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Article — Published Version

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Small Business Economics

Provided in Cooperation with:

Springer Nature

Suggested Citation: Johann, Matthias S.; Block, Jörn H.; Benz, Lena (2021) : Financial performance of hidden champions: Evidence from German manufacturing firms, Small Business Economics, ISSN 1573-0913, Springer US, New York, NY, Vol. 59, Iss. 3, pp. 873-892, <https://doi.org/10.1007/s11187-021-00557-7>

This Version is available at:

<https://hdl.handle.net/10419/286929>

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Financial performance of hidden champions: Evidence from German manufacturing firms

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Accepted: 24 August 2021 / Published online: 13 October 2021
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Abstract Hidden champions are market leaders in niche markets and are an important part of the German Mittelstand. Although the hidden champion phenomenon has received considerable interest in practice, few academic studies on this issue exist. We especially lack evidence on the financial performance of hidden champions. Our study addresses this gap and investigates the profitability of hidden champions. In analyzing a panel dataset of 4677 German manufacturing firms, of which 617 are hidden champions, we find that hidden champions have significantly higher profitability with regard to return on assets but less so regarding return on equity. The

hidden champion performance effect on return on assets is valued at 1.7 percentage points. Furthermore, the hidden champion performance effect decreases with firm size. Our paper contributes to the literature on the effect of firm strategy on firm profitability and adds to a better understanding of the hidden champion phenomenon.

Plain English Summary Hidden champions are little known to the public and yet so important to national economies. Defined as (world) market leaders in niche markets, hidden champions are an important part of the German Mittelstand and are heavily associated with the success of the German economy. In analyzing a sample of 4677 German manufacturing firms for a period of 10 years, we compare the financial performance of hidden champions to that of other mid-sized firms. Our paper shows that hidden champions outperform nonhidden champions, especially with regard to return on assets. Interestingly, the hidden champion performance effect decreases with firm size and disappears for firms with more than 900 employees. Our paper adds to a better understanding of the hidden champion phenomenon and extends research on the strategy-performance relationship, particularly addressing the role of firm size.

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Keywords Hidden champions · Niche market leadership · Mittelstand · Manufacturing · Financial performance · Profitability

JEL Classifications L25 · L26

1 Introduction

Hidden champions (HCs) are market leaders in niche markets and are an important part of the German Mittelstand. Such entities are associated with the success of the German Mittelstand and the German economy. HCs follow a strategy based on the combination of two paradigms: niche market focus and international expansion. HCs focus on narrowly defined (niche) markets and provide high-quality products. To increase sales and achieve scale economies, HCs expand internationally (e.g., Audretsch et al., 2020; Rammer & Spielkamp, 2015). Although the HC phenomenon has received much interest in practice, academic research on the topic is scarce. Prior research has investigated the characteristics of HCs and their firm strategies. HCs have higher export ratios than other firms (Rammer & Spielkamp, 2015) and often enter foreign markets through fully owned subsidiaries (Audretsch et al., 2018). HCs employ a highly skilled workforce, which they constantly educate and train (Lehmann et al., 2019; Voudouris et al., 2000). HCs are effective (incremental) innovators and often also technology leaders (Audretsch et al., 2020; Rammer & Spielkamp, 2015; Voudouris et al., 2000). However, while we already have an understanding of the characteristics of HCs and of their strategies, we know little about their economic performance. In particular, we lack quantitative empirical evidence on the financial performance of HCs relative to other firms. Although anecdotal evidence from the media (e.g., BBC, 2017; The Economist, 2012) and popular sciences (e.g., Langenscheidt & Venohr, 2014; Simon, 2012; Venohr & Meyer, 2007) suggests that HCs outperform other firms, no study has quantified these differences in economic and statistical terms. Our study aims to close this gap and investigates the profitability of HCs compared to other firms.

We use a panel dataset of 4677 German Mittelstand manufacturing firms, of which 617 are HCs, for a period of 10 years. Our results show that HCs have a significantly higher *return on assets* (ROA) but that this is not the case for *return on equity* (ROE). The HC performance effect on ROA is valued at 1.7 percentage points. Furthermore, the HC performance

effect decreases with firm size and disappears for firms with more than 900 employees.

Our study contributes to three strands of literature. First, this work contributes to a better understanding of the HC phenomenon (e.g., Audretsch et al., 2018, 2020; Benz et al., 2021; Lehmann et al., 2019) and shows that the HC strategy can indeed lead to stronger financial performance as measured by ROA. Second, as HCs are an important part of the German Mittelstand, our study also contributes to the broader literature on the (German) Mittelstand (e.g., Berghoff, 2006; Block & Spiegel, 2013), particularly its success factors (De Massis et al., 2018). We contribute to the literature on the strategies employed by successful Mittelstand firms (e.g., De Massis et al., 2018; Pahnke & Welter, 2019). Third, our study contributes to the literature on the determinants of financial profitability, particularly the link between strategy and firm performance (e.g., Bowman & Helfat, 2001; Dess & Davis, 1984; Hansen & Wernerfelt, 1989; Spanos et al., 2004; White, 1986). Prior research on strategy typologies describes a focused niche market strategy (e.g., Dalgic & Leeuw, 1994; Porter, 1980; Teplensky et al., 1993) and recommends this approach as a good strategy for small and medium-sized enterprises (SMEs) (e.g., De Massis et al., 2018; Franch Parella & Carmona Hernández, 2018; Gomes-Casseres, 1997; Lee et al., 1999; Muzyka et al., 1997) and family firms (e.g., Hennart et al., 2019; McCann et al., 2001). The results of our study contribute to this discussion by showing that such a strategy can indeed lead to financial outperformance and that the relative advantage of a HC strategy compared to other strategies decreases with firm size, making it a good strategy for SMEs. With this result, we also add to the literature on the role of firm size in the strategy-performance relationship (e.g., Lee, 2009; Leitner & Guldenberg, 2010; Serrasqueiro & Nunes, 2008; Shinkle et al., 2013; Thornhill & White, 2007; Wagner, 1995).

2 Theoretical background

2.1 The German Mittelstand and its characteristics

The term Mittelstand is associated with the success of the German economy. Since World War II and the German *Wirtschaftswunder*, the Mittelstand has been

considered the backbone of the German economy and the engine of its industrial and economic growth (e.g., Kayser & Wallau, 2002; Muzyka et al., 1997). Applying a quantitative criterion, Mittelstand firms include both SMEs (IfM Bonn, 2016) and midcaps (Röhl, 2018). A qualitative criterion stresses the identity of ownership and management (IfM Bonn, 2021), and the majority of Mittelstand firms are family firms. Many large family firms also consider themselves part of the Mittelstand, leading to the emergence of the term *Mittelstand by perception* or identity (Pahnke & Welter, 2019).

Because most Mittelstand firms are family-controlled and managed, they share some characteristics with family firms, including long-term orientation, regional embeddedness, and flat hierarchies (e.g., Berghoff, 2006; Block & Spiegel, 2013). Mittelstand firms have benefitted from globalization. They have internationalized and sell a significant share of their products abroad (Franch Parella & Carmona Hernández, 2018; Kraft et al., 2012). Despite limited resources, such firms often attach great importance to innovation (De Massis et al., 2018). However, while their long-term orientation and employee commitment positively influence innovation, the risk aversion of later family generations and resource constraints can pose a challenge (Decker & Günther, 2017; Werner et al., 2018). Prior research has found that resource constraints and liabilities of smallness can hinder the formation of dynamic capabilities needed for business model innovation (Heider et al., 2020).

As the term Mittelstand is difficult to operationalize, little research exists on the financial performance of Mittelstand firms. However, a number of studies have investigated the financial performance of German family firms. We identified five relevant studies. Andres (2008) finds that firms with an active founding family are more profitable than other firms. This result is confirmed by Audretsch et al. (2013), adding consideration of family monitoring to the literature. The authors argue that business families take an active monitoring role in the firm, protecting family wealth and positively influencing firm performance. Family influence also helps achieve a better strategic fit, which is closely linked to firm performance (Lindow et al., 2010). Other studies have examined the postsuccession performance of family firms and found that the involvement of the previous owner and

his/her human capital significantly affects firm performance (Ahrens et al., 2018). Additionally, family membership of the new CEO improves postsuccession firm performance according to Ahrens et al. (2019).

While the performance of family firms as an important part of the German Mittelstand has been analyzed, we lack large-scale quantitative investigations of the performance of HCs.

2.2 The HC phenomenon

HCs are referred to as the spearheading actors of the German Mittelstand. Simon (2012) defines HCs using three criteria. Market leadership is the first criterion. HCs are among the top three market-leading firms in the world or rank first on their continent. Second, HCs earn revenues of less than five billion Euros. Third, HCs are characterized by low public visibility. While market leadership and the amount of revenues can be quantified, low public visibility is difficult to measure and typically not included in the operational definition of HCs (e.g., Rammer & Spielkamp, 2015). HCs pursue the following two goals: market leadership and growth through internationalization. They achieve these goals through the use of a focused niche market strategy. HCs are focused on niche markets serving demanding customers with high-quality and premium-priced products. Selling their products internationally extends their market and increases their sales volume, enabling scale economies and profitable operations (e.g., Audretsch et al., 2018; Voudouris et al., 2000). The HC strategy resembles the focus strategy described by Porter's (1980) three generic competitive strategies. A focus strategy involves offering high-quality products to selected customers in narrowly defined market segments (Dalgic & Leeuw, 1994).

Toften and Hammervoll (2009) identify seven characteristics of niche market strategies, namely, market segmentation based on the firm's strengths, small thinking and acting, building long-term relationships, focusing on customer needs, appreciation of the firm's reputation, specialization and differentiation, and charging a price premium (Dalgic & Leeuw, 1994; Hammermesh et al., 1978). With the exception of "thinking and acting small," these characteristics fit with the HC strategy. While HCs operate in narrowly defined niche markets, they do not "think and

act small” but, on the contrary, have the ambitious goal of being the international market leader in their segment.

In addition to strategy research, entrepreneurship research has also analyzed the HC phenomenon, although the number of peer-reviewed articles is still low. Of the 94 studies identified by Schenkenhofer (2020), only a few studies are published in reputable academic journals. Audretsch et al. (2020) compare niche and scalable entrepreneurship across countries and identify Germany as the country where niche entrepreneurship is most prevalent. The authors’ findings further show that country context and entrepreneurship strategies interact with each other and that country-specific institutions can explain the high prevalence of niche entrepreneurship in Germany. Focusing on the regional level, Benz et al. (2021) examine the impact of HCs on various regional economic indicators in Germany. They find that a high regional HC intensity has a positive effect on the regional economy, for example in terms of income level or unemployment rate. Regarding regional innovation, a higher HC intensity has a positive effect on patent applications but no influence on R&D expenditures. Germany’s historical and traditional institutions of quality orientation and a strong engineering focus combined with a highly educated workforce provide good conditions for the Mittelstand and its HCs (Audretsch et al., 2018; Lehmann et al., 2019; Rammer & Spielkamp, 2015). In particular, the dual apprenticeship system in Germany is often cited as a major advantage, as it combines the relevant theoretical and practical knowledge and skills needed for high-quality manufacturing. HCs are more likely than other firms to qualify their employees to develop specific skills and human capital (Voudouris et al., 2000). Prior research has also investigated the particularities of HCs with regard to internationalization. As HCs’ products are of premium quality and require considerable explanation and service, HCs are more likely than other firms to enter foreign markets through a direct market entry strategy by means of foreign direct investments (FDI) and wholly owned subsidiaries. HCs aim to retain control and ownership over their internationalization and foreign market entry strategies (Audretsch et al., 2018). With regard to innovation, it is suggested that HCs are strong in incremental innovation, as they strive to continuously improve their

processes, products, and services (Lehmann et al., 2019). Close interactions with demanding customers are suggested to be the main source of innovation for HCs (Voudouris et al., 2000).

Regarding the performance of HCs, Benz et al. (2020) compare DAX 30 firms to 99 HCs listed in the CDAX according to different financial metrics that refer to growth, profitability, liquidity, and stock market performance. The authors’ results show that HCs achieve operating and stock market performance similar to that of DAX 30 firms but differ in terms of financial liquidity and capital structure. Rammer and Spielkamp (2015) show that HCs exceed their control group in terms of market share, sales growth, and *return on sales* (ROS). Nevertheless, most insights into the financial performance of HCs are based on anecdotal evidence. Little evidence from large-scale quantitative studies exists.

3 Data and method

3.1 Sample of German Mittelstand firms from the manufacturing sector

To compare the performance of HCs to that of other Mittelstand firms, we used the Orbis database to generate a sample of German manufacturing firms. The following criteria were applied: (1) the firm was active as of December 2020, (2) its primary NACE code was between 10 and 33, (3) its revenues were below five billion Euros¹ and its number of employees was between 50 and 2999,² and (4) it was not a subsidiary, foreign firm, nonprofit firm or public organization. We in turn obtained a sample of 9594 firms. For these firms, we collected data on financial performance for 2011 to 2020, yielding an unbalanced panel dataset of 4677 firms (28,584 firm-years).

3.2 Identification and operationalization of HCs

Among the 4677 firms, we were able to identify 617 HCs (3958 firm-years). To identify HCs, we use the

¹ The revenues should be below five billion Euros for at least one of the last five years (2016 to 2020).

² This was measured for 2018.

Table 1 Descriptions of all the variables used in the analyses

Variable	Description
ROA (%)	Percentage ratio based on EBT divided by total assets of the firm. Source: Orbis
ROE (%)	Percentage ratio based on EBT divided by shareholder funds. Source: Orbis
HC (dummy)	Equals one if the firm is a market leader, zero if not. Source: Own research
Firm age (log.)	Number of years since the founding of the firm (logarithmized). Source: Orbis
Employees (log.)	Number of employees of the firm (logarithmized). Source: Orbis
Patents per employee	Number of patents granted per employee of the firm calculated based on the Orbis data for the firm's number of granted publications in 2020 and the firm's average number of employees between 2011 and 2020. Source: Orbis
Patents (dummy)	Equals zero if patent data is available in Orbis, otherwise one. If patent data is not available in Orbis, we perform a missing value imputation by replacing missings with zero (for multivariate analyses only).
Export intensity (%)	Percentage ratio based on export revenue divided by operating revenue of the firm. Source: Orbis
Export (dummy)	Equals zero if export intensity data is available in Orbis, otherwise one. If export intensity data is not available in Orbis, we perform a missing value imputation by replacing missings with zero (for multivariate analyses only).
Liquidity ratio	Ratio of the current assets minus stocks to current liabilities of the firm. Source: Orbis
Debt-to-equity ratio (%)	Percentage ratio based on debt divided by equity of the firm. Source: Orbis
Blockholder (dummy)	Equals one if the firm has a recorded shareholder with a direct ownership of over 50 percent (BvD independence indicator D), otherwise zero. Classification is based on the BvD independence indicator which characterizes the degree of independence of a firm with regard to its shareholders. If the BvD independence indicator is not available in Orbis, we perform a missing value imputation by replacing missings with zero. Source: Orbis
Stock market listing (dummy)	Equals one if the firm is listed on the stock market, otherwise zero. Classification is based on Orbis data for the firm's IPO date and delisting date (if available). Source: Orbis
Industry diversification (dummy)	Equals one if the firm is active in more than one industry, otherwise zero. Classification is based on Orbis data for the firm's NACE primary code and NACE secondary code (if available). Source: Orbis
ROA volatility (%)	Standard deviation of the firm's ROA between 2011 and 2020 calculated based on the Orbis data for the firm's ROA between 2011 and 2020. Source: Orbis
Industry (dummies)	Equals one if the firm operates within the respective NACE primary code (10 to 33), otherwise zero.
Federal state (dummies)	Equals one if the firm is located in the respective German federal state (<i>Bundesland</i>), otherwise zero.
Year (dummies)	Equals one for the respective year (2011 to 2020), otherwise zero.

criteria of Simon (2012). HCs should be among the top three market leaders in the world or number one in Europe. We manually collected information on this criterion from the firms' websites or from other online and offline sources, such as press releases and Google alerts ("Weltmarktführer" and "Hidden Champion"). In addition, we checked publicly available lists such as those provided by *WirtschaftsWoche* (2020), Seibold et al. (2019), and Langenscheidt and Venohr (2014). We also checked lists of innovative (Mittelstand) firms published in Yogeshwar (2019)

and *Frankfurter Allgemeine Zeitung* (2019). The share of HCs included in our sample of Mittelstand firms amounts to 13.19%, which is similar to the share of 14.8% reported by Schlepphorst et al. (2016) for a comparable sample.

3.3 Variables and methods

Our dependent variable is financial performance measured by ROA and ROE. To calculate ROA (ROE), we divide a firm's earnings before tax (EBT)

by assets (equity).³ Our focal variable *HC* is a dummy variable. In line with prior research on (family) firm performance (Andres, 2008; Miller et al., 2007; Villalonga & Amit, 2006), we control for firm age, firm size (number of employees), capital (debt-to-equity ratio), and ownership structure. Table 1 provides an overview of the main variables used in our study.

Our analysis proceeds in three steps. First, we conduct descriptive analyses (Sect. 4.1). In addition to running correlations, we compare the means and medians of selected variables of HCs and non-HCs. Second, we run multivariate regressions to investigate whether HCs show higher levels of profitability than non-HCs (Sect. 4.2). We run two separate clustered OLS regressions for ROA and ROE for the 10-year period of 2011 to 2020. Third, we conduct several further analyses, subsample investigations, and robustness checks, as detailed in Sect. 4.3.

4 Results

4.1 Descriptive results

4.1.1 Correlations

Table 2 presents the correlations among the variables included in our multivariate analyses. Not surprisingly, there is a strong correlation between our two performance measures, ROA and ROE (0.64). Surprisingly, our focal variable *HC* shows only weak correlations with the performance variables. The correlation with ROA (ROE) is 0.04 (0.01). The variance inflation factors (VIFs) of our independent and control variables are relatively low, ranging from 1.02 (liquidity ratio) to 3.17 (export dummy). The average VIF is 1.42. Hence, multicollinearity is unlikely to be a major concern.

4.1.2 Comparison of HCs to non-HCs

Table 3 provides descriptive statistics for our main variables distinguishing between HCs and non-HCs. We report mean and median values, standard deviations, and *t*-tests for the equality of means and

Wilcoxon rank-sum-tests for the equality of medians. In this way, we examine whether the HCs in our sample have the typical characteristics attributed to HCs, namely, above-average export ratios, pronounced innovation activities, and healthy capital structures.

For *export intensity*, we find significantly higher mean and median values for HCs than for non-HCs. The mean export intensity is 54.78% for HCs versus 42.16% for non-HCs. HCs also show significantly higher levels of patent output. On average, HCs have 0.44 *patents per employee* (non-HCs: 0.29). The absolute numbers are even more impressive. HCs possess on average 264 (median: 86) granted patents, whereas non-HCs have only a mean of 85 (median: 18). Overall, our findings are consistent with prior research showing a stronger export orientation and higher innovation output for HCs compared to non-HCs (Lehmann et al., 2019; Rammer & Spielkamp, 2015; Voudouris et al., 2000).

We also find significantly lower *ROA volatility* (6.20% versus 6.73%, $p < 0.01$) and *debt-to-equity ratio* (117% versus 125%, $p < 0.01$) values for HCs than for non-HCs, which is in line with HCs having healthy capital structures and revenue streams (Benz et al., 2020). In addition, the HCs' *liquidity ratio* is slightly lower than that of the other firms (2.55 versus 2.68, $p < 0.10$).

Regarding financial performance, we find that HCs have a mean ROA of 9.31% (median 7.98%), whereas non-HCs have a mean of 8.00% (median: 6.80%). This difference is statistically significant at the 1% level. Moreover, HCs have a higher ROE (mean: 25.10%, median: 18.06%) than non-HCs (mean: 24.09%, median: 16.68%).

Significant differences between HCs and non-HCs also exist regarding firm age and firm size. HCs are on average larger (in terms of employees) and older than non-HCs. Differences are statistically significant at the 1% level. The mean *firm age* of HCs is 59.47 years (non-HCs: 39.99), and the mean number of *employees* is 598 (non-HCs: 300).

4.1.3 Industry distribution

Table 4 shows the industry distribution of HCs and non-HCs. Across all industries, HCs have a share of 10.20%. Except for NACE 12 (tobacco products), HCs are present in all industries. However, HCs are not distributed equally across industries. The

³ We also used other earnings measures such as EBIT and EBITDA. The corresponding results are available upon request.

Table 2 Correlations and variance inflation factors (VIFs) of all the variables used in the analyses

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	VIF
(1) ROA (%)															
(2) ROE (%)	0.64														1.19
(3) HC (d)	0.04	0.01													1.12
(4) Firm age (log.)	0.05	0.03	0.15												1.29
(5) Employees (log.)	-0.05	-0.02	0.30	0.17											1.05
(6) Patens per employee	-0.01	-0.00	0.10	0.05	0.02										1.18
(7) Patens (d)	-0.01	0.03	-0.22	-0.19	-0.27	-0.19									3.16
(8) Export intensity (%)	-0.01	0.00	0.17	0.07	0.24	0.06	-0.17								3.17
(9) Export (d)	0.03	0.01	-0.12	-0.08	-0.27	-0.02	0.14	-0.82							1.02
(10) Liquidity ratio	0.12	-0.02	-0.01	0.02	-0.05	0.05	-0.02	0.00	0.02						1.02
(11) Debt-to-equity ratio (%)	-0.18	0.09	-0.02	-0.06	0.04	-0.01	0.04	-0.02	0.00	-0.11					1.02
(12) Blockholder (d)	-0.02	0.01	-0.11	-0.19	-0.09	0.00	0.02	0.04	-0.03	0.01	0.03				1.08
(13) Stock market listing (d)	-0.06	-0.04	0.19	0.07	0.15	0.05	-0.07	-0.11	0.13	-0.03	-0.05	-0.17			1.13
(14) Industry diversification (d)	0.01	0.02	0.00	-0.03	0.03	0.00	-0.00	0.01	-0.02	0.02	0.02	0.05	-0.10		1.02
(15) ROA volatility (%)	0.01	0.02	-0.03	-0.17	-0.13	0.05	-0.03	-0.00	0.02	0.01	0.04	0.12	0.01	-0.02	1.06

N=28,584

SD standard deviation, VIF variance inflation factor, d dummy variable

Table 3 Descriptive statistics. Means, standard deviations, medians, and tests of differences in means and medians between HCs and non-HCs for selected variables. The sample

comprises 28,584 firm-years from 4677 firms. Asterisks denote statistical significance at the 0.01 (***) , 0.05 (**), and 0.10 (*) levels

	HCs			Non-HCs			t-stat	z-stat
	Mean	Std. dev	Median	Mean	Std. dev	Median		
ROA (%)	9.31	11.88	7.98	8.00	12.45	6.80	-6.41***	-7.52***
ROE (%)	25.10	59.91	18.06	24.09	75.34	16.68	-0.95	-4.43***
Firm age	59.47	56.63	43	39.99	40.00	27	-20.82***	-26.43***
Employees	598.15	524.84	416	299.63	373.53	181	-34.41***	-50.11***
Patents ^a	264.19	618.93	86	85.37	300.96	18	-17.14***	-41.40***
Patents per employees ^a	0.44	0.94	0.20	0.29	0.92	0.08	-9.13***	-26.14***
Export intensity (%) ^b	54.78	22.42	57.02	42.16	24.45	41.17	-22.38***	-21.41***
Liquidity ratio	2.55	4.00	1.57	2.68	5.03	1.29	1.87*	-11.68***
Debt-to-equity ratio (%)	116.92	138.98	68.30	124.53	155.85	68.66	3.14***	-1.75*
ROA volatility (%)	6.20	4.88	4.85	6.73	5.42	5.25	6.26***	6.22***
Number of firm-years	3958			24,626			28,584	
Number of firms	617			4060			4677	

^aAs we only consider available patent data, we refer to 19,724 firm-years from 3177 firms, thereof 3714 firm-years from 577 HCs.

^bAs we only consider available export intensity data, we refer to 10,638 firm-years from 2424 firms, thereof 2020 firm-years from 414 HCs.

lowest share of HCs is found in NACE 18 (printing and reproduction of recorded media) (1.22%); the largest shares of HCs are found in NACE 28 (machinery and equipment; 22.12%), NACE 32 (other manufacturing; 20.74%), NACE 27 (electrical equipment; 19.34%), NACE 26 (computer, electronic and optical products; 17.85%), and NACE 13 (textiles; 17.28%).

4.2 Multivariate results

Our multivariate regressions investigate the performance effect of HCs using ROA and ROE as dependent variables. We run clustered OLS regressions for an unbalanced panel dataset spanning 10 years. With regard to ROA, we find an economically and statistically significant effect. Being an HC has a positive relationship with ROA ($\beta=1.73$, $p<0.01$). With regard to ROE, we do not find a statistically significant HC performance effect ($\beta=2.56$, $p>0.10$).

Our control variables show significant industry effects. Interestingly, industries with a high HC share (Sect. 4.1) show a significantly higher profitability. For example, NACE 26 (computer, electronic, and optical products) and NACE 27 (electrical

equipment) have a significant positive relationship with ROA (NACE 26: $\beta=2.78$, $p<0.01$; NACE 27: $\beta=2.12$, $p<0.01$) and ROE (NACE 26: $\beta=9.14$, $p<0.05$; NACE 27: $\beta=8.24$, $p<0.10$). The same is true for NACE 28 (machinery and equipment), which shows a positive relationship with ROA ($\beta=1.31$, $p<0.05$). To conclude, the HC performance effect observed in practice may at least be partially attributed to industry effects. Innovation as measured by a firm's patents per employee shows a negative relationship with ROA ($\beta=-0.33$, $p<0.10$) but no relationship with ROE.

Table 5 summarizes the results of the main analyses. An extended version showing the detailed industry effects can be found in Table 6 of the Appendix.

We next calculate the interaction effects between HC status and firm size (as measured by the number of employees). Our empirical model is a clustered OLS regression using ROA as the dependent variable. In calculating and plotting margins with 95% confidence intervals, we find support for the statistically significant HC performance effect with regard to ROA. The effect, however, decreases with firm size and loses its statistical significance for firms with 900

Table 4 Industry distribution of HCs and non-HCs. Number and percent of firms by primary two-digit NACE code. HCs are defined according to the criteria described in the text. The sample comprises 4677 firm observations

NACE code	Industry description	All firms	HCs	Non-HCs	HCs in industry (%)
10	Manufacture of food products	346	19	327	5.49
11	Manufacture of beverages	72	5	67	6.94
12	Manufacture of tobacco products	11	0	11	0
13	Manufacture of textiles	81	14	67	17.28
14	Manufacture of wearing apparel	45	3	42	6.67
15	Manufacture of leather and related products	24	2	22	8.33
16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	78	10	68	12.82
17	Manufacture of paper and paper products	124	9	115	7.26
18	Printing and reproduction of recorded media	82	1	81	1.22
19	Manufacture of coke and refined petroleum products	20	2	18	10
20	Manufacture of chemicals and chemical products	319	31	288	9.72
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	122	11	111	9.02
22	Manufacture of rubber and plastic products	346	34	312	9.83
23	Manufacture of other non-metallic mineral products	183	15	168	8.20
24	Manufacture of basic metals	208	23	185	11.06
25	Manufacture of fabricated metal products, except machinery and equipment	585	62	523	10.60
26	Manufacture of computer, electronic and optical products	409	73	336	17.85
27	Manufacture of electrical equipment	274	53	221	19.34
28	Manufacture of machinery and equipment n.e.c	886	196	690	22.12
29	Manufacture of motor vehicles, trailers and semi-trailers	154	13	141	8.44
30	Manufacture of other transport equipment	62	4	58	6.45
31	Manufacture of furniture	44	3	41	6.82
32	Other manufacturing	135	28	107	20.74
33	Repair and installation of machinery and equipment	67	6	61	8.96
Total		4677	617	4060	13.19

employees or more. Figure 1 shows the interaction effects graphically.

With regard to ROE, we neither find a statistically significant HC performance effect nor evidence for an interaction effect with firm size. Figure 2 shows the interactions analysis for ROE.

4.3 Further analyses and robustness checks

In addition to our main analyses, we conduct several further analyses and robustness checks. As a first additional analysis, we perform the above described clustered OLS regressions for four subsamples based

on firm size, age, or revenue. Table 7 of the Appendix provides an overview of the main sample and the subsamples. We also perform a seemingly unrelated and median regression as well as a clustered OLS regression using *ROS* as the dependent variable. Finally, we test for the robustness of the results by winsorizing our dependent variables ROA and ROE.

4.3.1 Subsample regressions

The first subsample consists of firms with a maximum of 499 employees, often referred to as medium-sized enterprises (MEs) (IfM Bonn, 2016). Our subsample

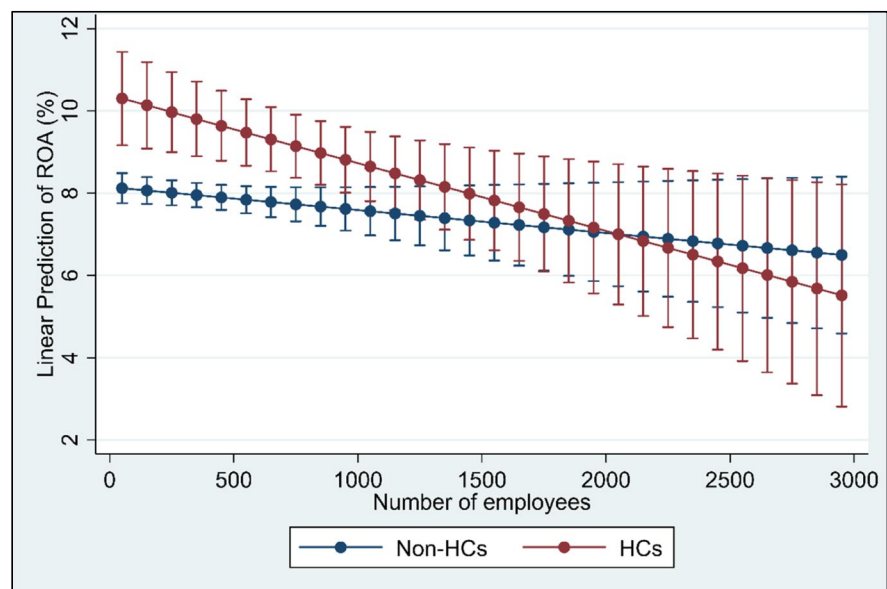
Table 5 Clustered OLS regressions for our main sample. Results of separate clustered OLS regressions of ROA and ROE on HC and further firm characteristics. All regressions include dummy variables for each year of the sample period, for German federal states, and for two-digit NACE codes. The sample comprises 28,584 firm-year observations from 4677 firms. The model shows coefficients with robust standard errors in parentheses. Asterisks denote statistical significance at the 0.01 (***) , 0.05 (**), and 0.10 (*) levels

Variables	ROA (%)	ROE (%)
HC (dummy)	1.73*** (0.45)	2.56 (2.41)
Firm age (log.)	0.71*** (0.17)	4.33*** (0.99)
Employees (log.)	-0.46*** (0.18)	-1.08 (1.02)
Patents per employee	-0.33* (0.17)	-0.39 (1.25)
Patents (dummy)	0.67* (0.36)	6.60*** (2.19)
Export intensity (%)	0.01 (0.01)	0.09 (0.06)
Export (dummy)	1.34*** (0.46)	5.51* (2.89)
Liquidity ratio	0.21*** (0.03)	-0.24*** (0.09)
Debt-to-equity ratio (%)	-0.01*** (0.00)	0.04*** (0.01)
Stock market listing (dummy)	-6.50*** (0.95)	-19.03*** (3.16)
Blockholder (dummy)	-0.57 (0.36)	0.38 (1.76)
Industry diversification (dummy)	0.02 (0.29)	1.59 (1.69)
ROA volatility (%)	0.03 (0.04)	0.21 (0.24)
Constant	9.80*** (1.48)	7.21 (8.52)
Observations	28,584	28,584
R-squared	0.07	0.02

regression using a sample of firms with between 50 and 499 employees shows an economically and statistically significant effect of HCs on both ROA ($\beta=2.33$, $p<0.01$) and ROE ($\beta=5.78$, $p<0.10$). The second subsample includes firms with a minimum of 500 employees and a maximum of 2999 employees, thus including midcaps but excluding MEs (IfM

Bonn, 2016; Röhl, 2018). The second subsample regression does not show a significant performance effect of HCs. In line with our analysis of interaction effects in the main analyses (Sect. 4.2), it seems that the HC performance effect exists for medium-sized Mittelstand firms but not for large Mittelstand firms. The third subsample is based on our main sample

Fig. 1 Predictive margins of HC with 95% confidence intervals for ROA. Marginsplot based on a clustered OLS regression of ROA on HC and further firm characteristics, including the interaction effect between HC and a firm's number of employees. The sample comprises 28,584 firm-year observations from 4677 firms



but excludes firms operating for less than 10 years to exclude startups. Our third subsample regression confirms our main results. Significances and effect sizes resemble those of the main analyses. While we find a significant effect of HCs on ROA ($\beta=1.80, p<0.01$), we do not find one for ROE. Tables 8, 9, and 10 of the Appendix show the results of the analyses.

We also perform a subsample regression for firms with revenues of less than three billion Euros. The HC criteria have slightly changed over time with regard to the upper threshold of revenues. Simon (2012) raised the threshold from three billion Euros to five billion Euros in 2012 to account for changing market conditions and firm growth. In analyzing 24,817 firm-years from 4630 firms (616 HCs), we can confirm the results of our main analyses (Sect. 4.2). While HC has an economically and statistically significant effect on ROA ($\beta=1.68, p<0.01$), it is insignificant with regard to ROE ($\beta=2.57, p>0.10$).

4.3.2 Seemingly unrelated and median regressions

As noted above, there is a strong correlation between our two dependent variables ROA and ROE ($r=0.64$), which may lead to a correlation in the error terms across the two regressions. When using a seemingly unrelated regression, accounting for such a correlation of error terms yields a positive significant

relationship between HC and ROA ($\beta=1.73, p<0.01$) and a positive effect on ROE ($\beta=2.56, p<0.10$). Table 11 of the Appendix provides the results.

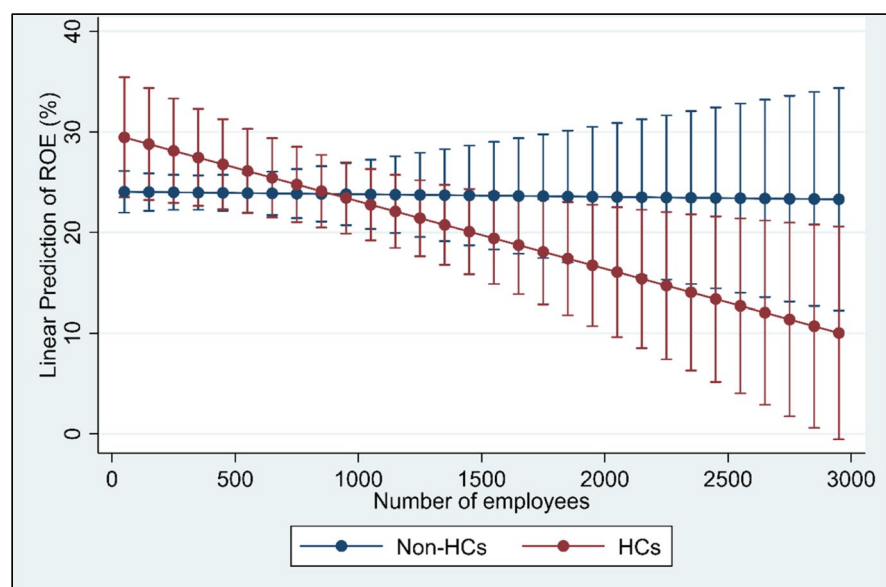
Additionally, we perform median regressions for ROA and ROE to account for the skewness of the dependent variables. This time, we find positive significant effects of HC on both ROA ($\beta=0.83, p<0.01$) and ROE ($\beta=1.75, p<0.01$). It seems that the insignificant relationship between HC and ROE found in the main analyses is at least partly due to the skewness of the dependent variable.

4.3.3 Using alternative dependent variables

As another analysis, we perform a clustered OLS regression using ROS as a performance measure. ROS is calculated as EBT divided by the operating revenue of the firm. Using an unbalanced panel dataset of 24,778 firm-years for 4630 firms (616 HCs), we find an economically and statistically significant performance effect of HCs ($\beta=1.03, p<0.01$). This result is in line with Rammer and Spielkamp (2015). Table 12 of the Appendix shows the regression results obtained when using ROS as the dependent variable.

Finally, we also performed regressions with winsorized dependent variables. To take into account outlier effects (Yale & Forsythe, 1976), we

Fig. 2 Predictive margins of HC with 95% confidence intervals for ROE. Marginsplot based on a clustered OLS regression of ROE on HC and further firm characteristics, including the interaction effect between HC and a firm's number of employees. The sample comprises 28,584 firm-year observations from 4677 firms



transform the top (bottom) 1% and 5% of ROA and ROE, respectively; 1% (5%) of the lowest values are recoded to the value of the 1st (5th) percentile, while 1% (5%) of the highest values are recoded to the value of the 99th (95th) percentile. The results are as follows: Winsorizing at the 1% level yields a significant relationship between HC and ROA of $\beta=1.65$ ($p<0.01$). The relationship between HC and ROE is $\beta=3.37$ ($p<0.10$). Winsorizing at the 5% level yields similar results. Table 13 of the Appendix displays detailed results.

4.4 Limitations

Our study has some limitations. First, our sample is limited to Germany and to the manufacturing sector. The German manufacturing sector is a strong, export-oriented industry dominated by Mittelstand firms (Bernard & Wagner, 1997). Our findings may not generalize to HCs and Mittelstand firms operating in industries that are less export-oriented, more B2C focused or more service dominated. A second limitation concerns the large number of missing values affecting our profitability measures, which could lead to sample selection bias. Third, as our sample firms are mostly privately owned, we do not have information on the firms' market values and market-based performance measures. Finally, as our focal variable HC is constant over time, we cannot run fixed-effects regressions, which limits the interpretation of our findings, as we cannot claim causal effects.

5 Discussion and implications

5.1 Summary of main results

The results of our empirical analyses support some of the earlier evidence on HCs (Audretsch et al., 2018; Rammer & Spielkamp, 2015; Voudouris et al., 2000). For example, our results show that HCs have higher export ratios and higher patent output levels than other Mittelstand firms. Moreover, they are older, have less performance risk, and have higher equity ratios. Regarding performance,

our regressions show that HCs have a higher ROA but not a higher ROE. The HC performance effect on ROA is 1.7 percentage points and is therefore not only of statistical but also of practical significance. We also find that the HC performance effect is very heterogeneous and varies greatly. In particular, an interaction exists, and the effect seems to decrease with firm size. What do these results mean for theory and practice?

5.2 Implications for theory and future research

Our study contributes to prior research on the determinants of financial profitability and particularly work on the link between strategy and performance (e.g., Bowman & Helfat, 2001; Dess & Davis, 1984; Hansen & Wernerfelt, 1989; Spanos et al., 2004; White, 1986). The question of which strategy leads to competitive advantage has been an integral part of the strategic management literature since such research began (e.g., Campbell-Hunt, 2000; Spanos et al., 2004). As a result, research has identified different strategic orientations of firms and examined their effects on performance. For example, the typologies developed by Porter (1980) and Miles and Snow (1978) are among the most prominent strategic frameworks to date (Campbell-Hunt, 2000; Ramos-Rodriguez & Ruiz-Navarro, 2004). Both authors define strategic archetypes that firms follow to gain a competitive advantage. While Porter (1980) distinguishes between three generic strategies (cost leadership, differentiation, and focus), Miles and Snow (1978) divide firms into defenders, prospectors, and analyzers according to their strategic orientation. Empirical evidence suggests that a firm's strategy indeed influences its performance (e.g., Bowman & Helfat, 2001; Leitner & Guldenberg, 2010; Spanos et al., 2004). For SMEs (De Massis et al., 2018; Franch Parella & Carmona Hernández, 2018; Gomes-Casseres, 1997; Lee et al., 1999; Muzyka et al., 1997) and family firms (e.g., Hennart et al., 2019; McCann et al., 2001), prior research has identified a focused niche market strategy as particularly suitable and profitable. Taking into account SMEs' resource constraints, Lee et al. (1999), for

example, show that a niche market strategy allows SMEs to successfully compete with larger firms. Moreover, Hennart et al. (2019) find the adoption of a global niche business model to be a fruitful path for family-managed SMEs to overcome internationalization limitations and increase foreign sales. Our results confirm that a niche market strategy can lead to superior financial performance and that such a strategy fits well with the characteristics of small and mid-sized firms. In this way, our study also contributes to research on the relationship between firm size and firm performance (e.g., Lee et al., 2009; Leitner & Guldenberg, 2010; Serrasqueiro & Nunes, 2008; Shinkle et al., 2013; Thornhill & White, 2007; Wagner, 1995), suggesting a niche strategy as an important moderator variable.

In addition to contributing to the broader strategy literature, our study contributes to a better understanding of the HC phenomenon. This is the first study to analyze the performance of HCs in a large-scale quantitative study. By evaluating the accounting performance of HCs in terms of ROA and ROE, we extend research on the characteristics of HCs (e.g., Audretsch et al., 2018, 2020; Benz et al., 2021; Lehmann et al., 2019) and Mittelstand firms (Berghoff, 2006; Berleemann & Jahn, 2016; Pahnke & Welter, 2019). We answer the question of whether and to what extent HCs outperform other Mittelstand firms. While we can generally confirm outperformance (at least with regard to ROA), we also find substantial performance heterogeneity *within* the group of HCs. This result parallels findings from research on the performance of family firms. Miller et al. (2007) and Andres (2008) show that family firm performance depends very much on the definition of family firm and on the type of family firm considered. Some researchers even go so far as to completely reject the idea of comparing the performance of family and non-family firms and suggest focusing only on performance differences *among* family firms instead.

Our study can be seen as a starting point for research on the performance of HCs and their

determining factors. More research is needed to better understand why and under which conditions HCs outperform other firms. When does a focused niche market strategy create economic value and when does it not? What internal and external factors interact with the HC strategy leading to (out-)performance? Potential external factors include country- and regional-level institutions (Audretsch et al., 2020; Lehmann et al., 2019; Pahnke & Welter, 2019), competitive factors (Porter, 1980), and technological and industry environments (Spanos et al., 2004). Potential internal factors include a firm's resources and capabilities, such as its absorptive capacity, ambidexterity, and dynamic capabilities. Such a resource-based perspective of the HC strategy is missing thus far in the literature on HCs. Such a perspective would also extend the strategic fit literature (Bingham et al., 2011; Geiger et al., 2006; Lindow et al., 2010; Zajac et al., 2000). A final direction would be to investigate the relationship between firm ownership and HC strategy. For example, are family owners, due to their long-term focus, the ideal owners to pursue a HC strategy (Le Breton-Miller & Miller, 2006; Lumpkin et al., 2010)?

5.3 Implications for practice

The results of our study have practical implications for firm managers and owners in showing that a HC strategy can lead to superior firm performance, particularly for firms with fewer than 900 employees. Focusing on niche markets with a strong international and export orientation seems to be a profitable strategy. Our results should be interpreted with caution, however. Notable performance differences exist *within* the group of HCs, and by far, not all HCs are successful. It is also difficult for other Mittelstand firms to imitate an HC strategy. Hence, it is questionable whether HCs can truly serve as a role model for other firms. More research is needed to better understand when and under which conditions a HC strategy leads to superior performance and should be employed.

Appendix

Table 6 Clustered OLS regressions for our main sample including industry dummies. Results of separate clustered OLS regressions of ROA and ROE on HC and further firm characteristics. All regressions include dummy variables for each year of the sample period and German federal state. The sample comprises 28,584 firm-year observations from 4677 firms. The model shows coefficients with robust standard errors in parentheses. Asterisks denote statistical significance at the 0.01 (***) , 0.05 (**), and 0.10 (*) levels

Variables	ROA (%)	ROE (%)
HC (dummy)	1.73*** (0.45)	2.56 (2.41)
Firm age (log.)	0.71*** (0.17)	4.33*** (0.99)
Employees (log.)	-0.46*** (0.18)	-1.08 (1.02)
Patents per employee	-0.33* (0.17)	-0.39 (1.25)
Patents (dummy)	0.67* (0.36)	6.60*** (2.19)
Export intensity (%)	0.01 (0.01)	0.09 (0.06)
Export (dummy)	1.34*** (0.46)	5.51* (2.89)
Liquidity ratio	0.21*** (0.03)	-0.24*** (0.09)
Debt-to-equity ratio (%)	-0.01*** (0.00)	0.04*** (0.01)
Stock market listing (dummy)	-6.50*** (0.95)	-19.03*** (3.16)
Blockholder (dummy)	-0.57 (0.36)	0.38 (1.76)
Industry diversification (dummy)	0.02 (0.29)	1.59 (1.69)
ROA volatility (%)	0.03 (0.04)	0.21 (0.24)
NACE (dummies)		
11	0.31 (1.07)	-4.90 (4.36)
12	6.87 (5.07)	57.43 (38.80)
13	-0.82 (1.03)	-0.09 (7.75)
14	-0.58 (1.68)	7.31 (12.28)
15	0.66 (1.44)	-4.10 (5.07)
16	-1.26 (1.12)	-7.87 (4.84)
17	-0.45 (1.06)	-0.02 (6.82)
18	0.06 (1.49)	0.28 (7.77)
19	-1.03 (1.54)	-7.10 (5.20)
20	2.16*** (0.68)	8.90** (4.21)
21	0.63 (1.10)	4.88 (5.02)
22	2.36*** (0.75)	4.46 (3.92)
23	-0.03 (0.98)	-2.12 (4.57)
24	-1.26* (0.73)	-6.15 (3.99)
25	0.77 (0.60)	6.26* (3.74)
26	2.78*** (0.75)	9.14** (3.96)
27	2.12*** (0.79)	8.24* (4.69)
28	1.31** (0.59)	3.18 (3.23)
29	0.46 (0.91)	-4.67 (6.11)
30	0.00 (1.55)	0.56 (8.96)
31	0.91 (1.24)	4.01 (7.47)
32	2.08** (1.04)	13.05 (8.06)
33	1.35 (1.26)	2.97 (7.48)
Constant	9.80*** (1.48)	7.21 (8.52)
Observations	28,584	28,584
R-squared	0.07	0.02

Table 7 Overview of the main sample and subsamples. Overview of all samples analyzed in this study. The table refers to firm-year observations and shows the corresponding firms in parentheses. Criteria were applied for the year 2018 regarding employees and for 2020 regarding age

Sample	Criteria	All firms	HCs	Non-HCs	HCs in sample (%)
Main sample	50 to 2999 employees	28,584 (4677)	3958 (617)	24,626 (4060)	13.85 (13.19)
Subsample 1	50 to 499 employees	23,052 (3781)	2242 (353)	20,810 (3428)	9.73 (9.34)
Subsample 2	500 to 2999 employees	5532 (896)	1716 (264)	3816 (632)	31.02 (29.46)
Subsample 3	50 to 2999 employees and at least 10 years old	27,498 (4370)	3840 (588)	23,658 (3782)	13.96 (13.46)
Subsample 4	Revenue threshold of 3 billion Euros	24,817 (4630)	3773 (616)	21,044 (4014)	15.20 (13.30)

Table 8 Clustered OLS regressions for subsample 1. Results of separate clustered OLS regressions of ROA and ROE on HC and further firm characteristics. All regressions include dummy variables for each year of the sample period, for German federal states, and for two-digit NACE codes. The sample comprises 23,052 firm-year observations from 3781 firms. The model shows coefficients with robust standard errors in parentheses. Asterisks denote statistical significance at the 0.01 (***), 0.05 (**), and 0.10 (*) levels

Variables	ROA (%)	ROE (%)
HC (dummy)	2.33*** (0.60)	5.78* (3.34)
Firm age (log.)	0.68*** (0.20)	4.85*** (1.21)
Employees (log.)	-0.55** (0.27)	-1.95 (1.61)
Patents per employee	-0.29 (0.19)	-0.38 (1.38)
Patents (dummy)	0.73* (0.39)	6.46*** (2.34)
Export intensity (%)	0.01 (0.01)	0.12* (0.07)
Export (dummy)	1.07** (0.53)	5.37* (3.14)
Liquidity ratio	0.24*** (0.03)	-0.23** (0.09)
Debt-to-equity ratio (%)	-0.01*** (0.00)	0.04*** (0.01)
Stock market listing (dummy)	-9.93*** (1.62)	-26.48*** (4.79)
Blockholder (dummy)	-0.63 (0.43)	0.43 (1.98)
Industry diversification (dummy)	0.13 (0.33)	2.87 (1.90)
ROA volatility (%)	0.02 (0.05)	0.18 (0.26)
Constant	10.64*** (1.90)	9.64 (10.79)
Observations	23,052	23,052
R-squared	0.08	0.02

Table 9 Clustered OLS regressions for subsample 2. Results of separate clustered OLS regressions of ROA and ROE on HC and further firm characteristics. All regressions include dummy variables for each year of the sample period, for German federal states, and for two-digit NACE codes. The sample comprises 5532 firm-year observations from 896 firms. The model shows coefficients with robust standard errors in parentheses. Asterisks denote statistical significance at the 0.01 (***) , 0.05 (**), and 0.10 (*) levels

Variables	ROA (%)	ROE (%)
HC (dummy)	0.67 (0.63)	- 1.78 (3.24)
Fim age (log.)	0.91*** (0.28)	2.71* (1.53)
Employees (log.)	- 0.56 (0.46)	- 0.91 (2.55)
Patents per employee	- 0.34 (0.39)	0.09 (2.38)
Patents (dummy)	0.77 (0.91)	11.15* (6.50)
Export intensity (%)	0.02 (0.02)	0.01 (0.12)
Export (dummy)	2.17** (0.90)	4.70 (6.72)
Liquidity ratio	0.09* (0.05)	- 0.17 (0.26)
Debt-to-equity ratio (%)	- 0.01*** (0.00)	0.04** (0.02)
Stock market listing (dummy)	- 3.74*** (1.05)	- 13.92*** (4.76)
Blockholder (dummy)	- 0.76 (0.57)	- 0.78 (3.67)
Industry diversification (dummy)	- 0.56 (0.57)	- 3.45 (3.67)
ROA volatility (%)	0.12 (0.10)	0.44 (0.60)
Constant	9.31*** (3.40)	12.01 (21.72)
Observations	5532	5532
R-squared	0.11	0.07

Table 10 Clustered OLS regressions for subsample 3. Results of separate clustered OLS regressions of ROA and ROE on HC and further firm characteristics. All regressions include dummy variables for each year of the sample period, for German federal states, and for two-digit NACE codes. The sample comprises 27,498 firm-year observations from 4370 firms. The model shows coefficients with robust standard errors in parentheses. Asterisks denote statistical significance at the 0.01 (***) , 0.05 (**), and 0.10 (*) levels

Variables	ROA (%)	ROE (%)
HC (dummy)	1.80*** (0.46)	2.68 (2.46)
Firm age (log.)	0.31 (0.19)	3.55*** (1.08)
Employees (log.)	- 0.44** (0.18)	- 1.08 (1.04)
Patents per employee	- 0.25 (0.16)	0.61 (0.87)
Patents (dummy)	0.68* (0.37)	6.47*** (2.20)
Export intensity (%)	0.01 (0.01)	0.09 (0.06)
Export (dummy)	1.46*** (0.48)	6.53** (2.97)
Liquidity ratio	0.22*** (0.03)	- 0.24*** (0.09)
Debt-to-equity ratio (%)	- 0.01*** (0.00)	0.05*** (0.01)
Stock market listing (dummy)	- 6.50*** (0.96)	- 19.46*** (3.18)
Blockholder (dummy)	- 0.68* (0.36)	0.09 (1.78)
Industry diversification (dummy)	0.07 (0.30)	1.40 (1.72)
ROA volatility (%)	0.05 (0.04)	0.24 (0.25)
Constant	10.95*** (1.54)	8.21 (8.84)
Observations	27,498	27,498
R-squared	0.07	0.03

Table 11 Seemingly unrelated regression for our main sample. Results of the seemingly unrelated regression of ROA and ROE on HC and further firm characteristics. Regression includes dummy variables for each year of the sample period, for German federal states, and for two-digit NACE codes. The sample comprises 28,584 firm-year observations from 4677 firms. The model shows coefficients with robust standard errors in parentheses. Asterisks denote statistical significance at the 0.01 (***) , 0.05 (**), and 0.10 (*) levels

Variables	ROA (%)	ROE (%)
HC (dummy)	1.73*** (0.23)	2.56* (1.38)
Firm age (log.)	0.71*** (0.09)	4.33*** (0.53)
Employees (log.)	-0.46*** (0.09)	-1.08* (0.55)
Patents per employee	-0.33*** (0.09)	-0.39 (0.56)
Patents (dummy)	0.67*** (0.18)	6.60*** (1.07)
Export intensity (%)	0.01** (0.00)	0.09*** (0.03)
Export (dummy)	1.34*** (0.26)	5.51*** (1.60)
Liquidity ratio	0.21*** (0.02)	-0.24*** (0.09)
Debt-to-equity ratio (%)	-0.01*** (0.00)	0.04*** (0.00)
Stock market listing (dummy)	-6.50*** (0.44)	-19.03*** (2.69)
Blockholder (dummy)	-0.57*** (0.18)	0.38 (1.11)
Industry diversification (dummy)	0.02 (0.15)	1.59* (0.88)
ROA volatility (%)	0.03** (0.01)	0.21** (0.08)
Constant	9.80*** (0.79)	7.21 (4.81)
Observations	28,584	28,584
R-squared	0.07	0.02
Chi-square	2253.81	700.94
Breusch-Pagan test of independence (Chi-square)	12,749.54***	

Table 12 Clustered OLS regression for ROS. Results of clustered OLS regression of ROS on HC and further firm characteristics. Regression includes dummy variables for each year of the sample period, for German federal states, and for two-digit NACE codes. The sample comprises 24,778 firm-year observations from 4630 firms. The model shows coefficients with robust standard errors in parentheses. Asterisks denote statistical significance at the 0.01 (***) , 0.05 (**), and 0.10 (*) levels

Variables	ROS (%)
HC (dummy)	1.03*** (0.35)
Firm age (log.)	0.48*** (0.14)
Employees (log.)	-0.06 (0.15)
Patents per employee	0.81** (0.34)
Patents (dummy)	0.14 (0.30)
Export intensity (%)	0.02*** (0.01)
Export (dummy)	1.20*** (0.32)
Liquidity ratio	0.24*** (0.03)
Debt-to-equity ratio (%)	-0.01*** (0.00)
Stock market listing (dummy)	-3.38*** (0.86)
Blockholder (dummy)	-0.17 (0.25)
Industry diversification (dummy)	0.20 (0.23)
ROA volatility (%)	-0.06* (0.03)
Constant	3.31*** (1.12)
Observations	24,778
R-squared	0.08

Table 13 Clustered OLS regressions for our main sample using winsorized data. Results of the clustered OLS regressions for our main sample analyzing the relationship between the independent variable HC and the winsorized dependent variables ROA and ROE. The sample comprises 28,584 firm-year observations from 4677 firms. The model shows coefficients with robust standard errors in parentheses. Asterisks denote statistical significance at the 0.01 (***) , 0.05 (**), and 0.10 (*) levels

Winsorization level	ROA (%)	ROE (%)
1%	1.65*** (0.42)	3.37* (2.02)
5%	1.36*** (0.34)	2.69** (1.16)

Acknowledgements We acknowledge helpful and constructive comments from participants of the G-Forum 2020. Special thanks is also given to the journals' editorial office and reviewing team. Furthermore, we would like to thank the Donors' Association for Science Statistics and the German Savings Banks and Giro-Association (DSGV) for supporting our research.

Funding Open Access funding enabled and organized by Projekt DEAL.

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