specifications, including unobserved firm, industry and time effects.

Binary Correlation

Table 3 reports the binary correlation coefficients between competitive advantage and its underlying sources, measured over 1, 3 and 5 years. According to panel A, containing the 1-year measures, the correlation between CA and CA_{IB} is 0.724. This implies that the industry-based competitive advantage explains 52.4% $(=0.724^2)$ of the variation in CA. The correlation between CA and RED_{RB} is 0.543, i.e. the return difference explains 29.5% of the variation in CA. Finally, the correlation between CA and RID_{RB} is 0.295, i.e. the risk difference explains 8.7% of the variation in CA. We may therefore conclude that the industry-based competitive advantage is about 40% more important than the resource-based competitive advantage (the ratio CA_{RB}/CA_{IB} is 0.7). If the period of accumulating performance is expanded to 3 or 5 years, the two resource-based competitive advantages typically become more important; see panels B and C of Table 3. Based on 5 years of measurement, the industry-based advantage explains about 70% less than the resource-based advantage, suggesting a ratio of resources-to-industry of about 3.5.

Table 3. Pearson Correlation Matrix

	Obs.	AR	CA	CA_{IB}	RED_{RB}
Panel A: 1 year of accumulating performance					
CA	3051	0.219***			
CA_{IB}	3051	0.019	0.724***		
RED_{RB}	3051	0.311***	0.543***	−0.047***	
RID_{RB}	3051	0.037*	0.295***	−0.040*	0.088***
Panel B: 3 years of accumulating performance					
CA	2340	0.365***			
CA_{IB}	2340	0.070***	0.536***		
RED_{RB}	2340	0.375***	0.697***	−0.098***	
RID_{RB}	2340	0.071***	0.316***	−0.008	−0.079***
Panel C: 5 years of accumulating performance					
CA	1802	0.499***			
CA_{IB}	1802	0.107***	0.431***		
RED_{RB}	1802	0.448***	0.731***	−0.150***	
RID_{RB}	1802	0.150***	0.345***	−0.014	−0.066***

AR is abnormal stock market return, CA is the competitive advantage, CA_{IB} is the industry-based competitive advantage, RED_{RB} is the return difference, and RID_{RB} is the risk difference relative to industry. The resource-based strategic advantage $CA_{RB}=RED_{RB}+RID_{RB}$. Obs. is the abbreviation for number of observations. The asterisks ***, ** and * indicate statistical significance at the 1, 2.5 and 5% level, respectively, when tested two-sided. Notice that the number of observations falls when accumulating competitive advantage and abnormal stock market performance over several years. To limit this effect, observations from 1985, 1984 and so forth are utilized successively. For example when accumulating over 5 years, data from 1981 to 2005 are included in the sample to obtain 1802 firm-year observations.

Furthermore, CA_{IB} is significantly negatively correlated with both RED_{RB} and RID_{RB}, irrespective of which measurement length is chosen. Firms with a large industry-based competitive advantage typically have both a significantly lower return difference (and vice versa) and a significantly lower risk difference (and vice versa). RED_{RB} is significantly positively correlated with RID_{RB} for 1-year and significantly negatively correlated for 3- and 5-year measures.[20] From the discussion following (2), these correlations are very interesting. An average correlation coefficient close to zero justifies our decomposition of the resource-based competitive advantage into a return and a risk difference. Each factor contributes independently to estimating the effects of extraordinary returns and funding abilities.

According to panel A, the correlation between abnormal return and competitive advantage is 0.219, i.e. competitive advantage explains 4.8% of the variation in abnormal stock returns, measured over 1 year. Consequently, the corresponding regression model in Table 4 produces an R^2 of

Table 4. Current Competitive Advantage and Current Abnormal Stock Market Performance—1 Year of Accumulation

	Coefficients	*t*- or *F*-value
Intercept	0.000	0.02
CA	0.286***	10.10
Adj. R^2	0.048***	4.28
F-value	101.97***	
Obs.	3051	
Intercept	0.010	1.08
CA_{IB}	0.062	1.91
RED_{RB}	0.680***	11.97
RID_{RB}	0.229***	3.17
Adj. R^2	0.101***	9.12
F-value	53.63***	
Obs.	3051	
Ratio of resources-to-industry	14.639***	93.68

The first regression model is given by (3), and the second is given by (4). The *t*-values of the regression coefficients are based on heteroskedasticity-adjusted estimates of the standard deviations; see White (1980). Having a large sample of 3051 observations, we utilize the HC1-estimator; see MacKinnon and White (1985). Since the 3051 firm-years include 504 firms over 1–20 years, some clustering over time may be present; see Rogers (1993). The cluster-adjusted *t*-values are 1.47 for CA_{IB}, 11.95 for RED_{RB} and 3.17 for RID_{RB}. Since the effect of clustering seems to be small, we choose to report only White-adjusted *t*-values, i.e. *t*-values robust against possible heteroskedasticity, except for panel A of Table 14, where the possibility of clustering has been dealt with. The *t*-value of the adjusted R^2 is based on the standard deviation found in Cramer (1987). The variance inflation factors are 1.01 for CA_{IB}, 1.01 for RED_{RB} and 1.00 for RID_{RB}. The mean of 1.01 implies that multicollinearity does not cause significant problems. The test for the null hypothesis that $(\beta_2+\beta_3)/\beta_1 = 1$ is performed as a linear Wald test $\beta_2+\beta_3 = \beta_1$.

4.8%. The current competitive advantage is value-relevant, leading to higher abnormal stock market return. This is consistent with the findings of Biddle *et al.* (1997), where EVA deflated by the previous year stock price, explains about 5–6% of the variance in market-adjusted annual stock return. Expanding the measurement horizon beyond 1 year increases the correlation between *AR* and *CA*; see panels B and C of Table 3. With 5 years of accumulation, *CA* explains almost 25% of the variation in *AR*.

The underlying sources of competitive advantage are not all value-relevant when accumulating performance over only 1 year. According to panel A, the correlation between abnormal stock market return and the industry-based competitive advantage, CA_{IB}, is only 0.019 and not significantly different from zero. The correlation between AR and the risk difference, RID_{RB}, is also low (0.037), although significant at the 5% level. Hence, for 1 year of measurement, CA_{IB} and RID_{RB} are not very important in explaining AR. At longer horizons, both correlations increase and become highly significant; see panels B and C. When measured over 1 year, the correlation between AR and the return difference is 0.311, i.e. RED_{RB} explains 9.7% of the variation in AR and is highly significant. The ability of RED_{RB} to explain AR also increases with accumulation and reaches 20.1% for 5-year of measurement. As the 5-year ratio of resources-to-industry is 19.5, we conclude that the return difference is definitely the most important factor explaining abnormal stock market performance. We expect to find support for this result also from the multiple regression analysis (4), in which the underlying sources of competitive advantage are accounted for simultaneously as separate variables.

Multiple Regressions—Pooled OLS

The results from running a multiple regression with abnormal stock market return measured over 1 year and the underlying sources of competitive advantage for that year as independent variables are reported in Table 4. Later, we shall control the pooled OLS results for unobserved fixed and random effects.

All three sources of competitive advantage have a positive response coefficient, meaning that they contribute positively to abnormal stock market return; see (4).[21] The combined value-relevance of them, as measured by the adjusted R^2, is 10.1%, which is significant at the 1% level. The two response coefficients measuring the impact of the resource-based competitive advantage are highly significant, while the coefficient representing the industry-based competitive advantage is not significant.[22] The relative contribution of each component is estimated at 6.4% [= 0.062/(0.062+0.680+0.229)] for the industry-based, 70.0% for the return difference and 23.6% for the risk difference.[23] Thus, the ratio of resources-to-industry is 14.6 [= (0.680+0.229)/0.062]; see Table 6 for the results when measuring performance and competitive advantage over periods of 2 up to 10 years. This ratio is significantly different from one.

In a semi-strong efficient stock market, prices immediately reflect all publicly available information. However, to capture the potential

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effect of a delayed incorporation of information about the competitive positioning of firms into their stock market value, we expand the time period over which abnormal stock market performance is measured relative to the period over which competitive advantage is measured. We shall therefore investigate abnormal stock market return the following year as well as the cumulative effect, i.e. examine abnormal return for a 2-year period, relative to the 1-year period of measuring competitive advantage.[24]

To test the predictability of the 1-year competitive advantage and its underlying sources for future abnormal return, we perform regressions with next year's abnormal return as the dependent variable. Table 5, panel A, reports the results. The number of observations decreases at 2747 due to lacking data on next year's abnormal returns.

The competitive advantage measured over 1 year is relevant for predicting next year's abnormal stock market return, which indicates a delay in the incorporation of information about the competitive advantage into stock prices. Although the regression coefficient is highly significant, the adjusted R^2 is only 0.6%. Looking at the underlying sources of competitive advantage, R^2 increases to 2.7%. The only significant coefficient is the one associated with the return difference. This suggests that buying stocks in firms with unique net assets producing an above average return in 1 year, leads to a statistically significant abnormal return also in the following year, although it might be difficult to exploit this relationship to obtain an extraordinary profit due to transactions costs and other sources of frictions in the stock market. We learn that the return difference is the most important factor also for prediction purposes.

The abnormal stock market return accumulated over 2 years is the basis for our next test of value-relevance. Table 5, panel B, reports the findings. The estimated 1-year competitive advantage is able to explain 4.3% of the variation in the estimated cumulative abnormal stock market return over 2 years. The adjusted R^2 and the regression coefficient are both highly significant. Within this broader, but still relatively short timeframe, the measured competitive advantage is again relevant for creating superior or abnormal stock market return. Splitting the 1-year competitive advantage into its three underlying sources yields an adjusted R^2 of 11.0%. The only significant regression coefficient is the one for the return difference.[25] The contribution of each component is estimated at 4.7, 82.2 and 13.1% for CA_{IB}, RED_{RB} and RID_{RB},

Table 5. Current Competitive Advantage and Abnormal Stock Market Performance—1 Year of Accumulation

	Coefficients	*t*- or *F*-value
Panel A: Next period's abnormal return		
Intercept	0.001	0.07
CA	0.109***	4.20
Adj. R^2	0.006	0.49
F-value	17.65***	
Obs.	2747	
Intercept	0.006	0.60
CA_{IB}	−0.006	−0.21
RED_{RB}	0.378***	6.36
RID_{RB}	−0.086	−1.27
Adj. R^2	0.027**	2.32
F-value	14.04***	
Obs.	2747	
Ratio of resources-to-industry	−46.081***	10.07
Panel B: Current and next period's abnormal return		
Intercept	−0.001	−0.07
CA	0.411***	10.50
Adj. R^2	0.043***	3.64
F-value	110.17***	
Obs.	2747	
Intercept	0.016	1.11
CA_{IB}	0.063	1.43
RED_{RB}	1.101***	12.22
RID_{RB}	0.175	1.65
Adj. R^2	0.110***	9.36
F-value	53.68***	
Obs.	2747	
Ratio of resources-to-industry	20.337***	78.41
Panel C: Current and next period's abnormal return		
		t-value
Intercept	−0.024	−1.51
i	1.135***	12.91
k	−0.121***	−2.91
Adj. R^2	0.128***	11.11
F-value	86.88***	
Obs.	2747	
Intercept	−0.017	−1.04
i	1.167***	12.60
k	−0.165	−1.57
i_I	−0.215	−1.78
k_I	0.080	0.76
Adj. R^2	0.129***	11.10
F-value	44.14***	
Obs.	2747	

The number of observations is reduced from 3051 to 2747 due to lacking observations of abnormal return in the following year. There is, for instance, no return for 2006 since these were not readily available in the database at the time when data were collected. The variance inflation factors of panel B are 1.01 for CA_{IB}, 1.01 for RED_{RB} and 1.00 for RID_{RB}, suggesting insignificant multicollinearity problems. The variance inflation factors of the last regression in panel C are 6.03 for i, 5.81 for k and 1.37 for i_I and 1.17 for k_I. The average vif is 3.60.

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respectively. This produces a large ratio of resource-based to industry-based competitive advantage equal to 20.3.[26] Hence, the resource-based competitive advantage, and especially the return difference, seems to be the most essential factor for creating abnormal stock market performance over the current and the following year.

Table 6 reports the results of measuring competitive advantage and abnormal stock market performance beyond single years. The abnormal stock market performance is accumulated 1 year longer than the competitive advantage to capture a possible delayed incorporation of information into stock prices.

Panel A reports the accumulation of competitive advantage and abnormal stock market performance over 1–5 years, while panel B reports the accumulation over 6–10 years. The competitive advantage is estimated to be significant for all measurement horizons and both the response coefficient and R^2 tend to increase with the number of years accumulated. Furthermore, the industry-based competitive advantage increases in importance with the length of the horizon, as its coefficient increases from 0.063 to 0.306 and 0.365 with 5 and 10 years of accumulation, respectively. The return difference decreases from 1.101 to 0.690 and 0.613 with 5 and 10 years of accumulation, respectively, while the risk difference increases from 0.175 to 0.438 and 0.768 with 5 and 10 years of accumulation, respectively. Including more than 3 years, all three sources are highly significant, suggesting that both industry-specific and firm-specific factors are important for superior stock market performance.

Table 6. Competitive Advantage and Abnormal Stock Market Performance—Accumulation of Different Length

	Years of accumulation				
	1	2	3	4	5
Panel A: Accumulation of performance over 1–5 years					
Intercept	−0.001	0.022	0.013	0.005	0.029
CA	0.411***	0.416***	0.519***	0.598***	0.556***
Adj. R^2	0.043***	0.078***	0.151***	0.217***	0.205***
F-value	110.17***	112.42***	144.08***	181.67***	186.68***
Obs.	2747	2417	2119	1848	1607
Intercept	0.016	0.050***	0.047*	0.037	0.079**
CA_{IB}	0.063	0.095*	0.288***	0.415***	0.306***
RED_{RB}	1.101***	0.754***	0.669***	0.704***	0.690***
RID_{RB}	0.175	0.164*	0.317***	0.420***	0.438***
Adj. R^2	0.110***	0.136***	0.175***	0.232***	0.231***
F-value	53.68***	20.69***	36.99***	54.87***	55.93***
Obs.	2747	2471	2119	1848	1607
Ratio	20.337***	9.685***	3.427***	2.711***	3.683***
Panel B: Accumulation of performance over 6–10 years					
	6	7	8	9	10
Intercept	0.117**	0.147***	0.240***	0.330***	0.369***
CA	0.460***	0.503***	0.514***	0.575***	0.596***
Adj. R^2	0.171***	0.218***	0.233***	0.268***	0.277***
F-value	23.97***	32.07***	32.68***	133.99***	123.65***
Obs.	1397	1224	1064	929	832
Intercept	0.167***	0.208***	0.308***	0.391***	0.426***
CA_{IB}	0.270***	0.321***	0.297***	0.304***	0.365***
RED_{RB}	0.507***	0.529***	0.536***	0.630***	0.613***
RID_{RB}	0.489***	0.606***	0.706***	0.735***	0.768***
Adj. R^2	0.180***	0.223***	0.251***	0.297***	0.296***
F-value	20.07***	33.59***	44.99***	59.63***	59.53***
Obs.	1397	1224	1064	929	832
Ratio	3.695***	3.540***	4.178***	4.485***	3.783***

This table is based on 2747 observations from the period 1986 to 2005; see Table 5. When accumulating the competitive advantage and the abnormal stock market return over several years, additional years are added to the sample, implying that the data for the 10-year accumulation are from the period 1976 to 2005. The variance inflation factors with 5 years of accumulating performance are 1.03 for CA_{IB}, 1.03 for RED_{RB} and 1.01 for RID_{RB}, with an average of 1.02. There are no significant multicollinearity problems.

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Using a 5-year horizon, the industry component constitutes 23.1%, the return difference 48.1% and the risk difference 30.6% of the total. Thus, the resource-based competitive advantage accounts for 78.7%, providing a ratio of resource-based to industry-based competitive advantage of 3.7, i.e. much below the ratio of 20.3 from only 1 year of accumulation.[27] Hence, the importance of the resource-based component decreases, while the importance of the industry-based component increases with the number of years. With 10 years, the ratio of resources-to-industry is 3.8, suggesting that the ratio 'stabilizes' around 3–4; the ratios being highly significantly different from one for all years of accumulations. As the number of years increases, the return component of the resource-based competitive advantage loses, while the risk component gains in importance. Accumulated over 5 years, the return component accounts for 61.2% of the resource-based advantage.

McGahan and Porter (1999) find that changes in industry structure have a relatively more persistent impact on abnormal firm performance than changes in firm structure, even though firm effects are larger than industry effects; see also Bou and Satorra (2007). This finding is confirmed by our result indicating that the relative importance of industry structure for creating superior stock market performance increases with the duration of the competitive advantage.

Table 7 splits the sample into firms having a competitive advantage and a competitive disadvantage; see (1). Both competitive advantage and disadvantage are highly relevant drivers of superior stock market return. On average, competitive advantage leads to positive abnormal stock market returns, while competitive disadvantage has the opposite effect. For value-creators in panel A, the resources-to-industry ratio is 3.8, and for value-destroyers in panel B, the resource-to-industry ratio is 3.9, when

Table 7. Stability Tests—Competitive Advantage Versus Competitive Disadvantage

	1 year		3 years		5 years	
	Coef.	*t*-value	Coef.	*t*-value	Coef.	*t*-value
Panel A: Competitive advantage 1986–2005						
Intercept	−0.006	−0.195	0.077**	1.987	0.051	0.888
CA	0.449***	7.009	0.457***	9.941	0.522***	10.347
Adj. R^2	0.027***	3.251	0.106***	6.299	0.155***	7.177
F-value	49.128***		98.825***		107.058***	
Obs.	1504		1143		880	
Intercept	0.023	0.796	0.117***	3.295	0.120**	2.185
CA_{IB}	0.192***	2.757	0.226***	3.741	0.290***	4.443
RED_{RB}	0.824***	7.452	0.602***	8.554	0.647***	9.674
RID_{RB}	0.432***	3.342	0.408***	4.013	0.459***	4.350
Adj. R^2	0.052***	4.639	0.128***	7.058	0.179***	7.953
F-value	20.885***		31.784***		35.840***	
Obs.	1504		1143		880	
Ratio	6.532***	41.91	4.479***	36.71	3.819***	36.30
Panel B: Competitive disadvantage 1986–2005						
Intercept	−0.066*	−1.707	−0.027	−0.840	0.032	0.770
CA	0.227*	1.944	0.542***	6.730	0.592***	7.418
Adj. R^2	0.003	0.782	0.154***	7.537	0.219***	8.549
F-value	3.780*		45.288***		55.031***	
Obs.	1243		976		727	
Intercept	−0.103***	−2.635	−0.006	−0.176	0.055	1.361
CA_{IB}	−0.398***	−2.914	0.318***	3.334	0.285***	2.657
RED_{RB}	1.099***	6.973	0.695***	5.546	0.718***	6.874
RID_{RB}	−0.381**	−2.013	0.165	1.571	0.398***	3.686
Adj. R^2	0.137***	7.783	0.185***	8.613	0.249***	9.519
F-value	27.565***		10.514***		18.188***	
Obs.	1243		976		727	
Ratio	−1.805***	26.46	2.709***	12.01	3.923***	29.77
Tests for differences between advantage and disadvantage						
ΔAdj. R^2	−0.085***	−4.053	−0.058**	−2.061	−0.070**	−2.024
F-value	6.79***		2.32		0.34	

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performance is accumulated over 5 years, i.e. no significant difference between the two with respect to the value-relevance of resource-based relative to industry-based competitive advantage.[28] On the other hand, since the adjusted R^2 is measured 7.0 percentage points higher for value-destroyers than for value-creators, a 5-year measure of competitive advantage is more value-relevant for destroyers than for creators. Having a competitive disadvantage suggests that it is more likely that the future is limited because of a higher risk of going bankrupt, making the correlation between superior stock market performance and short- and medium-term measure of competitive position higher.

Our finding that the resource-based competitive advantages are about 3–4 times more important than the industry-based competitive advantage when explaining superior stock market performance, is in line with the results of Rumelt (1991) and subsequent studies (McGahan and Porter, 1997; Hawawini *et al*., 2003). Those studies document that the firm-specific effect on average is about three times more important than the industry-specific effect.[29] Focusing on abnormal firm performance in terms of EVA deflated by invested capital in the firm, Hawawini *et al*. (2003) calculate this ratio at about 2.5.

Stability and Robustness Tests—Pooled OLS

The stability of our results over time is tested by splitting the 20-year period into two equal subperiods. Furthermore, the latter 10 years are divided into two 5-year periods. Since we are able to calculate abnormal return adjusted for systematic risk only over the last 10 years, our first robustness test is to examine possible effects of this change in measuring the required rate of return. In addition, we also investigate whether our results are robust against changing the industry specification from 11 to 23 industries, as well as against the possible impact of extreme observations. The robustness of the pooled OLS assumption will be analyzed in the next subsection.

Table 8 presents the results from dividing our 20-year period into the two equal subperiods. We learn that competitive advantage is highly value-relevant in both of them.

When competitive advantage is measured over 1 year, the industry-based competitive advantage is significantly different from zero in the subperiod 1986–1995; see panel A. In 1996–2005, however, the impact of the industry-based advantage is not significant; see panel B. We may speculate that industry-specific effects were more important in the first part of our sample period due to an increased focus on fair competition by the competition authorities in recent years. The risk difference is not significant in either subperiod. The return difference is highly significant in both subperiods, but its impact increases substantially in the second one. This divergence between the two subperiods also shows up in the highly significant change in adjusted R^2 of 7.1 percentage points. Over 5 years, the three sources CA_{IB}, RED_{RB} and RID_{RB} are also highly significant, although they obtain smaller values in the second than in the first subperiod. The ratio of resources-to-industry is 2.5 in 1986–1995 and 3.6 in 1996–2005.[30] This is consistent with the reduced importance of the industry-based competitive advantage measured on an annual basis. The difference in the ratio between the two subperiods is highly significant. Consequently, the hypothesis of stability over time is rejected; see Table 8, panel B.

Table 9 presents the results from splitting the last 10 years into two subperiods of 5 years. As shown in panels A and B, we see that competitive advantage, CA, is highly relevant for superior stock market performance in both subperiods, irrespective of the length over which it has been measured.

Once more, the return difference is significant, while the risk difference and the industry-based competitive advantage are not significant in either 5-year period when accumulating performance over only 1 year. In this case, panels A and B do not differ significantly, as the difference in adjusted R^2 is only 0.1 percentage points. When evaluated over 5 years, however, we observe a significant difference in adjusted R^2 of 8.5 percentage points. All sources of competitive advantage become more important in the second period, the industry-based component less than the resource-based components, which implies a significant decrease in the ratio of resources-to-industry from 3.5 in 1996–2000 to 3.2 in 2001–2005.[31]

Our first robustness test is to analyze whether the lacking adjustment for systematic risk in the required rate of equity return affects our findings; see the discussion in the previous section. Over the last 10 years, we are able to compute a required rate of equity return taking into consideration

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Table 8. Stability Tests—Specification on Different Time Periods within 1986–2005

	1 year		3 years		5 years	
	Coef.	*t*-value	Coef.	*t*-value	Coef.	*t*-value
Panel A: Competitive advantage and abnormal stock market performance 1986–1995						
Intercept	0.009	0.41	0.118***	3.44	0.136***	2.95
CA	0.395***	5.92	0.456***	8.35	0.715***	12.98
Adj. R^2	0.039*	2.05	0.101***	4.52	0.236***	9.12
F-value	35.07***		69.69***		168.43***	
Obs.	1031		753		561	
Intercept	0.022	1.00	0.104***	3.02	0.133**	2.55
CA_{IB}	0.166*	2.04	0.306***	4.12	0.575***	5.55
RED_{RB}	0.784***	5.82	0.686***	8.74	0.798***	10.89
RID_{RB}	0.232	1.57	0.270***	3.04	0.618***	6.33
Adj. R^2	0.063***	3.30	0.134***	5.99	0.245***	9.43
F-value	13.88***		29.09***		53.99***	
Obs.	1031		753		561	
Ratio	6.117***	15.73	3.123***	30.36	2.462***	35.78
Panel B: Competitive advantage and abnormal stock market performance 1996–2005						
Intercept	−0.007	−0.33	−0.058	−1.62	−0.037	−0.84
CA	0.418***	8.69	0.564***	9.38	0.526***	11.02
Adj. R^2	0.043***	2.94	0.181***	10.89	0.205***	10.81
F-value	75.52***		87.96***		121.46***	
Obs.	1716		1366		1046	
Intercept	0.011	0.55	0.003	0.11	0.038	0.99
CA_{IB}	0.024	0.47	0.330***	4.72	0.272***	4.66
RED_{RB}	1.253***	10.85	0.667***	7.56	0.676***	9.35
RID_{RB}	0.149	1.02	0.376***	3.56	0.312***	3.15
Adj. R^2	0.134***	9.08	0.194***	11.70	0.235***	12.35
F-value	40.92***		25.16***		36.04***	
Obs.	1716		1366		1046	
Ratio	57.930***	58.66	3.165***	23.53	3.632***	28.10
Tests for differences between 1986–1995 and 1996–2005						
ΔAdj. R^2	0.071***	2.95	0.060*	2.15	−0.010	−0.33
F-value	2.17		1.64		4.99***	

systematic risk, represented by the market risk parameter β estimated for each firm on the basis of the market model (employed on the return time series over the 36 months before the end of the year), as well as the previously employed proxy risk factors of firm size and book-to-price ratio. Table 10 reports the results and they should be compared with those of panel B of Table 8.

When focusing on competitive advantage over only 1 year, the adjusted R^2 decreases slightly from 13.4 to 12.2%. The industry-based advantage remains not significant, while the return difference continues to be highly significant. When taking β-risk into consideration, the major change is found in the risk difference. It becomes the most important factor for explaining superior stock market performance and is highly significant. When focusing on competitive advantage measured over 5 years, the ratio of resource-based to industry-based strategic advantage is 4.1, as compared to 3.6 in panel B of Table 8.[32] The difference in the resources-to-industry ratio is not significant. Again, the risk difference is found to be larger when taking β-risk into consideration, since it accounts for 50.8% of the resource-based advantage, as compared to 31.6% in panel B of Table 8. To have access to favorable funding is thus an important element for firms in order to create superior stock market performance. A strategic reduction of the firm's risk premium relative to its industry thus deserves attention as a potential source of competitive advantage.

The second robustness test is to examine whether our results depend on the specification of industries. A potential critique in our case is that a categorization of firms into only 11 industries may drive the result of a less important industry-based advantage relative to the resource-based advantage. We therefore expand the number of industries from 11 to 23.

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Table 9. Stability Tests—Specification on Different Time Periods within 1996–2005

	1 year		3 years		5 years	
	Coef.	*t*-value	Coef.	*t*-value	Coef.	*t*-value
Panel A: Competitive advantage and abnormal stock market performance 1996–2000						
Intercept	−0.021	−0.84	−0.055	−1.54	0.103**	2.35
CA	0.414***	6.22	0.526***	9.89	0.397***	6.74
Adj. R^2	0.045**	2.33	0.168***	7.39	0.140***	5.09
F-value	38.72***		97.82***		61.45***	
Obs.	989		732		502	
Intercept	0.004	0.19	−0.014	−0.39	0.087*	2.03
CA_{IB}	0.020	0.31	0.327***	3.50	0.212***	2.68
RED_{RB}	1.156***	8.39	0.634***	10.30	0.606***	7.67
RID_{RB}	0.262	1.56	0.249*	2.10	0.139	1.41
Adj. R^2	0.133***	6.81	0.185***	8.14	0.180***	6.55
F-value	24.30***		37.68***		22.17***	
Obs.	989		732		502	
Ratio	72.316***	40.79	2.703***	12.02	3.509***	12.38
Panel B: Competitive advantage and abnormal stock market performance 2001–2005						
Intercept	0.012	0.32	−0.061	−0.91	−0.270***	−3.09
CA	0.419***	6.10	0.587***	6.01	0.670***	8.04
Adj. R^2	0.040	1.78	0.183***	7.50	0.259***	9.84
F-value	37.18***		36.14***		64.69***	
Obs.	727		634		544	
Intercept	0.017	0.49	0.029	0.51	−0.111	−1.43
CA_{IB}	0.023	0.29	0.317***	3.29	0.428***	4.47
RED_{RB}	1.363***	7.08	0.684***	4.75	0.726***	7.10
RID_{RB}	0.059	0.27	0.522***	2.89	0.629***	3.53
Adj. R^2	0.134***	5.88	0.194***	7.94	0.265***	10.04
F-value	18.54***		11.44***		21.52***	
Obs.	727		634		544	
Ratio	61.214***	26.30	3.807***	15.36	3.169***	16.38
Tests for differences between 1996–2000 and 2001–2005						
ΔAdj. R^2	0.001	0.04	0.009	0.27	0.085*	2.23
F-value	0.47		0.56		2.58*	

If we observe an increase in the industry-based advantage, support for this critique has been found. We are able to perform this test only over the last 10 years, for which we have a full set of firm data categorized according to two separate industry specifications, the older one used exclusively by the OSE until the late 1990s and the international industry classification now officially adopted by the OSE; see footnotes 17 and 18. Table 11 presents the results when the required rate of return on equity is adjusted for systematic risk, as well as for the two proxy risk factors. The results of Table 11 should thus be compared with those of Table 10.

When accumulating competitive advantage and abnormal return over 1 year, the regression coefficient of the industry-based competitive advantage, termed β_1 in (4), is 0.066 with a categorization of firms into 11 industries and 0.070 with a categorization into 23 industries. Neither the individual coefficient estimates nor their differences are significant. This is true also for accumulations over 3 or 5 years. Based on the 5-year regression, the ratio of resource-based to industry-based competitive advantage is 3.7, as compared to 4.1 in Table 10.[33] Furthermore, the difference in the resources-to-industry ratio is also not significant. This leads to the conclusion that our initial result of the dominance of the resource-based over the industry-based advantage is robust against this finer specification of industries, at least for specifications that are tractable with market data.

Our next robustness test is to analyze the impact of having removed 1% of the highest and lowest annual observations of the measured competitive advantage and its three sources (Hawawini *et al*., 2003, 2005; McNamara *et al*., 2005); see Table 1. Table 12 reports the results over the last 10 years of our sample period with no removal of the 1% biggest strategic leaders and

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Table 10. Robustness Tests—Abnormal Returns Adjusted for Systematic Risk 1996–2005

	Obs.	Mean	St. dev.	Q_1	Median	Q_3
Panel A: Descriptive statistics for sample adjusted for systematic risk						
AR	1752	0.002	0.461	−0.187	0.004	0.197
CA	1752	0.031	0.514	−0.267	0.028	0.332
CA_{IB}	1752	0.059	0.375	−0.225	0.028	0.303
RED_{RB}	1752	−0.010	0.298	−0.107	0.010	0.132
RID_{RB}	1752	−0.019	0.347	−0.196	−0.015	0.155

Panel B: Competitive advantage and abnormal stock market performance 1996–2005

	1 year		3 years		5 years	
	Coef.	*t*-value	Coef.	*t*-value	Coef.	*t*-value
Intercept	−0.025	−1.61	−0.142***	−5.66	−0.181***	−5.24
CA	0.347***	9.59	0.434***	8.83	0.323***	8.39
Adj. R^2	0.070***	4.76	0.230***	12.71	0.175***	7.42
F-value	91.90***		77.89***		70.43***	
Obs.	1752		1151		681	
Intercept	−0.000	−0.03	−0.050	−1.76	−0.085**	−2.26
CA_{IB}	0.066	1.50	0.223***	3.68	0.174***	2.96
RED_{RB}	0.574***	7.20	0.387***	5.85	0.354***	6.24
RID_{RB}	0.655***	10.84	0.536***	10.24	0.366***	7.89
Adj. R^2	0.122***	8.31	0.257***	14.17	0.184***	7.81
F-value	50.53***		35.78***		22.24***	
Obs.	1752		1151		681	
Ratio	18.619***	104.19	4.134***	39.20	4.131***	27.29
Tests for differences in adjusted R^2 *relative to Table 8, panel B*						
ΔAdj. R^2	−0.013	−0.61	0.062**	2.53	−0.051	−1.67

Abnormal stock market return, AR, is calculated relative to the standard market model, using a 36-month return history before measuring abnormal return. The β-adjusted excess return is also adjusted on the cross-section of firms for firm size and book-to-price effects; see Fama and French (1992, 1993). Notice that the estimated competitive advantage and its underlying sources are also changed, due to the change in the required rate of return.

losers, after utilizing a three-factor risk-adjustment of the required rate of return on equity. Thus, the results of Table 12 should be compared with those of Tables 10 and 11.

First, we observe that the effect of removing observations is small and highest for the 1-year horizon. Using an industry specification of 11 industries, panel A of Table 12 reveals that the adjusted R^2 is in fact higher using the full sample than using the sample without extreme observations from Table 9, although the increase of 1.2 percentage points is not significant. Second, with an industry specification of 23 industries, panel B of Table 12, as compared to Table 10, yields the same finding. However, the increase in adjusted R^2 of 4.5 percentage points is statistically significant. We may conclude that the dominance of the firm-specific resource effect is strong, even when the effect of strategic leaders and losers is completely accounted for.

Our next test is to make the regressions (3) and (4) even more robust by including extreme observations. In addition to removing the 1% upper and 1% lower observations (see also Table 1), the regression coefficients will be produced by given higher weights to 'well-behaving' observations from a statistical point of view.[34] Table 13 reports the results for both industry specifications.

Evaluated over a 5-year period, the industry-based component accounts for 29.1%, the return difference for 33.1% and the risk difference for 37.8% of total competitive advantage. The ratio of resources-to-industry is estimated at 2.4. Using OLS coefficients such as in Tables 10 and 11, this ratio is 3.9 on average, which is a significant increase. Estimation of robust coefficients as well as robust standard deviations leads to higher industry-based coefficients and to lower resource-based coefficients, with increased statistical significance. This effect of robust estimation also shows up in the 1-year data. As before, the resource-based competitive advantage dominates.

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Table 11. Robustness Tests—Different Industry Specification 1996–2005

	Obs.	Mean	St. dev.	Q_1	Median	Q_3
Panel A: Descriptive statistics of sample with 23 industries						
AR	1704	0.017	0.433	−0.177	0.006	0.203
CA	1704	0.061	0.472	−0.247	0.037	0.345
CA_{IB}	1704	0.069	0.381	−0.224	0.003	0.315
RED_{RB}	1704	0.003	0.242	−0.104	0.010	0.130
RID_{RB}	1704	−0.010	0.311	−0.181	−0.009	0.141

Panel B: Competitive advantage and abnormal stock market performance 1996–2005

	1 year		3 years		5 years	
	Coef.	*t*-value	Coef.	*t*-value	Coef.	*t*-value
Intercept	−0.012	−0.78	−0.118***	−4.69	−0.147***	−4.36
CA	0.289***	7.82	0.409***	8.05	0.301***	7.91
Adj. R^2	0.044***	2.97	0.207***	11.35	0.158***	6.66
F-value	61.12***		64.78***		62.60***	
Obs.	1704		1125		665	
Intercept	0.006	0.40	−0.036	−1.34	−0.069*	−1.99
CA_{IB}	0.070	1.66	0.230***	4.53	0.183***	3.55
RED_{RB}	0.581***	6.36	0.363***	4.99	0.324***	5.22
RID_{RB}	0.651***	9.29	0.523***	9.28	0.354***	7.50
Adj. R^2	0.091***	6.12	0.235***	12.81	0.167***	6.98
F-value	36.50***		31.16***		20.89***	
Obs.	1704		1125		665	
Ratio	17.585***	79.41	3.854***	30.71	3.712***	19.80
Tests for differences adjusted R^2 relative to Table 10, panel B						
ΔAdj. R^2	−0.031	−1.48	−0.022	−0.85	−0.017	−0.52

The industries are: (1) energy, (2) materials, (3) industrials—capital goods, (4) industrials—commercial services and supplies, (5) industrials—transportation, (6) consumer discretionary—automobiles and components, (7) consumer discretionary—consumer durables and apparel, (8) consumer discretionary—hotels, restaurants and leisure, (9) consumer discretionary—media, (10) consumer discretionary—retailing, (11) consumer staples—food, beverage and tobacco, (12) health care—health care equipment and services, (13) health care—pharmaceuticals and biotech, (14) financials—banks, (15) financial—savings banks (primary capital certificates), (16) financials—diversified financials, (17) insurance, (18) real estate, (19) information technology—semiconductors and semiconductor equipment, (20) information technology—software and services, (21) information technology—technology hardware and equipment, (22) telecommunication services and (23) utilities.

To sum up our stability and robustness tests; our pooled OLS regression results seem to be stable over time, at least for the last 10 years, and robust against changes in test methodology, including improvements in how the required rate of return is computed, expansion in the number of industries and altering the influence of extreme observations. The robustness tests underscore that both favorable risk differences from financial funding and favorable return differences from firm's assets are important sources for resource-based competitive advantage.

Panel Data—Fixed, Random or Mixed Effects across Firms

Until now, the regression models (3) and (4) have been analyzed by pooled OLS regressions using robust standard deviations. Since we have a sample consisting of panel or longitudinal data, with cross-sectional observations over time, unobserved effects should also be considered (Wooldridge, 2002; Greene, 2007). Therefore, we shall now run tests for unobserved firm effects to learn whether these effects are fixed or random. In turn, we shall perform the type of regressions suggested by the tests, and discuss how the unobserved effects may affect the results relative to the pooled OLS results of the two previous subsections.

To determine whether unobserved firm effects do exist, we perform tests for both fixed and random effects. To test the hypothesis that the intercept terms are all equal across firms, we use the *F*-test described by Greene (2007, p. 197). The *F*-value is 5.20 over 5 years of performance, i.e. the null hypothesis is rejected in favor of the hypothesis of significant firm-specific intercept terms. To test the hypothesis of no firm-specific error terms, we use the Lagrange multiplier test

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Table 12. Robustness Tests—No Removal of Extreme Observations 1996–2005

	1 year		3 years		5 years	
	Coef.	*t*-value	Coef.	*t*-value	Coef.	*t*-value
Panel A: Industry classification with 11 industries						
Intercept	−0.018	−1.15	−0.139***	−5.58	−0.179***	−5.11
CA	0.310***	6.60	0.410***	8.66	0.294***	7.57
Adj. R^2	0.079***	5.48	0.233***	13.08	0.155***	6.66
F-value	43.62***		75.01***		57.35***	
Obs.	1820		1184		692	
Intercept	0.001	0.04	−0.046	−1.60	−0.083**	−2.20
CA_{IB}	0.072	1.66	0.197***	3.17	0.145**	2.37
RED_{RB}	0.283***	3.82	0.358***	5.85	0.326***	5.98
RID_{RB}	0.660***	8.67	0.509***	10.33	0.335***	7.06
Adj. R^2	0.134***	9.32	0.261***	14.61	0.164***	7.03
F-value	26.64***		35.78***		18.17***	
Obs.	1820		1184		692	
Ratio	13.026***	57.44	4.406***	40.56	4.546***	25.68
Tests for differences in adjusted R^2 *relative to Table 10, panel B*						
ΔAdj. R^2	0.012	0.59	0.004	0.16	−0.020	−0.59
Panel B: Industry classification with 23 industries						
Intercept	−0.018	−1.15	−0.139***	−5.58	−0.179***	−5.11
CA	0.310***	6.60	0.410***	8.66	0.294***	7.57
Adj. R^2	0.079***	5.48	0.233***	13.08	0.155***	6.66
F-value	43.62***		75.01***		57.35***	
Obs.	1820		1184		692	
Intercept	0.001	0.04	−0.057*	−2.13	−0.101***	−2.89
CA_{IB}	0.074	1.75	0.221***	4.17	0.169***	3.24
RED_{RB}	0.310***	3.62	0.367***	5.50	0.334***	5.37
RID_{RB}	0.682***	8.07	0.516***	10.09	0.341***	6.79
Adj. R^2	0.136***	9.48	0.259***	14.52	0.164***	6.99
F-value	22.71***		35.41***		17.22***	
Obs.	1820		1184		692	
Ratio	13.458***	44.23	3.990***	35.03	3.996***	20.33
Tests for differences in adjusted R^2 *relative to Table 11, panel B*						
ΔAdj. R^2	0.045*	2.19	0.025	0.96	−0.003	−0.09

The required rate of return on equity, used to calculate abnormal stock market return $r-k$, the competitive advantage $i-k$ and its three underlying sources, is adjusted for systematic risk and proxy risk factors in terms of firm size and book-to-price effects. The results of this table should therefore be compared with those of Tables 10 and 11, where the 1% highest and lowest observations of CA, CA_{IB}, RED_{RB} and RID_{RB} have been removed.

described by Greene (2007, pp. 205–208). The LM-value is 361.86, implying that the null hypothesis is rejected in favor of the hypothesis of significant firm-specific error terms. We conclude that there are both fixed and random effects, suggesting a mixed model.[35] However, if either a fixed or a random model should be chosen, Hausman's specification test points at the fixed effects model with firm-specific intercepts, as the value of this test statistic is 14.72 (Greene, 2007, pp. 208–209).

Table 14 reports the results from running a fixed effects model and a mixed model with both fixed and random effects. Panel A shows the results with firm-specific intercepts for data over the 20 years (1986–2005). These results should be compared with the results from accumulating performance over 1, 3 and 5 years in panel A of Table 6. It turns out that the coefficients are smaller when estimated by the FE-model than by the pooled OLS-model, and the coefficient of the risk difference is not significant, irrespective of measurement length. As for the OLS regression, the return difference is significant for all years of measurement, while the industry-based competitive advantage is only significant for 3 and 5 years. The ratio of resource-based to industry-based competitive advantage is 3.0 with 5 years of accumulating performance, as compared to 3.7 with pooled OLS. Thus, the resource-based advantage is slightly less dominant in the FE-model.

Panel B yields the results of the mixed model. It is assumed to have a fixed structure over all

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Table 13. Robustness Tests—Removal and Less Weight on Statistically Extreme Observations 1996–2005

	1 year		3 years		5 years	
	Coef.	*t*-value	Coef.	*t*-value	Coef.	*t*-value
Panel A: Industry classification with 11 industries						
Intercept	0.010	0.08	−0.099***	−5.47	−0.097***	−3.52
CA	0.379***	16.89	0.449***	24.67	0.374***	17.74
Adj. R^2	0.140***	9.54	0.346***	19.13	0.316***	13.43
F-value	285.24***		608.51***		314.82***	
Obs.	1752		1151		681	
Intercept	0.016	1.39	−0.040	−1.71	−0.057	−1.55
CA_{IB}	0.236***	7.81	0.335***	8.07	0.320***	7.38
RED_{RB}	0.418***	10.46	0.382***	15.45	0.371***	13.06
RID_{RB}	0.659***	19.12	0.514***	23.49	0.408***	15.96
Adj. R^2	0.195***	13.32	0.351***	19.40	0.322***	13.65
F-value	142.58***		208.53***		108.63***	
Obs.	1752		1151		681	
Ratio	4.564***	162.54	2.677***	104.19	2.434***	55.74
Tests for differences in adjusted R^2 *relative to Table 10, panel B; see Table 12, panel A*						
ΔAdj. R^2	0.073***	3.54	0.095***	3.70	0.138***	4.13
Panel B: Industry classification with 23 industries						
Intercept	0.010	0.86	−0.090***	−4.91	−0.085***	−3.04
CA	0.338***	14.06	0.441***	23.41	0.366***	17.21
Adj. R^2	0.103***	6.97	0.327***	17.91	0.308***	12.93
F-value	197.57***		548.00***		296.01***	
Obs.	1704		1125		665	
Intercept	0.023*	2.06	−0.026	−1.18	−0.041	−1.17
CA_{IB}	0.223***	7.66	0.315***	8.26	0.315***	7.78
RED_{RB}	0.397***	8.04	0.398***	15.08	0.351***	11.64
RID_{RB}	0.665***	17.21	0.531***	22.79	0.418***	15.68
Adj. R^2	0.164***	11.02	0.349***	19.07	0.320***	13.42
F-value	112.27***		202.05***		105.37***	
Obs.	1704		1125		665	
Ratio	4.766***	118.82	2.947***	124.67	2.441***	53.12
Tests for differences in adjusted R^2 *relative to Table 11, panel B; see Table 12, panel B*						
ΔAdj. R^2	0.073***	3.47	0.115***	4.42	0.154***	4.56

In the Tables 4–12, the *t*-values have been made robust by utilizing heteroskedasticity-adjusted standard deviations; see White (1980) and MacKinnon and White (1985). This implies, however, that the coefficients are based on OLS. In this table, also the coefficients are adjusted by giving less weight to observations identified as extreme from a statistical point of view by the robust regression procedure in the statistical program package Stata (i.e. the rreg—command).

observations and random effects across firms, both in terms of the intercept and other coefficient estimates.[36] Nevertheless, the results are very similar, which is also the case for the pure FE-model and the pooled OLS-model in panel A of Table 6. With 5 years of accumulating performance, the ratio of resource-based to industry-based competitive advantage is 4.1, as compared to 3.0 in the FE-model and 3.7 in the pooled OLS-model.[37] The major insight provided by the mixed firm effects model relative to the pooled OLS-model is that it, along with the firm-specific intercept model of panel A, questions the significance of the risk difference.

An interesting question is whether the lack of significance of the risk difference is caused by not taking systematic β-risk into consideration when estimating the required return on equity, a question also analyzed with pooled OLS. We use the subperiod 1996–2005, for which we have β-adjusted variables, to examine whether the significance of the risk difference is higher with more rigorous risk measurement. Table 15 reports the findings of the mixed model.

Panel A reports that the risk difference increases its importance when β is taken into consideration, which also was true when we compared panel B of Table 8 with panel B of Table 10. The mixed effects model yields a ratio of resources-to-industry of 15.7, while the pooled OLS-model produces a ratio of 4.1. Thus, the mixed model with unobserved firm effects

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Table 14. Panel Data Models—Unobserved Effects across Firms 1986–2005

	1 year		3 years		5 years	
	Coef.	*t*-value	Coef.	*t*-value	Coef.	*t*-value
Panel A: Fixed effects model (within): standard deviations adjusted for heteroskedasticity and clustering						
Intercept	0.010***	3.80	0.044***	3.47	0.090***	3.59
CA	0.229***	5.29	0.387***	7.31	0.406***	6.56
Overall R^2	0.043		0.151		0.205	
F-value	27.97***		53.40***		43.04***	
Obs.	2747		2119		1607	
Firms	435		343		270	
Intercept	0.184***	6.22	0.063***	4.02	0.103***	3.54
CA_{IB}	0.041	0.77	0.219***	3.32	0.228***	3.09
RED_{RB}	0.802***	7.96	0.574***	5.99	0.612***	6.07
RID_{RB}	0.023	0.21	0.044	0.45	0.061	0.53
Overall R^2	0.110		0.170		0.216	
F-value	21.93***		12.92***		13.09***	
Obs.	2747		2119		1607	
Firms	435		343		270	
Ratio	20.168***	27.52	2.821***	8.69	2.951***	6.80
Panel B: Mixed effects model: random intercept and coefficients across firms, unstructured covariance matrix						
	1 year		3 years		5 years	
	Coef.	*z*-value	Coef.	*z*-value	Coef.	*z*-value
Intercept	−0.030	−1.38	−0.038	−0.90	−0.028	−0.45
CA	0.346***	8.56	0.459***	11.07	0.470***	11.21
AIC	6497.2		5570.4		4507.6	
Wald χ^2	73.35***		122.49***		125.57***	
Obs.	2747		2119		1607	
Firms	435		343		270	
Intercept	0.021	1.26	0.057	1.66	0.084	1.54
CA_{IB}	0.019	0.37	0.182***	3.18	0.217***	3.66
RED_{RB}	0.992***	11.81	0.696***	11.12	0.724***	10.64
RID_{RB}	0.210*	2.05	0.253***	2.60	0.164	1.63
AIC	6081.0		5222.4		4163.2	
Wald χ^2	144.30***		138.68***		126.89***	
Obs.	2747		2119		1607	
Firms	435		343		270	
Ratio	62.700***	69.98	5.207***	35.46	4.094***	24.99

The fixed effects model is performed by the help of Stata's xtreg-command: xtreg y x, fe robust cluster(firmid), suggesting standard deviation adjusted for heteroskedasticity and clustering; y is the dependent variable, x is a vector of explanatory variables and firmid is the indicator for firms. The mixed effect model is based on Stata's xtmixed-command: xtmixed y x || firmid: x, cov(unstructured); see Rabe-Hesketh and Skrondal (2005). AIC is Akaike Information Criterion, which is a fit statistic, penalized by the number of parameters. Smaller AIC represents better fits.

questions the significance of the industry-based competitive advantage even more than the pooled OLS model. Panel B reports the corresponding results with a finer industry classification; see Table 11 for corresponding OLS results. The results are replicated, although the industry-based competitive advantage is slightly more significant. The ratio of resources-to-industry is now estimated at 7.4.

Although statistical tests reject the hypothesis of no unobserved firm effects, we have found that the results obtained by the fixed effects and the mixed effects models correspond closely to those obtained by pooled OLS regression. That also explains why we have chosen to carry out traditional pooled OLS regressions in the two previous subsections.

CONCLUSIONS

This study estimates the relative importance of industry-based and resource-based competitive advantage. We introduce an intuitive, simple and powerful decomposition of competitive advantage into its underlying sources and focus on these sources' ability to explain superior stock market

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Table 15. Mixed Effect Model Random Intercept and Coefficients with Unstructured Covariance Matrix 1996–2005

	1 year		3 years		5 years	
	Coef.	*z*-value	Coef.	*z*-value	Coef.	*z*-value
Panel A: Industry classification with 11 industries						
Intercept	−0.019	−1.17	−0.112***	−3.02	−0.160***	−2.77
CA	0.336***	8.66	0.386***	10.13	0.234***	6.58
AIC	3437.6		2294.1		1482.7	
Wald χ^2	74.99***		102.64***		43.33***	
Obs.	1752		1151		681	
Firms	336		260		187	
Intercept	0.007	0.47	0.004	0.11	−0.032	−0.65
CA_{IB}	0.061	1.18	0.076	1.51	0.043	0.82
RED_{RB}	0.534***	7.26	0.381***	6.36	0.310***	5.53
RID_{RB}	0.709***	12.11	0.515***	11.02	0.369***	7.85
AIC	3203.6		2132.0		1401.8	
Wald χ^2	165.03***		128.11***		67.93***	
Obs.	1752		1151		681	
Firms	336		260		187	
Ratio	20.143***	105.03	11.786***	58.58	15.679***	34.26
Panel B: Industry classification with 23 industries						
Intercept	−0.008	−0.47	−0.109***	−2.99	−0.138***	−2.43
CA	0.285***	7.12	0.385***	9.88	0.214***	6.07
AIC	3260.7		2190.8		1425.4	
Wald χ^2	50.74***		97.61***		36.82***	
Obs.	1704		1125		665	
Firms	332		259		185	
Intercept	0.015	0.97	0.004	0.11	−0.043	−0.92
CA_{IB}	0.097*	2.04	0.120***	2.65	0.100*	2.03
RED_{RB}	0.579***	6.38	0.415***	6.16	0.383***	5.53
RID_{RB}	0.684***	11.21	0.515***	11.01	0.360***	7.28
AIC	3.019.5		2078.0		1355.1	
Wald χ^2	140.44***		127.54***		59.03***	
Obs.	1704		1125		665	
Firms	332		259		185	
Ratio	12.964***	83.72	7.775***	55.21	7.432***	33.68

performance. With this new approach, we find that firm-specific factors are about 3–4 times more important than industry-specific factors. Although the ratio of firm-specific factors to industry-specific factors varies, depending on whether a short- or a long-term measurement horizon is utilized, the dominance of the resource-based competitive advantage seems to be both stable over time and robust against altering the test specification. Thus, our results give support to the findings of Rumelt (1991), and to most of the subsequent studies on accounting-based firm performance.

A unique contribution of this study is to decompose the resource-based competitive advantage into a return and a risk difference, taking into consideration the relationship between risk and return. We have learned that the risk difference is very important when evaluating competitive advantage, as it accounts for 39% of the total resource-based advantage. This finding clearly demonstrates the importance for firms of obtaining favorable funding.

In our study, we have focused on the output of having a competitive advantage, i.e. creating a return on equity that exceeds the required cost of capital, and we have analyzed the impact of competitive advantages on superior stock market performance, i.e. creating a stock market return that exceeds the required cost of capital, as suggested in the value-based management literature. A potential for future research would be to analyze underlying drivers of competitive advantage and identify how they influence abnormal stock market performance. For instance, is the industry-based competitive advantage related to the number of competitors or other measures of concentration in that industry, e.g. the Herfindahl–Hirschman Index? Is the return difference related to particular assets

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such as intangibles, e.g. human resources? Is the risk difference related to ownership, e.g. foreign versus domestic investors, institutional versus private investors in a firm or corporate governance issues? Multiple regression analyses of abnormal stock market performance on these and additional strategy drivers would be an appropriate approach to reveal which fundamental factors are the most important ones for superior stock market performance.

NOTES

1. Rumelt (1991) and most subsequent studies find that business-level effects account for most of the total firm-specific effect on firm performance. Corporate effects are small. We are not distinguishing between corporate and business-level effects since our focus on consolidated accounting information and stock market valuation does not allow us to divide the sources of competitive advantage into business segments and a separate corporate headquarter function.
2. A very simple example illustrates the difference between firm performance and stock market performance; compare (1) with (3): A firm invests 100 in year 0 and expects a cash flow of 70 in year 1 and 60 in year 2. The internal rate of return i is found by: $-100+70/(1+i)+60/(1+i)^2=0$, yielding an annual firm performance $i=20\%$. If the risk-adjusted cost of capital $k=8\%$, the competitive advantage, CA, is 12%. A competitive advantage of 12% implies that the firm is expected to have an abnormal performance of 12% each year, or accumulated 25.4% over year 1 and 2. It does not imply that shareholders are expected to acquire an abnormal stock market return of 12% in each of these years. If the stock market efficiently incorporates all information, there will be no abnormal stock market return in year 1 and 2, the stock market value will increase immediately from 100 to 116.3 at time 0 and thus yield an expected return of 8% in year 1 and 2; aggregated 16.6%. This example also illustrates that there is an important difference between calculated firm performance and observed stock market performance, due to the timing of income. Firm performance is typically recorded at a later period than stock market performance, responding immediately to news about e.g. new investment projects.
3. A well-established research area in strategic management is to evaluate the time-series properties of abnormal firm return (1), i.e. its sustainability (Connolly and Schwartz, 1985; Jacobsen, 1988; Penman, 1991; McGahan and Porter, 1999; Bou and Satorra, 2007). However, in these studies abnormal return is usually measured as the firm's accounting return minus the average accounting return of all firms in a particular period; see Jacobsen (1988) for an adjustment involving accounting beta. The main finding is that abnormal return converges toward zero, i.e. that firm performance is mean reverting. But the convergence process does not lead to zero abnormal return in the long run, consistent with the existence of sustainable competitive advantage for some firms.
4. Our data suggest that the correlation between the return and risk difference is only −0.066 when accumulated over 5 years; see panel C of Table 3. This implies that the collinearity between the return and the risk difference is statistically significant, but low in magnitude. This makes our decomposition of the resource-based competitive advantage meaningful.
5. If the firm is operating in multiple industries, (2) could in principle be specified in accordance with each industry, business unit or segment, including the corporate headquarter supplying joint services to all units. The cumulative competitive advantage of a firm would then be the sum of its competitive advantages in each segment plus the additional competitive advantage of being organized as a single corporation. This expansion of (2) may be utilized to study the effect of business-level versus corporate-level strategy, which is in accordance with the empirical studies on the drivers of firm performance in the previous section. If this distinction is less important, the firm's average i and k may be utilized to capture an aggregate firm effect, i.e. the sum of the business-level and the corporate-level effect.
6. Regression (3) may be accused of being in some sense tautological since superior performance is regressed on superior performance. However, the left-hand side is superior *stock market* performance and the right-hand side includes superior *firm* performance as the outcome of having a competitive advantage. In this way, (3) only tests whether a firm with superior firm performance, or a competitive advantage according to our definition (1), also generates superior stock market performance. This is not more tautological than explaining stock return by accounting return; see e.g. Easton and Harris (1991). The fact that we do not obtain results with unreasonably high R^2-values, also indicates sound models in this respect; see Table 4.
7. An examination of the value relevance of competitive advantage, specified by regression (3), is closely related to the literature testing the value relevance of various performance metrics, such as firm return or abnormal firm return. Easton and Harris (1991), and most of the literature on the value relevance of accounting information, demonstrate that accounting earnings and changes in such earnings, deflated by the stock price, are highly relevant for explaining abnormal stock market return. In large samples, the accounting

DOI: 10.1002/mde

return on market-based equity typically explains about 8–10% of abnormal stock market return, measured on an annual basis. Deflated abnormal earnings in terms of Stern Stewart & Co's Economic Value Added (EVA), have been found to explain about 5–6% of abnormal stock market return (Biddle *et al.*, 1997), questioning whether EVA is superior to earnings as a performance metric. This and most succeeding studies are consistent with the hypothesis that the competitive advantage of a firm is highly relevant for explaining its abnormal stock market performance.

8. The nature of stock market data implies that they do not provide information at the business-level, since stock market returns on separate business units are usually not observable; they include only the aggregated return for the listed company as a single unit. This implies that in practice, (3) and (4) may be run only at the corporate-level, making the approach inappropriate for testing business-level effects.
9. Notice that all variables in (4) have the same unit of measurement; abnormal percentage return, either market-based or firm-based. This suggests that the coefficients may be used as measures of the relative impact of CA_{IB}, RED_{RB} and RID_{RB}, respectively.
10. Similar to the variance decomposition approach of Schmalensee (1985) and Rumelt (1991), a different way is to specify a three-way crossed random effects model: $AR = \alpha + CA_{IB} + RED_{RB} + RID_{RB} + \varepsilon$. If the three sources of competitive advantage are independent, the variance of abnormal stock market return $\sigma^2_{AR} = \sigma^2_{IB} + \sigma^2_{RED} + \sigma^2_{RID} + \sigma^2_{\varepsilon}$. The importance of resources relative to industry may then be measured by the ratio $(\sigma^2_{RED} + \sigma^2_{RID})/\sigma^2_{IB}$. As a robustness check, this variance-based ratio should be reported in addition to the coefficient-based counterpart for key empirical findings. A problem with the variance decomposition approach is the assumption of strict independence among the sources of competitive advantage (Misangyi *et al.*, 2006).
11. McGahan and Porter (1999) find that changes in industry structure have a relatively more persistent impact on abnormal firm performance than changes in firm structure, even though firm effects are larger than industry effects; see also Bou and Satorra (2007). By utilizing (4) conditioned on a sustainable competitive advantage, one may explore whether a persistent industry-based advantage generates a relatively higher abnormal stock market performance than a short-run industry-based advantage, and whether a resource-based advantage would be less persistent in terms of value-relevance.
12. An additional argument for not focusing primarily on unobserved effects models is that they are less robust with respect to specification errors, e.g. specification errors related to whether the effects are fixed or random.
13. For the period 1993–2005, our data contain almost all firms listed on the OSE. For the period 1986–1992, some firms are missing, mostly smaller firms. The market returns are collected from the Stock Market Data Base at NHH, while the accounting data are collected from the annual financial statements, Kierulf's Handbook of Corporate Information and Datastream.
14. In a sample of firms reporting financial statements according to IFRS, Christensen and Nikolaev (2009) find no companies using fair value accounting for intangible assets and only 3% using fair value accounting for property, plant and equipment.
15. Since we are able to adjust for possible effects of systematic (beta) risk for only the last 10 years of our sample period, we shall take the opportunity to learn whether our initial results are robust against such a change in abnormal return calculations; see Table 10.
16. The number of firms over industries is 525, larger than 511, because 14 firms have changed industry over time and are therefore counted twice when splitting the number of firms according to industry.
17. We also perform a robustness test where we use the revised industry classification (the Global Industry Classification Standard developed by Morgan Stanley and Standard and Poor's), in which the number of industry groups is increased from 11 to 23; see Table 11. As for systematic risk, we are only able to investigate the possible effects of this change over the last 10 years of our sample period, since the new classification system was introduced on OSE in January 1995.
18. Other studies using market-based measures of performance, e.g. Hawawini *et al.* (2003), also contain a small number of industry groups relative to studies using accounting-based measures of performance; see Table 1 in Bowman and Helfat (2001). Hawawini *et al.* include 5620 observations for 562 firms across 55 industry classifications. Owing to a more homogeneous industry structure in Norway, the listed OSE firms are categorized into 23 industries.
19. All removed observations will be utilized later in a robustness test; see McNamara *et al.* (2005) and Table 12. In order to further investigate the impact of extreme observations, Table 13 presents the results from running robust regressions in which extreme observations from a statistical point of view are given less weights.
20. Low correlations between the 'independent' variables imply insignificant multicollinearity problems in the abnormal return regression given by (4). Thus, our approach is not affected by the criticism of lacking independence, which affects studies analyzing variance components (Misangyi *et al.*, 2006).
21. The variance inflation factors are 1.01 for CA_{IB}, 1.01 for RED_{RB} and 1.00 for RID_{RB}, suggesting that there is no problem caused by multicollinearity in (4); see also Table 3 for an overview of the correlation coefficients between variables.
22. When testing for the statistical significance of the regression coefficients, we utilize standard

DOI: 10.1002/mde

deviations adjusted for possible heteroskedasticity; see White (1980). As the sample size is large, we utilize the HC1 estimator; see MacKinnon and White (1985).

23. Measured by the marginal increase in adjusted R^2, the importance of the three sources of competitive advantage is 0.1% for the industry-based advantage, 10.0% for the return difference and 0.4% for the risk difference. The ratio of resources-to-industry is 104.0. Alternatively, the variance of abnormal stock market return could be decomposed into its sources by assuming a three-way crossed random effects model: $\sigma^2_{\mathrm{IB}} = 0.003$, $\sigma^2_{\mathrm{RED}} = 0.458$, $\sigma^2_{\mathrm{RID}} = 0.048$ and $\sigma^2_{\epsilon} = 0.254$; see footnote 10. The variance-based ratio of resources-to-industry is $(0.458+0.048)/0.003 = 172.2$. The variances could be estimated by the xtmixed—command in Stata, employing the structure: xtmixed AR ||_all: $\mathrm{CA_{IB}}$, noconstant ||_all: $\mathrm{RED_{RB}}$, noconstant ||_all: $\mathrm{RID_{RB}}$, noconstant variance; see Rabe-Hesketh and Skrondal (2005).
24. Alternatively, the current year's abnormal return AR_t could be expanded to capture predictability by computing $\mathrm{AR}_t \cdot (1+\mathrm{AR}_{t+1})$ instead of $\mathrm{AR}_t + \mathrm{AR}_{t+1}$. Both variables may be regarded as inefficiency-adjusted versions of AR_t; see Aboody *et al.* (2002).
25. Panel C of Table 5 reveals, somewhat tautologically, that the reason why the profitability-based competitive advantage is the most significant factor explaining stock market performance stems from the fact that the return on equity, i, is clearly the most important factor explaining abnormal stock market return. Evaluated individually, the other factors, k, i_{I} and k_{I}, are not significant.
26. The marginal increase in adjusted R^2 for the one-year horizon is: Industry-based advantage 0.1%, return difference 11.1% and risk difference 0.1%. Hence, the ratio of resource-based to industry-based strategic advantage is 112.0, suggesting that industry effects are not significant when measured over short-term periods. Alternatively, the variance of abnormal return could be decomposed into its sources by assuming a three-way crossed random effects model: $\sigma^2_{\mathrm{IB}} = 0.002$, $\sigma^2_{\mathrm{RED}} = 1.197$, $\sigma^2_{\mathrm{RID}} = 0.020$ and $\sigma^2_{\epsilon} = 0.590$. The variance-based ratio of resources-to-industry thus becomes $(1.197+0.020)/0.002 = 751.1$.
27. The marginal increase in adjusted R^2 for the 5-year horizon is: Industry-based competitive advantage 2.0%, return difference 21.5% and risk difference 2.2%. Hence, the ratio of the resource-based to industry-based competitive advantage is 11.8. Alternatively, the variance of abnormal return could be decomposed into its sources: $\sigma^2_{\mathrm{IB}} = 0.091$, $\sigma^2_{\mathrm{RED}} = 0.474$, $\sigma^2_{\mathrm{RID}} = 0.187$ and $\sigma^2_{\epsilon} = 1.217$. The variance-based ratio of resources-to-industry is thus $(0.474+0.187)/0.091 = 7.2$.
28. For comparison, the variance-based ratio of resources-to-industry is 7.8 for value creators and 8.9 for value-destroyers.
29. This dominance of firm-specific effects over industry-specific effects is also confirmed in a study using a nonparametric approach as a substitute for the usual variance decomposition methodology; see Ruefli and Wiggins (2003) and McGahan and Porter (2005). A similar effect is observed when taking into account the high inter-dependence between the explanatory variables in these types of studies; see Misangyi *et al.* (2006).
30. The variance-based ratio of resources-to-industry is 3.1 in 1986–1995 and 7.7 in 1996–2005. Thus, the increase in the importance of resources is also found when using a variance decomposition approach similar to Schmalensee (1985) and Rumelt (1991).
31. In comparison, the variance-based ratio is 12.4 in 1996–2000 and 5.2 in 2001–2005. Again this approach yields similar results as the coefficient-based ratio.
32. The variance-based ratio of resources-to-industry is estimated to be 9.3, as compared to 7.7 with only size and book-to-price-adjusted abnormal returns. Thus, the tendency of an increased importance of resources relative to industry is strengthened by our variance decomposition.
33. The variance-based ratio of resources-to-industry is estimated at 7.3, compared with 9.3 when industry is classified into 11 industries. Thus, variance decomposition suggests that finer specifications of industry improve the importance of industry. However, the main result that resources dominate industry is confirmed.
34. We have performed an initial screening based on Cook's distances larger than one to eliminate gross outliers before calculating starting values and then perform Huber iterations followed by biweight iterations as suggested by Li (1985).
35. Performing a conservative likelihood ratio test of the hypothesis of no mixed effects yields a chi-squared test statistic of 757.72. This means that the pooled OLS regression model should be rejected in favor of the mixed effects regression model.
36. The mixed model is $\mathrm{AR}_{ti} = (\alpha+\alpha_i)+(\beta+\beta_i)\,\mathrm{CA}_{ti}+\varepsilon_{ti}$, where AR_{ti} is the dependent variable over t times and i firms, α is the overall intercept, α_i is the firm-specific intercept for firm i, β is the overall slope coefficient, β_i is the firm-specific slope, CA_{ti} is a vector of explanatory variables, and ε_{ti} is the error term; see e.g. Greene (2007, pp. 223–224). Accordingly, α and β represent the fixed effects over all firms and α_i and β_i represent the random firm effects. The coefficients α_i and β_i are assumed to be correlated with an unstructured covariance matrix, which therefore has to be estimated along with the other parameters. The mixed model is estimated by the xtmixed—command in Stata, which has the structure: xtmixed $\mathrm{ARCA_{IB}}$ $\mathrm{RED_{RB}}$ $\mathrm{RID_{RB}}$ Firmid: $\mathrm{CA_{IB}}$ $\mathrm{RED_{RB}}$ $\mathrm{RID_{RB}}$, cov(unstructured); see Rabe-Hesketh and Skrondal (2005).
37. We have also analyzed an even more general mixed effects model with unobserved and nested time (t), industry (j) and firm (i) effects, all with an

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unstructured covariance matrix between groups: $AR_{tji} = (\alpha+\alpha_t+\alpha_j+\alpha_i)+(\beta+\beta_t+\beta_j+\beta_i)\ CA_{tji}+\varepsilon_{tji}$. This model yields a CA_{IB} coefficient of 0.444 (with t-value = 5.47), a RED_{RB} coefficient of 0.730 (13.28) and a RID_{RB} coefficient of 0.546 (6.15), and thus the ratio of resources-to-industry is 2.9. If the mixed effects model is nested only by industry and firm, the CA_{IB} coefficient is 0.240 (1.73), the RED_{RB} coefficient is 0.713 (8.09) and the RID_{RB} coefficient is 0.158 (1.37), implying a ratio of resources-to-industry of 3.6. The ratio of 2.9 relative to 3.6 suggests that there is a tendency of underestimating the industry effect if time effects are not taken explicitly into consideration. The industry effect is more important in the first 10 years of our sample period, a period of less weight due to fewer observations; compare our discussion of time stability within the pooled OLS framework.

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