Nordic Journal of Business

Vol. 74, No. 1
(Spring 2025)

NJB

Nordic Journal of Business

SUOMEN KAUPPAKORKEAKOULUT
ASSOCIATION of BUSINESS SCHOOLS FINLAND
FÖRENINGEN för HANDELSHÖGSKOLORNA I FINLAND

Contents

Editor's Letter

This issue of the *Nordic Journal of Business* features two peer-reviewed articles. In the first article, Samuli Knüpfer examines the prevalence and importance of privately held firms in Finland and documents patterns and trends in their ownership. The second article by Markus Fütterer, Marc Steffen Rapp and Michelle Schlosser focuses on technology-motivated acquisitions of non-tech firms and introduces a novel approach for identifying such acquisitions.

I hope you enjoy reading the interesting articles included in this issue of the *Nordic Journal of Business*.

Sami Vähämaa
Editor
Nordic Journal of Business

Ownership of Privately Held Companies in Finland, 2006–2022*

Samuli Knüpfer

Abstract

Using comprehensive register data on the shareholders of Finnish limited liability firms in 2006–2022, this paper studies the prevalence and importance of privately held firms and documents patterns and trends in their ownership. In 2022, privately held firms account for 86 % of companies, 30 % of revenue, and 49 % of employment. Only 3 % of the population own shares in these firms with 81 % of owners holding just one firm. Men, Swedish-speakers, and Master's degree holders are more likely to own privately held firms. The wealthiest 1 % of owners account for 48 % of business wealth, with average business wealth being the highest in Helsinki, Joensuu, Vaasa, and Turku. Owners are responsible for 12 % of the country's personal income tax bill and 31 % of corporate income taxes. The owner population shows significant turnover with only 35 % of its members in 2006 surviving as owners until 2022. Emigrating owners have moved to foreign ownership an estimated 6 % of total business wealth during the sample period.

Keywords:

Privately held firm, ownership, wealth concentration

Samuli Knüpfer is Professor of Ownership at Aalto University School of Business. He is also Adjunct Professor of Finance at BI Norwegian Business School, Norway, and Research Affiliate at the Research Institute of Industrial Economics (IFN), Sweden.

* I thank Statistics Finland for providing me with the data. I am also grateful to Philip Aminoff, Krista Elo-Pärssinen, Jussi Herlin, Jari Huovinen, Matti Keloharju, Vesa Puttonen, Salla Pöyry, Lari Raitavuo, Antti Suhonen, Pasi Torppa, and Minna Vanhala-Harmanen for comments, and Elias Rantapuska and Juhana Peltonen for help in accessing and processing the data.

1 Introduction

Almost everything we know about stock ownership stems from studies on publicly traded firms. However, privately held firms—an integral part of any market economy—also have shareholders. How many owners are there in such firms? What are their socioeconomic characteristics? How is their business wealth distributed? How much turnover occurs within the owner population over time? Are owners likely to move abroad? This paper is the first to comprehensively document patterns and trends in the ownership of privately held firms. Using detailed ownership data from Finland over the 2006–2002 period, coupled with comprehensive records of firm financials, I explore various aspects of ownership in these firms.

I classify each firm according to the type of its majority owners and document the prevalence and economic significance of privately held firms. I report the number of owners in these firms and compare their socioeconomic characteristics to the general population. By valuing the equity stakes held by each owner, I study the level and concentration of business wealth. The long time series allows me to document how these key patterns have evolved, how owners have transitioned into and out of their shareholder positions over time, and whether they have emigrated.

This paper is related to the work that analyzes ownership in publicly traded firms and mutual funds (Badarinza, Campbell, and Ramadorai, 2016; Breitkopf, Knüpfer, and Rantapuska, 2021; Campbell, 2006; Keloharju and Lehtinen, 2021). This study also connects with papers studying the concentration of wealth and its drivers (Bach, Calvet, and Sodini, 2020; Fagereng, Guiso, Malacrino, and Pistaferri, 2020). A few papers investigate the behavior of privately held firms, but their focus is not on the firms' owners (Asker, Farre-Mensa, and Ljungqvist, 2015; Brav, 2009; Gilje and Taillard, 2016; Michaely and Roberts, 2012; Saunders and Steffen, 2011; Sheen, 2020).

The remainder of the paper unfolds as follows. Section 2 describes the data, Section 3 presents the results, and Section 4 summarizes the findings.

2 Data and definitions

2.1 Data sources

The data for this study are sourced from Statistics Finland (SF). It provides qualified researchers with access to comprehensive register-based data on firms and individuals in Finland. These statistical units are linked by pseudonymized, unique identification numbers, which allows the merging of information from various government registers. The sample period spans 2006 –2022, determined by the availability of ownership data.

Ownership data. Ownership of privately held companies originates from the annual tax returns companies are required to file with the Finnish Tax Administration (FTA). Active firms classified as limited liability companies by the FTA must report all their shareholders and the number of shares they hold, provided they have no more than ten shareholders. Firms exceeding this limit report shareholders who hold at least 10 % of the company's shares or have a shareholder loan from the company.

The shareholder reporting requirement applies to both natural and legal persons. Because legal-person shareholders are typically companies that must also report their own shareholders, I can identify the natural persons that are the ultimate beneficiary owners. The only excep-

tion is when the beneficiary owner does not appear in Finnish registers, such as foreign firms and individuals not having to report to the FTA. I allow for a maximum of ten layers of firms in the ownership chain to identify the ultimate owner.

SF also hosts additional data that helps in identifying shareholders who do not meet the reporting requirement. Business groups file consolidated accounts with the Finnish Patent and Registration Office. These accounts need to detail the parent company's ownership stakes in the group subsidiaries. Firms must also report to the FTA the dividends they pay to their shareholders. These tax filings identify each shareholder and the number of shares they hold. I use these additional sources of data to supplement the original ownership records. Although this addition identifies some new shareholders, particularly in privately held firms with dispersed ownership, it does not significantly alter the conclusions of this study. This minor improvement is expected, given the high coverage of shareholder reporting documented by the FTA.[1]

Firm data. SF compiles extensive information on all Finnish companies. From these data, I extract information on industry, institutional sector, ownership category, number of employees, standard financials (including revenue, book value of equity, EBITDA, and corporate income taxes), and public listing status. For business groups, the financials refer to the unconsolidated accounts of each firm within the group. This lack of consolidation, along with the focus on the beneficial ultimate owners, may lead to some inflation of book value due to the assets of a holding and an operating company being counted twice and some inflation of revenue in cases of intra-group transactions. SF also uses unconsolidated accounts in preparing their official statistics, explaining that evolving business group structures make consolidation challenging. I restrict the analysis to firms with strictly positive revenue and at least one-half full-time equivalent employee during the year. The latter restriction is also used by SF to determine whether a firm qualifies as a statistical unit for the purposes of official statistics, among other criteria. For the purposes of this study, these restrictions help in excluding the large number of firms that are either inactive or are set up as a holding company that ultimately leads to the beneficial owner.

Individual data. From SF's comprehensive individual data, I extract information on gender, birth year, native language, level of education, province and municipality of residence, and labor and capital income, along with income taxes paid. This information is available for individuals that belong to the officially defined population of Finnish residents.

2.2. Definitions of ownership types

I classify firms into five ownership types based on detailed ownership data and the information on the ownership category and listing status supplied by SF. The ownership category allows for the separate identification of firms controlled by foreign shareholders and by state and local governments. The listing status, combined with the business group data, makes it possible to indicate publicly traded firms and their subsidiaries. Because the ownership data do not record the voting rights associated with each share, I assume they align perfectly with cash flow rights.

Privately held. In these companies, natural persons hold more than 50 % of the shares, either directly in own names or indirectly through a corporate entity. This definition ensures that in-

1 An FTA report, "Omistajat osakeyhtiön organisaatiohenkilönä", documents that 9 % of the 175,455 active registered firms that needed to report shareholders in 2012 missed the information. My sample includes only 100,586 firms in 2012 because it omits firms with no revenue or less than 0.5 FTE employees. These restrictions likely increase the coverage of shareholder data because the operationally active firms more likely file their tax return correctly.

dividuals collectively can control the most important governance aspects of the firm, including the election of the board.

Foreign. SF classifies these firms as being majority-controlled by foreign shareholders.

Other. In these domestically controlled firms, the collective ownership of individual shareholders does not meet the majority threshold, or no individuals appear as shareholders in the ownership data. Examples of firms in this category include companies controlled by institutional investors, private equity firms, co-operatives, and charitable foundations.

Government. SF classifies these firms as being majority-controlled by either the state or local governments.

Listed. These firms have their shares quoted on the national stock exchange. The business group data expand the set of firms in this category to include the listed parent and its subsidiaries. The listing status takes precedence over all the other ownership types, ensuring that no firms in the other categories are publicly listed. For example, a publicly traded firm that is controlled by the government is categorized as a listed rather than a government-controlled firm.

3 Results

3.1 Prevalence and importance of privately held firms

Table 1 presents an overview of firm characteristics stratified by ownership type in 2022. The ownership types are categorized into non-listed firms (privately held, foreign, other, and government), listed firms, and all firms combined. The key metrics analyzed include the number of firms, revenue, and number of employees. The table also reports on book value of equity, EBITDA, and corporate income taxes.

Table 1 Firm characteristics by ownership type, 2022
This table reports the number of firms, revenue, book value of equity, EBITDA, number of employees, and corporate income taxes, categorized by ownership type in 2022. Privately held firms are defined as those majority-owned by individuals. The categories of foreign and government refer to firms majority-owned by foreign shareholders and by local or state governments, respectively. Other non-listed firms include companies that do not fall into any of the three non-listed categories. Listed firms are publicly listed on NASDAQ Helsinki and take precedence over other ownership types; for example, a government-owned listed firm is classified as a listed firm. Subsidiaries are categorized based on the ownership type of their parent company.

	OWNERSHIP TYPE					ALL FIRMS
	NON-LISTED FIRMS				LISTED FIRMS	
	PRIVATELY HELD	FOREIGN	OTHER	GOVERN-MENT		
Totals, mill. euros / persons						
Revenue	146,590	114,603	51,615	27,663	142,144	482,615
Book value of equity	61,712	52,535	24,401	22,848	107,558	269,053
EBITDA	9,881	9,843	2,229	3,177	5,420	30,551
Corporate income taxes	1,983	1,507	519	302	1,703	6,013
Number of employees	626,568	283,515	168,499	58,001	154,301	1,290,884
Means, th. euros / persons						
Revenue	1,596	38,163	5,082	34,708	228,528	4,534
Book value of equity	672	17,494	2,402	28,668	172,922	2,528
EBITDA	108	3,278	219	3,987	8,715	287
Corporate income taxes	22	509	51	383	2,774	57
Number of employees	7	94	17	73	248	12
Medians, th. euros / persons						
Revenue	323	7,548	439	2,935	8,884	355
Book value of equity	78	1,819	57	1,679	2,755	83
EBITDA	20	321	10	180	197	21
Corporate income taxes	1	21	0	0	7	1
Number of employees	2	26	3	12	40	2
Number of firms	91,855	3,003	10,157	797	622	106,434

The overall sample includes 106,000 firms, with their total sales amounting to 480 billion euros. Official aggregate statistics from SF report 570,000 firms generating 580 billion euros in revenue in 2022. Out of these firms, 230,000 are limited liability firms with 520 billion euros in revenue.[2] These numbers show that the choice of restricting attention to active firms with positive employment and revenue only removes 7 % of the sales of all the limited liability firms in Finland.

Privately held firms account for 86 % of all firms. The average privately held firm has annual sales of two million euros and it employs seven people. Both the high frequency and the small size distinguish privately held firms from the other ownership types. Listed firms have the highest average revenue at 229 million euros, followed by 38 million for foreign-controlled firms, 35 million for government-controlled firms, and five million for other firms. Listed firms are also the fewest in number with 622 firms, followed by 797 government-controlled firms, 3,003 foreign firms, and 10,157 other firms. The number of listed firms is higher than that appearing at NASDAQ Helsinki because it includes any subsidiaries of listed companies.

The lower medians reflect a skewed distribution of firm size. Privately held firms have the lowest median sales at 0.3 million euros followed by other firms at 0.4 million. The median government-controlled firm has a revenue of 3 million whereas foreign-controlled and listed firms have 8 million and 9 million, respectively. This ranking remains similar for employment.

Despite their small size, privately held firms collectively matter the most. Their aggregated sales amount to 147 billion, and they employ 627,000 people. Listed firms have 142 billion in revenue, but they employ only 154,000 people in Finland. Foreign-owned firms are the third most important category with total sales of 115 billion euros. Their employment with 284,000 employees puts them at the second place. Government-controlled firms generate 28 billion euros in revenue and employ 58,000 people whereas the residual category of other firms has 52 billion euros in sales and 169,000 employees.

Figure 1 summarizes these statistics by reporting the fraction of revenue, employment, and number of firms in privately held firms, compared separately to all firms, domestic firms, and domestic non-listed firms. Privately held firms account for 30 % of the revenue and 49 % of the employment of all firms. Excluding foreign-controlled firms increases these fractions to 40 % and 62 % whereas further removing listed firms results in fractions of 65 % and 73 %, respectively.

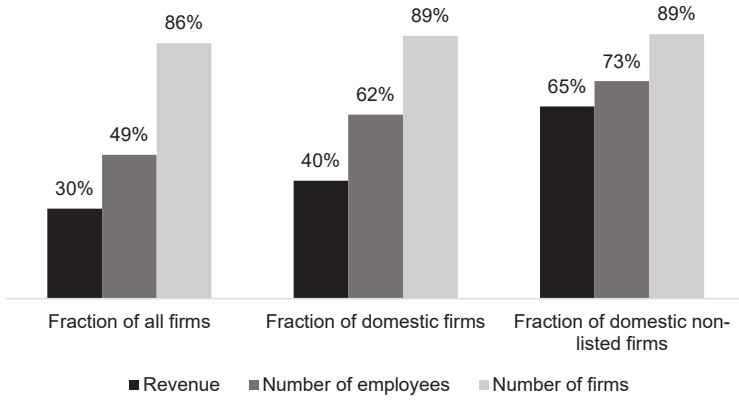


Figure 1. Importance of privately held firms compared to all firms, domestic firms, and non-listed domestic firms, 2022
This figure illustrates the total revenue and the number of employees in privately held firms, along with the number of these firms, as a fraction of those for all firms, domestically owned firms, and domestically owned non-listed firms.

2 The aggregate statistics cited in this paper are from the StatFin database at https://stat.fi/tup/statfin/index_en.html.

Figure 2 reports the development in these fractions over time. From 2006 to 2022, privately held firms have somewhat increased in importance, both in numbers and fraction of revenue and employment. The revenue share has grown from 28 % to 30 % whereas employment has increased from 46 % to 49 %. These findings show that privately held firms are significant for the Finnish economy, particularly so when focusing on the domestically controlled non-listed business sector. Their importance has remained high throughout the sample period and has somewhat increased over time.

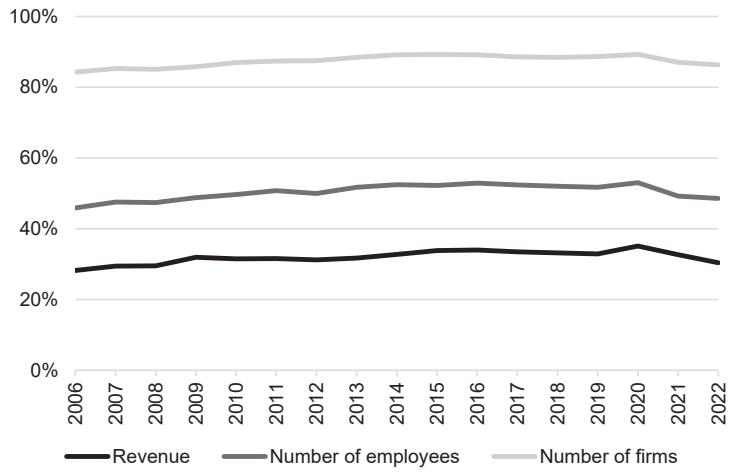


Figure 2. Importance of privately held firms compared to all firms, 2006–2022
This figure illustrates the total revenue and the number of employees in privately held firms, along with the number of these firms, as a fraction of those for all firms over time.

Table 2 analyzes the importance of privately held firms and the other ownership types across the firm size distribution. The table breaks down firms into five categories by their number of employees and calculates the fraction of firms, revenue, and employment in each category by ownership type. In the smallest firms of 1–9 employees, privately held firms account for 90 % of firms, 74 % of revenue, and 88 % of employment. At the other end of the spectrum in the largest firms employing at least 500 people, these fractions are only 16 %, 6 %, and 12 %, respectively. 48 % of the medium-sized firms with 50–249 employees are privately held. These 1,432 firms account for 27 % of revenue and 44 % of employment in their size category.[3]

3 Adding the firms employing 250–499 people, there are 1,527 privately held firms that loosely qualify for the "Mittelstand" definition used by Confederation of Finnish Industries (EK). EK estimates, based on a combination of business surveys and official statistics, that there are about 1,500 Mittelstand firms in Finland. Scaling the revenue and employment fractions by the fractions reported in the last column of Table 2 shows that Mittelstand firms account for 9 % of revenue and 12 % of employment of all the firms in my sample.

Table 2 Ownership types by firm size, 2022
This table reports the fraction of firms, revenue, and number of employees in each firm size category by ownership type. Each row in the table sums up to 100%, with the last column reporting the fraction of firms, revenue, and number of employees accounted for by each firm size category. The measure of firm size is number of employees, broken down into 1-9, 10-49, 50-249, 250-499, and at least 500 employees. Refer to Table 1 for definitions of the ownership types.

	OWNERSHIP TYPE					FRACTION OF FIRMS, REVENUE, OR EMPLOYEES IN EACH SIZE CATEGORY
	NON-LISTED FIRMS				LISTED FIRMS	
	PRIVATELY HELD	FOREIGN	OTHER	GOVERNMENT		
Fraction of firms						
1–9 employees	90 %	1 %	9 %	0.4 %	0.2 %	83 %
10–49	77 %	8 %	12 %	2 %	1 %	14 %
50–249	48 %	25 %	17 %	4 %	5 %	3 %
250–499	25 %	37 %	14 %	7 %	16 %	0.4 %
500–	16 %	43 %	12 %	7 %	22 %	0.3 %
Fraction of revenue						
1–9 employees	74 %	8 %	13 %	3 %	3 %	13 %
10–49	59 %	18 %	14 %	4 %	5 %	18 %
50–249	27 %	31 %	12 %	6 %	24 %	26 %
250–499	18 %	40 %	8 %	8 %	26 %	11 %
500–	6 %	22 %	8 %	7 %	58 %	33 %
Fraction of employees						
1–9 employees	88 %	2 %	9 %	1 %	0.3 %	18 %
10–49	73 %	10 %	13 %	2 %	2 %	23 %
50–249	44 %	28 %	17 %	4 %	7 %	22 %
250–499	26 %	36 %	15 %	7 %	17 %	10 %
500–	12 %	36 %	12 %	9 %	32 %	27 %

As expected based on the patterns of firm size across ownership types reported in Table 1, the other ownership types show much less concentration towards small firms. Among the largest firms of at least 500 employees, 43 % are foreign-controlled and 22 % are listed. These two ownership types account for 22 % and 58 % of revenue and 36 % and 32 % of employment in the largest firms.

Table 3 illustrates the industry distribution of revenue and employment for privately held firms and all other ownership types in 2022. Privately held firms are particularly dominant in several industries. They have a strong presence in the construction sector, and they are significantly engaged in wholesale and retail trade. Privately held firms are also involved in professional, scientific, and technical activities, as well as administrative and support services. Their notable presence in the accommodation and food service activities sector underscores their role in hospitality and tourism.

Table 3 Fraction of firm revenue and employees by industry, 2022
This table reports the share of revenues and employees for privately held firms and the other four ownership types by industry in 2002. Refer to Table 1 for definitions of the ownership types.

INDUSTRY CODE AND NAME		PRIVATELY HELD		OTHER OWNERSHIP TYPES	
		REVENUE	EMPLOYEES	REVENUE	EMPLOYEES
A	Agriculture, forestry and fishing	2.0 %	2.2 %	0.2 %	0.2 %
B	Mining and quarrying	0.5 %	0.4 %	0.6 %	0.4 %
C	Manufacturing	21.3 %	18.6 %	46.3 %	27.7 %
D	Electricity, gas, steam and air conditioning	0.1 %	0.1 %	6.6 %	1.7 %
E	Water supply, sewerage, waste management	0.8 %	0.6 %	0.6 %	0.9 %
F	Construction	18.6 %	17.7 %	4.5 %	5.9 %
G	Wholesale and retail trade	29.3 %	14.5 %	21.0 %	12.9 %
H	Transportation and storage	5.9 %	7.6 %	4.8 %	7.4 %
I	Accommodation and food service activities	2.8 %	4.9 %	0.8 %	2.9 %
J	Information and communication	3.0 %	4.5 %	6.3 %	10.6 %
K	Financial and insurance activities	1.2 %	0.2 %	0.1 %	0.1 %
L	Real estate activities	1.2 %	1.1 %	0.4 %	1.0 %
M	Professional, scientific, and technical activities	6.9 %	10.0 %	3.0 %	7.7 %
N	Administrative and support service activities	3.3 %	10.9 %	1.9 %	9.2 %
P	Education	0.2 %	0.5 %	0.1 %	0.5 %
Q	Human health and social work activities	1.9 %	4.2 %	2.0 %	9.8 %
R	Arts, entertainment and recreation	0.6 %	1.0 %	0.5 %	0.9 %
S	Other service activities	0.6 %	1.1 %	0.1 %	0.2 %

Privately held firms are much less common in the manufacturing industry that typically requires substantial capital and a large scale. The electricity, gas, steam, and air conditioning supply sector has minimal involvement from privately held firms, reflecting government control of this infrastructure. Similarly, the information and communication industry shows more participation from other ownership types, possibly due to its high-tech nature and the need for substantial R&D investments.

These patterns indicate that privately held firms are more dominant in industries that require less physical capital and that are easier to enter. They are also more likely to be found in consumer-driven, service-oriented, and human-capital intensive industries.

Table 4 takes a closer look at the ownership structure of privately held firms in 2022. 49 % of these firms are owned by just one individual with a further 27 % owned by two individuals. These firms account for 41 % of sales and 47 % of employees of privately held firms. Only 2 % of the firms have ten or more owners with but these firms account for 17 % of revenue and 14 % of employees. Accordingly, the mean revenue and employment increase in the number of owners whereas the fraction of shares held by individuals declines. These patterns show large differences in ownership structure that correlate with differences in firm financials.

Table 4 Privately held firms by number of owners, 2022
This table reports the number of firms, the fractions of total revenue and employment, the average revenue and employment, and the average fraction of the firm's shares held by individuals, categorized by the number of individual shareholders in the firm

NUMBER OF OWNERS	NUMBER OF FIRMS	FRACTION OF TOTAL		MEAN		
		REVENUE	EMPLOYEES	REVENUE, TH. EUROS	EMPLOYEES	INDIVIDUAL OWNERSHIP SHARE
1	44,678	21 %	25 %	688	4	99 %
2	25,185	21 %	22 %	1,193	5	98 %
3	8,810	13 %	13 %	2,184	9	98 %
4	4,977	10 %	9 %	2,871	11	97 %
5	4,689	14 %	14 %	4,513	19	95 %
6–9	1,331	4 %	4 %	4,572	17	95 %
10–19	1,332	6 %	6 %	6,920	28	91 %
20–49	515	5 %	4 %	15,243	44	88 %
50–	338	5 %	4 %	23,529	78	81 %

3.2. Number of owners in privately held firms

Table 5 shows that privately held firms have 169,000 unique individuals registered as owners in 2022. This number represents 3.0 % of the population. Table 5 and Figure 3 show an increase from the 2.6 % rate observed in 2006, reflecting a 17 % increase in relative terms. Interestingly, there was a temporary increase in 2020, possibly due to the abolishment of the minimum equity capital requirement for limited-liability firms in 2019, and the COVID-19 period that saw many employees laid off or furloughed.

Table 5 Number of individual owners, their business wealth, and number of firms per owner, 2006–2022
This table reports the number of individual owners in privately held firms in 2006–2022. It also reports the mean and median business wealth, defined as the book value of equity attributable to each owner based on her ownership stake, and the mean number of firms held by an individual owner.

YEAR	OWNERS		BUSINESS WEALTH, EUROS		MEAN NUMBER OF FIRMS PER OWNER
	NUMBER	FRACTION OF POPULATION	MEAN	MEDIAN	
2006	136,532	2.6 %	175,393	22,991	1.39
2007	146,995	2.8 %	191,455	23,573	1.53
2008	153,488	2.9 %	204,053	23,720	1.44
2009	155,142	2.9 %	208,099	22,714	1.44
2010	159,490	3.0 %	213,255	22,531	1.44
2011	163,126	3.0 %	213,448	22,958	1.48
2012	164,420	3.0 %	211,954	23,581	1.45
2013	166,733	3.1 %	217,901	23,561	1.46
2014	167,873	3.1 %	228,661	24,122	1.48
2015	166,469	3.0 %	236,291	25,789	1.50
2016	170,063	3.1 %	246,296	26,314	1.65
2017	171,436	3.1 %	258,595	27,911	1.61
2018	173,490	3.1 %	280,919	29,515	1.59
2019	172,751	3.1 %	299,074	31,544	1.62
2020	183,536	3.3 %	302,968	31,655	1.65
2021	164,709	3.0 %	329,375	35,159	1.64
2022	168,703	3.0 %	337,278	36,798	1.53

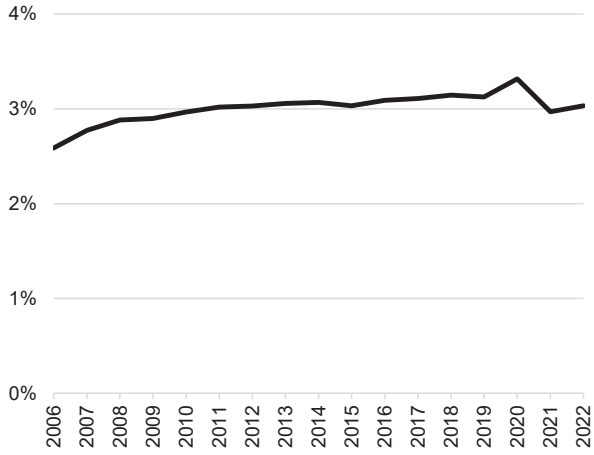


Figure 3. Number of owners as a fraction of population, 2006–2022
This figure reports the fraction of population who own shares in privately held firms over time.

The scarcity of owners is striking when compared to the fraction of the population that holds equity in publicly listed companies. In 2022, Statistics Finland reports 15 % of the population holds publicly traded stock. Many individuals also hold shares through mutual funds. Breitkopf, Knüpfer, and Rantapuska (2021) find a 12 % participation rate in directly held stock in 2016, which increases to 18 % when holdings in equity mutual funds are included. The relatively few individuals in ownership positions, coupled with the substantial footprint of privately held firms in the economy, show that this small owner segment of the population matters greatly for economic growth and job creation.

Table 5 also reports the mean business wealth for each owner, defined as the value of each owner's equity stake in a firm multiplied by the company's book value of equity and summed up across all firms held by an individual. For example, an individual holding 70 % of the shares in firm A and 20 % of firm B with both firms having a book value of equity of 10 million euros would result into $0.7 \times 10 + 0.2 \times 10 = 9$ million euros of business wealth. The lack of readily available measures of market values for non-listed firms dictates the use of book values. Because market values exceed book values, barring unusual cases such as financial distress, the resulting business wealth estimates are conservative.

The average owner holds 337,000 euros of business wealth whereas the median equals 37,000 euros. Applying a conservative market-to-book ratio of two and a typical 20 % discount for illiquidity would yield market values of 540,000 and 59,000 for the mean and median owner, respectively. These estimates are an order of magnitude larger than the portfolio values of public equity investors. Breitkopf, Knüpfer, and Rantapuska (2021) report that the mean portfolio value of individuals investing in directly held stock or equity mutual funds is 49,000 euros, with a median of 6,000 euros.

Table 5 also shows that each owner holds shares in an average of 1.5 firms. Table 6 stratifies the owners by the number of firms in which they hold equity stakes. The vast majority, 81 %,

are shareholders in just one firm. These owners account for 36 % of total business wealth. An additional 11 % of owners hold shares in two firms whereas those with more than two holdings account for the remaining 8 %. Despite their small number, serial owners account for a large fraction of business wealth. Those with at least ten holdings represent 1 % of owners but account for 19 % of business wealth. Not surprisingly, these serial owners are substantially wealthier than one-firm owners, with a mean business wealth of 7 million euros.

Table 6 Number of firms held, 2022
This table reports the number and fraction of owners, along with the total and mean business wealth, categorized by the number of firms held by an individual owner. Business wealth is defined as the book value of equity attributable to an owner based on her ownership stake.

NUMBER OF FIRMS HELD	NUMBER OF OWNERS	FRACTION OF OWNERS	FRACTION OF BUSINESS WEALTH	MEAN BUSINESS WEALTH, EUROS
1	135,967	81 %	36 %	152,352
2	18,457	11 %	15 %	473,252
3	5,726	3 %	9 %	909,249
4	2,667	2 %	5 %	1,124,211
5	1,755	1 %	4 %	1,357,581
6	946	0.6 %	4 %	2,652,948
7	827	0.5 %	2 %	1,633,016
8	342	0.2 %	2 %	3,129,812
9	458	0.3 %	2 %	2,072,856
10-	1,558	1 %	19 %	7,049,443

3.3 Owners in privately held firms compared to the population

Figure 4 reports the fraction of the population who are owners in privately held firms in 2022, stratified by gender, native language, and level of education. The highest ownership rates are obtained for men, Swedish-speakers, and Master's degree holders. Although all these rates are small in absolute terms, their relative differences are large. The 4 % ownership rate for men is double the 2 % rate for women whereas the 4 % rate for Swedish-speakers is one third higher than the 3 % rate for Finnish-speakers. The differences are particularly pronounced in education: Master's degree holders have an ownership rate of 6 %, compared to just 1 % for those with basic education.

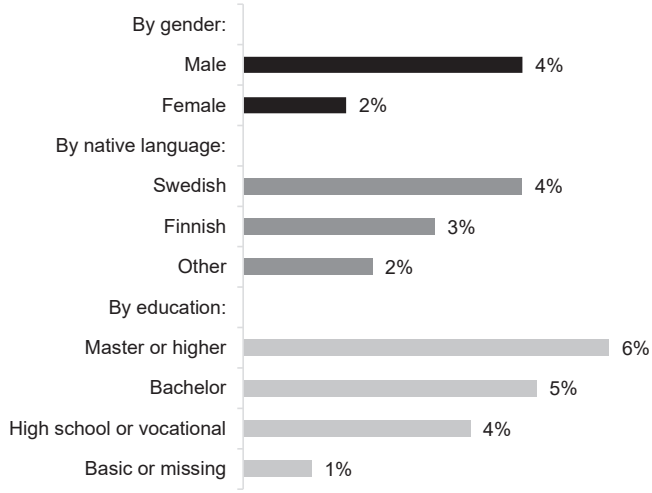


Figure 4. Owners as a fraction of population by gender, native language, and education
This figure reports the fraction of population who own shares in privately held firms, categorized by gender, native language, and level of education.

Table 7 shows ownership rates over time. The fraction of owners has increased the most, 40 % in relative terms, among those whose native language is neither of the two official languages. Men have increased their ownership rates by 19 % whereas the increase for women is only 11 %. Those with a basic or Master's education have experienced a small drop in ownership whereas those with secondary or Bachelor's education have increased their rate.

Table 7 Fraction of owners by individual characteristics, 2006–2022
This table reports the fraction of owners within subgroups of the population categorized by gender, native language, and level of education, in 2006-2022.

YEAR	GENDER		NATIVE LANGUAGE			LEVEL OF EDUCATION			
	MALE	FEMALE	FINNISH	SWE-DISH	OTHER	BASIC OR MISSING	HIGH SCHOOL OR VOCA-TIONAL	BACHE-LOR	MASTER OR HIGHER
2006	3.7 %	1.5 %	2.5 %	3.9 %	1.5 %	1.2 %	3.4 %	4.6 %	6.2 %
2007	4.0 %	1.6 %	2.7 %	4.2 %	1.6 %	1.2 %	3.6 %	4.8 %	6.5 %
2008	4.2 %	1.6 %	2.8 %	4.3 %	1.7 %	1.3 %	3.7 %	4.8 %	6.7 %
2009	4.2 %	1.6 %	2.9 %	4.4 %	1.7 %	1.3 %	3.7 %	4.8 %	6.7 %
2010	4.3 %	1.7 %	2.9 %	4.5 %	1.7 %	1.3 %	3.8 %	4.8 %	6.8 %
2011	4.4 %	1.7 %	3.0 %	4.7 %	1.7 %	1.3 %	3.8 %	4.8 %	6.8 %
2012	4.4 %	1.7 %	3.0 %	4.7 %	1.7 %	1.3 %	3.8 %	4.8 %	6.8 %
2013	4.5 %	1.7 %	3.0 %	4.7 %	1.8 %	1.2 %	3.8 %	4.8 %	6.8 %
2014	4.5 %	1.7 %	3.1 %	4.7 %	1.8 %	1.2 %	3.8 %	4.8 %	6.7 %
2015	4.4 %	1.7 %	3.0 %	4.7 %	1.8 %	1.2 %	3.8 %	4.7 %	6.6 %
2016	4.5 %	1.7 %	3.1 %	5.0 %	1.8 %	1.2 %	3.8 %	4.7 %	6.7 %
2017	4.6 %	1.7 %	3.1 %	4.9 %	1.9 %	1.2 %	3.8 %	4.8 %	6.6 %
2018	4.6 %	1.7 %	3.1 %	4.8 %	1.9 %	1.2 %	3.8 %	4.8 %	6.6 %
2019	4.6 %	1.7 %	3.1 %	4.8 %	2.0 %	1.2 %	3.7 %	4.8 %	6.6 %
2020	4.9 %	1.8 %	3.3 %	5.0 %	2.2 %	1.2 %	3.9 %	5.1 %	6.8 %
2021	4.4 %	1.6 %	3.0 %	4.4 %	2.0 %	1.1 %	3.5 %	4.6 %	5.8 %
2022	4.5 %	1.6 %	3.0 %	4.4 %	2.1 %	1.1 %	3.6 %	4.7 %	5.8 %

Figure 5 analyzes the age-gender distribution of owners compared to the general population, with a detailed breakdown of the numbers appearing in Table 8. The left side of the figure shows the fraction of the population and the fraction of owners falling into each age category for men whereas the right side provides corresponding statistics for women. The figure shows that the distribution of owners is heavily skewed towards men, with only 27 % of owners being women. This gender disparity is even more striking when considering wealth shares: women account for only 23 % of business wealth of all owners. Thus, women are underrepresented in numbers and particularly in economic significance.

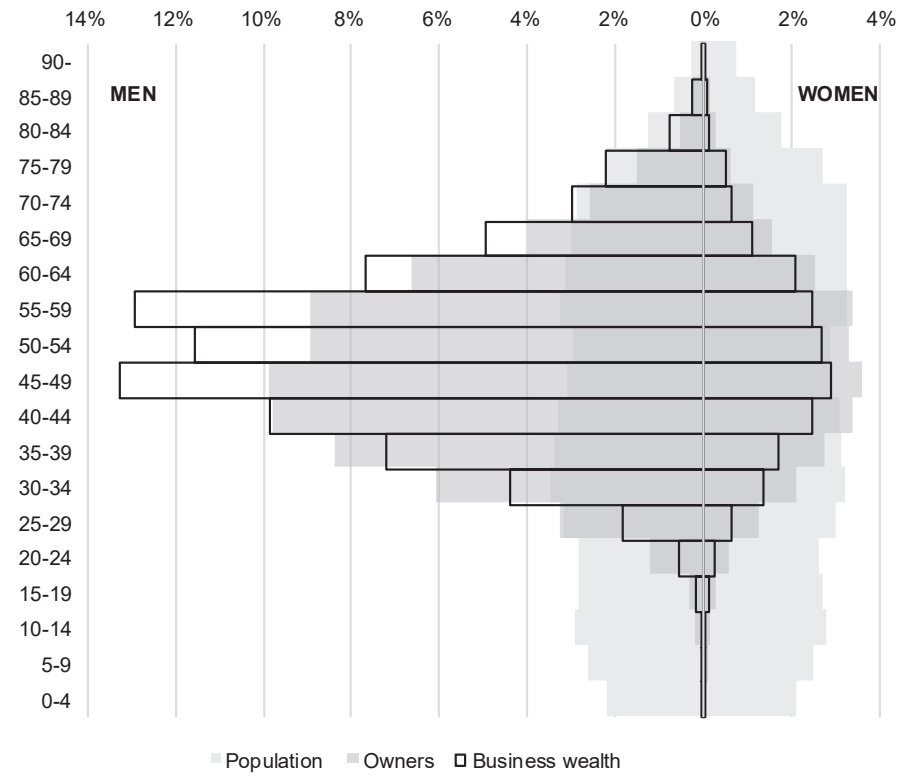


Figure 5. Fraction of population, owners, and business wealth by age and gender, 2022
This figure displays the fraction of the population and owners within each of the 19 age categories, stratified by gender. It also reports business wealth—defined as the book value of equity attributable to an owner based on her ownership stake—across these age-gender groups.

Figure 5 also shows that owners are concentrated in the middle of the age pyramid. Individuals under 40 years old comprise 46 % of the population but only 27 % of the owners. Similarly, those aged 65 and above make up 23 % of the population but only 13 % of the owners. In contrast, individuals between these bottom and top age groups represent 31 % of the population but account for 60 % of owners. This age group becomes even more significant in terms of business wealth, contributing 64 % of the total. The sharp drop for owners and business wealth starting at the age of 60 likely reflects owners retiring from their roles by selling or closing their business or transferring it to the next generation.

Table 8 Population, owners, and business wealth by age and gender, 2022
This table reports the fractions of the population, owners, and business wealth within each of the 19 age categories, stratified by gender in 2022. Business wealth is defined as the book value of equity attributable to an owner based on her ownership stake.

AGE GROUP	POPULATION		OWNERS		BUSINESS WEALTH	
	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN
90–	0.3 %	0.8 %	0.1 %	0.1 %	0.0 %	0.0 %
85–89	0.7 %	1.2 %	0.2 %	0.2 %	0.7 %	0.1 %
80–84	1.2 %	1.8 %	0.5 %	0.3 %	1.0 %	0.2 %
75–79	2.2 %	2.7 %	1.5 %	0.6 %	4.3 %	0.7 %
70–74	2.9 %	3.3 %	2.6 %	1.1 %	3.5 %	1.3 %
65–69	3.0 %	3.3 %	4.0 %	1.6 %	5.6 %	1.9 %
6–64	3.1 %	3.2 %	6.6 %	2.5 %	7.4 %	2.3 %
55–59	3.3 %	3.3 %	8.9 %	3.4 %	12.0 %	2.6 %
50–54	3.0 %	2.9 %	8.9 %	3.3 %	10.7 %	2.6 %
45–49	3.1 %	2.9 %	9.9 %	3.6 %	12.3 %	3.2 %
40–44	3.3 %	3.1 %	9.8 %	3.4 %	7.8 %	3.3 %
35–39	3.4 %	3.2 %	8.4 %	2.8 %	5.6 %	1.8 %
30–34	3.5 %	3.2 %	6.1 %	2.1 %	3.4 %	1.7 %
25–29	3.2 %	3.0 %	3.3 %	1.3 %	1.9 %	0.7 %
20–24	2.8 %	2.6 %	1.2 %	0.6 %	0.6 %	0.3 %
15–19	2.8 %	2.7 %	0.3 %	0.3 %	0.2 %	0.2 %
10–14	2.9 %	2.8 %	0.2 %	0.2 %	0.0 %	0.0 %
5–9	2.6 %	2.5 %	0.1 %	0.1 %	0.0 %	0.0 %
0–4	2.2 %	2.1 %	0.0 %	0.0 %	0.0 %	0.0 %
Total	49.5 %	50.5 %	72.6 %	27.4 %	77.1 %	22.9 %

Table 9 reports on the geographical distribution of owners and the population across provinces. The largest province of Uusimaa is broken down into the Greater Helsinki Area and the rest of the province. Predictably, population size explains differences in the number of owners across provinces. However, some provinces stand out in the prevalence of owners relative to their population. These differences are particularly large when judged by business wealth attributable to owners across provinces.

Table 9 Owners in provinces, 2022
This table displays the fractions of the population, owners, and business wealth in each province in 2022. It also reports the number of owners scaled by the number of inhabitants, as well as the mean business wealth in each province. Business wealth is defined as the book value of equity attributable to an owner based on her ownership stake.

PROVINCE	FRACTION OF POPULATION	FRACTION OF NUMBER OF OWNERS	FRACTION OF BUSINESS WEALTH	NUMBER OF OWNERS PER INHABITANTS	MEAN BUSINESS WEALTH, EUROS
Uusimaa, Greater Helsinki Area	22.0 %	25.0 %	38.4 %	3.5 %	517,020
Uusimaa, others	9.2 %	10.7 %	7.7 %	3.5 %	242,400
Varsinais-Suomi	8.7 %	9.5 %	9.6 %	3.3 %	340,882
Satakunta	3.8 %	3.4 %	2.6 %	2.7 %	259,115
Kanta-Häme	3.0 %	2.8 %	2.1 %	2.8 %	248,965
Pirkanmaa	9.6 %	9.8 %	8.1 %	3.1 %	279,109
Päijät-Häme	3.7 %	3.3 %	2.7 %	2.7 %	278,723
Kymenlaakso	2.9 %	1.9 %	1.2 %	2.0 %	209,394
Etelä-Karjala	2.3 %	1.6 %	1.1 %	2.1 %	242,659
Etelä-Savo	2.3 %	1.9 %	1.3 %	2.4 %	241,935
Pohjois-Savo	4.5 %	3.5 %	2.4 %	2.4 %	229,409
Pohjois-Karjala	2.9 %	2.2 %	2.6 %	2.2 %	412,382
Keski-Suomi	4.9 %	4.1 %	2.6 %	2.5 %	212,906
Etelä-Pohjanmaa	3.4 %	4.0 %	3.4 %	3.5 %	287,211
Pohjanmaa	3.2 %	3.7 %	3.7 %	3.5 %	339,152
Keski-Pohjanmaa	1.2 %	1.3 %	0.9 %	3.1 %	244,874
Pohjois-Pohjanmaa	7.5 %	7.0 %	5.3 %	2.8 %	255,232
Kainuu	1.3 %	0.9 %	0.9 %	2.1 %	352,965
Lappi	3.2 %	2.7 %	2.1 %	2.6 %	266,071
Ahvenanmaa	0.5 %	0.8 %	1.2 %	4.6 %	479,929
Total	100.0 %	100.0 %	100.0 %	3.0 %	337,278

Figure 6 depicts these differences by dividing the fraction of business wealth held by owners in a province by the fraction of the population residing in that province. Ratios above one indicate provinces that have more business wealth than expected based on their population size whereas the reverse applies for ratios below one. Ahvenanmaa, Greater Helsinki Area, Pohjanmaa, and Varsinais-Suomi emerge as hot spots for business wealth creation whereas Kymenlaakso, Etelä-Karjala, Keski-Suomi, and Pohjois-Savo have particularly little wealth.

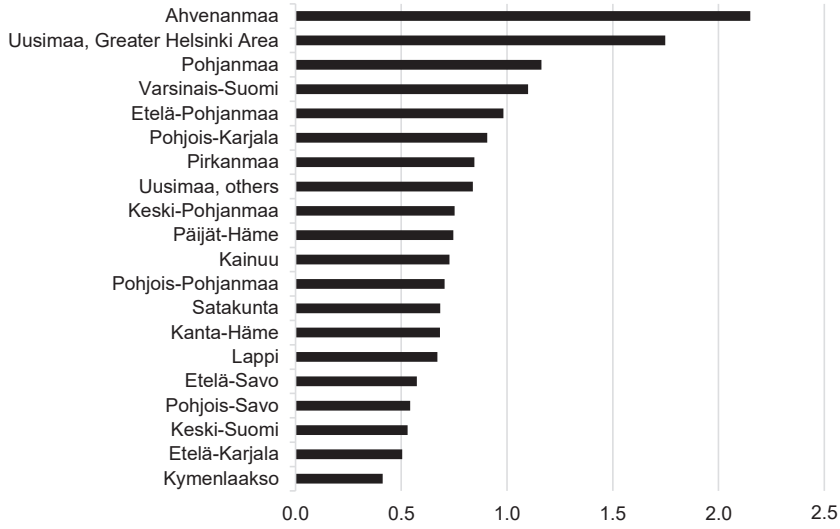


Figure 6. Fraction of business wealth divided by fraction of population, by province, 2022
This figure plots the ratio of business wealth in each province—defined as the book value of equity attributable to owners residing in that province—divided by the fraction of the population living in the province. Ratios above one indicate that the province has more business wealth than expected based on its population size, while ratios below one indicate the opposite.

Table 10 conducts a similar analysis of the 30 most populous municipalities. Figure 7 shows that Helsinki, Espoo, Joensuu, Nurmijärvi, Kirkkonummi, Vaasa, and Salo punch above their population weight. Conversely, the business wealth shares in Kotka, Kouvola, Kerava, Hämeenlinna, and Vantaa are well behind their population share.

Table 10 Owners in the 30 largest municipalities, 2022
This table displays the fractions of the population, owners, and business wealth in each of the 30 most populous municipalities in 2022. It also reports the number of owners scaled by the number of inhabitants, as well as the mean business wealth in each municipality. Business wealth is defined as the book value of equity attributable to an owner based on her ownership stake.

MUNICIPALITY	FRACTION OF POPULATION	FRACTION OF NUMBER OF OWNERS	FRACTION OF BUSINESS WEALTH	NUMBER OF OWNERS PER INHABITANTS	MEAN BUSINESS WEALTH, EUROS
Helsinki	11.9 %	14.0 %	27.8 %	3.5 %	671,874
Espoo	5.5 %	6.7 %	7.2 %	3.7 %	362,411
Tampere	4.5 %	4.1 %	3.4 %	2.8 %	281,436
Vantaa	4.4 %	3.9 %	2.0 %	2.7 %	173,280
Oulu	3.8 %	3.5 %	2.4 %	2.8 %	237,381
Turku	3.6 %	3.1 %	3.5 %	2.7 %	376,900
Jyväskylä	2.6 %	2.2 %	1.4 %	2.5 %	213,437
Kuopio	2.2 %	1.8 %	1.4 %	2.5 %	253,952
Lahti	2.2 %	1.7 %	1.7 %	2.4 %	327,004
Pori	1.5 %	1.2 %	0.8 %	2.4 %	237,345
Kouvola	1.4 %	1.0 %	0.5 %	2.0 %	187,717
Joensuu	1.4 %	0.9 %	1.7 %	2.0 %	626,308
Lappeenranta	1.3 %	0.9 %	0.7 %	2.1 %	275,072
Hämeenlinna	1.2 %	1.1 %	0.6 %	2.6 %	174,051
Vaasa	1.2 %	1.0 %	1.3 %	2.5 %	446,099
Seinäjoki	1.2 %	1.1 %	1.2 %	2.9 %	353,771
Rovaniemi	1.2 %	1.0 %	0.8 %	2.5 %	276,817
Mikkeli	0.9 %	0.7 %	0.5 %	2.4 %	228,096
Porvoo	0.9 %	1.2 %	0.9 %	3.8 %	261,451
Salo	0.9 %	1.0 %	1.0 %	3.4 %	326,699
Kotka	0.9 %	0.5 %	0.3 %	1.8 %	207,455
Kokkola	0.9 %	0.9 %	0.7 %	3.0 %	268,489
Hyvinkää	0.8 %	0.7 %	0.6 %	2.7 %	287,899
Lohja	0.8 %	0.8 %	0.5 %	3.0 %	200,212
Järvenpää	0.8 %	0.8 %	0.5 %	2.9 %	196,138
Nurmijärvi	0.8 %	1.1 %	0.9 %	4.1 %	285,503
Kirkkonummi	0.7 %	1.0 %	0.8 %	4.0 %	289,932
Tuusula	0.7 %	1.0 %	0.7 %	4.1 %	254,245
Rauma	0.7 %	0.5 %	0.6 %	2.3 %	377,323
Kerava	0.7 %	0.6 %	0.3 %	2.5 %	182,122
Total	58.8 %	56.9 %	64.4 %	3.3 %	381,717

Two forces may drive the geographical distribution of business wealth. An area may have more owners than implied by its population share. Alternatively, owners in an area may have more valuable ownership stakes, resulting in higher wealth shares. Table 10 shows, for example, that Nurmijärvi and Tuusula have the highest ownership rates but their owners are not particularly wealthy. On the other hand, Joensuu and Vaasa have wealthy owners but their ownership rates are particularly high. The top municipalities in terms of average business wealth are Helsinki, Joensuu, Vaasa, Rauma, and Turku.

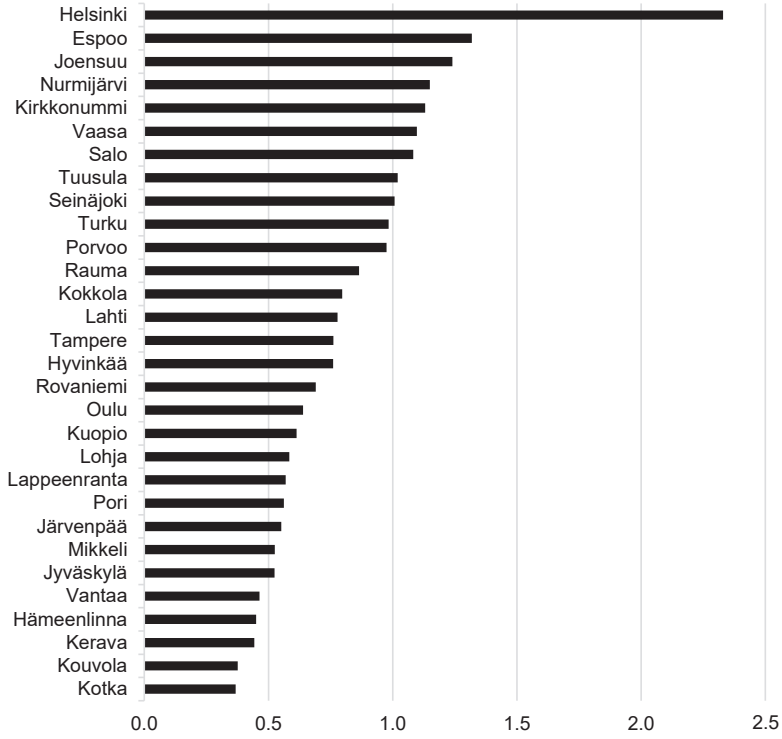


Figure 7. Fraction of business wealth divided by fraction of population, by municipality, 2022
This figure plots the ratio of business wealth in each municipality—defined as the book value of equity attributable to owners residing in that province—divided by the fraction of the population living in the municipality. Ratios above one indicate that the municipality has more business wealth than expected based on its population size, while ratios below one indicate the opposite. The figure shows the 30 most populous municipalities.

3.4 Concentration of business wealth among owners of privately held firms

Table 11 analyzes wealth concentration among owners in 2022 by ranking owners by their business wealth and grouping them according to percentiles of the business wealth distribution. This categorization starts from the bottom 30 % of the distribution and proceeds up to the 90th percentile in intervals of 10 %. To gain more insight into the distribution at the top, I further divide the top 10 % into the 90th to 95th percentiles, the 95th to 99th percentiles, and the top 1 %.

Table 11 Distribution of business wealth among owners, 2022
This table reports the number of owners, the fraction of business wealth, and mean business wealth within groups of owners defined by various percentiles of the business wealth distribution. Business wealth is defined as the book value of equity attributable to an owner based on her ownership stake.

	NUMBER OF OWNERS	BUSINESS WEALTH			MEAN NUMBER OF FIRMS
		SHARE OF TOTAL	MEAN, EUROS	MEDIAN, EUROS	
Bottom 30%	50,612	0.2 %	2,501	1,206	1.30
30%-40%	16,871	0.4 %	14,592	14,369	1.28
40%-50%	16,870	1 %	27,937	27,665	1.39
50%-60%	16,869	1 %	49,378	48,787	1.41
60%-70%	16,872	3 %	86,300	84,962	1.47
70%-80%	16,869	5 %	156,104	152,905	1.56
80%-90%	16,870	10 %	325,161	310,452	1.64
90%-95%	8,435	10 %	701,755	678,132	1.94
95%-99%	6,748	22 %	1,865,096	1,610,212	2.83
99%-100%	1,687	48 %	16,089,516	7,998,589	5.87

The distribution of business wealth is heavily skewed towards the top. The bottom 50 % accounts for only 2 % of business wealth in privately held firms. In contrast, the top 10 % holds 80 % of business wealth, with the top 1 % alone accounting for 48 %. The average wealth of the 1,700 owners in the top 1 % is 16 million euros whereas the average for the bottom 30 % is only 2,500 euros. The medians are 8 million euros and 1,200 euros, respectively. Figure 8 illustrates these patterns by plotting the cumulative wealth distribution among owners, showing a steep increase in the cumulative wealth share starting not until the 80th percentile.

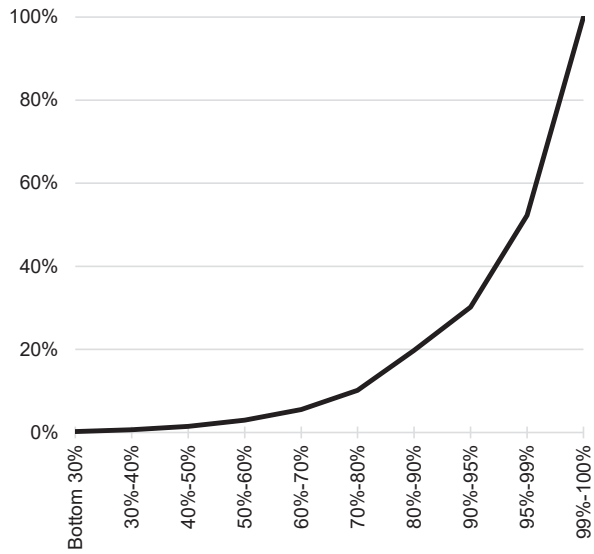


Figure 8. Cumulative distribution of business wealth among owners
This figure shows the cumulative distribution of business wealth, defined as the book value of equity attributable to an owner based on her ownership stake. Each owner is assigned to a group corresponding to various percentiles of the business wealth distribution.

How do these numbers compare with the concentration of wealth in publicly listed firms? Within shareholders of publicly listed firms, Keloharju and Lehtinen (2021) find that the top 1 % holds 48 % of wealth. This number is coincidentally the same as the top 1 % share I find among owners of privately held firms. However, within the entire population, business wealth in privately held firms is naturally more concentrated because all such wealth is held by 3 % of the population whereas 15 % of the population holds listed shares in 2022, according to Statistics Finland. Keloharju and Lehtinen (2021) report that the top 1 % of the population holds 78 % of publicly traded stock wealth. Table 11 shows that the top 30 % of owners in privately held firms, which roughly corresponds to the top 1 % of the entire population, hold 94 % of business wealth in privately held firms. Business wealth is thus more heavily concentrated in the population, largely because there are fewer owners in privately held firms than in publicly listed companies.

Another point of comparison is the total value of stock holdings in the household sector. Statistics Finland reports that publicly traded stock wealth amounts to 46 billion euros in 2022 whereas the total business wealth in privately held firms held by individuals equals 57 billion euros. Using the top 1 % wealth shares in the population reported above implies that the top 1 % holds 36 billion euros in publicly traded stocks whereas the corresponding top 1 % share in business wealth would equal 54 billion. Because business wealth in privately held firms is based on book values, the top 1 % of owners in privately held firms likely holds substantially more wealth than the corresponding public-market investors.

Figure 9 analyzes the evolution of wealth concentration over time. The top wealth shares have remained remarkably stable throughout the 2006–2022 period. The share of the bottom 90 % has hovered around 20 % whereas the top 1 % share has varied between 45 % to 48 %.

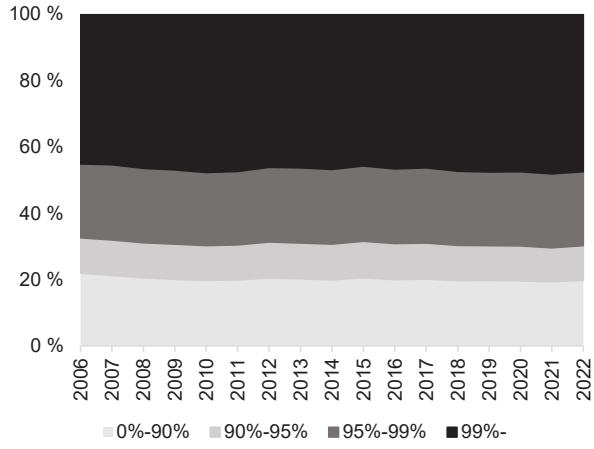


Figure 9. Top business wealth shares among owners over time
This figure illustrates the distribution of business wealth, defined as the book value of equity attributable to an owner based on her ownership stake, in 2006–2022. Each owner is assigned to a group corresponding to various percentiles of the business wealth distribution. The groups displayed are the bottom 90%, 90%–95%, 95%–99%, and the top 1%.

These analyses reveal that the owners' economic footprint varies significantly across individuals. Another way to assess the societal impact of ownership is to analyze the taxes owners pay on their income. Table 12 reports the total income taxes paid by each wealth group, both in euros and as a fraction of the national totals. The table reports two income tax measures. The first measure includes personal income taxes levied by the municipal and state governments. Because the tax return data do not separately identify income derived from ownership stakes in privately held firms, the personal tax measures necessarily include all sources. The second measure allocates the corporate income taxes paid by the firms that the owners hold to each owner according to their ownership stake.

Table 12 Owners' income taxes, 2022
This table reports owners' personal income taxes (state and municipal) and their firms' corporate income taxes, stratified by owner groups across the business wealth distribution. It also details their contributions to the total personal income taxes paid by the population and the total corporate income taxes paid by the firms included in Table 1, respectively. Business wealth is defined as the book value of equity attributable to an owner based on her ownership stake.

BUSINESS WEALTH PERCENTILE	FRACTION OF POPULATION	PERSONAL INCOME TAXES		CORPORATE INCOME TAXES	
		TOTAL, MILL. EUROS	FRACTION OF POPULATION TOTAL	TOTAL, MILL. EUROS	FRACTION OF FIRM TOTAL
Bottom 30 %	0.9 %	695	2.2 %	14	0.2 %
30 %–40 %	0.3 %	228	0.7 %	16	0.3 %
40 %–50 %	0.3 %	263	0.8 %	27	0.4 %
50 %–60 %	0.3 %	287	0.9 %	46	0.8 %
60 %–70 %	0.3 %	322	1.0 %	78	1.3 %
70 %–80 %	0.3 %	403	1.3 %	133	2.2 %
80 %–90 %	0.3 %	481	1.5 %	261	4.3 %
90 %–95 %	0.2 %	318	1.0 %	247	4.1 %
95 %–99 %	0.1 %	371	1.2 %	443	7.4 %
99 %–100 %	0.03 %	360	1.1 %	610	10.1 %
Owner total	3.0 %	3,728	11.9 %	1,874	31.2 %
Population total		31,446		6,013	

The owners in privately held firms are responsible for 12 % of the national personal income taxes of 31 billion euros and 31 % of the national corporate income taxes of 6 billion euros. Across the wealth distribution, owners in the bottom 30 % contribute the largest share of personal taxes whereas those in the top 1 % pay the most in corporate taxes. More informative comparisons emerge when the tax shares of each wealth group are scaled by their population shares. Figure 10 depicts these ratios for each wealth group by adding together their personal and corporate income taxes. The contribution to national totals monotonically increases in business wealth and is substantially larger for more affluent owners. Income taxes paid by owners in the top 1 % are 85 times their population share. Even in the bottom 30 % of the distribution, this ratio equals two.

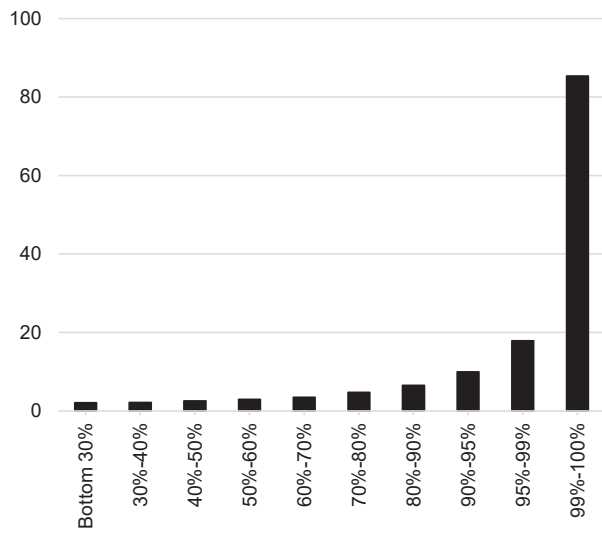


Figure 10. Fraction of owners' income taxes divided by their fraction in population
This figure presents the ratio of the fraction of owners' income taxes to the fraction of owners in the population, stratified by owner groups across the business wealth distribution. Income taxes include the owners' personal income taxes (state and municipal), and the firms' corporate income taxes are allocated to each owner based on her ownership stake. The national total encompasses the personal income taxes paid by the population and the corporate income taxes paid by the firms included in Table 1.

Table 13 examines the characteristics of owners across the business wealth distribution. 67 % of owners in the bottom 30 % are men whereas this fraction rises to 81 % at the 90th percentile. Interestingly, the male ratio drops to 76 % in the top 1 %. The fraction of Swedish-speakers doubles from the 7 % fraction at the bottom of the distribution to 14 % in the top 1 %. An opposite pattern obtains for owners with native languages other than Finnish or Swedish, with only 2 % of the top 1 % belonging to this group. The fraction of Master's degree holders hovers around 20 % up to the 90th percentile with a steep increase to 35 % in the top 1 %.

Table 13 Owner characteristics compared to the population, 2022
This table reports mean age, and fractions by gender, native language, and level of education among owners, categorized by groups across the business wealth distribution, and among the general population. Business wealth is defined as the book value of equity attributable to an owner based on her ownership stake.

	MEAN AGE	GENDER		NATIVE LANGUAGE			LEVEL OF EDUCATION			
		MALE	FEMALE	FINNISH	SWE-DISH	OTHER	BASIC OR MIS-SING	HIGH SCHOOL OR VOCA-TIONAL	BAC-HELOR	MASTER OR HIGHER
Population	43.2	49 %	51 %	86 %	5 %	9 %	37 %	43 %	11 %	10 %
Owners	48.6	73 %	27 %	86 %	8 %	6 %	13 %	51 %	17 %	20 %
By wealth:										
Bottom 30 %	47.2	67 %	33 %	84 %	7 %	9 %	15 %	49 %	17 %	19 %
30 %–40 %	47.2	69 %	31 %	85 %	7 %	7 %	14 %	52 %	16 %	18 %
40 %–50 %	48.1	72 %	28 %	86 %	7 %	7 %	13 %	52 %	17 %	18 %
50 %–60 %	48.4	74 %	26 %	87 %	8 %	6 %	13 %	53 %	17 %	18 %
60 %–70 %	49.2	75 %	25 %	87 %	8 %	5 %	12 %	53 %	17 %	19 %
70 %–80 %	49.9	77 %	23 %	88 %	8 %	4 %	12 %	52 %	17 %	19 %
80 %–90 %	50.5	79 %	21 %	89 %	8 %	3 %	12 %	51 %	16 %	21 %
90 %–95 %	51.2	81 %	19 %	89 %	8 %	3 %	12 %	50 %	16 %	22 %
95 %–99 %	51.6	81 %	19 %	88 %	10 %	2 %	11 %	47 %	17 %	25 %
99 %–100 %	53.0	76 %	24 %	85 %	14 %	2 %	8 %	38 %	19 %	35 %

Table 14 reports the distribution of business wealth by owner characteristics. If business wealth were distributed similarly as the number of owners across different characteristics, the two fractions reported in the first two columns would be identical. This is usually not the case: several owner groups emerge as more significant holders of business wealth than their frequency suggests. These differences reflect variation in average business wealth held by each group. Men average a business wealth of 358,000 euros with women having 75,000 euros less. Swedish-speakers have 580,000 euros whereas Finnish-speakers and speakers of other native languages own stock worth of 332,000 and 105,000 euros, respectively. Higher education is accompanied by greater business wealth with Master's degree holders having a mean wealth of 530,000 euros whereas those with basic education have 247,000 euros. The medians are an order of magnitude lower but the differences between groups remain. These differences explain why business wealth is disproportionately held by men, Swedish-speakers, and Master's degree holders.

Table 14 Business wealth by owner characteristics, 2022
This table reports the fraction of owners, the fraction of business wealth, and the mean business wealth by gender, native language, and level of education among owners. Business wealth is defined as the book value of equity attributable to an owner based on her ownership stake.

	FRACTION OF OWNERS	FRACTION OF BUSINESS WEALTH	MEAN BUSINESS WEALTH, EUROS	MEDIAN BUSINESS WEALTH, EUROS
Gender				
Male	73 %	77 %	357,736	43,857
Female	27 %	23 %	282,943	22,910
Native language				
Finnish	86 %	85 %	332,380	38,635
Swedish	8 %	13 %	579,950	44,284
Other	6 %	2 %	104,651	14,970
Level of education				
Basic or missing	13 %	10 %	246,991	28,380
High school or vocational	51 %	42 %	281,102	37,563
Bachelor	17 %	17 %	353,812	36,633
Master or higher	20 %	31 %	530,165	41,830

Table 15 reports on the business wealth distribution by using cutoffs defined by absolute values of business wealth in lieu of percentiles. 5 % of owners have at least one million euros in business wealth whereas those with at least 10 million euros amount to 0.4 % of owners. These two groups hold 70 % and 36 % of business wealth, respectively. The differences in characteristics become more pronounced at the very top of the distribution. Among those having at least 10 million euros, 16 % are Swedish-speaking and 40 % have completed a Master's degree. The reversal of the increase in the gender gap at the top of the distribution also becomes stronger.

Table 15 Owners at different business wealth cutoffs, 2022
This table reports the number of owners, the share of total business wealth, and the mean business wealth within groups of owners defined by different cutoffs of business wealth. It also reports the fraction of owners by gender, native language, and level of education in each wealth group. Business wealth is defined as the book value of equity attributable to an owner based on her ownership stake.

	BUSINESS WEALTH, EUROS				
	-10,000	10,000–100,000	100,000–1 MIL.	1 MIL–10 MIL.	10 MIL.–
Number of owners	27,021	63,315	45,633	7,895	643
Share of total business wealth	0.2 %	5 %	25 %	34 %	36 %
Mean business wealth, euros	2,588	41,401	313,668	2,447,007	31,902,432
Median business wealth, euros	1,264	35,011	234,887	1,763,700	16,849,062
Fraction by gender	0	0	0	0	0
Male	67 %	72 %	79 %	80 %	75 %
Female	33 %	28 %	21 %	20 %	25 %
Fraction by native language	0 %	0 %	0 %	0 %	0 %
Finnish	84 %	86 %	89 %	88 %	83 %
Swedish	7 %	7 %	8 %	10 %	16 %
Other	9 %	6 %	4 %	2 %	1 %
Fraction by level of education	0 %	0 %	0 %	0 %	0 %
Basic or missing	15 %	13 %	12 %	10 %	7 %
High school or vocational	49 %	52 %	51 %	46 %	34 %
Bachelor	17 %	17 %	16 %	18 %	18 %
Master or higher	19 %	18 %	20 %	26 %	40 %

Figure 11 reports the number of owners with business wealth below and above the one-million cutoff over time. The number of owners below the one-million cutoff has increased by 20 %, whereas owners with at least one million euros have witnessed a growth rate of 150 %, from 3,400 to 8,500 owners. This large increase likely reflects growth in firm values, entry of new owners of highly successful companies, and the transfer of family business ownership to the members of the next generation.

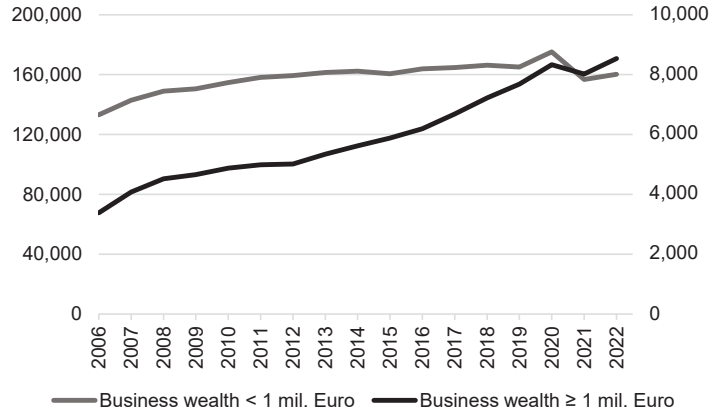


Figure 11. Number of owners with less than and at least one million euros in business wealth
This figure illustrates the number of owners whose business wealth either is below or exceeds one million euros by year. Business wealth is defined as the book value of equity attributable to an owner based on her ownership stake.

3.5 Turnover among owners of privately held firms

Table 16 examines the turnover in the owner population over time by reporting the number of individuals becoming owners and the number of owners ceasing to their ownership position each year. Averaged over all years, the number of new owners, scaled by the number of owners at the start of the year, equals 12.5 %. Conversely, about 11.1 % of existing owners exit their position annually. The net entry rate, which is the difference between the entry and exit rates, is thus 1.4 %. These results show that the relatively small net entry rate masks substantial turnover within the owner population.

Table 16 Number of entering and exiting owners by year, 2007–2022
This table reports the number of owners at the start and end of each year in 2007-2022. It also details the number of entering and exiting owners, along with their fraction relative to the number of beginning-of-year owners. Net entry is calculated as the difference between the number of entering and exiting owners.

YEAR	OWNERS, START OF YEAR	ENTERING OWNERS		EXITING OWNERS		NET ENTRY		OWNERS, END OF YEAR
		NUMBER	%	NUMBER	%	NUMBER	%	
2007	136,532	23,491	17 %	13,028	10 %	10,463	8 %	146,995
2008	146,995	20,620	14 %	14,127	10 %	6,493	4 %	153,488
2009	153,488	18,161	12 %	16,507	11 %	1,654	1 %	155,142
2010	155,142	18,719	12 %	14,371	9 %	4,348	3 %	159,490
2011	159,490	19,432	12 %	15,796	10 %	3,636	2 %	163,126
2012	163,126	17,929	11 %	16,635	10 %	1,294	1 %	164,420
2013	164,420	19,129	12 %	16,816	10 %	2,313	1 %	166,733
2014	166,733	18,346	11 %	17,206	10 %	1,140	1 %	167,873
2015	167,873	16,814	10 %	18,218	11 %	-1,404	-1 %	166,469
2016	166,469	21,475	13 %	17,881	11 %	3,594	2 %	170,063
2017	170,063	20,832	12 %	19,459	11 %	1,373	1 %	171,436
2018	171,436	21,337	12 %	19,283	11 %	2,054	1 %	173,490
2019	173,490	21,106	12 %	21,845	13 %	-739	0 %	172,751
2020	172,751	27,614	16 %	16,829	10 %	10,785	6 %	183,536
2021	183,536	16,363	9 %	35,190	19 %	-18,827	-10 %	164,709
2022	164,709	24,998	15 %	21,004	13 %	3,994	2 %	168,703
Average			13 %		11 %		1 %	

Does the high turnover in the owner population align with other data sources? Statistics Finland reports that 16,200 new firms are established and 9,800 firms cease to exist in 2022. In addition, 3,600 firms experience an ownership transition due to an acquisition or a family firm succession. Assuming these firms have the average 1.5 owners reported in Table 5 and that the ownership transition does not lead to new net entry suggests about 30,000 entering owners and 20,000 exiting owners in 2022. These numbers are broadly in line with those reported in Table 16.

Table 17 studies the survival of owners over the entire 2006 –2022 period. The sample includes individuals who were owners in 2006. For each business wealth group in 2006, it reports the fraction of owners who have passed away and the ownership and residence status of the surviving individuals. The table also reports the owners' average percentile rank in the wealth distribution in 2022.

Table 17 Survival of owners over time, 2006–2022
This table shows the survival rates of owners within percentile groups of the business wealth distribution in 2006. It reports ownership and residence status and position within the business wealth distribution in 2022 for individuals who are owners in 2006. The 2006 owners who are alive in 2022 are separately split into owners or non-owners and to those who reside in Finland or abroad. The average percentile rank refers to the rank in the business wealth distribution among all owners in 2022, including those who became owners after 2006. Business wealth is defined as the book value of equity attributable to an owner based on her ownership stake.

	NUMBER OF OWNERS IN 2006	DECEASED	STATUS OF OWNERS ALIVE IN 2022				AVERAGE PERCENTILE RANK IN 2022
			OWNER		RESIDENT IN FINLAND		
			YES	NO	YES	NO	
Bottom 30 %	40,982	9 %	28 %	72 %	98 %	2 %	42 %
30 %–40 %	13,632	8 %	34 %	66 %	99 %	1 %	50 %
40 %–50 %	13,653	8 %	36 %	64 %	99 %	1 %	54 %
50 %–60 %	13,657	9 %	39 %	61 %	99 %	1 %	59 %
60 %–70 %	13,649	9 %	40 %	60 %	99 %	1 %	63 %
70 %–80 %	13,653	9 %	42 %	58 %	99 %	1 %	69 %
80 %–90 %	13,653	9 %	47 %	53 %	99 %	1 %	75 %
90 %–95 %	6,827	10 %	52 %	48 %	99 %	1 %	81 %
95 %–99 %	5,461	10 %	58 %	42 %	98 %	2 %	84 %
99 %–100 %	1,365	12 %	74 %	26 %	96 %	4 %	90 %
Total	136,532	9 %	38 %	62 %	99 %	1 %	61 %

In 2022, 9 % of the owners of 2006 are deceased. Mortality is higher at the top of business wealth distribution presumably because these owners are older. Out of the individuals alive in 2022, 38 % have remained as owners. This survival rate strongly increases in business wealth, with the bottom and top segments of the wealth distribution emerging as their mirror images. Only 28 % of owners in the bottom 30 % retain their ownership status whereas the corresponding figure for the top 1 % is 74 %. Figure 12 illustrates these numbers.

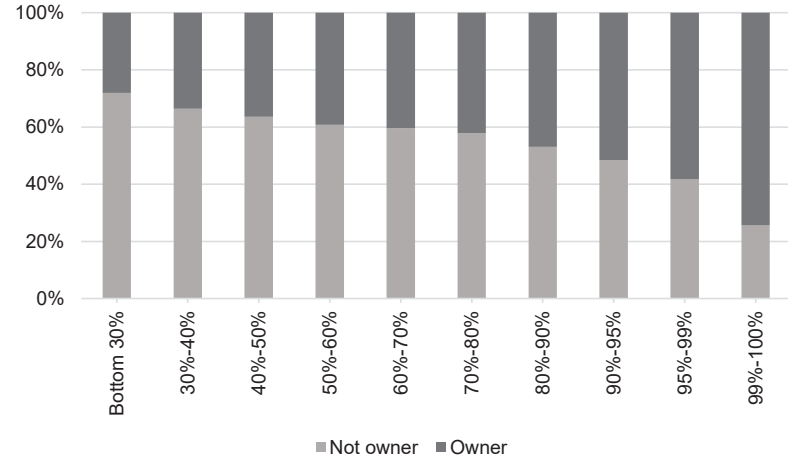


Figure 12. Ownership status in 2022 by business wealth in 2006
This figure shows the ownership status in 2022 as a function of business wealth percentile in 2006. The sample includes individuals who are owners in 2006 and are alive in 2022. These 2006 owners are split into two based on whether they are owners or not. Business wealth is defined as the book value of equity attributable to an owner based on her ownership stake.

The surviving owners' position in the wealth distribution is highly persistent. The average surviving owner is at the 61th percentile of the 2022 distribution. This percentile is not exactly at the middle of the distribution because the sample of owners used to calculate the percentiles in 2022 also includes individuals who became owners after 2006. This inclusion makes it possible to conclude that the rank of the surviving owners of 2006 is on average higher than that of the more recent owners. Owners in the bottom 30 % in 2006 are on average at the 42nd percentile of the 2022 distribution whereas those in the top 1 % are at the 90th percentile. This strong persistence in wealth rank is suggestive of successful owners possessing a unique bundle of ownership skills that allow them to retain their position in the wealth distribution.

3.6 Emigration of owners of privately held firms

Table 17 also splits the 2006 owners by their residence status in 2022 and shows that emigration is much more likely at the top of the distribution. In the top 1 %, 4 % of owners reside abroad in 2022 whereas this rate is about 1 % across much of the other parts of the distribution. The exception to this pattern is the bottom 30 % that shows an emigration rate of 2 %.

Table 18 analyzes emigration patterns across all the owners in the 2006 –2022 period. It calculates the average probability that an owner resident in Finland moves abroad during a year. This probability obtains from looking at all owners resident in Finland at the beginning of each year and tracking their residence status at the end of the year. The table averages the annual probability over all the years and across the owner's beginning-of-year position in the business wealth distribution.

Table 18 Owner emigration, 2007–2022
This table shows the fraction of owners resident in Finland by their residence status at the end of a year. It also calculates the fraction of beginning-of-year business wealth attributable to owners by their end-of-year resident status and the average beginning-of-year business wealth of each owner. Owners are stratified by their position in the business wealth distribution at the beginning of each year, and the sample only includes owners who remain alive throughout the year. The table displays the average annual fractions over the 2007-2022 period. Business wealth is defined as the book value of equity attributable to an owner based on her ownership stake.

	FRACTION OF OWNERS		FRACTION OF BUSINESS WEALTH		AVERAGE BUSINESS WEALTH, EUROS	
	RESIDENT	NOT RESIDENT	RESIDENT	NOT RESIDENT	RESIDENT	NOT RESIDENT
Bottom 30 %	99.7 %	0.3 %	99.8 %	0.2 %	1,742	1,606
30 %–40 %	99.8 %	0.2 %	99.8 %	0.2 %	10,039	9,718
40 %–50 %	99.8 %	0.2 %	99.8 %	0.2 %	19,473	19,441
50 %–60 %	99.9 %	0.1 %	99.9 %	0.1 %	34,887	34,774
60 %–70 %	99.9 %	0.1 %	99.9 %	0.1 %	61,593	61,732
70 %–80 %	99.9 %	0.1 %	99.9 %	0.1 %	112,846	110,883
80 %–90 %	99.9 %	0.1 %	99.9 %	0.1 %	236,565	238,388
90 %–95 %	99.9 %	0.1 %	99.9 %	0.1 %	509,961	524,770
95 %–99 %	99.8 %	0.2 %	99.8 %	0.2 %	1,347,617	1,491,848
99 %–100 %	99.6 %	0.4 %	99.4 %	0.6 %	11,444,337	18,458,232
Total	99.8 %	0.2 %	99.6 %	0.4 %	240,088	498,722

Like the analysis in Table 17 that focuses on the 2006 owners, Table 18 shows that owners in the top 1 % are most likely to emigrate, with their annual probability of moving equaling 0.4 %. This probability also attracts high values in the bottom half of the wealth distribution, but does not reach the level observed for the top 1 %. The business wealth held by the emigrating top 1 % prior to their move amounts to 0.6 % of the total business wealth of that wealth group. This fraction is higher than the average probability of moving because the mean wealth of the emigrating owners is 18 million euros whereas it is only 11 million for the remaining ones.

These numbers allow one to calculate a back-of-the-envelope estimate of how much business wealth has transferred to foreign ownership due to owner emigration. The 0.4 % moving probability for the top 1 % emanates from about 100 moving owners over the 2007 –2022 period. Multiplying this frequency with the emigrating owners' mean business wealth prior to their move results into an estimate of 1.8 billion euros. Using all the 4,900 moving owners across the wealth distribution and multiplying their frequency with their average wealth of 499,000 euros yields an estimate of 2.4 billion euros. In relative terms, Table 18 reports that emigrating owners' business wealth represents 0.4 % of the annual stock of business wealth. The corresponding cumulative rate over the sample period multiplies the annual rate by the number of years in the sample, suggesting 6.2 % of the total stock of wealth has left the country.

Table 19 documents the characteristics of owners by their residence status. It calculates the same characteristics as in Table 13 for owners who have moved abroad taking the characteristic's value from the beginning of the year of the move. It also calculates the non-moving owners characteristics across all the annual observations from 2007 –2022. In addition to describing the owners, the table also calculates how business wealth of moving and non-owning is distributed among owners of different types.

Table 19 Owner characteristics by emigration, 2007–2022

This table shows owner characteristics by emigration status, defined in the same way as in Table 18. Characteristics includes mean age, being aged 60 or above, native language, and level of education. The last two rows in the table calculate the fraction of business wealth held by different types of owners. Numbers for the non-movers in this table are not the same as in Table 13 because this table include owners from all the years 2007–2022 whereas Table 13 focuses on 2022. Business wealth is defined as the book value of equity attributable to an owner based on her ownership stake.

	MEAN AGE	AGED 60 OR ABOVE	GENDER		NATIVE LANGUAGE			LEVEL OF EDUCATION			
			MALE	FEMALE	FINNISH	SWEDISH	OTHER	BASIC OR MISSING	HIGH SCHOOL OR VOCA-TIONAL	BACHELOR	MASTER OR HIGHER
Moved	39.0	7 %	70 %	30 %	71 %	15 %	14 %	18 %	38 %	16 %	28 %
Not moved	47.9	20 %	72 %	28 %	88 %	8 %	3 %	16 %	52 %	14 %	18 %
Moved, wealth			64 %	36 %	62 %	35 %	4 %	7 %	47 %	23 %	22 %
Not moved, wealth			76 %	24 %	83 %	16 %	1 %	12 %	44 %	16 %	27 %

Table 19 refutes two hypotheses about the identity of moving owners. First, it shows that moving owners are generally not close to retirement. The mean age of movers is 39 years and only 7 % of them are aged 60 years or above. The corresponding stayers are on average 48 years old, with one fifth of them having reached the age of 60. Second, movers typically are not non-natives of Finland. Although non-speakers of the two native languages of Finland represent a much larger fraction among movers than stayers, 86 % of them still likely are Finnish natives. Moreover, the fraction of business wealth possessed by non-speakers of the two native languages is a mere 4 %.

Table 19 also reveals other interesting patterns. Female owners are somewhat more likely to move and women command a larger fraction of business wealth among movers than non-movers. Moving owners are more likely to speak Swedish than non-movers, possibly because mastering Swedish greatly eases the transition to neighboring Nordic countries. Movers also have a considerably higher level of education.

Figure 13 plots the rates of emigration for owners over time by averaging the emigration rates in the 2007–2014 and 2015 –2022 periods. To gain insights into the differences in emigration by wealth, it plots the rates separately for owners who are below and in the top 1 % of the business wealth distribution at the time of emigration. It also multiplies the annual rates by the number of years in the period to arrive at a cumulative emigration rate. The fraction of emigrating owners below the top 1 % remains stable around 1.5 %. The owners in the top 1 % display a substantial increase in the emigration rate with the 2015 –2022 rate more than doubling to 4.2 % from the 2007 –2014 period. The increasing rate for the top 1 % suggests that the wealthiest owners have become disproportionately more likely to move abroad over time, with much of their higher overall emigration rate emanating from more recent years.

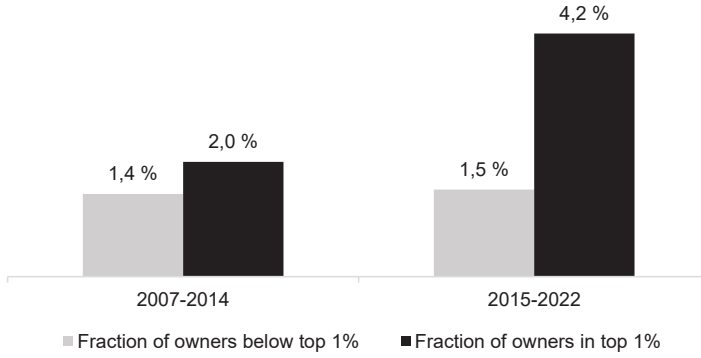


Figure 13. Fraction of emigrating owners over time
This figure plots the fraction of emigrating owners separately for the 2007–2014 and 2015–2022 periods and for the owners below and in the top 1% of the business wealth distribution. The emigration rate plotted is the annual fraction of moving owners multiplied the number of years in the period.

4 Summary

The key findings of this study are the following:

- Privately held firms are important for the Finnish economy. In 2022, they represent 86 % of the 106,000 active limited liability firms studied in this paper. They account for 30 % of revenue and 49 % of employment. Excluding foreign-owned and publicly listed firms, these fractions are 65 % and 73 %, respectively. Privately held firms have mildly increased their importance in 2006–2022.
- Privately held firms represent sizeable fractions of firms and their activities across the firm size distribution, with the largest prevalence among small firms. They account for 90 % of firms, 74 % of revenue, and 88 % of employment in firms employing 1 –9 workers. The corresponding fractions for firms employing at least 500 people are 16 %, 6 %, and 12 %.
- The industry distribution of privately held firms differs from that of other ownership types. They are particularly common in construction, trade, and professional services. This overrepresentation is made up with them being less common in manufacturing, utilities, and ICT.
- About 169,000 individuals own shares in privately held firms in 2022. This number amounts to 3 % of the population and it has increased from the rate observed in 2006.
- The average owner has 337,000 euros in business wealth according to her ownership stakes across all firms in 2022. The median is an order of magnitude lower at 37,000 euros. The average owner has equity stakes in 1.5 companies with 81 % of owners holding shares in just one firm. At the other extreme, 1 % of owners hold stakes in ten or more companies. The average business wealth of these serial owners is 7 million euros.
- Owners in privately held firms are more likely to be men than the population. Men represent 73 % of owners and their equity stakes amount to 77 % of business wealth.
- Owners are disproportionately likely to be between the ages of 40 and 64. This group accounts for 31 % of the population, but 60 % of owners and 64 % of business wealth. Those aged 65 or above represent 23 % of the population, but only 13 % of owners and 19 % of business wealth. The scarcity of this age group among owners likely reflects selling or closing the business at retirement or successions in family firms.
- Owners are unevenly distributed across the country. Ahvenanmaa, Greater Helsinki Area, Pohjanmaa, and Varsinais-Suomi have more business wealth than what would be expected based on their population size. Across the 30 largest municipalities, Helsinki, Espoo, Joensuu, Nurmijärvi, Kirkkonummi, Vaasa, and Salo punch above their population weight. Conversely, the business wealth shares are well behind population shares in the provinces of Kymenlaakso, Etelä-Karjala, Keski-Suomi, and Pohjois-Savo and the cities of Kotka, Kouvola, Kerava, Hämeenlinna, and Vantaa. The average owner is the most affluent in Helsinki, Joensuu, Vaasa, Turku, and Rauma.
- Business wealth is unevenly distributed among owners. The 1,700 owners in the top 1 % account for 48 % of total wealth in 2022 whereas the cumulative top 5 % and top 10 % shares are 70 % and 80 %, respectively. These shares have remained virtually unchanged since 2006. The average wealth in the top 1 % is 16 million euros.
- Owners' income taxes contribute substantially to national totals. Their personal income tax bill amounts to 12 % of the national total whereas their firms' corporate

income taxes represent 31 % of those paid by all limited liability firms. The owners in top 1 % of business wealth contribute 85 times their population share to personal and corporate income taxes.

- Wealthier owners differ in their characteristics from less affluent owners. The share of women among owners is 33 % in the bottom 30 % of the wealth distribution whereas it is 24 % in the top 1 %. Native language also differs across the wealth distribution. Wealthier owners are much less likely to speak a native language other than Finnish or Swedish. This decline by wealth is partly offset by an increase in Swedish-speaking owners with them accounting for 14 % of owners in the top 1 %. Education also sets wealthier owners apart from less affluent owners. 19 % of owners in the bottom 30 % hold a Master's degree whereas this fraction is 35 % in the top 1 %.
- One in twenty owners has at least one million euros in business wealth whereas those with at least 10 million euros amount to 0.4 % of owners. The number of millionaire owners has increased from 3,400 to 8,500 in 2006 –2022. This increase likely reflects growth in firm values, entry of new owners of highly successful companies, and successions in family firms.
- The owner population displays considerable turnover over time. Every year, about 11 % of existing owners cease their ownership status whereas the corresponding rate for new entering owners is 13 %. Each year thus sees a positive 1 % net entry rate. From 2006 to 2022, the owner population retains only 35 % of its members. This rate is much higher for more affluent owners with the top 1 % having a survival rate of 67 %. Business wealth is highly persistent, with the wealth rank in 2006 strongly predicting the corresponding rank in 2022.
- Emigration is more likely among the wealthiest owners. The probability of moving in a year for the wealthiest 1 % is four times the equivalent probability for owners at the middle of the business wealth distribution. Emigrating owners have moved to foreign ownership an estimated 2.4 billion euros worth of business wealth, equivalent to 6 % of the total. About 80 % of this wealth is attributable to the owners in the top 1 % having an average business wealth of 18 million at the time of their move. This tendency of the wealthiest owners being disproportionately more likely to move has strengthened over time.

References

Asker, J., Farre-Mensa, J., & Ljungqvist, A. (2015). Corporate investment and stock market listing: A puzzle? *Review of Financial Studies* 28, 342–390.

Badarinza, C., Campbell, J., & Ramadorai, T. (2016). International comparative household finance. *Annual Review of Economics* 8, 111–144.

Bach, L., Calvet, L. & Sodini, P. (2020). Rich pickings? Risk, return, and skill in household wealth. *American Economic Review* 110, 2703–47.

Brav, O. (2009). Access to capital, capital structure, and the funding of the firm. *Journal of Finance* 64, 263–308.

Breitkopf, N., Knüpfer, S. & Rantapuska, E. (2021). Mutual fund and share ownership in Finland: Trends and patterns in 2004 –2016. *Nordic Journal of Business* 70, 287–308.

Campbell, J. (2006). Household finance. *Journal of Finance* 61, 1553–1604.

Fagereng, A., Guiso, L., Malacrino, D., & Pistaferri, L. (2020). Heterogeneity and persistence in returns to wealth. *Econometrica* 88, 115–170.

Gilje, E., & Taillard, J. (2016). Do private firms invest differently than public firms? Taking cues from the natural gas industry. *Journal of Finance* 71, 1733–1778.

Keloharju, M. & Lehtinen, A. (2021). A quarter century of shareholdings and trades of Finnish stocks. *Nordic Journal of Business* 70, 5–38.

Michaely, R., & Roberts, M. (2012). Corporate dividend policies: Lessons from private firms. *Review of Financial Studies* 25, 711–746.

Saunders, A., & Steffen, S. (2011). The costs of being private: Evidence from the loan market. *Review of Financial Studies* 24, 4091–4122.

Sheen A. (2020). Do public and private firms behave differently? An examination of investment in the chemical industry. *Journal of Financial and Quantitative Analysis* 55, 2530–2554.

Technology-motivated Acquisitions and the Real Option Portfolio of Non-tech Firms*

Markus Fütterer, Marc Steffen Rapp, Michelle Schlosser

We are interested in "access to technology" acquisitions of non-tech firms and propose a novel approach to identify such acquisitions, which we call technology-motivated acquisitions (TMA). Studying a large sample of European non-tech firms, we document an increasing importance of TMA deals and empirically examine the role of such deals in firms' real option portfolios. We find that firms investing in their real option portfolios are more likely to engage in TMA, a pattern that is more pronounced in firms with high financial flexibility. Furthermore, engaging in TMA significantly improves the value of firms' real option portfolios, in particular, for small and focused firms. We identify TMA using a novel dictionary covering (i) perspectives from academic literature, (ii) publicly available emerging technology lists, and (iii) suggestions from practitioners.

> "The disruptive effect of technology companies has propelled non-technology companies to explore opportunities outside of their core sectors of expertise."
> **Citi Group (2018), Disruptors at the Gate.**

Markus Fütterer, Ph.D., is Manager at WTS Deutschland, Germany.
Marc Steffen Rapp is a Professor of Business Administration at Philipps-Universität Marburg, Germany, and a Professor at the Center for Corporate Governance at Copenhagen Business School, Denmark.
Michelle Schlosser, Ph.D., is a Strategic Controller and Corporate Developer at Geschwister Oetker Beteiligungen KG, Germany.

* We appreciate helpful comments from Federico Magno, Jens Pfeifer, Andrew Reek, Philipp Schaller, and an anonymous reviewer. During the revision of the manuscript the authors used ChatGPT in order to improve readability. After using the tool, the author(s) reviewed and edited the content as needed and take full responsibility for the content of the published article. The usual caveat applies.

1 Introduction

What is the importance of the "access to technology" motive for acquisitions by non-tech firms? When do non-tech firms engage in technology-motivated acquisitions (TMA) and what are the consequences of TMA? For many years, scholars from different disciplines have been challenged by these questions (Frey and Hussinger 2006 for non-tech firms; or Hanelt et al. 2021; Christensen et al. 2011; Kohers and Kohers 2000, Canace and Mann 2014). We add to this debate by taking the view of a strategist interested in the role of TMA for a firm's real option portfolio (Grullon et al. 2012; Lee et al. 2018; Rossi et al. 2013).[1]

Emerging technologies threaten existing business models but also provide the potential for "creative destruction".[2] The challenge is to get access to these emerging technologies. One potential avenue in that regard is to engage in what we call a *technology-motivated acquisition* (TMA), i.e., an acquisition where the target firm has access to the technology.[3] In a recent survey among "representatives of leading industrial firms, investment banks, and investors," A.T. Kearney (2019) finds that executives consider "technology access" to be the most important driver of M&A activity (see Figure 1). Other professional service firms have found similar results.[4]

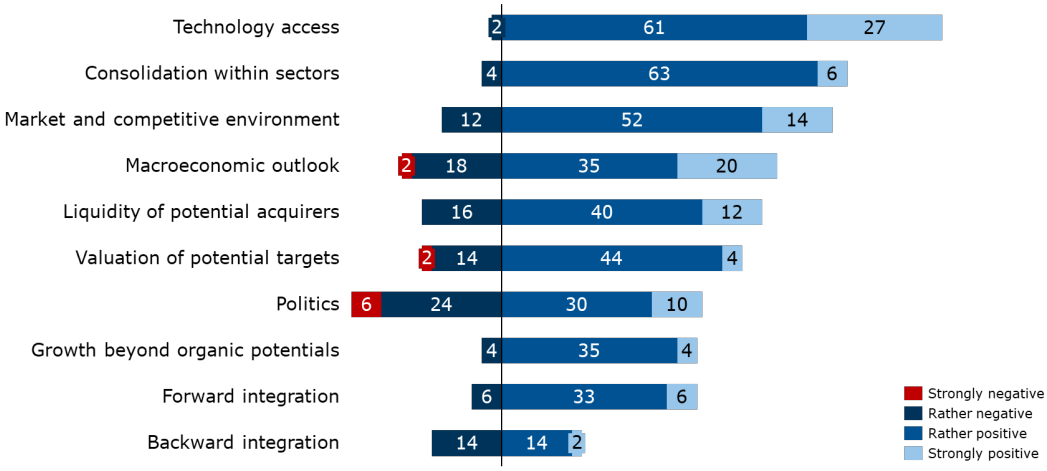


Figure 1: Deal rationales as reported by A.T. Kearney's Industrials Executive Mergers and Acquisitions Report 2019

Notes: This figure reports the result of a survey conducted by the consulting firm A.T. Kearney among "representatives of leading industrial firms, investment banks, and investors in January and February 2019." (See A.T. Kearney, 2019).

1 We take an empirical approach here following the lines of Grullon et al. (2012) and Lee et al. (2018). Others approach the issue from a theoretical (or case-based) perspective. See for instance, Ulrich (2013).
2 "Creative destruction (German: schöpferische Zerstörung), sometimes known as Schumpeter's gale, is a concept in economics that since the 1950s is the most readily identified with the Austrian-born economist Joseph Schumpeter who derived it from the work of Karl Marx and popularized it as a theory of economic innovation and the business cycle." (Wikipedia, 2022).
3 The literature has identified a variety of merger motives, e.g., access to customers, products, or markets (Calipha et al. (2010); Barkema and Vermeulen 1998), access to technology (BCG 2017; Presutti et al. 2006), etc. See A.T. Kearney (2019) for a survey.
4 For instance, DLA Piper finds in a survey from 2020 that "access to new technology" is the "most beneficial feature from the acquisition of an external company" (see DLA Piper 2020).

To study the "access to technology" acquisition motive for a large sample of firms, we propose a novel approach to identify TMAs. Specifically, we suggest applying textual analysis to descriptions of the deal synopsis and the business model of the target firm based on a novel dictionary covering (i) perspectives from academic literature, (ii) publicly available emerging technology lists, and (iii) suggestions from practitioners.[5] Constructing such a dictionary allows us to identify TMAs for a large panel of European listed non-tech firms and to study the role of TMA in a firm's real option portfolio.

A firm's *real option portfolio* refers to its set of "discretional business opportunities". More specifically, a *real option* or *strategic option* refers to the right (but not the obligation) to decide in the future to realize a specified business activity at a specified cost (Trigeorgis and Reuer 2017). Pioneered by Myers (1977), the idea of real options has become increasingly accepted in research and practice, specifically in situations characterized by highly uncertain environments, for instance, in the case of investments in new technologies (e.g., Anand et al. 2017).

A firm's real option portfolio may consist of different types of real options. Trigeorgis and Reuer (2017) describe categories of real options referring to organizational flexibility (e.g., the option to scale production or switch suppliers) and investment opportunities (e.g., the option to grow in existing or to enter new markets). Anand et al. (2017) argue that there might be a trade-off between switching options and study theoretical determinants of the value of a firm's real option portfolio. Empirically, the value of a firm's real option portfolio is often measured by the firm's real option intensity, which is the firm-specific sensitivity of firm value to uncertainty, where the latter is proxied by changes in firm-level stock return (e.g., Grullon et al. 2012; Lee et al. 2018).

To study the role of TMA in firms' real option portfolios, we draw accounting, market, and M&A data for all listed European non-tech firms residing in the EU17 countries over the 2001 –2020 period. This gives us an unbalanced panel of 71,731 firm-year observations and 53,454 access-of-control acquisitions. In the first step, we classify the acquisitions as TMA. Therefore, we generate a novel dictionary aiming to capture "emerging technologies" which covers (i) perspectives from academic literature, (ii) publicly available emerging technology lists, and (iii) suggestions from practitioners. We then use this dictionary and classify an acquisition as a TMA in case one of the "emerging technologies" recorded in our dictionary appears either in the deal synopsis or the description of the target´s business model. Overall, we find that 14% of our deals classify as TMA.

In a second step, we examine which firms are more likely to engage in TMA. Specifically, we study the role of real options and leverage. *First*, we argue that TMAs, which provide access to emerging technologies and thus a pathway for "creative destruction", may be more valuable in case of higher organizational flexibility, more investment opportunities, and thus for firms with more valuable real option portfolios (Grullon et al. 2012; Trigeorgis and Reuter 2017; or Lee et al. 2018). In the empirical analysis, we follow the approach of Grullon et al. (2012) and Lee et al. (2018) and proxy the value of a firm's real option portfolio by its real option intensity (RI). As such, we hypothesize that RI represents a determinant for TMA activity. *Second*, we argue that leverage might play an important role in the real option-TMA nexus. McConnell and Servaes (1995) find a negative relation between leverage and firm value for growth firms, and Harford et al. (2009) document that firms re-adjust their capital structure after acquisitions. In the context of TMA, we conjecture that a firm's real option portfolio is more important in

5 Textual analysis has become increasingly common in the economics and business literature. See for instance, Gentzkow et al. (2019); Loughran and McDonald (2016); or Merrick (2015).

case the firm has sufficient financial means to eventually exercise the real options. Arguing that spare debt capacity represents a proxy for financial flexibility, we hypothesize that RI is more (less) important for firms with low (high) leverage.[6]

In a third step, we analyze whether firms that undertake a TMA benefit in terms of an increase in the value of their real option portfolio.[7] The literature has shown that firms can actively invest in their real option portfolio, either organically (CAPEX, R&D) or inorganically using M&A, and increase the value of their portfolio of real option or their *real option intensity* (RI) (Anand et al. 2007; Grullon et al. 2012; McGrath and Nerkar 2004; Cheng 2016).[8] We argue that TMAs might be particularly valuable in this respect, specifically for non-tech firms. Indeed, TMA might provide valuable complementary additions and novel opportunities to non-tech firms outside their core business and hence add to firms' real option portfolios (e.g., McGrath and Nerkar 2004; Rossi et al. 2013). As such, we hypothesize that TMA will increase the value of firms' real option portfolios.

Our results are threefold. First, we document that the relative importance of TMA increased significantly over the last 20 years within our sample covering listed firms from seventeen European countries, culminating in 2020, when 21.1% of all M&A transactions classify as TMA. Second, we find that non-tech firms with high RI are more likely to engage in TMA. A one standard deviation increase in RI significantly increases the odds of engaging in TMA in the next period by 5%. Consistent with intuition, the effect is greater (12%) for firms with lower leverage, suggesting that higher debt capacity or higher financial flexibility facilitates TMA activity.[9] *Third*, we show that non-tech firms engaging in TMA demonstrate a significantly higher RI two years after the deal compared to the event year. The positive TMA effect of 0.072 represents 60% of the mean RI, suggesting economic importance. In line with intuition, the pattern is more pronounced for smaller and more focused firms with limited growth option potential.

Of course, our empirical analysis is prone to several endogeneity concerns. As such, we also examine the robustness of our results and find that they are robust to (i) controlling for deal characteristics commonly discussed in the literature, (ii) matching based on RI characteristics, as well as (iii) taking into account the fact that "engaging in a TMA" is a choice variable by analyzing withdrawn TMA deals.

We contribute to literature along three dimensions. *First*, we identify real option considerations as an additional explanation for the increased interest in TMA by non-tech firms (e.g., Ihamuotila et al. 2021). *Second*, integrating a real options perspective on TMA allows for a more holistic view of acquisition gains beyond product innovation, often measured by new patents (e.g., Hanelt et al. 2021). *Finally*, our findings complement the understanding of real options around investments, as we confirm the proposed development of RI found in the literature (e.g., Grullon et al. 2012) and extend this stream by considering the business model of the target firm as a decisive factor to increase RI (e.g., Cheng 2016).

---

6 The argument here is that today's leverage determines tomorrow's borrowing capacity of a firm (e.g., Rapp et al. 2014).

7 Many studies focus on (short-term) performance implications of acquisitions. For instance, Morck et al. (1990) and many others document that diversifying acquisitions destroy shareholder value (in the short run). Fernandes (2019) studies why M&A transactions often fail to create value and proposes five "golden rules" to mitigate the problem. We are interested in the effect of TMA for a firm's real option intensity.

8 One might argue that undertaking investments corresponds to the exercise of real options and thus might decrease the value of the portfolio of real options. However, the idea is that some investments create new real options that outweigh the loss due to the exercise of the initial real option (see Trigeorgis and Reuer 2017).

9 Increasing the mean probability to invest in TMA from 6% to 11%, or 18% respectively.

The remainder of this paper is organized as follows. Section 2 introduces the sample and the data. Specifically, it introduces our approach to identifying TMAs. Section 3 introduces the empirical approach, provides the results of our empirical analysis and discusses their robustness. Finally, Section 4 concludes.

2 Sample and data

2.1 Sample construction

We draw our data from Refinitiv (Datastream and the Securities Data Company (SDC) database) in four steps. First, we define the sample to cover European firms. We consider the analysis of European firms to be particularly interesting due to the relatively lower levels of technology adoption among these firms compared to their counterparts in other regions (e.g., Rückert et al., 2020). This creates a "technology gap" (e.g., Smith et al., 2022; Schnabel, 2024) with implications for economic growth (e.g., Krueger and Kumar, 2004). Specifically, we define the sample to cover firms from EU17 countries[10] and restrict the sample to listed firms because we need relatively detailed information on firms' market values to estimate their real option intensity.

Second, we follow the process described in Hanauer (2014) and identify all firms in the Refinitiv universe incorporated and listed in *one of the sample countries during the sample period 2001–2020. Third*, we follow the standard procedure of corporate finance studies and eliminate financial and utility firms. Focusing on non-tech firms, we also eliminate high-tech firms based on the classification proposed by Galindo-Rueda and Verger (2016).[11] Moreover, we eliminate firm-year observations with missing, negative, or zero total assets, total sales, and total shareholder's equity. This gives us an unbalanced panel of 71,731 firm-year observations from 7,338 firms. Fourth, we identify all access-of-control acquisitions by these firms reported by SDC.[12] Access-of-control acquisitions are acquisitions of independent firms where the acquirer owns less than 50% of shares before the transaction and more than 50% after the transaction (Martynova and Renneboog, 2011). We identify 53,454 deals from SDC, which were restricted according to the same specifications as the accounting data (Hanauer 2014). We then merge the deals to the panel data based on the announcement-year of the transaction. The resulting dataset contains 39,009 firm-year observations.

10 The EU17 countries are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.
11 Several authors have developed classification schemes to identify "high-tech firms". We follow Galindo-Rueda and Verger (2016) in our baseline analysis. We re-run the main analysis using the classification of Klasa et al. (2009). Results, which are available upon request, remain robust.
12 We also include deals of non-listed acquirers when the corresponding ultimate parent is publicly listed, frequently representing the actual acquirer.

Table 1: Identified TMA deals per country

Notes: This table reports the distribution of technology-motivated deals across countries and time. We draw deals from Refinitiv, clean the data as described in Section 2.1, and identify technology-motivated deals as described in Section 2.2.

COUNTRY	´01	´02	´03	´04	´05	´06	´07	´08	´09	´10	´11	´12	´13	´14	´15	´16	´17	´18	´19	´20	TOTAL
Austria	3	1	3	0	2	2	2	4	1	3	2	1	2	1	1	3	3	0	1	1	36
Belgium	1	1	2	6	0	7	9	5	4	8	5	1	5	6	9	2	5	4	1	2	83
Denmark	3	4	4	4	5	5	9	3	6	2	4	2	1	3	3	9	2	5	4	1	79
Finland	12	10	5	7	7	8	15	13	10	14	5	6	7	6	13	17	10	9	7	7	188
France	47	33	33	30	46	57	66	63	47	43	52	43	36	53	60	60	60	48	36	38	951
Germany	44	23	23	14	36	43	56	46	52	34	46	37	35	39	33	41	55	53	36	22	768
Greece	3	1	0	1	0	2	3	1	1	3	2	1	1	1	0	0	3	0	0	1	24
Ireland	5	2	0	0	0	4	4	1	0	0	0	0	0	0	0	0	1	0	1	1	19
Italy	12	5	7	9	15	13	13	9	4	5	12	3	3	8	13	18	13	22	15	22	221
Luxembourg	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	4
Netherlands	16	11	10	10	19	13	25	19	10	16	12	9	6	10	7	11	9	3	8	7	231
Norway	16	4	7	12	15	12	28	10	4	12	7	6	7	9	11	6	8	4	9	14	201
Portugal	3	0	0	0	0	1	6	3	3	0	2	0	0	1	0	2	0	0	1	1	23
Spain	3	3	1	2	3	5	14	8	3	6	3	7	5	10	5	2	3	14	12	9	118
Sweden	11	11	4	11	36	34	35	21	13	29	31	26	33	24	30	38	46	48	46	70	597
Switzerland	4	6	7	4	9	11	13	16	17	12	9	9	7	10	18	7	16	8	13	13	209
United Kingdom	103	58	60	73	95	120	131	105	66	69	62	81	75	89	75	68	68	60	50	47	1,555
TOTAL	**286**	**174**	**166**	**183**	**289**	**338**	**429**	**327**	**241**	**256**	**254**	**232**	**223**	**270**	**278**	**285**	**302**	**278**	**240**	**256**	**5,307**

Figure 2 reports the proportion of TMA deals along the EU17 countries. With a share of approximately 29% (10,978 deals), the UK accounts for the largest number of acquisitions, followed by France (17%) and Germany, with almost 12% of transactions. With 31% of tech-motivated deals, Luxembourg leads the way in the TMA segment (due to the low number of deals, this could potentially be considered negligible), followed by Germany, where 18% of deals are technology-motivated, and Norway, with 16% of deals being TMA.

2.2 Identifying tech-motivated deals

Our aim is to identify tech-motivated deals. Therefore, we draw on the method of textual analysis and conduct the deal classification using a dictionary-based approach. Specifically, we proceed in three main steps. *First*, we construct a dictionary of tech terms, i.e., a collection of terms characterizing (emerging) technologies. The dictionary aggregates terms from

> academic literature (Chen and Srinivasan 2019; Garcia de Lomana et al. 2019; Hanelt et al. 2021; Kindermann et al. 2020),
> publicly available technology-related lists (following Bonaccorsi et al. 2020; Joung and Kim 2017), namely the annual MIT list of *10 Breakthrough Technologies*, Wiki lists on *Emerging Technologies*, Gardner's *Top 10 Strategic Technology Trends*, and Scientific American's *Top 10 emerging technologies*,
> and
> suggestions from business experts.

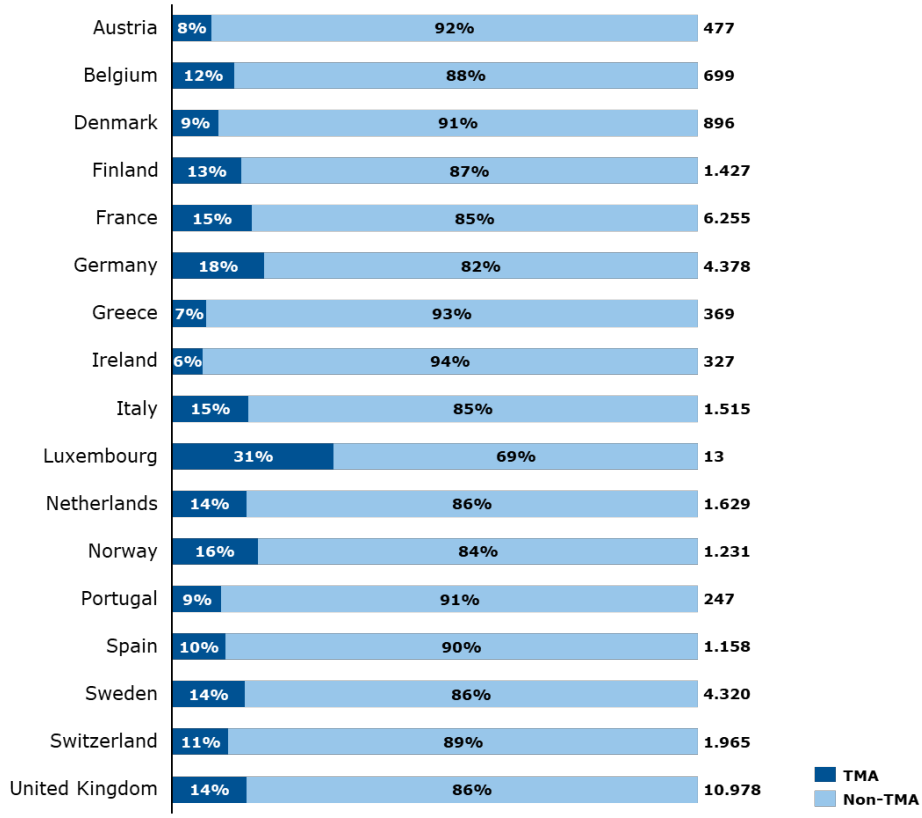


Figure 2: Distribution of TMA deals per Country

Notes: This figure reports all extracted and technology-motivated deals in all EU17 countries. The countries include Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and United Kingdom. For a detailed summary of TMA deals over the sample years 2001–2020 see Table 1.

Each keyword in the dictionary is converted to lowercase characters, word endings are adjusted to allow for multiple word forms, and connotations and other notations are added whenever appropriate.[13] The resulting dictionary contains 759 unique keywords which can be allocated to three main categories – *digital*, *product and process improvement*, and *environment*, as provided in the Appendix.

Second, we construct a deal summary for each identified deal. The deal summary provides the text to classify the transaction as tech-motivated. Relying on all relevant transaction information disclosed by SDC, we aggregate all textual information contained in the variables "Target Business Description" and "Deal Synopsis". In addition, we remove company names as a precautionary measure. For example, any acquirer that includes "software" in its company name could potentially lead to misclassification of the deal and is therefore removed.

Third, using the Linguistic Inquiry and Word Count (LIWC) from Pennebaker et al. (2015), we analyze the deal summaries and classify a transaction as a tech-motivated deal if the summary includes at least one of the tech-related terms from our dictionary. Overall, we find that 14% of our deals classify as TMA. See Table 1 and Figure 2 for an overview.

13 While this includes adding "3-D printer" not only "3D printer" this also addresses language spelling differences, such as "internet of behavior" and "internet of behaviour".

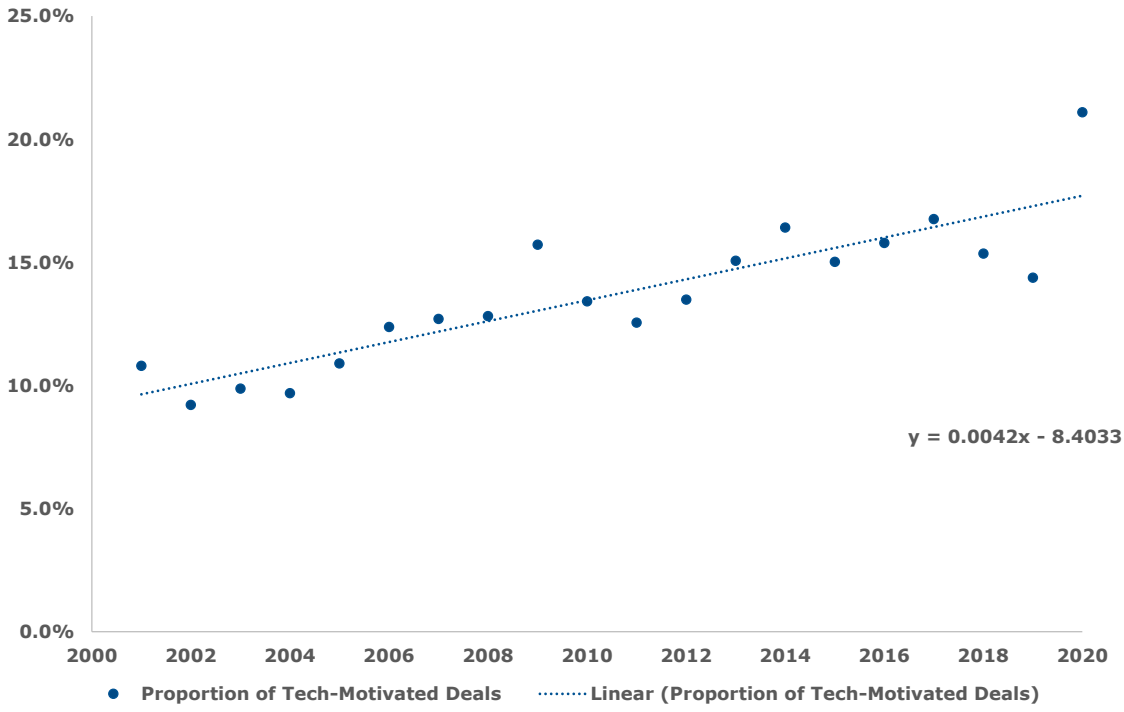


Figure 3: Development of TMA of non-tech firms

Notes: This figure illustrates the proportion of technology-motivated deals and their development over the years 2001–2020 in EU17 countries. The countries are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.

As presented in Figure 3, the relative importance of TMA of non-tech acquirers increased significantly over the last 20 years within our sample covering listed firms from seventeen European countries. More specifically, examining the fraction of M&A transactions that classify as a TMA, the relevance of TMA nearly doubled from 2001 (10.8%) to 2020 (21.1%) with a cyclical but steady trend (a linear regression suggests an average annual increase in the proportion of TMA of 0.42 basis points per year).

2.3 Real option intensity

We measure RI as the annual firm-specific sensitivity of stock returns to changes in stock return volatility, following Lee et al. (2018), by estimating

$$r_{(i,t)}-r_{(f,t)}=a_t+\beta\Delta Volatility_{(i,t)}+\gamma\eta_{(i,t)}+\sum\delta X_{(i,t)}+\varepsilon_{(i,t)} \qquad (1)$$

where $r_{(i,t)}-r_{(f,t)}$ is the weekly excess return of firm i in week t, $\Delta Volatility_{(i,t)}$ is the difference in volatility between week t and $t-1$ for firm i (based on daily returns within a week), $\eta_{(i,t)}$ represents the market factor loading estimated on daily information in a given month, and $X_{(i,t)}$ embodies a vector of firm controls known at the beginning of a given week for firm i. These control variables are: ln(1+Book Equity/Market Equity), ln(1+Market Equity), the six week lagged return and

weekly trading volume per number of shares. a_t is the constant and $\varepsilon_{(i,t)}$ is the error term. We estimate equation 1 separately for each firm-year, to obtain a firm-specific β estimate, which is our measure of RI.

2.4 Summary statistics

We use accounting and market data from Refinitiv, OECD, World Bank, and the European Central Bank to measure deal, firm, and country characteristics. Table 2 presents the control variables separately for the firm-level (Table 2, Panel A) and the deal-level (Table 2, Panel B) analysis. The mean firm shows a RI of 0.16, has 3,320 million EUR in total assets, leverage of 21%, has a positive cash flow of 4% of total assets, which exhibits a volatility of 6% per year, and

Table 2: Summary statistics

Notes: This table provides definitions for variables for the panel data perspective (firm-year level) in Panel A and the deal data perspective (deal event-year level) in Panel B. Firm-level and deal-level data is downloaded from Refinitiv. Country-level data is drawn from OECD, World Bank, and the European Central Bank. All non-dichotomous firm level variables are winsorized by year at the 1% and 99% threshold, to mitigate concerns of outliers. The corresponding samples are constructed as described in section 2. Variables are defined in Table 7.

VARIABLE	N	MEAN	STD	P25	MEDIAN	P75
Panel A: Panel-data perspective						
TMA	39,009	0.06	0.24	0.00	0.00	0.00
Real Option Intensity (RI)$_{(t-1)}$	39,009	0.16	0.67	-0.29	0.15	0.60
Size$_{(t-1)}$	39,009	12.45	2.12	10.91	12.23	13.88
Leverage$_{(t-1)}$	39,009	0.21	0.16	0.06	0.19	0.32
Cash Flow$_{(t-1)}$	39,009	0.04	0.14	0.03	0.06	0.09
Cash Flow Volatility$_{(t-1)}$	39,009	0.06	0.09	0.02	0.03	0.06
Tobin´s Q$_{(t-1)}$	39,009	1.99	1.89	1.01	1.42	2.21
Payout$_{(t-1)}$	39,009	0.67	0.47	0.00	1.00	1.00
Negative Net Income$_{(t-1)}$	39,009	0.23	0.42	0.00	0.00	0.00
Capex$_{(t-1)}$	39,009	0.04	0.05	0.01	0.03	0.06
R&D/Assets$_{(t-1)}$	39,009	0.02	0.05	0.00	0.00	0.01
Loan Spread$_{(t-1)}$	39,009	1.56	0.43	1.32	1.55	1.72
Panel B: Deal-data perspective						
TMA	12,731	1	0	1	1	1
Real Option Intensity (RI)	12,731	0.12	0.71	-0.36	0.15	0.61
Size$_{(t-1)}$	12,731	13.70	2.55	11.68	13.46	15.63
Book-to-Market$_{(t-1)}$	12,731	0.40	0.23	0.23	0.36	0.50
Long Term Leverage$_{(t-1)}$	12,731	0.14	0.13	0.02	0.12	0.21
lnR&D$_{(t-1)}$	12,731	5.09	5.53	0.00	0.00	10.20
Diversification$_{(t-1)}$	12,731	1.33	0.50	1.10	1.39	1.61
Payout$_{(t-1)}$	12,731	0.75	0.43	1.00	1.00	1.00
Trading Volume$_{(t-1)}$	12,731	0.00	0.01	0.00	0.00	0.00
Firm Age$_{(t-1)}$	12,731	3.55	0.97	2.89	3.43	4.39
Cash Flow$_{(t-1)}$	12,731	0.06	0.09	0.04	0.07	0.10
Cash Flow Volatility$_{(t-1)}$	12,731	0.07	0.15	0.02	0.03	0.07
Cash Holdings$_{(t-1)}$	12,731	0.18	0.13	0.08	0.14	0.23
Tangibility$_{(t-1)}$	12,731	0.11	0.13	0.03	0.06	0.14
Closely Held Shares$_{(t-1)}$	12,731	2.93	1.23	2.31	3.32	3.91
Deal Experience$_{(t-1)}$	12,731	7.70	10.78	0.00	4.00	11.00
GDP per Capita$_{(t-1)}$	12,731	10.67	0.13	10.60	10.63	10.72

Tobin´s Q of 1.99. 67% of firms pay dividends and 23% exhibit negative net income. The average firm invests 4% of total assets in Capex, 2% in R&D, and has a loan spread of 1.56%. All non-dichotomous firm level variables are winsorized by year at the 1% and 99% thresholds to mitigate concerns of outliers.

3 Empirical results

3.1 The likelihood to engage in TMA

We examine the likelihood to engage in a TMA in the next period based on the following logistic regression:

$$TMDeal_{(t+1)}=a_0+\beta_1 RI_{(i,t)}+\sum\beta_{(2,i)}X_{(i,t)}+\beta_3\eta_i+\beta_4\varphi_t+\varepsilon_{(i,t)}, \quad (2)$$

where $TMDeal_{(t+1)}$ represents a dummy equal to one in case a TMA is performed in the next period.[14] $RI_{(i,t)}$ is real option intensity, $X_{(i,t)}$ represents a vector of lagged control variables, mainly inspired by Bauguess and Stegemoller (2008) and extended with R&D expenditure as a further determinant of TMA (e.g., Xie et al. 2018).[15] The term η_i describes firm fixed effects to capture time-invariant firm-specific heterogeneity, φ_t are year-effects controlling for unobserved time-varying shocks affecting deal activity.

Table 3 reports our results. In Specification 1.A, we only control for firm size and leverage, as well as year, industry, and country fixed effects.[16] Firm size and leverage are known to be important determinants of M&A activity (e.g., Bauguess and Stegemoller 2008; Caprio et al. 2011). In Specification 2.A we add additional firm characteristics, and in Specification 1.C we allow for firm fixed effects. Consistent with our hypothesis, we find a statistically significant positive coefficient for real option intensity in all three specifications. Also, the correlation is meaningful in economic terms. According to Specification 1.B, increasing RI by one standard deviation increases the odds of engaging in TMA in the next period by 5 percentage points. In other words, the propensity of performing an TMA rises from 6% to 11%.

14 The results remain qualitatively consistent when applying an ordered logit regression model, replacing the TMA deal dummy by the actual number of technology-motivated deals in the next period.

15 The controls consist of Size, Leverage, Cash Flow, Tobin´s Q, Payout, Loss, Capex, R&D and Loan Spread as defined in Table 7.

16 We define industry affiliation following the 10 industry portfolios by Eugene Fama and Kenneth R. French. See https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html for details.

Table 3: Probability to engage in tech-motivated M&A

Notes: This table presents the results of logit regressions of the effect of RI on the probability of engaging in a TMA deal in the next period. Specification 1.A presents the baseline results with firm size, leverage, year, industry and country effects as the only controls. Specification 1.B allows for further controls (Leverage, Cash Flow, Tobin's Q, Payout, Negative Net Income, Capex, R&D, and Loan Spread) following Bauguess & Stegemoller (2008). Specification 1.C allows for firm fixed effects. Specifications 2.A–2.C follow the logic of 1.A to 1.C, but simultaneously allow leverage to moderate the correlation between RI and future TMA activity. All non-dichotomous firm-level variables are winsorized by year at the 1% and 99% threshold, to mitigate concerns of outliers. All independent variables are lagged by one period. All variables are defined in Table 7. The t-statistics in parentheses are based on robust standard errors, clustered at the firm level. *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

SPECIFICATION	1.A	1.B	1.C	2.A	2.B	2.C
SAMPLE	NON-TECH FIRMS	NON-TECH FIRMS	NON-TECH FIRMS	NON-TECH FIRMS	NON-TECH FIRMS	NON-TECH FIRMS
DEPENDENT VARIABLE	TMA	TMA	TMA	TMA	TMA	TMA
METHOD	LOGIT REGRESSION	LOGIT REGRESSION	LOGIT REGRESSION	LOGIT REGRESSION	LOGIT REGRESSION	LOGIT REGRESSION
Real Option Intensity [RI] $_{(t-1)}$	0.092***	0.079**	0.088**	0.191***	0.166***	0.189***
	(2.73)	(2.35)	(2.13)	(3.75)	(3.30)	(2.88)
Leverage $_{(t-1)}$ x RI				-0.542**	-0.470**	-0.542**
				(-2.46)	(-2.20)	(-1.99)
Leverage $_{(t-1)}$	-1.353***	-0.733***	-1.382***	-1.266***	-0.659**	-1.295***
	(-5.17)	(-2.77)	(-3.46)	(-4.71)	(-2.44)	(-3.21)
Firm Size $_{(t-1)}$	0.414***	0.418***	0.249***	0.413***	0.417***	0.253***
	(16.63)	(16.02)	(3.04)	(16.60)	(15.98)	(3.09)
Cash Flow $_{(t-1)}$		0.472	-0.094		0.462	-0.109
		(1.57)	(-0.27)		(1.54)	(-0.32)
Cash Flow Volatility $_{(t-1)}$		1.131***	0.196		1.120***	0.185
		(3.37)	(0.32)		(3.34)	(0.30)
Tobin´s Q $_{(t-1)}$		0.038***	0.078***		0.037***	0.078***
		(2.75)	(3.88)		(2.72)	(3.86)
Dividends $_{(t-1)}$		-0.086	0.057		-0.086	0.055
		(-1.16)	(0.55)		(-1.16)	(0.53)
Loss $_{(t-1)}$		-0.405***	-0.488***		-0.405***	-0.488***
		(-4.70)	(-4.55)		(-4.71)	(-4.55)
Capex/Assets $_{(t-1)}$		-5.303***	-0.671		-5.291***	-0.639
		(-5.24)	(-0.52)		(-5.23)	(-0.50)
R&D/Assets $_{(t-1)}$		2.363***	-1.845		2.350***	-1.872
		(4.16)	(-1.55)		(4.14)	(-1.57)
Loan Spread $_{(t-1)}$		-0.169	-0.102		-0.170	-0.107
		(-1.63)	(-0.76)		(-1.64)	(-0.80)
YEAR EFFECTS	YES	YES	YES	YES	YES	YES
INDUSTRY (FF 48) EFFECTS	YES	YES	NO	YES	YES	NO
COUNTRY EFFECTS	YES	YES	NO	YES	YES	NO
FIRM EFFECTS	NO	NO	YES	NO	NO	YES
NUMBER OF OBSERVATIONS	39,009	39,009	12,227	39,009	39,009	12,227

As discussed above, we expect this correlation to be even stronger for firms exhibiting financial flexibility. To examine this idea, we re-estimate Specifications 1.A –1.C, however, allowing leverage (as a proxy for financial flexibility) to moderate the relation between RI and TMA activity. The results are reported in Specification 2.A–2.C. Consistent with intuition, the coefficient for RI increases in size, and the coefficient for the interaction term is statistically significant and negative. Indeed, the baseline coefficients actually double in size, suggesting that increasing RI by one standard deviation increases the odds of engaging in TMA in the next period by 12 percentage points for zero-leverage firms from 6% to 18%.

3.2 Consequence analysis

3.2.1 Empirical approach

To study the consequences of TMA activity for RI, we re-arrange the dataset. Specifically, we create a panel-data set, where "deals" are the subject of analysis and the time variable is defined as "calendar year of the deal". In other words, we switch the time dimension to event-time relative to the event-year (t=0). Thereby, we only keep the years t –2, t –1, 0, t+1, t+2.

Using this data, we then regress a firm's RI on the corresponding event-years and a set of controls:

$$RI_{it} = a_0 + \beta_1 year_{(t-2)} + \beta_2 year_{(t-1)} + \beta_3 year_{(t+1)} + \beta_4 year_{(t+2)} + \sum \beta_{(5,i)} X_{(i,t-1)} + \beta_6 \vartheta_i + \beta_7 \varphi_t + \varepsilon_{it}, \quad (3)$$

where the choice of lagged control variables ($Xi,t-1$) is based on Lee et al. (2018) and extended by further determinants of RI (cash flow, cash flow volatility, cash holdings, tangibility, closely held shares) and other deal- and country-related controls (deal experience and GDP-per capita), all defined in Table 7. The variable ϑ_i includes deal fixed effects to control for time invariant deal-specific factors.

3.2.2 Baseline results

Table 4 reports our baseline results with regard to consequences of TMA activity. While Specification 1 allows for firm and country characteristics, as well as deal fixed effects, Specification 2 also allows for calendar year effects.

Two results stand out. First, we do not find significant coefficients for the pre-event periods ($year_{t-2}$ *and* $year_{t-1}$) relative to the year of the acquisition (t=0). Second, we find a positive significant coefficient of 0.07–0.08 in year two after the deal ($year_{t+2}$). Specifically, the coefficient of 0.072 for $year_{t+2}$ in Specification 2 represents approximately 60% of the mean RI (0.12), suggesting economic importance.

Table 4: Consequence analysis – baseline results

Notes: This table presents the results of OLS regressions of the event-year dependent effect of TMA activity on RI relative to the event-year (t=0). Specification 1 presents the baseline results and includes deal fixed effects and a set of control variables as described in section 3.2.1. Specification 2 expands the model by adding year fixed effects. In all regression specifications, real option intensity is used as the dependent variable. All non-dichotomous firm-level variables are winsorized by year at the 1% and 99% threshold to mitigate concerns of outliers. All independent variables are lagged by one period. All variables are defined in Table 7. The t-statistics in parentheses are based on robust standard errors, clustered at the firm level. *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

SPECIFICATION	1	2
SAMPLE	TMA OF NON-TECH FIRMS	TMA OF NON-TECH FIRMS
DEPENDENT VARIABLE	REAL OPTION INTENSITY	REAL OPTION INTENSITY
METHOD	OLS	OLS
Eventyear t–2	-0.024 (-0.81)	-0.019 (-0.54)
Eventyear t–1	0.022 (0.99)	0.016 (0.67)
Eventyear t+1	0.040* (1.75)	0.037 (1.44)
Eventyear t+2	0.077** (2.50)	0.072** (2.01)
CONTROLS	YES	YES
DEAL EFFECTS	YES	YES
YEAR EFFECTS	NO	YES
-NUMBER OF OBSERVATIONS	12,731	12,731
NUMBER OF DEALS	3,263	3,263
R-SQUARED	0.050	0.086

3.2.3 Cross-sectional heterogeneity

We argue that the increase in RI of non-tech firms pursuing TMA is based on the newly acquired options to grow. Consequently, we expect that the effect is relatively stronger for firms that benefit more from the acquired options. Hence, we examine cross-sectional variation for small firms (e.g., Grimpe and Hussinger 2008) with a comparably lower level of RI. Additionally, we investigate less diversified firms (more focused firms) in terms of product segmentation, which limits options for growth.

To test this conjecture, we expand equation (3) with interaction-effects between small (focused) firms and the corresponding event-year. Table 5 reports the results of this exercise.[17] In line with expectations, we find a positive significant interaction term between small firms and event-year t+2 ($year_{t+2}$ *CSH) in both specifications. Moreover, the size of the interaction term is impressive, suggesting that the correlation triples for small and focused firms.

17 We classify a firm as small in the case that firm size is within the bottom three deciles in event-year t–2. We define a firm as focused if the number of product segments is within the bottom three deciles in a given country in event-year t–2. The classification is based on the event-year t–2 to mitigate the concern of a deal-effect on the corresponding classification.

Table 5: Consequence analysis – cross-sectional heterogeneity

Notes: This table presents the results of cross-sectional heterogeneity of small and more focused firms. Specifically, we expand the specifications from Table 4 by adding interaction terms between the corresponding event-year and the characteristic small firm (1) and more focused firm (2). In all regression specifications, real option intensity is used as the dependent variable. All non-dichotomous firm level variables are winsorized by year at the 1% and 99% threshold to mitigate concerns of outliers. All independent variables are lagged by one period. All variables are defined in Table 7. The t-statistics in parentheses are based on robust standard errors, clustered at the firm level. *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

SPECIFICATION	1	2
SAMPLE	TMA OF NON-TECH FIRMS	TMA OF NON-TECH FIRMS
DEPENDENT VARIABLE	REAL OPTION INTENSITY	REAL OPTION INTENSITY
METHOD	OLS	OLS
CSH	SMALL FIRMS	FOCUSED FIRMS
Eventyear t–2	-0.035 (-0.85)	-0.024 (-0.59)
Eventyear t–1	0.008 (0.26)	0.019 (0.68)
Eventyear t+1	0.052* (1.70)	0.040 (1.38)
Eventyear t+2	0.066* (1.74)	0.077** (2.10)
Eventyear t–2 x CSH	0.012 (0.23)	-0.007 (-0.09)
Eventyear t–1 x CSH	0.046 (1.00)	0.052 (0.71)
Eventyear t+1 x CSH	-0.006 (-0.11)	0.057 (0.81)
Eventyear t+2 x CSH	0.124** (2.05)	0.161** (1.99)
CONTROLS	YES	YES
DEAL EFFECTS	YES	YES
YEAR EFFECTS	YES	YES
NUMBER OF OBSERVATIONS	10.339	10.339
NUMBER OF DEALS	2.310	2.310
R-SQUARED	0.090	0,090

3.3 Robustness of results

3.3.1 Alternative deal-level explanations

Arguably, the significant positive effect of TMA on RI could also stem from non-technology-related deal characteristics. Accounting for this concern, we perform horse-race regressions, controlling for four common deal characteristics from the related literature (e.g., Aybar and Ficici 2009; Martynova and Renneboog 2011). Specifically, in the four specifications reported in Table B1, we separately control for (i) cross-border deals, (ii) private targets, (iii) cash deals, and (iv) deal value disclosures. The results remain unchanged.

3.3.2 Heterogeneity in RI

Our findings may be prone to structural differences in RI of firms pursuing TMA and hence are subject to a sample selection bias. To address this concern, we match non-TMA to our sample of

TMA with similar RI characteristics in advance of the deals. Matching is based on industry affiliation, RI, RI-growth, and a battery of further variables potentially correlated with RI.[18] For the analysis, we introduce an interaction term between non-TMA and the corresponding event-year capturing the non-TMA differential effect. In case TMA creates significantly higher RI than non-TMA with a similar pre-deal RI, we should observe no significant difference between the two types of deals in advance of the event ($year_{t-1}$; $year_{t-2}$), consistent with the parallel trend assumption (e.g., Wei et al. 2020), and a significant positive coefficient in the post-event-years. Consistently, we find in Table 6, Specification 1 a significant positive coefficient of 0.093 for the base effect in, $year_{t+2}$ referring to TMA and a significant negative coefficient of -0.062 for $year_{t+2}$ ** Counterpart*, implying that non-TMA show a significantly smaller effect on RI, alleviating concerns of sample selection bias.

3.3.3 TMA as a choice variable

Considering that TMA activity is a variable of choice, it might be argued that the identified RI-effect is not driven by TMA but by another (omitted) variable, which is positively correlated with both the decision to pursue a TMA and RI (e.g., Martynova and Renneboog, 2011). We face this concern by forming a second matched sample, integrating withdrawn TMA.[19] This approach allows for the separation of the decision to engage in TMA from the effective outcome. In line with our previous results, the positive TMA effect should only be observable for completed TMA containing the newly acquired real options.

The results in Table 6, Specification 2 further corroborate our previous findings, with a positive significant base effect quantified by a coefficient of 0.229 capturing the implemented TMA, and a significant negative effect for the withdrawn TMA ($year_{t+2}$ **Counterpart*) of -0.256. As we do not expect to find any effect on RI for withdrawn TMA, we apply a test of difference in coefficients from zero ($\lambda_1 + \lambda_2 = 0$). As expected, we cannot reject the null of a significant difference from zero for firms with withdrawn TMA (p-value 0.873).

18 The matching variables are Industry affiliation (following the 10 industry portfolios by Eugene Fama and Kenneth R. French), RI, RI-Growth, Firm Size, Book-to-Market, Leverage, Trading Volume, Firm Age, Tangibility, and Deal Experience. The matching procedure is based on event-year t–1 using nearest neighbor matching without replacement. The match is conducted in event-year t–1 to maximize similarity in the event-year. In order to control for distances of matched pairs, we apply a caliper restriction of 0.001.

19 We classify a TMA as withdrawn, in case we find a "withdrawn date" provided by the SDC-database. The matching procedure is conducted as in 3.3.2

Table 6: Matched sample regressions

Notes: This table provides results for matched sample analyses. Specification 1 provides the results for matching non-TMA to the sample of TMA based on the following matching variables: Industry affiliation (FF 10), RI, RI-Growth, Firm Size, Book-to-Market, Leverage, Trading Volume, Firm Age, Tangibility, and Deal Experience (matching period event-year t-1; nearest neighbor matching without replacement). We apply the Fama-French 10 industry definition to trade off the number of matched pairs. The match is conducted in event-year t-1 to maximize similarity in the event-year. In order to control for distances of matched pairs, we apply a caliper restriction of 0.001. In all regression specifications, real option intensity is used as the dependent variable. All non-dichotomous firm-level variables are winsorized by year at the 1% and 99% threshold to mitigate concerns of outliers. All independent variables are lagged by one period. All variables are defined in Table 7. The t-statistics in parentheses are based on robust standard errors clustered at the firm level. *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

SPECIFICATION	1		2
SAMPLE	MATCHED SAMPLE		MATCHED SAMPLE
DEPENDENT VARIABLE	REAL OPTION INTENSITY		REAL OPTION INTENSITY
METHOD	OLS		OLS
MATCHING APPROACH	MATCHING OF NON-TECH MOTIVATED DEALS TO TECH-MOTIVATED DEALS	*COEFFICIENT*	MATCHING OF COMPLETED TECH-MOTIVATED DEALS TO ANNOUNCED BUT WITHDRAWN TECH-MOTIVATED DEALS
Eventyear t-2	-0.021 (-0.58)		-0.070 (-0.43)
Eventyear t-1	0.017 (0.67)		-0.116 (-0.94)
Eventyear t+1	0.050* (1.95)		0.022 (0.20)
Eventyear t+2	0.093*** (2.68)	Λ_1	0.229* (1.82)
Eventyear t-2 x Counterpart	-0.022 (-0.86)		-0.092 (-0.81)
Eventyear t-1 x Counterpart	-0.008 (-0.35)		-0.052 (-0.41)
Eventyear t+1 x Counterpart	-0.045* (-1.88)		-0.095 (-0.80)
Eventyear t+2 x Counterpart	-0.062** (-2.19)	Λ_2	-0.256** (-2.19)
Difference		H_0: $\Lambda_1 + \Lambda_2 = 0$	*p = 0.873*
CONTROLS	YES		YES
DEAL EFFECTS	YES		YES
YEAR EFFECTS	YES		YES
NUMBER OF OBSERVATIONS	21,770		484
NUMBER OF DEALS	4,820		106
R-SQUARED	0.091		0.244

4 Summary and conclusions

This study empirically examines "access to technology" acquisitions, which we call technology-motivated acquisitions, and the role of real options in the acquisition behavior of European non-tech firms. Analyzing 39,009 M&A transactions by listed European firms over the period 2001–2020, we find that non-tech firms actively managing their real option portfolios are more likely to engage in technology-motivated acquisitions. Furthermore, our findings indicate that such acquisitions lead to an increase in firms' real option intensity. These results are robust across several sensitivity tests.

Our study has important managerial implications. *First*, non-tech firms can enhance their real option intensity (RI) by investing in technology-driven business models outside their core business areas. Notably, this positive effect typically outweighs potential challenges related to post-merger integration of acquired technologies. Our findings are consistent with a "transformational role" view of technology-motivated acquisitions, where non-tech firms leveraging active RI management can further strengthen their real option intensity through these deals. To realize this potential, non-tech firms should re-think their capital allocation process. Specifically, it is important to not only feed the existing businesses, but also invest in –from the perspective of the non-tech firm– "unexplored territory". However, to be successful in this endeavor, the firm must develop organizational capabilities that enable them to:

(i) systematically monitor technological trends and advancements,
(ii) adapt their strategic direction in response to such developments,
(iii) proactively identify and evaluate market opportunities,
(iv) effectively negotiate with target firms that may have distinct corporate cultures, and
(v) successfully close these deals and integrate the targets to align with their corporate strategy.

Second, firms seeking to access externally developed technology through technology-motivated acquisitions should carefully manage their capital structure. Research by McConnell and Servaes (1995) highlights a negative relationship between leverage and firm value for growth-oriented firms. Similarly, our findings show that high leverage (a) reduces the likelihood of engaging in technology-motivated acquisitions and (b) weakens the positive relationship between a firm's real option portfolio and its propensity to pursue such acquisitions. These results underscore the importance of maintaining financial flexibility to enable firms to undertake transformational strategies effectively (Fischer et al., 2024).

Third, the dictionary developed in this study offers a practical tool for both practitioners and researchers to identify technology-motivated acquisitions. By adopting a holistic perspective, the dictionary consolidates insights from (i) academic literature, (ii) publicly available technology-related lists, and (iii) practitioner input, making it a valuable resource for facilitating target identification.

Lastly it is essential to acknowledge the limitations of the textual analysis approach used in this study. First, the dictionary employed is inherently idiosyncratic. Since it forms the basis for deal classification, alternative dictionaries may yield different classifications and potentially different results. Second, our analysis relies on deal summaries provided by the data source used in this study (Refinitiv, now part of LSEG). Future research could extend this approach by incorporating other sources of information, such as corporate announcements, earnings calls, analyst reports, or media coverage, to improve deal classification and analysis.

Table 7: Variable definitions

Notes: This table provides definitions for variables on firm-level (Panel A), deal-level (Panel B) and country-level (Panel C). Firm level and deal level data is downloaded from Refinitiv. Country level data is drawn from OECD, World Bank, and the European Central Bank

VARIABLES	DEFINITION
Panel A: Firm level variables	
Real Option Intensity (RI)	Defined as in Lee et al. (2018), real option intensity (β) represents the sensitivity of stock returns to changes in stock return volatility based on the following equation: $r_{(i,t)} - r_{(f,t)} = a_t + \beta \Delta Volatility_{(i,t)} + \gamma \eta_{(i,t)} + \sum \delta X_{(i,t)} + \varepsilon_{(i,t)}$, with $r_{(i,t)} - r_{(f,t)}$ defined as weekly excess return, $\Delta Volatility_{(i,t)}$ as the difference in standard deviation of daily stock returns between week t and week t–1 for firm i. The term $\eta_{(i,t)}$ represents the market factor loading estimated with daily information in a given month for firm i and $X_{(i,t)}$ as a vector of firm characteristics known at the beginning of a given week for firm i, which include: ln(1+Book Equity/ Market Equity), ln(1+Market Equity), six week lagged return, and weekly trading volume per number of shares.
$Size_{(t-1)}$	Logarithm of (1+ total assets).
$Leverage_{(t-1)}$	Book value of total debt divided by total assets.
$Cash\ Flow_{(t-1)}$	Earnings after interests, dividends, and taxes before depreciation divided by total assets.
$Tobin´s\ Q_{(t-1)}$	Market value of assets divided by the book value of assets. The market value of assets is defined as the book value of assets minus the book value of equity plus the market value of equity.
$Payout_{(t-1)}$	Dummy variable equal to one if the firm pays dividends in the corresponding period.
$Negative\ Net\ Income_{(t-1)}$	Dummy variable equal to one if net income is negative in the corresponding period.
$Capex_{(t-1)}$	Capital expenditures divided by total assets.
$lnR\&D_{(t-1)}$	Logarithm of (1+research and development expenses).
$Book\text{-}to\text{-}Market_{(t-1)}$	Logarithm of (1+total shareholders' equity divided by the market value of equity).
$Long\ Term\ Leverage_{(t-1)}$	Long-term debt divided by total assets.
$Diversification_{(t-1)}$	Logarithm of (1+ number of business segments).
$Trading\ Volume_{(t-1)}$	Yearly average trading volume divided by the number of shares.
$Firm\ Age_{(t-1)}$	Logarithm of (1+firm age).
$Cash\ Flow\ Volatility_{(t-1)}$	The standard deviation of cash flow calculated as the firm–year standard deviation of cash flow for the previous five years (minimum three years).
$Cash\ Holdings_{(t-1)}$	Cash and short-term investments divided by total assets.
$Tangibility_{(t-1)}$	Net property, plant and equipment divided by total assets.
$Closely\ Held\ Shares_{(t-1)}$	Logarithm of (1+closely held shares).
$Deal\ Experience_{(t-1)}$	Moving sum of deals conducted by a firm in the three preceding years.
Panel B: Deal level variables	
M&A Deal	Dummy variable equal to one if the firm engages in an M&A deal.
TMA	Dummy variable equal to one if the firm engages in a TMA deal.
Cross Border Deal	Dummy variable equal to one if the firm performs a cross border M&A deal.
Cash Deal	Dummy variable equal to one if the firm performs a (100%) cash deal.
Private Target	Dummy variable equal to one if the target firm is private.
Deal Value Disclosure	Dummy variable equal to one if the deal value of the corresponding M&A deal is disclosed.
Panel C: Country level variables	
$Loan\ Spread_{(t-1)}$	Lending margins for new business loans (from European Central Bank). Missing countries were replaced by available corresponding data from the World Bank. Missing country year observations were replaced by the closest available year observation in the respective country.
$ln(GDP\ p.c.)_{(t-3)}$	Logarithm of the gross domestic product in constant 2015 U.S. dollars divided by the total population.

References

Anand, J., Oriani, R., & Vassolo, R. S. (2007). Managing a portfolio of real options. *Advances in Strategic Management* 24, 275–303.

A.T Kearney (2019). *Industrial Executive M&A Report 2019*.

Aybar, B., & Ficici, A. (2009). Cross-border acquisitions and firm value: An analysis of emerging-market multinationals. *Journal of International Business Studies 40*, 1317–1338.

Barkema, H. G., & Vermeulen, F. (1998). International expansion through start-up or acquisition: A learning perspective. *Academy of Management Journal 41*, 7–26.

Bauguess, S., & Stegemoller, M. (2008). Protective governance choices and the value of acquisition activity. *Journal of Corporate Finance 14*, 550–566.

BCG. (2017). *The 2017 M&A Report: The Technology Takeover*. Boston Consulting Group Report.

Bonaccorsi, A., Chiarello, F., Fantoni, G., & Kammering, H. (2020). Emerging technologies and industrial leadership: A Wikipedia-based strategic analysis of Industry 4.0. *Expert Systems with Applications 160*, 113645.

Calipha, R., Tarba, S., & Brock, D. (2010). Mergers and acquisitions: A review of phases, motives, and success factors. *Advances in Mergers and Acquisitions*, 1–24.

Canace, T. G., & Mann, S. V. (2014). The impact of technology-motivated M&A and joint ventures on the value of IT and non-IT firms: A new examination. *Review of Quantitative Finance and Accounting 43*, 333–366.

Caprio, L., Croci, E., & Del Giudice, A. (2011). Ownership structure, family control, and acquisition decisions. *Journal of Corporate Finance 17*, 1636–1657.

Chen, W., & Srinivasan, S. (2019). Going digital: Implications for firm value and performance. *Harvard Business School Working Paper*, 1–56.

Cheng, Y. (2016). *Investigating the role of real option in merger and acquisition* (Doctoral dissertation, The Hong Kong Polytechnic University).

Christensen, C. M., Alton, R., Rising, C., & Waldeck, A. (2011). The new M&A playbook. *Harvard Business Review*, 1–11.

DLA Piper. (2020). *Acquisition of External Businesses*.

Fernandes, N. (2019). *The Value Killers: How Mergers and Acquisitions Cost Companies Billions—And How to Prevent It*. Palgrave Macmillan.

Fischer, L., Rapp, M. S., & Roser, M. (2024). EU-Taxonomie, CO2-Emissionen und Transformationspotential: Eine Untersuchung der Prime Standard Unternehmen. *Corporate Finance*, CF1462801.

Frey, R., & Hussinger, K. (2006). The role of technology in M&As: A firm-level comparison of cross-border and domestic deals. *Deutsche Bundesbank – Discussion Paper Series 1: Economic Studies*, 45.

Gaffney, N., Karst, R., & Clampit, J. (2016). Emerging market MNE cross-border acquisition equity participation: The role of economic and knowledge distance. *International Business Review 25*, 267–275.

Galindo-Rueda, F., & Verger, F. (2016). OECD taxonomy of economic activities based on R&D intensity. *OECD Science, Technology and Industry Working Papers*.

Garcia de Lomana, G., Strese, S., & Brickmann, J. (2019). Adjusting to the digital age: The effects of TMT characteristics on the digital orientation of firms. In *Academy of Management Annual Meeting 2019*, 1–40.

Gentzkow, M., Kelly, B., & Taddy, M. (2019). Text as data. *Journal of Economic Literature 57*, 535–574.

Grimpe, C., & Hussinger, K. (2008). Market and technology access through firm acquisitions: Be-

yond one size fits all. *Centre for European Economic Research – Discussion Paper*, 037.
Grullon, G., Lyandres, E., & Zhdanov, A. (2012). Real options, volatility, and stock returns. *Journal of Finance 67*, 1499–1537.
Hanelt, A., Firk, S., Hildebrandt, B., & Kolbe, L. M. (2021). Digital M&A, digital innovation, and firm performance: An empirical investigation. *European Journal of Information Systems 30*, 3–26.
Hanauer, M. X. (2014). *Risk factors and capital market anomalies* (Doctoral dissertation). Technische Universität München.
Harford, J., Klasa, S., & Walcott, N. (2009). Do firms have leverage targets? Evidence from acquisitions. *Journal of Financial Economics 93*, 1–14.
Ihamuotila, M., Liljeblom, E., & Maury, B. (2021). High-tech acquisitions by low-tech firms: Does acquirer experience count? *Nordic Journal of Business 70*, 163–183.
Joung, J., & Kim, K. (2017). Monitoring emerging technologies for technology planning using technical keyword-based analysis from patent data. *Technological Forecasting and Social Change 114*, 281–292.
Kindermann, B., Beutel, S., Garcia de Lomana, G., Strese, S., Bendig, D., & Brettel, M. (2020). Digital orientation: Conceptualization and operationalization of a new strategic orientation. *European Management Journal 39*, 645–657.
Khorana, A., Shivdasani, A., Wang, C., Zhong, G., & Hein, P. (2018). Disrupters at the gate: Strategic M&A for managing disruptive innovation. *Citi GPS: Global Perspectives & Solutions*, 12–26.
Klasa, S., Maxwell, W. F., & Ortiz-Molina, H. (2009). The strategic use of corporate cash holdings in collective bargaining with labor unions. *Journal of Financial Economics 92*, 421–442.
Kohers, N., & Kohers, T. (2019). The value creation potential of high-tech mergers. *Financial Analysts Journal 56*, 40–50.
Krueger, D., & Kumar, K. B. (2004). US–Europe differences in technology-driven growth: Quantifying the role of education. *Journal of Monetary Economics 51*, 161–190.
Lee, J. M., Park, J. C., & Folta, T. B. (2018). CEO career horizon, corporate governance, and real options: The role of economic short-termism. *Strategic Management Journal 39*, 2703–2725.
Loughran, T., & McDonald, B. (2016). Textual analysis in accounting and finance: A survey. *Journal of Accounting Research 54*, 1187–1230.
Martynova, M., & Renneboog, L. (2011). The performance of the European market for corporate control: Evidence from the fifth takeover wave. *European Financial Management 17*, 208–259.
McConnell, J. J., & Servaes, H. (1995). Equity ownership and the two faces of debt. *Journal of Financial Economics 39*, 131–157.
McGrath, R. G., & Nerkar, A. (2004). Real options reasoning and a new look at the R&D investment strategies of pharmaceutical firms. *Strategic Management Journal 25*, 1–21.
Merrick, A. (2015). Why words are the new numbers. *Chicago Booth Review*. Accessed May 9, 2022.
Morck, R., Shleifer, A., & Vishny, R. W. (1990). Do managerial objectives drive bad acquisitions? *Journal of Finance 45*, 31–48.
Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics 5*, 147–175.
Pennebaker, J. W., Boyd, R., Jordan, K., & Blackburn, K. (2015). The development and psychometric properties of LIWC2015. *University of Texas at Austin*.
Presutti, M., Boari, C., & Fratocchi, L. (2006). Knowledge acquisition and the foreign development of high-tech start-ups: A social capital approach. *International Business Review 16*, 23–46.
Rapp, M. S., Schmid, T., & Urban, D. (2014). The value of financial flexibility and corporate financial policy. *Journal of Corporate Finance 29*, 288–302.
Rossi, M., Tarba, S. Y., & Raviv, A. (2013). Mergers and acquisitions in the high-tech industry: A

literature review. *International Journal of Organizational Analysis 21*, 66–82.
Rückert, D., Weiss, C., & Revoltella, D. (2020). Adoption of digital technologies by firms in Europe and the US: Evidence from the EIB Investment Survey. *VoxEU Column*, 18 March 2020.
Schnabel, I. (2024). From laggard to leader? Closing the euro area's technology gap. *Inaugural lecture of the EMU Lab, European University Institute*, Florence, 16 February 2024.
Smit, S., Tyreman, M., Mischke, J., Ernst, P., Hazan, E., Novak, J., Hieronimus, S., & Dagorret, G. (2022). *Securing Europe's Competitiveness: Addressing Its Technology Gap*. McKinsey Global Institute Report, 22 September 2022.
Trigeorgis, L., & Reuer, J. (2017). Real option theory in strategic management. *Strategic Management Journal 38*, 42–63.
Ulrich, C. (2013). Valuation of IT investments using real option theory. *Business & Information Systems Engineering 5*, 331–341.
Wikipedia. (2022). Creative destruction. *Wikipedia Archive*. Accessed May 9, 2022.
Wei, C., Hu, S., & Chen, F. (2020). Do political connection disruptions increase labor costs in a government-dominated market? *Journal of Corporate Finance 62*, 101554.
Xie, X., Zou, H., & Qi, G. (2018). Knowledge absorptive capacity and innovation performance in high-tech companies: A multi-mediating analysis. *Journal of Business Research 88*, 289–297.

Appendix 1. Dictionary of tech-terms

Our aim is to identify tech-motivated deals. Therefore, we draw on the method of textual analysis and conduct the deal-classification using a dictionary-based approach. Specifically, we proceed in three main steps. *First*, we construct a dictionary of tech-terms, i.e., dictionary of terms characterizing (emerging) technologies. The dictionary aggregates terms from

- > academic literature (Chen and Srinivasan, 2019; Garcia de Lomana et al., 2019; Hanelt et al., 2021; Kindermann et al., 2020),
- > publicly available technology related lists (following Bonaccorsi et al., 2020; Joung and Kim, 2017), namely the annual MIT list of *10 Breakthrough Technologies*, Wiki lists on *Emerging Technologies*, Gardner's *Top 10 Strategic Technology Trends*, and Scientific American's *Top 10 emerging technologies,* and
- > suggestions from business experts.

Each keyword in the dictionary is transferred to lowercase, word endings are adjusted to allow for multiple word forms, and connotations and other notations are added whenever appropriate. Resulting in a dictionary containing 759 unique keywords which can be allocated to three main categories – *digital, product and process improvement,* and *environment* as provided in the following table.

Second, we construct a *deal summary* for each identified deal. The *deal summary* provides the text to classify the transaction as tech-motivated. Relying on all relevant transaction information disclosed by SCD, we aggregate all textual information contained in in the variables "Target Business Description" and "Deal Synopsis". In addition, we remove company names as a precautionary measure. Any acquirer that includes, i.e., "software" in its company name could potentially lead to misclassification of the deal and is therefore removed.

Third, using the Linguistic Inquiry and Word Count (LIWC) from Pennebaker et al. (2015), we analyze the deal summaries and classify a transaction as a tech-motivated deal in case the summary includes at least one of the tech-related terms from the dictionary of tech-terms.

Appendix A: Dictionary of tech-terms

This table represents all used keywords of our dictionary, grouped into three main categories – digital, product and process improvement, and environment. Double listings between categories can occur. * indicates different ending.

DIGITAL						
3d displa*	autonomous car*	cpp/gmr	expressive augmentation	internet of nanothings	physical internet	social media computing
3-d displa*	autonomous rail rapid transit	crash-proof code	eyetap	internet of things	platform	social robot*
3d optical data storage	autonomous thing	crowdfunding	ferro liquid displa*	internet of things platform	practical blockchain	social tv
3-d optical data storage	autonomous vehicle*	cryptocurrenc*	ferroelectric ram	invisible analytic*	practical quantum computer*	software
3d print*	avoid drone*	cybermethodolog*	field emission displa*	iot	predictive analytic*	software-defined anything
3-d print*	babel-fish earbud	cybersecurity mesh	fjg	laser displa*	programmable metallization cell	software-defined application*
3d xpoint	baxter	data analytic*	flexible displa*	laser video displa*	project loon	software-defined infrastructure*
4g cellular communication*	bayesian machine learning	data as a service	four-dimensional printing	li-fi	qarnot	software-defined networking
5g	bi-directional	data product	free-space displa*	m2m	quantified self	software-defined radio
5g wireless	big data	data-based insurance	gastrobot*	maas	quantum computer*	sonos
5g cellular communication*	biometric*	deep learning	general purpose computing	machine augmented cognition	quantum computing	spatial computing
6g cellular communication*	bionic contact lens*	device mesh	general-purpose computing	machine to machine	quantum dot	speech recognition
actionable analytic*	blockchain	differential privacy	gestural interface*	machine translation	quantum dot displa*	stasis chamber*
adaptive security architecture	body-adapted wearable electronic*	diffusion tensor imaging	gesture recognition	machine vision	racetrack memory	strategic big data
advanced analytic*	botnets of things	digital	google glass*	magic leap	reality mining	subvocal recognition
advanced food tracking	bpm	digital ethic*	gyrnoid	magnetoresistive random-access memory	real-time search	surface-conduction electron-emitter display
advanced machine learning	brain-computer interface*	digital genome	hamr	mamr	reinforcement learning	swarm robotic*
advanced system architecture	brain-reading	digital imaging	hi mems	mesh app	robot dexterity	taas
agricultural drone*	business analytics	digital medicine	high altitude platform*	micro mobility	robotic surgery	tdmr
agricultural robot*	business intelligence	digital money	high energy density power system*	millipede memory	robotic*	telescopic pixel displa*
agricultural robotic*	capable digital helper	digital privacy	holograph*	mobile 3-d	rram	temporary social media
ai	car-to-car communication*	digital scent technology	holographic data storage	mobile app*	scooter-sharing system	tesla autopilot
ai engineering	cbram	digital technology platform	home energy system	mobile collaboration	screenless displa*	tiny ai
ai foundation	cell-phone virus	digital twin*	hosted virtual desktop	mobile device	self driving system*	t-ram
ai security	civic technolog*	distributed cloud	html5	mobility on demand	self-driving car*	ttram
ai-discovered molecule	claytronic	distributed ledger technolog*	hybrid cloud	multimodal contactless biometric face system	self-driving truck*	ubiquitous computing

ai-driven development	client architecture	distributed storage	hyperautomation*	multimodal contactless biometric iris system	self-reconfiguring modular robot*	ultraprivate smartphone*
ai-led molecular design	client computing	dna app store	immersive virtual reality	multi-primary color displa*	semantic web	unhackable internet
airborne network	cloud architecture	dna data storage	in memory computing	natural language processing	sense and avoid drone*	universal authentication
ambient intelligence	cloud computing	dna digital data storage	information oriented software development	neural-sensing headset	serverless computing	vehicle on demand
ambient user experience*	cloud program-ming	driverless car*	intelligent analytic*	nram	skyrmion	virtual appliance
android	cloud streaming	drone displa*	intelligent app	nvsram	smart grid	virtual patient
answer machine*	cloud to the edge	drone*	intelligent apparel	oculus rift	smart machine*	virtual reality
anywhere ope-ration*	computer-generated imagery	dueling neural network	intelligent composable business	oled displa*	smart space*	virtual retinal displa*
apple pay	computing everywhere	e-learning	intelligent software assistant	open ai ecosystem	smart speaker	volumetric displa*
artificial general intelligence	connected service	emergent artificial intelligence	intelligent thing	optical computing	smart transformer	wearable computer
artificial intelligence	continuous adaptive risk	emerging magnetic data storage technolog*	interferometric modulator displa*	personal cloud	smart watch*	web app*
augumented analytic*	continuous adaptive trust	empowered edge	internet of behavior	pervasive analytic*	smart wind	web-scale it
augumented reality	conversational interface*	e-textile	internet of behaviour	pervasive wireless	smarter fertilizer	wireless communication
automation	conversational platform*	event driven	internet of dna	phase-change memory	smooth-talking ai assistant*	x-ray communication
autonomous agent	conversational system*	exascale computing	internet of everything	photonic computing	smr	z-ram
PRODUCT AND PROCESS IMPROVEMENT						
$100 genome	carbon nanotube field-effect transistor	fullerene	lightweight small arms technology program	nanowire lithium-ion batter*	quantum computing	stretchable silicon
2d material*	caseless ammunition	fusion rocket	liquid batter*	nantenna	quantum cryptograph*	superalloy
2-d material*	cbram	galileo	liquid biopsies	navigation doppler lidar	quantum dot	supercharged photosynthesis
3d displa*	cellulolytic enzyme	gastrobot*	liquid biopsy	neuroinformatic*	quantum dot displa*	supergrid*
3-d displa*	charging infrastructure	gene drive	lithium iron phosphate batter*	neuromorphic chip	quantum radar	super-plastic alloy
3d metal print*	charging service	gene editing	lithium-air batter*	neuromorphic engineering	quantum sensing	supersonic transport*
3-d metal print*	circula economy	gene therapy 2.0	lithium-ion batter*	neuromorphic technolog*	quantum supre-macy	surface-conduction electron-emitter display
3d print*	circular material usage	generation iv reactor	lithium-sulfur batter*	neuron control	quantum wire	suspended animation*
3-d print*	cloak of invisibility	genetic engineering	litracon	neuronal-sensing headset	racetrack memor*	synthetic biolog*
3d printing material	cloaking device	genetic fortune-telling	logistics on demand	neuroprosthetic*	racetrack memory	synthetic cell*
3-d printing material	cognitive radio	genetically modified food	lower- carbon cement	new-wave nuclear power	radio-frequency identification	synthetic diamond
3d transistor	collaboration technolog*	genome editing	m2m	next gerneration batter*	reality mining	synthetic genomic*
3-d transistor	collaborative telepresence	genomic vaccine*	maas	next-generation robotic*	regenerative medicine	systems metabolic engineering
3d xpoint	comparative interactomic	global navigation satellite system	maglev train	non-rocket spacelaunch	remanufacturing	tdmr

adaptive compliant wing*	conductive polymer*	graphene	magnesium batter*	nootropic	remote manufacturing	telescoped ammunition
additive manufacturing	connectomic*	graphene transistor	magnetic levitation	nram	remote sensing	telescopic pixel displa*
advanced food packaging	construction 3d print*	graphic processing unit*	magnetic nanoparticle	nuclear launch cannon	resveratrol	temporary social media
aerogel	context-rich system*	gravity batter*	magnetic refrigeration	nuclear photonic rocket*	reusable launch system*	thermal copper pillar bump
aeroscraft	counterparty technolog*	ground effect train	magnetic-resonance force microscopy	nuclear pulse propulsion	reusable rocket	thick-film dielectric electroluminescent technolog*
agile robot*	cpp/gmr	gynoid	magnetoresistive random-access memory	nuclear reprogramming	reversing paralysis	three-dimensional integrated circuit
agricultural drone*	crower six stroke engine*	gyrnoid	magnetorheological fluid*	nuclear fusion power	risk-based securit*	time crystal
agricultural robot*	cryogenic treatment	ha batter*	magnonic	nvsram	risk-based self-protection	time-multiplexed optical shutter
agricultural robotic*	cryonic	hamr	mahem	offline web application*	rna-based therapeutic*	tiny ai
airborne laser	cryoprotectant	hashcache	male contraception	oled	rnai interference	tissue engineering
airless tire	cultured meat	head transplant	mamr	oled displa*	robot dexterity	traceabilit*
alcubierre drive	custom cancer vaccine	hi mems	mass driver	olev	robotic surgery	t-ram
americium batter*	de-extinction	hibernation animation*	material quantum leap	omni processor	robotic*	trans-cranial neural characterisation
amorphous metal	democratization	high-speed material discover*	meat incubator	oncolytic virus	rram	trans-cranial neural characterization
ampakine	directed energy weapon	high-temperature superconductivity	megascaledesalination*	online electric vehicle*	safer nuclear reactor	trans-cranial neural sensing
answer machine*	disordered protein*	high-temperature superfluidity	memory implant*	optical transistor	satellite mega-constellation	translucent concrete
anti-aging drug*	distributed manufacturing	homomorphic encryption	memristor	optogenetic*	scramjet	traveling-wave reactor
anti-gravity	distributed storage	hoverbike	metabolic engineering	orbital rocket	sds	t-ray
antimatter weapon*	domed city	hovertrain	metabolomic*	organic electronic*	sds kit	tricorder
arcology	driverless car*	human augmentation	metal foam	organic light-emitting diode	sector coupling	ttram
artificial brain	drone displa*	human cell atlas	metal insulator metal chip	organic light-emitting transistor	sector storage	tweel
artificial embryo*	drone*	human dna vaccination	metamaterial cloaking	organs-on-chip*	self-healing material*	twistronic*
artificial gravity	dual-action antibod*	human microbiome therapeutic*	metamaterial*	orion nuclear starship	senolytic*	ultra high definition television
artificial intelligence	dynamic armor	hvd	micro air vehicle*	paper diagnostic*	sense and avoid drone*	ultracapacitor*
artificial photosynthesis	egg stem cell*	hybrid forensic*	microfluidic optical fiber	particle beam weapon*	sense drone*	ultra-high-definition television
artificial uterus	electric double-layer capacitor	hydrogen economy	microfluidic*	particle-beam weapon*	sensing city	universal authentication
asteroid mining	electro hydrodynamic propulsion	hyperautomation*	microneedle*	personal aircraft	separating chromosome*	universal memory
atmospheric carbon dioxide removal	electroceutical	hypercapacitor	microscale 3-d printing	personal rapid transit	service architecture*	universal translation
atomic magnetometer	electroencephalograph*	hypereutectic alloy	millipede memory	personalised medicine	silicene	unmanned vehicle*
atomtronic	electrolaser	hyperloop*	mim chip	personalized medicine	silicon photonic*	utility fog
automatic visual insepction of aircraft	electromagnetic weapon	hyper-personalized medicine	miniaturized satellite	phage therap*	silicon–air batter*	vactrain

automation	electronic nose	hypersonic cruise missile	mobility solution*	phase-change memory	single-cell analysis	vehicle on demand
autonomous agent	electronic textile*	hypertelescope	modeling surprise	phased array optic*	skyrmion	vehicular communication system
autonomous car*	electrothermal-chemical technolog*	immersive experience	molecular assembler	phased-array optic*	slack	vertical farming
autonomous rail rapid transit	emerging magnetic data storage technolog*	immune engineering	molecular electronic*	photon rocket	smr	vertical landing
autonomous thing	engineered negligible senescence	immuno oncology	molecular nanotechnolog*	photonic laser thruster	social commerce	vertical take-off
autonomous vehicle*	engineered stem cell*	immunotherap*	molten salt batter*	picotechnolog*	social indexing	vertical take-off and landing
avoid drone*	enhanced education technolog*	implantable drug-making cell*	molten salt reactor	plantibod*	social robot*	virotherap*
backpack helicopter	enzybiotic*	implantabl electronic*	multi function structure*	plasma propulsion engine*	social tv	virtual retinal displa*
bacterial factor*	epigenetic*	in memory computing	multiexperience*	plasma weapon	solarcity's gigafactor*	vitrification*
battery swapping	e-textile	in vitro meat	multimodal contactless biometric face system	plasmonic material*	solid-state batter*	volumetric displa*
baxter	exocortex	inflatable space habitat	multimodal contactless biometric iris system	power grid control	solid-state drive	vortex engine
bead washing machine	exocortice	interferometric modulator displa*	multi-primary color displa*	powered exoskeleton	solid-state transformer	vortex ring gun
beam-powered propulsion	femtotechnolog*	invisible revolution	nano-architecture	precise genetic engineering technique*	sonic weapon*	v-tex
bi-directional	ferro liquid displa*	ion drive	nanobiomechanic*	precise genetic-engineering technique*	sonogenetic*	vtol
biomechatronic*	ferroelectric ram	ion thruster	nanoelectrome-chanical system*	precision agriculture	sonos	web app*
biosomatic cellular engineering	field emission displa*	isolated brain	nanofiber	precision-guided firearm	space elevator	web-scale it
biotechnolog*	fjg	jet pack	nanohealing	precooled jet engine*	space fountain	whole-genome synthesis
body implant*	flexible electronic*	lab-grown meat	nanomaterial*	predicting preemie	space gun	wireless communication
bpm	flexible wing*	lab-on-a-chip	nanomedicine	prenatal dna sequencing	spaceplane*	wireless energy transfer
brain mapping	float to orbit	laser displa*	nanopiezo-electronic*	presicion farming	special purpose vehicle *	wireless long-range electric shock weapon
brain organoid	fluidic flight control	laser video displa*	nanopore sequencing	privacy-enhancing computation	spintronic*	witricit*
brain-computer interface*	flying car*	laser weapon	nanoradio	probabilistic chip	spv	x-53 active aeroelastic wing*
cancer genomic	force field	launch loop	nanorobotic*	programmable matter	srt1720	z-ram
carbon management	four-dimensional printing	led lamp	nanoscale engineering	programmable metallization cell	starchip*	
carbon dioxide catcher	fourth-generation optical disc*	life extension	nanosensor*	propellant depot	starshot*	
carbon dioxide compensation	fourth-generation reactor*	lightcraft*	nanostructured carbon composite	prosthesis	stasis chamber*	

carbon dioxide conversion	free-space displa*	light-field photography	nanowire	pulse detonation engine	stealth technolog*	
carbon nanotube	full genome sequencing	light-trapping photovoltaic*	nanowire batter*	pure fusion weapon	stem cell treatment	
ENVIRONMENT						
airborne wind turbine	climate change attribution	e-fuel*	fuel-cell vehicle*	home fuel cell	solar fuel*	ultra-efficient solar
alternative fuel vehicle*	closed ecological system*	electric aviation	fusion power	hot solar cell	solar microgrid*	wireless power
bio fuel*	co2 compensation	electric car*	green bullet*	nanocharging solar	solar power	zero-carbon natural gas
biofuel*	co2 conversion	energy harvesting	green concrete	ocean thermal energy conversion	solar roadway	zero-energy building
biological machine	concentrated solar power	energy-efficient water purification	green energy	perovskite solar cell*	solar sail	
biomechatronic*	csp concentrated solar power	enviromatic*	green hydrogen	photovoltaic*	solar gravita-tional lens	
bioplastic*	cst concentrated solar thermal	environmental design	grid energy storage	recyclable thermo-set plastic*	space-based solar power	
bio-print*	decarbonisation	flywheel energy storage	grid-scale electri-city storage	recycling	sun-powered chemistr*	
biotechnolog*	efuel*	fuel cell vehicle*	home energy system	smart wind	thorium fuel cycle	

Aims and Scope

The Nordic Journal of Business is a scholarly journal that publishes original scientific research in all fields of business studies. Different aspects of business theory and practice related, among others, to accounting, corporate governance, entrepreneurship, finance, information systems, international business, management, and marketing are within the scope of the Journal.

The Nordic Journal of Business welcomes submissions of high-quality empirical and theoretical papers that contribute to knowledge of business theory and practice. The Journal is primarily interested in contributions based on the foundational disciplines of business studies, but we also encourage creative approaches and multidisciplinary research that reflects the intricate real- life relationships between functional areas of business. While the Journal provides an international forum for business research, submissions that focus on Nordic research problems or use data from Denmark, Finland, Iceland, Norway, and Sweden are particularly encouraged.

Editorial Policy

The Nordic Journal of Business features:
- Empirical and theoretical research articles
- Survey and review articles
- Research notes

The core of the Journal comprises empirical and theoretical research articles. Comprehensive survey and review articles as well as short research notes will also be considered for publication. The Journal regularly publishes special issues that focus on specific research topics. All submissions are subject to initial editorial screening and are subsequently double-blind refereed by two reviewers who are recognized experts in the field of the manuscript.

About the Journal

The Nordic Journal of Business is an open access journal published four times a year by the Association of Business Schools Finland. The Journal was founded in 1952 and was formerly known as the Finnish Journal of Business Economics. Its audience includes scholars and researchers at universities and business schools, as well as executives and other practitioners interested in the application of research to practical business decisions.

Instructions for Authors and Style Guidelines

The Nordic Journal of Business (NJB) is a scholarly journal that publishes original scientific research in all fields of business studies. The Journal welcomes submissions of empirical and theoretical papers that contribute to knowledge of business theory and practice. All submissions are subject to initial editorial screening and are subsequently double-blind refereed by two reviewers who are experts in the field of the manuscript.

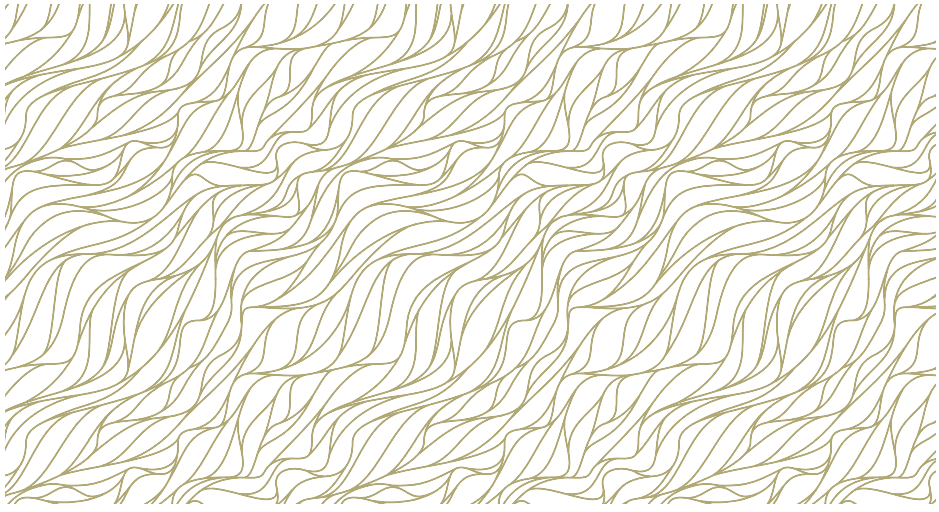
NJB publishes (i) empirical and theoretical research articles, (ii) survey and review articles, and (iii) research notes.

Research articles communicate original scientific research. All submitted research articles are subjected to a double-blind peer-review process. The maximum length of research articles is 10,000 words and double-spaced manuscripts should not exceed 50 pages including the abstract, main text, references, tables, and figures. Survey and review articles are peer-reviewed communications which aim to analyze, synthesize, and summarize recent research topics and themes. The maximum length of survey and review articles is 8,000 words and double-spaced manuscripts should not exceed 40 pages including the abstract, main text, references, tables, and figures.

Research notes are short and concise communications of original scientific research. All submitted research notes are subjected to an expedited double-blind peer-review process after which the manuscripts are accepted as is, conditionally accepted with minor changes, or rejected.

The maximum length of research notes is 2,000 words and double-spaced manuscripts should not exceed 12 pages including the abstract, main text, references, tables, and figures.

1) Submissions to the Nordic Journal of Business should be sent as a PDF or Word file by e-mail to editor@njb.fi
2) There is no submission fee.
3) Manuscripts must be written in English.



4) Manuscripts should be double-spaced with wide margins and 12-pt font size.
5) The title page should contain (i) the title of the manuscript, (ii) author names, professional titles, and institutional affiliations, (iii) an abstract of less than 150 words, and (iv) postal and e-mail addresses of the authors and full contact information for the corresponding author. The title page should be submitted as a separate PDF or Word file.
6) The first page of the manuscript should contain (i) the title and (ii) an abstract of less than 150 words and should not contain any author information in order to ensure anonymity during the peer-review process.
7) The title of the manuscript should be concise and informative.
8) The abstract should contain less than 150 words. The abstract should concisely explain the purpose of the paper and summarize the main findings and conclusions. The abstract should be able to stand alone.
9) The main text of the manuscript should be divided into clearly defined sections and subsections which should be numbered consecutively throughout the manuscript. It is advisable to keep the structure of the manuscript as simple as possible.
10) References should be arranged in alphabetical order. When necessary, references to publications by the same author(s) should be arranged chronologically and multiple references to the same author(s) in the same year must be identified with lower-case letters after the year of publication (e.g., 2015a, 2015b etc.).
11) The reference style used by the Nordic Journal of Business is the following:
    (i) Articles in periodicals:
    Last name of the author, first name(s) or initials (year of publication). Title of the article. *Name of the Journal* volume number: issue number, page numbers.
    Keloharju, M., Knüpfer, S., & Rantapuska, E. (2012). Mutual fund and share ownership in Finland. *Finnish Journal of Business Economics* 61:2, 178–198.
    (ii)Books:
    Last name of the author, first name(s) or initials (year of publication). *Title of the book.* Edition. Publisher.
    Wooldridge, J.M. (2010). *Econometric Analysis of Cross Section and Panel Data*. 2nd Edition. The MIT Press.
    ISSN 2342-9003 (print),
    ISSN 2342-9011 (online)

The Nordic Journal of Business is an open access journal published four times a year by the Association of Business Schools Finland. The Journal's audience includes scholars and researchers at universities and business schools, as well as executives and other practitioners interested in the application of research to practical business decisions.

Editorial correspondence: The Association of Business Schools Finland, Mr. Juuso Leivonen, Pohjoinen Makasiinikatu 7 A 2 00130 Helsinki, Finland.

E-mail: editor@njb.fi
http://www.njb.fi