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Where are the zombie companies?

*Analysis of zombie companies in France, Germany, and
Switzerland*

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Abstract

By using firm-level data of public and private companies in France, Germany, and Switzerland from 2011 to 2019 and applying two different sets of criteria, we identify zombie companies accordingly. We define zombie companies as mature companies with a persistent lack of profitability, poor expected future profits, and companies that do not exit the market although they are expected to do so. By applying a stricter definition for zombies than the prevailing literature, we find an almost non-existing level of zombification in the public data set of below 1% without any clear increasing trend over time. In our private data set, we find a higher level of zombification of 1% to 4% and a slightly increasing trend. The higher prevalence of private zombie companies is primarily driven by the modified and less strict definition of a zombie company that we apply due to lower firm-level data availability.

Keywords: zombie companies, bankruptcy

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List of Abbreviations

CapEx	Capital expenditure
CF.....	Cashflow
EBIT	Earnings before interest and taxes
EBITDA.....	Earnings before interest, taxes, depreciation, and amortization
ICR.....	Interest coverage ratio
ICT.....	Information and communication technologies
ND.....	Net debt
OECD.....	Organisation for Economic Co-operation and Development
P/B.....	Price to book ratio
ROA.....	Return on assets
SME.....	Small and medium sized enterprises

1. Introduction and main findings

The immense progress in the last decades in the information and communication technologies sector (ICT) improved the healthcare of a better than ever educated workforce and increased the participation and integration of companies in the global value chains (Peña-López (2017), Jack & Lewis (2009), Gouveia & Osterhold (2018)). Although these advancements can be seen everywhere, they do not manifest themselves in the productivity growth of OECD economies according to Solow (1987). On the contrary, the slowdown in productivity growth over the past decade led to several research efforts trying to explain the "productivity paradox". Adler et. al. (2017) argue that mismeasurement of productivity in the digital economy only plays a limited role and that structural headwinds such as the slowing global trade, the fading ICT revolution, and the aging workforce can better help explain the slowing productivity growth. Gordon (2017) tries to explain the paradox by pointing out the fundamental differences between current innovations past discoveries such as the steam engine or electricity (Gouveia & Osterhold (2018)). Other researchers argue that the slowdown in productivity growth can be explained by the rising dispersion in productivity across companies, declining business dynamism (Decker et al. (2016)), and increasing misallocation of resources (Gopinath et al. (2017), McGowan et al. (2017b)).

This consequently raises the concern of so-called "zombie companies", typically defined in the literature as companies that would usually exit a competitive market but are still surviving. Consequently, these zombie companies crowd out the growth of more innovative firms, create barriers to entry for young firms, and potentially prohibit the reallocation of resources across sectors while dragging down average productivity growth by exhibiting a low productivity themselves (McGowan et al. (2017a, 2017b)).

In this context recent literature such as Acharya et al. (2020), Banerjee & Hofmann (2020), and McGowan et al. (2017a) measures, despite applying different zombie definitions, an increasing prevalence of zombie companies in OECD countries. The rising number of zombie firms has led to an increasing attention in the public discussion, and with the Covid-19 pandemic, the debate gained even further momentum as governments were forced to provide extensive support measures for the corporate sector (Banerjee & Hofmann, 2020).

We focus our research on the time period prior to the pandemic. We seek to analyze whether the increasing media attention towards zombie companies, prior to the Covid-19 pandemic, claiming that the low-interest-rate environment leads to a zombification of the economy (Sharma (2019), Taylor (2019), Armstrong (2020)), is justified or not. In line with our belief that a company should not easily be classified as a zombie company and that a magnitude of different characteristics defines a zombie company rather than one or two simple characteristics, we define a novel, more strict set of criteria to classify zombie companies. We derive our set of criteria from our definition of zombie companies being mature companies with a persistent lack of profitability, poor expected future profits, that do not exit

the market although they are expected to do so. We gather data on public and private companies in France, Switzerland, and Germany from 2011 to 2019 and apply our set of criteria to classify zombie companies. Due to feasibility reasons, we define two different sets of criteria. The first set of criteria is more stringent and is applied to the public data set as there is more data available. With less data available for the private data set, we modify our set of criteria to ensure that a sufficient number of companies can be analyzed. We find an almost non-existing level of zombification in the public data set with the stricter criteria and a moderately low level of zombification in the private data set with the less strict criteria. Cross-testing our public data set results, the increasing level of zombification seems to be driven by the removal of criteria rather than the public-private status of the company. Ultimately, we compare our public data set with the prevailing literature by applying criteria used in the literature and find similar results. Hence, we conclude that our results are driven by the zombie classification criteria that we selected rather than sample selection. We provide an alternative view to the current press and prevailing literature by defining a strict set of criteria which leads us to find an almost non-existing level of zombification.

2. Literature and Press Review

In chapter 2, we discuss the most relevant findings of the prevailing literature as well as their definitions of zombie companies.

2.1 The zombification of the Japanese economy

The first broad research on the identification of zombie companies as well as their distorting effects on the economy has been conducted in regard to the Japanese stagnation during the 1990s by Caballero et al. (2008) and Hoshi (2006). However, there are even earlier references of zombie companies in relation to the US savings and loans industry by Kane (1989).

Although many possible explanations for Japan's economic underperformance have been proposed, no finite consensus could be reached. However, the annual report of the Bank for International Settlements (2002, p. 135) concisely summarized a broadly accepted view as follows: "Overall, the Japanese situation highlights the powerful two-way links between the real economy and the financial system: the depressed state of the economy is hurting the banking system, and the poor health of the banking system is impeding the economic recovery" (Hoshi & Kashyap (2004)).

Undisputedly, the Japanese economy experienced, years of stagnating real GDP growth starting from the 1990s after having grown faster than all the other major developed economies during the 1980s (Caballero et al. (2005)). Additionally, Japan experienced a large drop in stock and land prices in the early 1990s. Stock prices fell about 80% from their 1989 peak through mid-2003 and commercial land prices fell about 60% since their 1992 peak (Caballero et al. (2005)). Since land was often used as collateral for loans the decline in land prices likely caused financial problems for the financial sector (Hoshi & Kashyap, 2004). Nevertheless, Hoshi & Kashyap (2004) assert that Japan's financial difficulties seem disproportionately large compared to its macroeconomic stagnation (Matre & Solli (2019)).

According to Caballero et al. (2005), the government and the regulator failed to acknowledge the issues in the banking system and delayed any serious reforms or restructurings. However, the banks still had to comply with the Basel capital standards which required banks to write off capital if they wanted to call in a nonperforming loan (Matre & Solli (2019)). As the Japanese government and regulator forced their banks to only recognize a few insolvencies, the Japanese banks continued extending credit to insolvent borrowers, the so-called "zombies", to avoid falling below the Basel capital standards (Matre & Solli (2019)).

The "zombies" that were kept alive by the Japanese banks distorted the competition by depressing market prices of their products, by raising market wages as they kept their workers whose productivity was declining, and by generally congesting their markets. This distortion also impacted healthy firms

negatively as the higher wages and lower prices reduced their profits and consequently limited their ability to generate collateral and hence discouraged market entry and investment (Caballero et al. (2008)).

McGowan et al. (2017b) and Gouveia & Osterhold (2018) refer to Caballero et al.'s (2008) research on the zombification and stagnation of the Japanese economy suggesting that the current increasing share of zombie companies in the OECD region may contribute to explaining the slowing down of growth among OECD countries.

2.2 Zombie definitions

"In economic terms, a zombie is a firm that is not viable and therefore, when competitive forces are at play, should be compelled to exit the market or, where feasible, restructure." (Gouveia & Osterhold (2018)).

So far, the literature uses different definitions to identify zombie companies ranging from profitability conditions (Banerjee & Hofmann (2020)) to subsidized credits (Caballero et al. (2008)), with each approach having its advantages and disadvantages. The challenge with identifying companies that obtain subsidized credits is typically the access of information since neither creditor nor their borrowers are incentivized to reveal any mispriced loans (Caballero et al. (2008)). Even with detailed debt information such as debt facilities and lending relationships and the possibility to connect those to the correct interest expense portion, it would be challenging to identify subsidized companies. On the one hand, banks have many ways other than interest rates to provide subsidies to their clients and on the other hand, there are many ways to value those other ways of subsidy.

While Hoshi (2006) describes zombie companies as insolvent firms with little hope of recovery but that avoid failure thanks to support from their bank, Caballero et al. (2008) describe zombie companies as unprofitable borrowers that are kept alive by creditors. Both research papers analyze a dataset of listed Japanese companies from 1981 to 2002 comprising between 1,844 and 2,506 publicly traded firms depending on the year. Both research papers define zombie companies as companies whose actual interest expense is below the estimated minimum interest expense of the most creditworthy borrower as they assume that those companies paying less than their estimated minimum interest expense receive subsidized credit. The advantage of this approach is that it does not consider productivity or profitability, allowing them to more differentiated evaluate the effect of zombies on the economy (Caballero et al. (2008)). If zombies are defined based on their operating characteristics, then industries dominated by zombie companies inherently exhibit low profitability, and likely also have low growth (Caballero et al. (2008)). However, this approach also has its disadvantages as it may mistakenly classify extremely healthy firms as zombies that deserve lower interest rates than the prime rates or healthy companies that

decided to voluntarily pay down a significant portion of their debt. Last but not least, this measure may also fail to recognize some zombie companies that enjoy support other than interest concession or debt forgiveness from lenders (Caballero et al. (2008)).

McGowan et al. (2017a, 2017b) analyze listed and private firm-level data across 13 OECD countries from 2003 to 2013. They describe zombies as old firms that have persistent problems meeting their interest payments. They define zombie companies as companies that are older than 10 years and whose interest coverage ratio (ICR) is below 1 for 3 consecutive years. Also, the Bank of Korea (2013) uses an ICR below 1 for 3 consecutive years to define zombie companies. The advantage of using ICR is that its easily comparable across countries and less endogenous to productivity compared to negative profits (McGowan et al. (2017a)). However, a major disadvantage of this measure is that it contradicts the idea of identifying zombie companies that are defined as companies that are artificially kept alive by subsidized credits as those companies should enjoy a lower interest expense making it harder to identify them through an ICR filter (Storz et al. (2017)). The idea of only considering companies older than 10 years as potential zombies is to avoid classifying young innovative start-ups only based on profitability measures as zombie companies (McGowan et al. (2017a)). However, Banerjee & Hofmann (2020) criticize that it is not clear why younger companies could not be unviable too. McGowan et al. (2017a) explain that looking at the persistence of financial weakness through a 3-year window addresses the concerns of the business cycle effects on the prevalence of zombie companies.

Storz et al. (2017) analyze how the interdependence of private and public small and medium-sized enterprises (SME) and the financial sector impacts the firms' leverage choices by matching around 423,000 SMEs to around 900 banks in five stressed euro area countries (Spain, Greece, Ireland, Portugal, and Slovenia) and two non-stressed comparison countries: Germany and France over the period between 2010 to 2014. In their research paper, they describe zombie companies as firms, which are "artificially" kept alive through evergreening credit. Concretely, they define a company as a "zombie" if its return on assets (ROA) and net investments are negative, and if its EBITDA over total financial debt is lower than 5% for at least 2 consecutive years. Combining the restrictions on ROA and net investments ensures to only identify companies as zombies, which neither are profitable nor invest more than the value of their depreciation. Especially, the net investment constraint allows them to not mistakenly identify young, expanding companies as "zombies" (Storz et al. (2017)). By using low debt servicing capacity instead of ICR as a restriction, they avoid classifying zombie companies with subsidized credits as "healthy" companies (Storz et al. (2017)).

Banerjee & Hofmann (2020) who analyze a dataset of 32,000 listed companies across 14 OECD countries in the period of 1980 to 2017 describe zombie companies as unprofitable firms with low stock market valuation. More precisely, they classify a company as a "zombie" if its ICR is below 1 and its assets' market value to replacement cost (Tobin's Q) is below the median within its sector for at least 2 consecutive years. For a zombie company to get reclassified as a "healthy" company, it needs to have

an ICR larger than 1 and a Tobin's Q above the median for 2 consecutive years. Adding a Tobin's Q filter allows, according to Banerjee & Hofmann (2020), to capture the investors' expectation of the firm's future profit potential. Hence, it helps to avoid classifying loss-making companies as "zombies" that are expected to be profitable in the future (e.g., start-ups).

Acharya et al. (2020) analyze private and public firm-level data of 1.1 million firms from 12 European countries from 2009 to 2017 describe zombie firms as low-quality firms that receive debt financing at "very low" interest rates. They classify a company as a "zombie" if its IRC is below the median and its leverage (total financial debt/total assets) above the median of the respective country-industry level, and if the cost of debt is lower than the cost of debt paid by the most creditworthy comparable firms.

2.3 Anatomy of a zombie

Banerjee & Hofmann (2020), who use firm-level data of listed companies covering 14 advanced economies from the mid-80s to 2017, find that zombie companies are much smaller than non-zombie firms. On average the assets, the capital stock, and the number of employees of zombie firms are three times smaller than those of non-zombies. They also find that zombie companies spend about 0.5 percentage points of assets less on capital expenditures compared to profitable companies. Another characteristic behavior of zombie companies is reduced investment in intangible capital (research and development expenditures and organizational capital) by about 1.2 percentage points of assets compared to healthy companies. Zombies also tend to shrink their operations, reflected by higher asset disposal compared to non-zombies. Simultaneously, zombies reduce their employee base on average by 6% per year, compared to an average 3% employment growth for non-zombie companies. Another finding of Banerjee & Hofmann (2020) is that zombies are less productive than non-zombies, reflected by both, their labor productivity, and their total factor productivity. The lower profitability of zombies is also reflected by the lower payout of dividends by more than 1 percentage point of their total assets compared to the non-zombie companies. Additionally, Banerjee & Hofmann (2020) find that zombie firms receive subsidized credit as the interest expenses of zombie companies are only 0.1 percentage points higher than those of non-zombie companies. This difference is not statistically significant and counterintuitive as lending to zombie companies should be associated with higher lending risks. Furthermore, zombie companies are on average significantly more leveraged (total debt to total assets), which should increase the lending risk further. In line with the pecking order (Myers (1984)) zombie companies tend to issue significantly more equity (relative to total assets) than non-zombie companies. The pecking order suggests that equity financing for mature companies is used as last-resort financing and may suggest distress of the issuing company.

Hoshi (2006) focuses on identifying zombies in Japan, using data of listed firms in manufacturing, construction, real estate, retail and wholesale trade (excluding the largest general trading companies),

and services industries for the period 1993 to 2001. Hoshi (2006) finds that zombie companies are on average more indebted and depend more on their banks compared to non-zombie companies. Zombies are more likely to be in the non-manufacturing industries, such as real estate and construction, and located outside large metropolitan areas. He also finds that overall smaller companies (by assets or employment) are more likely to become a zombie but among small firms, relatively larger firms are more likely to be protected by banks and become zombies instead of going bankrupt.

McGowan et al. (2017b) use harmonized cross-country firm-level data of listed and unlisted companies across 13 OECD countries in the period of 2003 to 2013 and find that larger companies measured by the number of employees and older companies tend to be more likely to become a zombie.

2.4 Lifecycle of a zombie

Banerjee & Hofmann's (2020) analysis finds that the performance of zombies deteriorates several years prior to reaching zombie status and that their performance remains significantly poorer. Additionally, up to two years before being classified as a zombie, the indebtedness grows strongly compared to non-zombies before debt accumulation continues to fall after becoming a zombie. Although companies improve after zombification, they still do not manage to catch up with the productivity of healthy companies in terms of labor productivity and total factor productivity. Additionally, zombies also continue to shrink significantly in asset size in the post-zombification years. In the run-up to zombification, Tobin's Q deteriorates significantly before it starts to rise steadily after reaching zombie status, suggesting that the market increasingly expects recovery the longer the firm survives. Over time, Banerjee & Hofmann (2020) find that about 25% of zombie companies exit the market, while 60% recover from the zombie status. Banerjee & Hofmann (2020) also note that recovered zombies are more likely of relapsing into zombie status compared to companies that never have been zombies. They conclude that the zombie disease seems to cause long-term damage and hence that the risks in advanced economy corporate sectors might not be fully reflected by the number of current zombie companies.

2.5 Impact of zombie companies on the economy

By analyzing over 1 million companies across 12 European countries after the financial crisis, Acharya et al. (2020) identify an increasing portion of zombie companies and measure their effects on the markets in which they operate.

They explain the co-occurrence of the rise of zombie credit and low inflation by a simple model that illustrates that a rise in zombie credit, defined as keeping distressed companies alive that would otherwise go bankrupt, slows down the adjustment in the production capacity. After a negative demand shock, the excess capacity puts downwards pressure on product prices and consequently lowers

inflation. Acharya et al.'s (2020) analysis shows that markets, defined as industry-country pairs, that experience an increase in the share of zombies subsequently have fewer firm defaults and entries, more active companies, higher sales growth, higher input costs, lower productivity, lower markups, and lower inflation growth compared with markets with a lower ratio of zombie companies. They further estimate that without the rise in zombie credit post-2012 the annual inflation would have been 0.45 percentage points higher in Europe from 2012 to 2016.

Banerjee & Hofmann (2020) suggest that zombie firms give rise to significant congestion effects. More precisely, their panel regression results indicate that a one percentage point increase in the zombie share in a sector leads to a lower capital expenditure (CapEx) rate of non-zombie firms by around 1 percentage point, representing a 10% reduction compared to the average investment rate. Additionally, it also leads to a 0.16 percentage points lower employment growth corresponding to a 5% reduction.

When Banerjee & Hofmann (2020) further analyze the effect of zombies on productivity they find that productivity decreases significantly when the share of zombies increases.

Zombie firms are therefore not only less productive, but also hinder the growth of more productive firms. However, from these findings, we can still not infer the wider effect of zombie firms on productivity growth. According to Banerjee & Hofmann (2020), zombie companies may be significantly less productive and give rise to significant congestion effects, but the effects may quantitatively still be too small to affect aggregate productivity growth. They estimate that the increase of about 10 percentage points in the share of zombie companies since the late 1980s, may have depressed aggregate productivity growth by about 1 percentage point, representing about half of the overall registered slowdown over the period.

2.6 Zombie prevalence across OECD countries

Both, Banerjee & Hofmann (2020) and the OECD analyze the prevalence of zombie companies in different OECD countries as well as their characteristics. While the OECD covers the prevalence of zombies in the years 2007, 2010, and 2013 (Figure 1), Banerjee & Hofmann (2020) cover the period from the mid-1980s to 2017 (Figure 2).

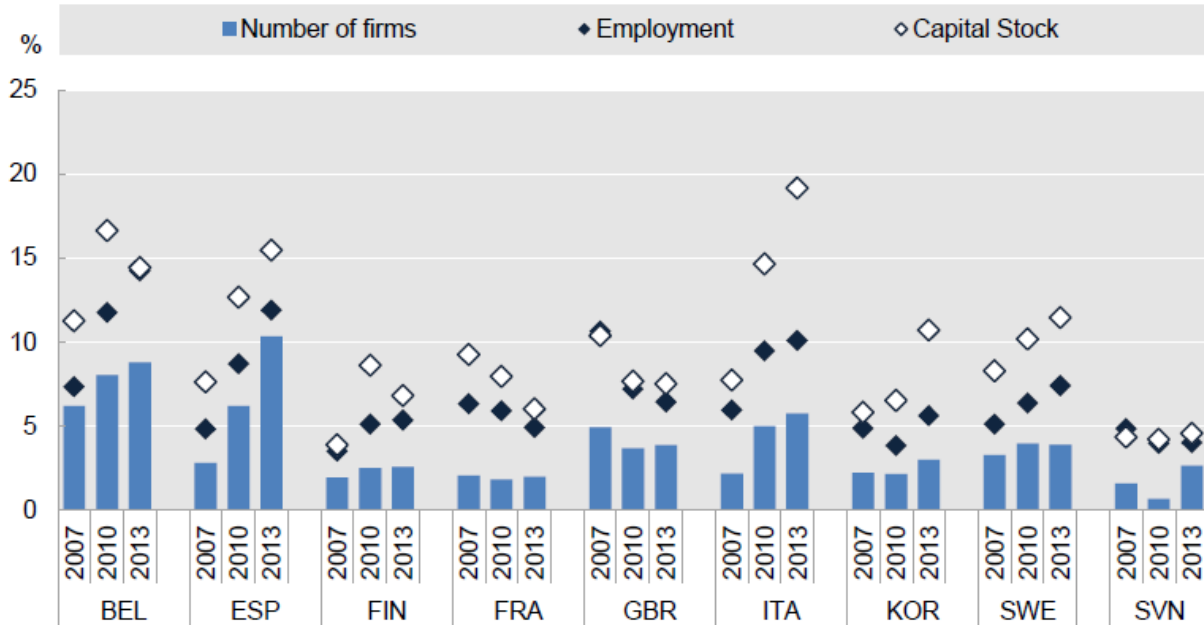


Figure 1: Zombie prevalence in 9 selected OECD countries.

Note: Firms aged ≥ 10 years and with an interest coverage ratio < 1 over three consecutive years. Capital stock and employment refer to the share of capital and labor sunk in zombie firms. The sample excludes firms that are larger than 100 times the 99th percentile of the size distribution in terms of capital stock or number of employees.

Source: McGowan et al. (2017b) (OECD calculations based on Orbis)

As illustrated in Figure 1, the share of zombies in 2013 is the highest at 10% in Spain and the lowest in France at 2%. The latter is consistent with Avouyi-Dovi et al.'s (2016) analysis of lending rates suggesting that zombie lending appears to be relatively rare in France (McGowan et al. (2017a)). Furthermore, the share of capital sunk in zombie firms in 2013 ranges from under 5% in Slovenia to up to 19% in Italy, while the share of labor sunk in zombies ranges from under 5% in Slovenia to around 14% in Belgium.

McGowan et al. (2017b) argue that there is an increase in both the prevalence of zombie companies and the resources sunk in them over time. However, Figure 1 and Figure 2 suggest that the development of both varies across time and country. Figure 1 illustrates that France, Slovenia, and the United Kingdom experience a decrease in the share of zombie companies and in the share of capital sunk in zombie companies from 2007 to 2010, while these two metrics increase for the other countries in the sample over the same period. The same principle applies to labor sunk in zombie companies from 2007 to 2010, which decreases in France, Slovenia, Korea, and the United Kingdom and increases in all the other countries (see Figure 1).

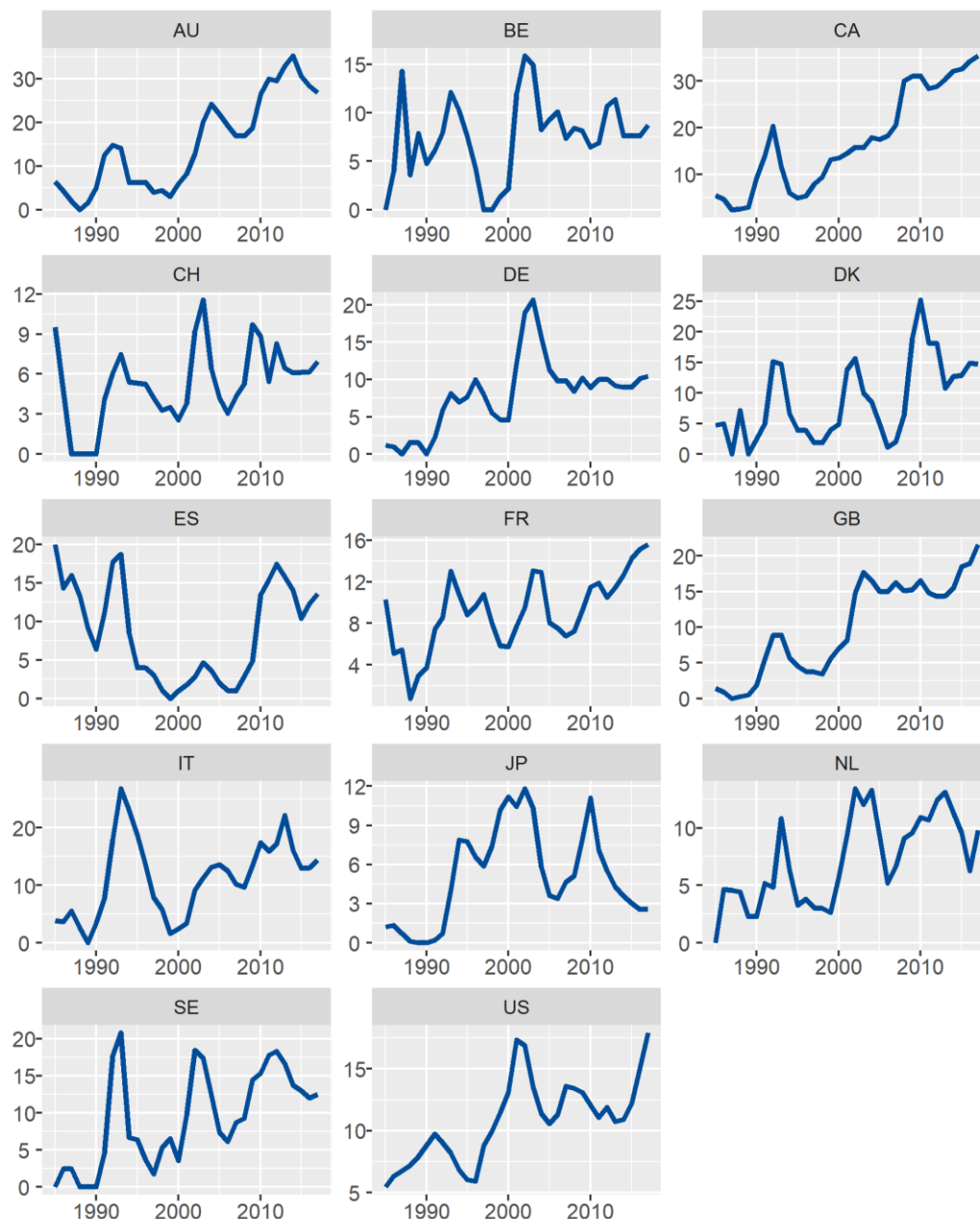


Figure 2: Zombie prevalence in 15 selected OECD countries.

Note: Zombie firms defined as firms with both an interest coverage ratio of less than 1 and a Tobin's Q below the sector median over two years. To be declassified as a zombie firm, an ICR larger than one or a Tobin's Q above the sector median over two years is required.

Source: Datastream Worldscope; Banerjee & Hofmann's (2020) calculations.

In contrast to the OECD that uses a dataset of private companies and applies its filters over 3 years (Figure 1), Banerjee & Hofmann (2020) use a dataset of listed companies and apply their filters over 2 years (Figure 2), ultimately finding a zombie share in France of 13% in 2013. According to Figure 2, the prevalence of zombie companies strongly varies over time and across countries. However, Figure 2 also indicates an upwards trending prevalence of zombie companies for most OECD countries.

2.7 Insolvency Regimes

McGowan et al.'s (2017b) research suggests that the design of insolvency regimes across OECD countries is linked to the prevalence of zombie companies and capital misallocation. The indicators of insolvency regimes used in their research are constructed based on countries' responses to an OECD questionnaire designed to gain an understanding of the main design features of insolvencies that impact the timely initiation and resolution proceedings of insolvencies. The OECD questionnaire yields 13 key design features across countries which the OECD splits into the four categories "treatment of failed entrepreneurs", "prevention and streamlining", "restructuring tools", and "other factors".

Their empirical results suggest that insolvency regimes can induce productivity-enhancing capital reallocation and reduce the capital sunk in zombie firms by reducing barriers to corporate restructuring and by reducing the personal costs associated with entrepreneurial failure. They also find evidence of a positive correlation between an increasing share of zombie capital and more stringent product market regulations and weaker rule of law, suggesting that these policy and structural factors are also linked to the exit margin.

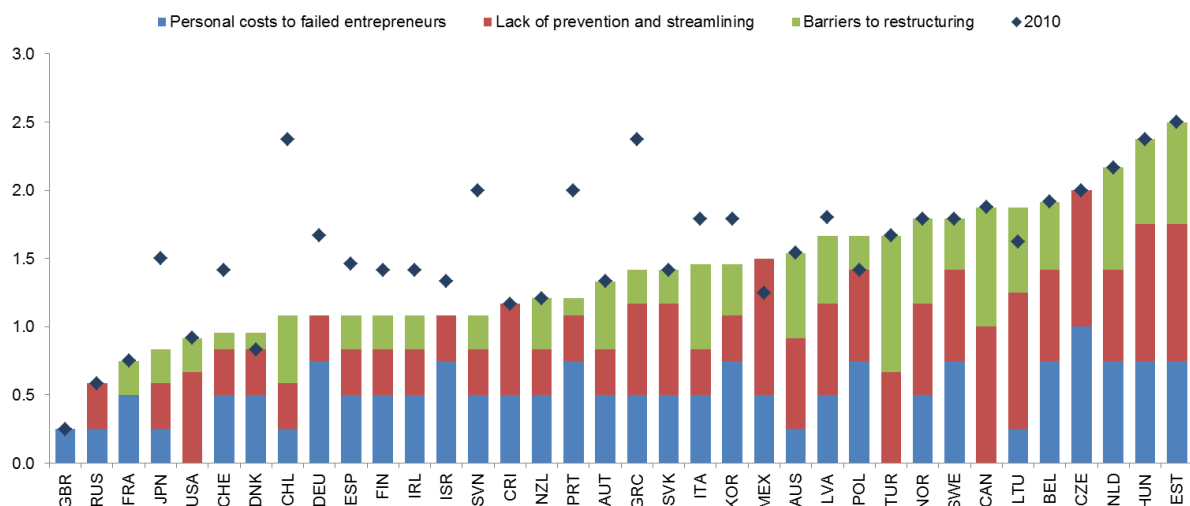


Figure 3: OECD indicator of insolvency regimes.

Note: The stacked bars correspond to three subcomponents of the insolvency indicator in 2016. The diamond corresponds to the value of the aggregate insolvency indicator based on these three subcomponents in 2010. Only countries for which data is available for the three sub-components in 2016 are included.

Source: Calculations based on the OECD questionnaire on insolvency regimes (McGowan & Andrews (2018)).

Figure 3 depicts the distribution of the three sub-indicators (personal cost to failed entrepreneurs, lack of prevention and streamlining, and barriers to restructuring) in 2016 as well as the sum of the 3 sub-indicators in 2010 across 36 countries.

According to Figure 3, the differences in the design of insolvency regimes are significant ranging from United Kingdom (GBR) displaying the least strict insolvency regime combination to Estonia (EST) having the strictest insolvency regime combination across the 36 countries (McGowan et al. (2017b)). The difference in the 2010 and 2016 levels for the three sub-indicators indicates that countries such as

Chile (CHL), Greece (GRC), Slovenia (SVN), Portugal (PRT), Germany (DEU), and Japan (JPN) went through a major insolvency regime reform with a tendency to reduce strictness (McGowan et al. (2017b)). According to McGowan & Andrews (2018), larger reform activities from 2010 to 2016 could not have been predicted by a high level of any indicator of insolvency regimes in 2010. This observation stands in contrast to Duval et al.'s (2016) finding that the scope for reform is larger for countries with an initially stricter stance on product market regulation.

France is ranked the 3rd least restrictive in the OECD insolvency regimes indicator ranking. France's insolvency regime is, in relative terms, characterized by a best-in-class lack of prevention and streamlining, by low barriers to restructuring, and by low to medium personal costs to failed entrepreneurs.

Germany is ranked 9th least restrictive in the OECD insolvency regimes indicator ranking. Germany's insolvency regime is, in relative terms, characterized by low to medium level of lack of prevention and streamlining, by best-in-class barriers to restructuring, and by high personal costs to failed entrepreneurs.

2.8 Prevalence of zombie companies in the public discussion

The Covid-19 pandemic, a period that we do not cover in our quantitative analysis, has given the discussion around the zombification of OECD economies further impetus as the Covid-19 crisis caused governments to put severe restrictions on the economic activity while simultaneously enacting extensive support measures for the corporate sector (e.g., Lynch (2020), Financial Times (2020), Banerjee & Hofmann (2020)).

However, Banerjee & Hofmann (2020) suggest that the topic of zombie companies has already attracted increasing attention in the public discussion prior to the Covid-19 crisis. The press describes the continued low-interest-rate environment as the main source of the corporate zombification (c.f. Sharma (2019), Taylor (2019), Armstrong (2020)), arguing that the reduced interest expense potentially causes creditors to evergreen loans to non-viable firms.

An argument supported by their search result depicted in Figure 4 indicating that number of new articles in newspapers, news magazines, or blogs that contain the keywords "zombie firms" or "zombie companies" published each year increased, especially after 2015.

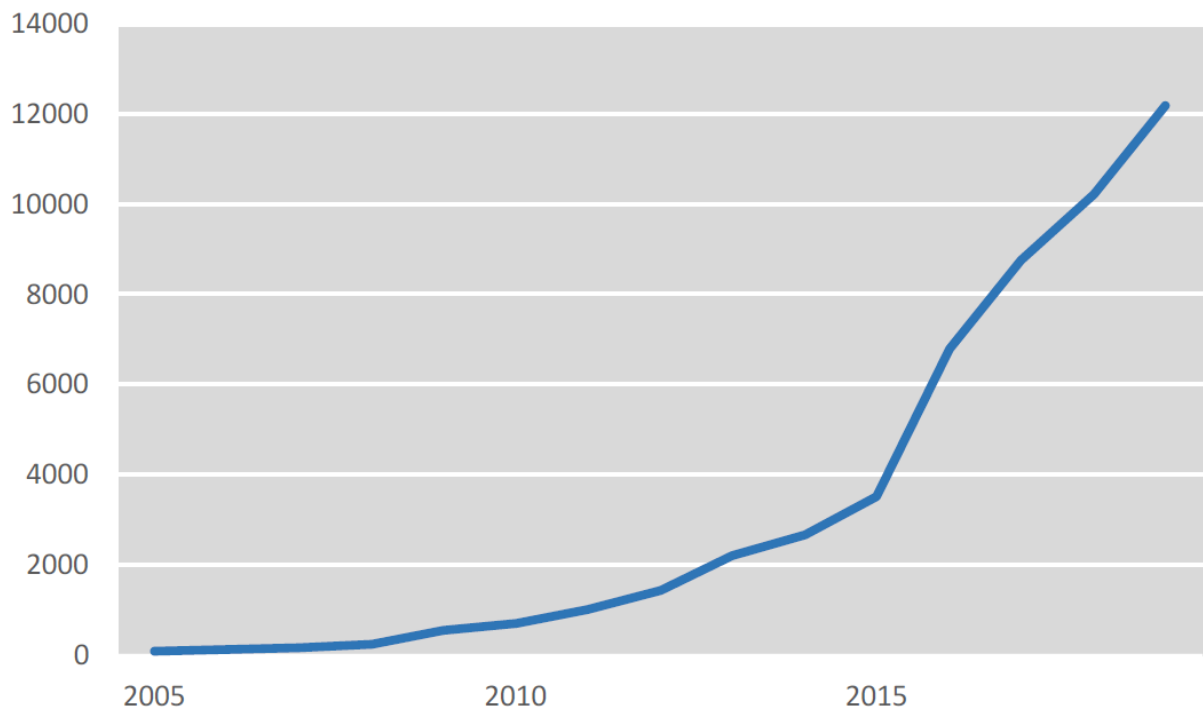


Figure 4: The public discussion about zombie companies. Cumulative number of times the words "zombie firms" or "zombie companies" appeared in English, German, French, Italian and Japanese-language newspapers and news magazines as well as in blog or board entries. Source: Banerjee & Hofmann's (2020) search in Factiva.

3. Methodology

3.1 Dataset

As a first step, we focus on publicly listed companies to ensure sufficient availability and accuracy of the data. In a second step, we extend our research to privately held companies, which comprise the majority of firms in the selected geographic region. Based on the authors' geographic familiarity, the sample includes companies with a listing in France, Switzerland, and Germany. We use the Refinitiv-Eikon platform (Thomson Reuter) to collect data of the publicly traded companies as it provides a comprehensive database for financial data. For the private data set, we use the Orbis database. Due to differing operating metrics, we exclude financial and real estate companies. Furthermore, for young startups, it is not unusual to be unprofitable and cash-burning in the beginning. Hence, to guarantee the relevance of the operating metrics, we exclude companies founded after 2010. In addition to our hereafter described classification criteria, we gather firm-level data to characterize the data set. Due to data availability issues, we do not gather firm-level data on net debt, operating cashflow, the Z-Score, and the Tobin's Q for the private data set. In total, this yields us 1,690 publicly traded companies out of which 1,162 remain after removing financial and real estate companies and filtering out companies founded after 2010. In the private data set, we retrieve 90,696 companies excluding those operating in the financial and real estate sector and being younger than 10 years.

3.2 Analytical methods

Fundamentally, the analysis of the level of zombification is driven by the criteria selected to characterize zombie companies. We believe that the prevailing literature classifies companies too loosely as zombie companies. Principally, we define zombie companies as mature companies with a persistent lack of profitability, poor expected future profits, and companies that do not exit the market although they are expected to do so. However, as mentioned above the extent of the data availability varies between the public and private datasets, we use two different sets of criteria to identify zombie companies.

In our public dataset, we define a company as a zombie if i) the company is older than 10 years (McGowan et al. 2017a, 2017b), ii) its operating cashflow is below 0, iii) its asset turnover is above 0.01, iv) its ICR is below 1 (McGowan et al. 2017a, 2017b), v) its Z-Score¹ (Altman (1968), (2002), (2013)) is below 0², vi) its Tobin's Q (market value of equity/ book value of equity) (Banerjee & Hofmann 2020) is below 1, and vii) and its revenue growth rate is below 3% viii) for 3 or 2 consecutive years (McGowan et al. 2017a, 2017b). The i) age restriction, the iii) the asset turnover, and vii) the

¹ In our analysis, we determined the Z-Score for each company by applying the Z-Score for manufacturing companies and the Z''-Score for non-manufacturing companies.

² In 2020, Edward I. Altman states in an interview with McKinsey that in today's low-interest-rate environment a Z-Score cut-off point of 0 to detect "distressed companies" is more appropriate.

revenue growth restriction helps to avoid classifying young start-ups, biotech companies, or fast-growing businesses as zombie companies. Using the ii) the operating cashflow and the iv) the ICR restrictions allows us to identify unprofitable and unviable businesses. The v) Z-Score restriction helps us to identify companies that continue to exist although they are expected to go bankrupt. The vi) Tobin's Q restriction helps to avoid defining unprofitable companies that are expected to be profitable in the future as zombie companies. Applying a viii) 3-year window partly addresses the issues of business cycles and one-time effects.

In our private company dataset, we classify companies as zombies if i) the company is older than 10 years, ii) its EBIT is below 0, iii) its asset turnover is above 0.01, iv) its ICR is below 1, and v) its revenue growth below 3% vi) for 2 or 3 consecutive years. As we did not have access to sufficient firm-level for private companies we reduced or changed the restrictions to identify zombie companies. In this context, we changed from operating cashflow to ii) EBIT in order to identify unprofitable and unviable companies. As we do not have access to market prices, we waived the vi) Tobin's Q criterion. Due to the lack of sufficient data to calculate the v) Z-Score for private companies, we also removed this filter.

4. Descriptive Statistics

Chapter 4 aims to provide an overview of the summary statistics and descriptive insights with reference to our set of criteria covering among others profitability, age, size, and prevalence of zombie companies depending on the definition applied. Furthermore, chapter 4 analyzes the zombification in our data sets and provides sensitivity analyses.

4.1 Summary statistics of the public data set

The variables we use to classify publicly traded companies into zombie companies are the operating cashflow, the interest coverage ratio (ICR), revenue growth, the Z-Score, Tobin's Q (i.e., the price to book ratio), and the company's asset turnover. The companies in the data sample are on average 43.2 years old and the median age is 28.0. This implies a right-skewed distribution as supported by Figure 5. Furthermore, the whole public data set is composed by 736 French, 721 German, and 233 Swiss companies (c.f. Table 11).

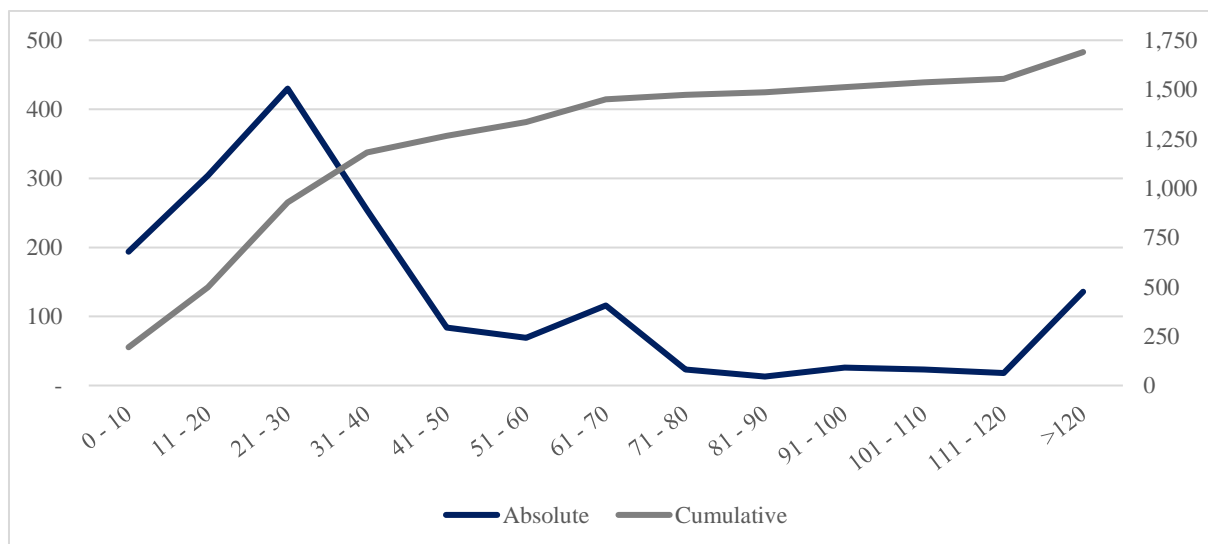


Figure 5: Number of public firms categorized by company age.
Source: Refinitiv Eikon.

Refinitiv Eikon classifies companies into 11 distinct sectors and 69 industries in accordance with the global industry classification standard (GICS) system. The data sample covers 11 distinct sectors and 67 industries. Table 1 shows the number of companies operating in the respective sector or industry. For illustrative purposes, only the ten most frequent industries are shown. A full detailed breakdown can be found in Appendix A.

Sector	Total	Industry	Total
Industrials	323	Capital Markets	128
Information Technology	269	Real Estate Management & Development	115
Financials	214	Machinery	101
Consumer Discretionary	213	Software	79
Health Care	183	IT Services	68
Real Estate	150	Biotechnology	60
Communication Services	114	Electronic Equipment, Instruments & Components	60
Materials	85	Health Care Equipment & Supplies	52
Consumer Staples	82	Media	51
Utilities	33	Chemicals	44
Energy	24	Other	932
Total	1,690	Total	1,690

Table 1: Public companies classified by sector and industry.
Source: Refinitiv Eikon.

Furthermore, data on the company's financial performance (revenue and EBITDA), the company's financial situation, i.e., net debt, and general company data was collected. The tables below summarize the data set in the financial years 2019 to 2017. Data was collected over the past decade (2019 to 2010). A full summary of the financial data of the data set can be found in Appendix G to Appendix Q.

	Z-Score			Tobin's Q (P/B)		
	2019	2018	2017	2019	2018	2017
Min	(291.7)	(164.2)	(507.2)	(516.7x)	(69.1x)	(783.9x)
25% Quartile	0.0	0.0	0.0	0.9x	0.9x	1.0x
Median	2.1	2.2	2.4	1.6x	1.5x	1.7x
Average	5.6	4.0	17.5	6.4x	3.2x	2.6x
75% Quartile	4.1	4.4	5.1	3.3x	2.9x	3.2x
Max	2,418.0	351.0	21,478.0	2,969.0x	764.8x	545.6x
<i>Data available abs</i>	<i>1,674</i>	<i>1,675</i>	<i>1,678</i>	<i>691</i>	<i>1,480</i>	<i>1,485</i>
<i>Data available %</i>	<i>99.1%</i>	<i>99.1%</i>	<i>99.3%</i>	<i>40.9%</i>	<i>87.6%</i>	<i>87.9%</i>

Table 2: Descriptive statistics of the Z-Score and Tobin's Q in the public data set.
Source: Refinitiv Eikon.

The average and median Z-Score in the period under observation does not predict that the average or median company is likely heading for bankruptcy as they are greater than 1.8. In a recent interview

(McKinsey & Altman (2020)), Prof. Altman mentioned that in recent times he even uses a cut-off point of 0.0 instead of 1.8 for the Z-Score due to changes in the interest rate environment. However, it has to be noted that in line with his old cut-off points, the median company is in a grey area (Z-Score greater than 1.8 but smaller than 3.0) where the Z-Score does not predict a probable bankruptcy but also does not predict that company is highly unlikely to go bankrupt. Average Tobin's Q values are upward biased by extreme positive values. Surprisingly, in 2019, there is a low data availability of only 41% in the whole data set for Tobin's Q.

	Asset turnover			Operating CF (in EURm)		
	2019	2018	2017	2019	2018	2017
Min	0.0x	0.0x	0.0x	(50,837.0)	(54,171.0)	(43,430.2)
25% Quartile	0.3x	0.3x	0.3x	(0.1)	(0.4)	(0.1)
Median	0.7x	0.7x	0.8x	14.2	8.7	9.9
Average	0.8x	0.8x	0.9x	357.8	348.3	384.4
75% Quartile	1.1x	1.2x	1.2x	135.1	99.4	90.9
Max	13.5x	13.6x	11.6x	36,303.0	26,203.0	39,577.0
<i>Data available abs</i>	<i>1,429</i>	<i>1,459</i>	<i>1,455</i>	<i>1,391</i>	<i>1,416</i>	<i>1,428</i>
<i>Data available %</i>	<i>84.6%</i>	<i>86.3%</i>	<i>86.1%</i>	<i>82.3%</i>	<i>83.8%</i>	<i>84.5%</i>

Table 3: Descriptive statistics of the asset turnover and operating cashflow in the public data set.
Source: Refinitiv Eikon.

The asset turnover criterion was introduced to exclude companies that are not yet engaging in the commercial distribution of their products or services. A concrete example for this are drug developers that are still in the research or development phase and do not have a product to sell yet. Due to differences in asset heaviness across different industries, it does not make sense to draw conclusions from the asset turnover characteristic across the data set. The large difference between the average and median operating cashflow indicates a rightwards skewed distribution. This means many companies have a comparably low operating cashflow and a few companies have an extraordinarily large operating cashflow by comparative standards across the data set. Even the 75% quartile company has a lower operating cashflow than the average public company. This pattern will repeat across different financial metrics and indicates that there are many small companies and a few exceptionally large companies.

	EBITDA (in EURm)			Interest Coverage Ratio (ICR)		
	2019	2018	2017	2019	2018	2017
Min	(1,865.6)	(13,226.5)	(1,436.6)	(33,313.0x)	(17,556.0x)	(36,637.0x)
25% Quartile	0.5	0.5	0.5	-0.3x	0.2x	0.6x
Median	16.8	13.9	14.2	4.6x	5.4x	5.5x
Average	643.6	544.2	544.5	7.0x	56.6x	2470.1x
75% Quartile	156.5	136.6	117.3	18.0x	22.6x	21.7x
Max	45,145.7	40,295.0	46,547.9	44,084.8x	20,017.4x	3,304,848.0x
<i>Data available abs</i>	<i>1,524</i>	<i>1,562</i>	<i>1,581</i>	<i>1,369</i>	<i>1,341</i>	<i>1,358</i>
<i>Data available %</i>	<i>90.2%</i>	<i>92.4%</i>	<i>93.6%</i>	<i>81.0%</i>	<i>79.3%</i>	<i>80.4%</i>

Table 4: Descriptive statistics of the EBITDA and Interest Coverage Ratio in the public data set.
Source: Refinitiv Eikon.

The distribution of EBITDA is skewed to the right as well as shown by the large difference in average and median EBITDA. This indicates many companies with a comparatively low EBITDA and a few companies with a comparatively very high EBITDA. The average and median company shows financial stability measured by the ICR. On average and median, EBIT is sufficient to cover over four times the interest expenses of the respective period.

	Revenue (in EURm)			Revenue growth		
	2019	2018	2017	2019	2018	2017
Min	(8)	(40)	(0)	(276.0%)	(352.8%)	(314.2%)
25% Quartile	15	14	12	(2.9%)	(2.3%)	(3.2%)
Median	127	113	103	4.8%	5.3%	4.9%
Average	3,287	3,040	2,937	23.0%	154.6%	49.2%
75% Quartile	821	751	695	14.3%	14.9%	15.4%
Max	252,632	235,849	229,550	5,922.6%	121,183.9%	14,306.3%
<i>Data available abs</i>	<i>1,483</i>	<i>1,519</i>	<i>1,532</i>	<i>1,438</i>	<i>1,456</i>	<i>1,442</i>
<i>Data available %</i>	<i>87.8%</i>	<i>89.9%</i>	<i>90.7%</i>	<i>85.1%</i>	<i>86.2%</i>	<i>85.3%</i>

Table 5: Descriptive statistics of revenue and revenue growth in the public data set.
Source: Refinitiv Eikon.

In line with the findings for operating cashflow and EBITDA, revenue also shows a rightwards skewed distribution. Negative revenue, which is highly unusual for operational companies, stems from investment firms in the data set. Consequently, revenue growth rates smaller than -100% are possible too. Revenue growth on average and median is significantly above the gross domestic product (GDP) growth rates for Germany, Switzerland, and France. Germany's GDP grew 0.6%, Switzerland's GDP

0.9%, and France's GDP 1.5% in 2019³. Firstly, average growth rates do not necessarily represent the growth rate of the whole sample as growth rates for operational companies are capped at -100% for revenue decreases, whereas revenue growth has no natural border. Median growth rate values may also not reflect the growth rate of the whole data set as there clearly is a rightwards skewness in terms of the size of the companies, measured by operating cashflow, revenue, or EBITDA (e.g., c.f. Figure 6). Hence, the revenue growth of the larger firms has a bigger impact on the overall revenue growth than the revenue growth of small companies. Secondly, this data subset only includes publicly traded companies that are listed in France, Germany, and Switzerland whereas GDP tries to capture the whole national economic output including unlisted companies. Lastly, companies listed in the three countries potentially sell products outside of these three countries. These sales then do not contribute to the GDP of the three countries. Reversing this, companies listed outside of the three countries potentially sell products in the three countries and hence contribute to the GDP but are not included in our sample.

	Net debt (in EURm)			ND / EBITDA		
	2019	2018	2017	2019	2018	2017
Min	(272,284)	(242,929)	(224,185)	0.0x	0.0x	0.0x
25% Quartile	(4)	(8)	(11)	1.3x	1.1x	0.9x
Median	7	3	1	2.6x	2.4x	2.2x
Average	1,135	847	744	7.9x	6.0x	7.0x
75% Quartile	173	107	79	5.6x	5.2x	4.9x
Max	143,502	133,279	131,485	1239.0x	337.0x	377.7x
<i>Data available abs</i>	<i>1,533</i>	<i>1,575</i>	<i>1,594</i>	<i>1,429</i>	<i>1,459</i>	<i>1,455</i>
<i>Data available %</i>	<i>90.7%</i>	<i>93.2%</i>	<i>94.3%</i>	<i>84.6%</i>	<i>86.3%</i>	<i>86.1%</i>

Table 6: Descriptive statistics of net debt and ND/EBITDA ratio in the public data set.
Source: Refinitiv Eikon.

Similar to revenue and EBITDA, net debt also shows a rightwards skewness. Net debt (ND) is calculated as total debt minus cash and short-term investments. Refinitiv Eikon does not calculate ND/EBITDA ratios if net debt or EBITDA is negative. Hence, ND/EBITDA has a lower boundary of 0.0x but no upper boundary. In line with the previous explanation for revenue growth, this leads to potentially deteriorated averages. The average ND/EBITDA ratio implies very high leverage, whereas the median ND/EBITDA ratio implies a modest level of leverage. The total net debt in the sample over the total EBITDA in the sample confirms a moderate level of leverage of 1.8x in 2019. Though, this value has to be taken with care as it does not necessarily reflect the individual indebtedness of companies.

³ World Bank, World Development Indicators, 2021

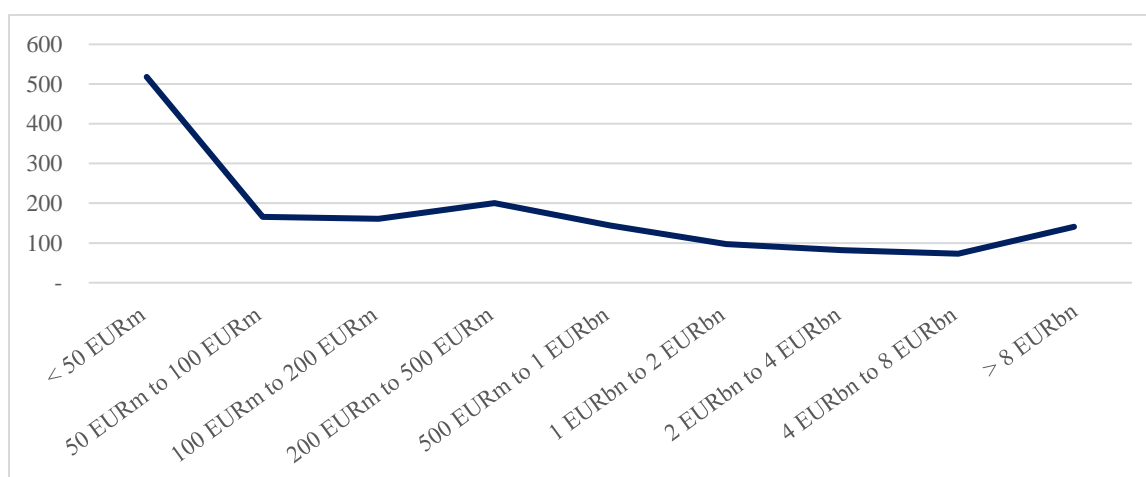


Figure 6: Number of public firms categorized by market capitalization.
Source: Refinitiv Eikon.

The median market capitalization is 153 EURm in 2019 whereas the average market capitalization is 3,810 EURm. This implies a right-skewness of the distribution of the firm's market capitalization, meaning that there are many small companies and fewer large companies which have a market capitalization that far exceeds the market capitalization of the smaller firms. Figure 6 illustrates the rightwards skewed distribution.

4.2 Analysis of zombie companies in the public data set

To be classified as a zombie company the following criteria needed to be fulfilled simultaneously:

Criterion	Specification
Company age	> 10 years
Operating CF smaller than	0.00 EURm
ICR below	1.00x
Rev growth below	3.00%
Z-Score below	0.00
Tobin's Q (P/B)	1.00x
Asset turnover	0.01x

Table 7: Criteria to classify public zombie companies.

To avoid including financially sound companies that have a bad year, we specified that these criteria needed to be present over a 2-year or 3-year window. After removing financial and real estate companies, we find five companies over a 3-year window and 17 companies over a 2-year window that are zombie companies at least once in the decade between 2019 and 2009. Out of the 1,690 companies in the sample, 1,162 companies are not financial or real estate companies and are older than 10 years. Hence, we find that 0.4% of the sample is at some point a zombie company over the 3-year window and 1.5% over the 2-year window. Table 8 and Table 9 below detail the breakdown of zombie companies over time. Furthermore, the zombification over any given time period ranges from 0% to 0.34% under

the 2-year window and from 0% to 0.17% in the 3-year window case. This low, almost non-existent level of zombification is far lower than the levels observed in the prevailing literature.

3-year window	19–17	18–16	17–15	16–14	15–13	14–12	13–11	12–10	11–09
(1) Air Berlin Plc						✓			
(2) Amalphi AG					✓				
(3) Groupe Actiplay SA	✓								
(4) Olympique Lyonnais Groupe SA						✓	✓	✓	
(5) Prologue SA							✓		
Total	1	0	0	0	1	2	2	1	0
Zombification	0.09%	0.00%	0.00%	0.00%	0.09%	0.17%	0.09%	0.09%	0.00%

Table 8: Zombification in the public data set over time applying a 3-year criteria window.
Source: Our own calculation based on Refinitiv Eikon.

2-year window	19–18	18–17	17–16	16–15	15–14	14–13	13–12	12–11	11–10	10–09
(1) Air Berlin Plc						✓	✓			
(2) Amalphi AG					✓	✓				
(3) Groupe Actiplay SA	✓	✓								
(4) Olympique Lyonnais Groupe SA						✓	✓	✓	✓	
(5) Prologue SA							✓	✓		
(6) Avenir Telecom SA					✓					
(7) Cesar SA		✓								
(8) Cybergun SA	✓									
(9) Europlasma SA	✓									
(10) Fyber NV	✓									
(11) Groupe Flo SA				✓						
(12) Kuros Biosciences AG						✓				
(13) Les Hotels de Paris SA				✓						
(14) MyHammer Holding AG						✓				
(15) Nextedia SA					✓					
(16) Smalto SA				✓						
(17) Yoc AG						✓				
Total	4	2	0	3	3	6	3	2	1	0
Zombification	0.34%	0.17%	0.00%	0.17%	0.26%	0.43%	0.26%	0.17%	0.09%	0.00%

Table 9: Zombification in the public data set over time applying a 2-year criteria window.
Source: Our own calculation based on Refinitiv Eikon.

It is noteworthy that out of the five companies that are classified as zombie companies over a 3-year rolling window, companies 2 to 5 are still reporting financial figures in 2019. Hence, it can be assumed that these companies are still operating. Aside from company 3 (Groupe Actiplay SA), it can be therefore assumed that these companies recovered from their zombie status and are now operating at a more normal level again. Company 3 (Groupe Actiplay SA) was classified as a zombie company in the most recent period. Hence, we do not draw conclusions about the survival of the zombie status. Upon individual research, company 3 (Groupe Actiplay SA) is still in operations as of May 2021. Company 1 (Air Berlin Plc) is the only company in the dataset that is not engaging in operations anymore. Drawing conclusions on certain sectors or industries being especially prone to zombification is not viable due to the low, almost non-existent level of zombification. Looking at the 2-year rolling window analysis, companies 1 to 5 represent the companies that are zombies under the 3-year rolling window criterion as well. Hence, applying the 2-year rolling window criterion, these companies are classified as zombies still over the same period. Logically, that means if a company was classified as a zombie company over the 3-year rolling window from 2012 to 2014, applying the 2-year rolling window, the company is classified as a zombie in the period 2012 to 2013 and 2013 to 2014. Analysing company 6 to 17, company 16 is the only company without operational data recorded within Thomson Reuters since FY17. However, individual analysis yields that the company still seems in operations. Aside from company 16 (Smalto SA) and companies 8 to 10, who recently fell into the zombie status, it can be therefore concluded the companies recovered from their zombie status.

The average age of companies that ever were a zombie over the period from 2019 to 2009, is 21.6 years considering a 3-year rolling window and 25.1 considering a 2-year rolling window. The median age of these companies considering a 3-year rolling window is 21.0 and 26.0 considering a 2-year rolling window. Below, Table 10 details the sector occurrence of the companies that over the period from 2019 to 2009 at least once were classified as a zombie company.

3-year rolling window		2-year rolling window	
Sector	Total	Sector	Total
Communication Services	2	Consumer Discretionary	6
Information Technology	2	Information Technology	4
Industrials	1	Communication Services	4
Total	5	Industrials	2
		Health Care	1
		Total	17
Industry	Total	Industry	Total
Airlines	1	Software	2
IT Services	1	IT Services	2
Media	1	Hotels, Restaurants & Leisure	2
Entertainment	1	Leisure Products	2
Software	1	Interactive Media & Services	2
Total	5	Commercial Services & Supplies	1
		Specialty Retail	1
		Airlines	1
		Media	1
		Biotechnology	1
		Entertainment	1
		Textiles, Apparel & Luxury Goods	1
		Total	17

Table 10: Public zombie companies classified by sector and industry.
Source: Our own calculation based on Refinitiv Eikon.

Table 11 below details the breakdown of the zombie companies by country.

Country	Total	Ever Zombie – 3-year window	Ever Zombie – 2-year window
France	736	3	11
Germany	721	2	5
Switzerland	233	0	1
Total	1,690	5	17

Table 11: Country distribution of zombie companies in the public data set.
Source: Our own calculation based on Refinitiv Eikon.

Over the years 2017 to 2019, there were only two companies classified as zombie companies applying a 3-year rolling window, and between four and six companies applying a 2-year rolling window. Furthermore, analyzing the descriptive statistics needs to be done with care as many of the data points are capped by the criteria to classify as a zombie company. For example, to be considered as a zombie company, we determined that amongst other criteria, the company needs to have an ICR below 1. Hence,

the average or median ICR of the subsample of zombie companies will always show ICR values below 1, whereas the median ICR for the whole sample is between 4 and 6 for the same period. Notable observations are that the market capitalization, as well as related turnover and profitability figures, are very small or negative, respectively. Low asset turnover of significantly below 1 points towards poor operational performance. However, it has to be noted that asset turnover is heavily influenced by the asset heaviness of the business model. Negative operating cashflows confirm poor operational performance. Cashflows may be influenced by timing, for example, problems with cash collection which is expected to happen in the next period. However, average and median EBITDA values of significantly below 0 indicate that the negative operating cashflow is not due to timing issues but due to operational problems. Comparing net debt and market capitalization indicates a high leverage level in zombie companies.

3-year window	Average			Median		
	2019	2018	2017	2019	2018	2017
# Zombie companies	2	2	2	2	2	2
Z-Score	(16.3)	(7.6)	(4.1)	(16.3)	(7.6)	(4.1)
Tobin's Q (P/B)	(0.5)	(0.3)	(0.1)	(0.5)	(0.3)	(0.1)
Asset turnover	0.1x	0.2x	0.2x	0.1x	0.2x	0.2x
Operating CF (in EURm)	(0.6)	(1.4)	(0.1)	(0.6)	(1.4)	(0.1)
EBITDA (in EURm)	(1.5)	(1.8)	(1.7)	(1.5)	(1.8)	(1.7)
Interest coverage ratio	(21.4x)	(2,766.9x)	(40.5x)	(21.4x)	(2,766.9x)	(40.5x)
Revenue	0.9	2.2	4.7	0.9	2.2	4.7
Revenue growth	(43.8%)	(51.4%)	(41.4%)	(43.8%)	(51.4%)	(41.4%)
Net Debt (in EURm)	1.9	7.1	5.4	1.9	7.1	5.4
ND / EBITDA	9.7x	n.a.	n.a.	9.7x	n.a.	n.a.
Market cap (in EURm)	2.7	1.5	2.7	2.7	1.5	2.7

Table 12: Descriptive statistics of the public zombie companies applying a 3-year criteria window.
Source: Our own calculation based on Refinitiv Eikon.

2-year window	Average			Median		
	2019	2018	2017	2019	2018	2017
# Zombie companies	5	6	4	5	6	4
Z-Score	(9.8)	(10.9)	(11.1)	(11.2)	(7.6)	(7.8)
Tobin's Q (P/B)	(0.2)	(0.3)	0.2	(0.2)	(0.1)	0.2
Asset turnover	0.4x	0.4x	0.5x	0.2x	0.5x	0.4x
Operating CF (in EURm)	(3.8)	(6.0)	(0.2)	(1.8)	(2.7)	(0.1)
EBITDA (in EURm)	(3.6)	(3.8)	(1.2)	(2.9)	(3.3)	(1.1)
Interest coverage ratio	(12.1x)	(941.9x)	(297.9x)	(7.8x)	(15.2x)	(40.5x)
Revenue	30.4	29.7	3.4	3.2	7.7	2.0
Revenue growth	(35.8%)	(29.2%)	(35.0%)	(25.9%)	(29.0%)	(39.7%)
Net Debt (in EURm)	30.6	35.7	2.7	10.8	13.3	0.6
ND / EBITDA	9.7x	n.a.	n.a.	0.0x	0.0x	0.0x
Market cap (in EURm)	12.3	4.2	1.5	11.0	1.5	1.4

Table 13: Descriptive statistics of the public zombie companies applying a 2-year criteria window.
Source: Our own calculation based on Refinitiv Eikon.

To put the zombie subsample and its potential economic impact into perspective, we analyze the representation of zombie companies in terms of market capitalisation and revenue compared to the whole sample. As the zombie companies in the public data set are very small companies in terms of size and turnover as well as the fraction of number of companies they represent, they do not reflect a significant portion of the total market capitalisation or turnover of the sample (c.f. Table 14). Regardless, it has to be mentioned that the representation in terms of market capitalisation and revenue is below the representation in terms of number of companies. We find that over the period under observation 0.4% and 1.5% of all companies were a zombie at least once, applying a 3-year and 2-year window, respectively.

	Market cap (in EURm)		Revenue 2019 (in EURm)		Revenue 2018 (in EURm)		Revenue 2017 (in EURm)	
	Abs	%	Abs	%	Abs	%	Abs	%
3yr window Ever zombie	188	0.0%	272	0.0%	313	0.0%	377	0.0%
2yr window Ever zombie	612	0.0%	732	0.0%	777	0.0%	950	0.0%
Whole sample	6,027,975	100.0%	4,874,448	100.0%	4,617,021	100.0%	4,498,928	100.0%

Table 14: Representation of zombie companies in the public data set.
Source: Our own calculations based on Refinitiv Eikon.

We do realize that the combination of our criteria is very restrictive in comparison to the prevailing literature on zombie companies because we believe that a company should not baselessly be classified

as a zombie company. Below Table 15 and Table 16 detail how restrictive each criterion individually is.

3-year rolling window	19–17	18–16	17–15	16–14	15–13	14–12	13–11	12–10	11–09
Not RE/Fin	1,326	1,326	1,326	1,326	1,326	1,326	1,326	1,326	1,326
Older than 10 yrs	1,482	1,482	1,482	1,482	1,482	1,482	1,482	1,482	1,482
Combined	1,162	1,162	1,162	1,162	1,162	1,162	1,162	1,162	1,162
Operating CF negative	113	123	119	116	107	90	79	62	39
ICR below 1	135	116	117	121	116	110	99	82	44
Rev growth below 3%	121	139	124	147	151	187	149	88	91
Z-Score below 0	53	56	53	48	56	48	49	34	18
Tobin's Q below 1	138	119	123	144	159	171	189	188	106
Asset turnover > 0.01	990	1,000	999	990	974	964	927	902	449
<i>Operating CF negative</i>	<i>9.7%</i>	<i>10.6%</i>	<i>10.2%</i>	<i>10.0%</i>	<i>9.2%</i>	<i>7.7%</i>	<i>6.8%</i>	<i>5.3%</i>	<i>3.4%</i>
<i>ICR below 1</i>	<i>11.6%</i>	<i>10.0%</i>	<i>10.1%</i>	<i>10.4%</i>	<i>10.0%</i>	<i>9.5%</i>	<i>8.5%</i>	<i>7.1%</i>	<i>3.8%</i>
<i>Rev growth below 3%</i>	<i>10.4%</i>	<i>12.0%</i>	<i>10.7%</i>	<i>12.7%</i>	<i>13.0%</i>	<i>16.1%</i>	<i>12.8%</i>	<i>7.6%</i>	<i>7.8%</i>
<i>Z-Score below 0</i>	<i>4.6%</i>	<i>4.8%</i>	<i>4.6%</i>	<i>4.1%</i>	<i>4.8%</i>	<i>4.1%</i>	<i>4.2%</i>	<i>2.9%</i>	<i>1.5%</i>
<i>Tobin's Q below 1</i>	<i>11.9%</i>	<i>10.2%</i>	<i>10.6%</i>	<i>12.4%</i>	<i>13.7%</i>	<i>14.7%</i>	<i>16.3%</i>	<i>16.2%</i>	<i>9.1%</i>
<i>Asset turnover > 0.01</i>	<i>85.2%</i>	<i>86.1%</i>	<i>86.0%</i>	<i>85.2%</i>	<i>83.8%</i>	<i>83.0%</i>	<i>79.8%</i>	<i>77.6%</i>	<i>38.6%</i>

Table 15: Restrictiveness of criteria applying a 3-year criteria window in the public data set.
Source: Our own calculation based on Refinitiv Eikon.

2-year rolling window	19–18	18–17	17–16	16–15	15–14	14–13	13–12	12–11	11–10	10–09
Not RE/Fin	1,326	1,326	1,326	1,326	1,326	1,326	1,326	1,326	1,326	1,326
Older than 10 years	1,482	1,482	1,482	1,482	1,482	1,482	1,482	1,482	1,482	1,482
Combined	1,162	1,162	1,162	1,162	1,162	1,162	1,162	1,162	1,162	1,162
Operating CF negative	143	159	162	152	151	139	117	103	88	54
ICR below 1	182	172	157	156	174	157	160	125	111	69
Rev growth below 3%	241	228	247	233	222	333	317	208	139	157
Z-Score below 0	82	70	77	70	72	63	67	56	44	23
Tobin's Q below 1	203	167	142	172	192	201	213	245	237	120
Asset turnover > 0.01	1,008	1,030	1,029	1,019	1,005	994	973	936	913	459
<i>Operating CF negative</i>	<i>12.3%</i>	<i>13.7%</i>	<i>13.9%</i>	<i>13.1%</i>	<i>13.0%</i>	<i>12.0%</i>	<i>10.1%</i>	<i>8.9%</i>	<i>7.6%</i>	<i>4.6%</i>
<i>ICR below 1</i>	<i>15.7%</i>	<i>14.8%</i>	<i>13.5%</i>	<i>13.4%</i>	<i>15.0%</i>	<i>13.5%</i>	<i>13.8%</i>	<i>10.8%</i>	<i>9.6%</i>	<i>5.9%</i>
<i>Rev growth below 3%</i>	<i>20.7%</i>	<i>19.6%</i>	<i>21.3%</i>	<i>20.1%</i>	<i>19.1%</i>	<i>28.7%</i>	<i>27.3%</i>	<i>17.9%</i>	<i>12.0%</i>	<i>13.5%</i>
<i>Z-Score below 0</i>	<i>7.1%</i>	<i>6.0%</i>	<i>6.6%</i>	<i>6.0%</i>	<i>6.2%</i>	<i>5.4%</i>	<i>5.8%</i>	<i>4.8%</i>	<i>3.8%</i>	<i>2.0%</i>
<i>Tobin's Q below 1</i>	<i>17.5%</i>	<i>14.4%</i>	<i>12.2%</i>	<i>14.8%</i>	<i>16.5%</i>	<i>17.3%</i>	<i>18.3%</i>	<i>21.1%</i>	<i>20.4%</i>	<i>10.3%</i>
<i>Asset turnover > 0.01</i>	<i>86.7%</i>	<i>88.6%</i>	<i>88.6%</i>	<i>87.7%</i>	<i>86.5%</i>	<i>85.5%</i>	<i>83.7%</i>	<i>80.6%</i>	<i>78.6%</i>	<i>39.5%</i>

Table 16: Restrictiveness of criteria applying a 2-year criteria window in the public data set.
Source: Our own calculation based on Refinitiv Eikon.

Across all periods, the Z-Score criterion is the most restrictive. Removing the Z-Score criterion altogether yields 12 companies that were ever a zombie company applying a 3-year rolling window and 46 applying the 2-year rolling window with the below development over time. The maximum zombification rate is therefore 0.3% and 0.9% applying a 3-year and a 2-year rolling window, respectively. When Eduard Altman originally published the Z-Score for the first time (Altman, 1968), he used 1.8 as a cut-off point to deem a company likely to go bankrupt in the near-term future. Even though, he recommends using 0 as a cut-off point nowadays (McKinsey & Altman (2020)), we analyze the data set using a 1.8 cut-off point as well. This yields 7 and 31 companies ever being classified as zombie company, applying the 3 and 2-year rolling window, respectively. The maximum zombification during the whole period is 0.2% and 0.7%, respectively, applying a 3 and 2-year window (c.f. Table 17 and Table 18).

3-year rolling window	19–17	18–16	17–15	16–14	15–13	14–12	13–11	12–10	11–09	Ever Zombie?
Without Z-Score	2	2	0	1	3	2	3	2	0	12
Zombification	0.2%	0.2%	0.0%	0.1%	0.3%	0.2%	0.3%	0.2%	0.0%	1.0%
Z-Score 1.8	2	1	0	0	1	2	2	1	0	7
Zombification	0.2%	0.1%	0.0%	0.0%	0.1%	0.2%	0.2%	0.1%	0.0%	0.6%

Table 17: Sensitivity analysis of zombification in the public data set with modified Z-Score criterion applying a 3-year criteria window.

Source: Our own calculation based on Refinitiv Eikon.

2-year roll. window	19–18	18–17	17–16	16–15	15–14	14–13	13–12	12–11	11–10	10–09	Ever Zombie?
Without Z-Score	6	10	5	7	6	9	8	5	3	2	46
Zombification	0.5%	0.9%	0.4%	0.6%	0.5%	0.8%	0.7%	0.4%	0.3%	0.2%	4.0%
Z-Score 1.8	6	8	3	3	4	7	4	3	1	1	31
Zombification	0.5%	0.7%	0.3%	0.3%	0.3%	0.6%	0.3%	0.3%	0.1%	0.1%	2.7%

Table 18: Sensitivity analysis of zombification in the public data set with modified Z-Score criterion applying a 2-year criteria window.

Source: Our own calculation based on Refinitiv Eikon.

4.3 Analysis of zombies in the public data set with criteria from the literature/press

Using a different data sample than the prevailing literature due to our geographic restrictions, we analyze our data set using criteria proposed in said literature as well. McGowan et al. (2017a) propose classifying a zombie company as "old firms that have persistent problems meeting their interest payments". Hence, their criteria are that the company is older than 10 years and has an ICR below 1 for 3 consecutive years. They use a data set covering nine countries, including Belgium, Finland, France, Italy, Korea, Slovenia, Spain, Sweden, and United Kingdom over the period from 2003 to 2013. Furthermore, farming and financial companies are excluded. They find a prevalence of zombie firms between 1% and 10% depending on the country and the period under investigation. We extend their analysis by adding Germany and Switzerland to the geographic data sample as well as covering a different time period. Applying the above-mentioned two filters, we find 507 companies that ever were classified as zombie companies over the period from 2009 to 2019. Table 19 below details the development of the zombification over time which is in line with McGowan et al.'s (2017a) findings.

3-year rolling window	19–17	18–16	17–15	16–14	15–13	14–12	13–11	12–10	11–09	Ever Zombie?
Excl. financials	152	130	131	132	131	124	109	94	57	339
<i>Zombification</i>	10.3%	8.8%	8.9%	8.9%	8.9%	8.4%	7.4%	6.4%	3.9%	23.0%
Excl. financials & real estate	135	116	117	121	116	110	99	82	44	300
<i>Zombification</i>	11.6%	10.0%	10.1%	10.4%	10.0%	9.5%	8.5%	7.1%	3.8%	25.8%

Table 19: Public data set zombie analysis with criteria from McGowan et al. 2017a applied.
Source: Our own calculation based on Refinitiv Eikon.

Closely following McGowan et al. (2017a) are Banerjee & Hofmann (2020). In their working paper, they propose as criteria that the ICR is below 1 for 2 consecutive years and the price to book ratio is below the industry median for 2 consecutive years and define zombie companies as "unprofitable firms with low stock market valuation". Their data set includes listed companies from Belgium, Canada, Denmark, France, Germany, Italy, Japan, Netherlands, Spain, Sweden, Switzerland, United Kingdom, and the US spanning from the 1980s to 2017. Our data set is far more limited in terms of geographies and period, but in addition to Banerjee & Hofmann's (2020) data set, we do include the years 2018 and 2019. Applying their filter, we find zombification levels ranging between 2.8% and 7.1% if we include financial and real estate companies and ranging between 2.7% and 8.3% if we exclude financial and real estate companies, which is at the lower end of their results. Banerjee & Hofmann (2020) describe a trend of increasing zombification over time. Our data set clearly shows an increase in zombification comparing the latest with the oldest two periods. The periods between 2011 and 2017 do not show a clear trend.

2-year rolling window	19–18	18–17	17–16	16–15	15–14	14–13	13–12	12–11	11–10	10–09	Ever Zombie?
Incl. financials and real estate	120	105	92	90	101	86	97	93	77	48	371
<i>Zombification</i>	7.1%	6.2%	5.4%	5.3%	6.0%	5.1%	5.7%	5.5%	4.6%	2.8%	22.0%
Excl. financials and real estate	96	87	69	72	78	56	65	59	42	31	280
<i>Zombification</i>	8.3%	7.5%	5.9%	6.2%	6.7%	4.8%	5.6%	5.1%	3.6%	2.7%	24.1%

Table 20: Public data set zombie analysis with criteria from Banerjee & Hofmann (2020) applied.
Source: Our own calculation based on Refinitiv Eikon.

Alternatively, the Bank of Korea (2013) classifies a company as a zombie company if the ICR is below 1 for 3 consecutive years or the cashflow from operations is negative for 3 consecutive years. Applying this to our data set yields zombification levels between 6.5% and 17.2% including financial and real

estate companies and between 6.5% and 19.4% excluding financial and real estate companies. This is in line with the 14% prevalence of Korean zombie companies found by the Bank of Korea at the end of 2012.

3-year rolling window	19–17	18–16	17–15	16–14	15–13	14–12	13–11	12–10	11–09	Ever Zombie?
Incl. financials and real estate	290	280	271	263	254	230	205	181	110	584
<i>Zombification</i>	<i>17.2%</i>	<i>16.6%</i>	<i>16.0%</i>	<i>15.6%</i>	<i>15.0%</i>	<i>13.6%</i>	<i>12.1%</i>	<i>10.7%</i>	<i>6.5%</i>	<i>34.6%</i>
Excl. financials and real estate	225	216	212	211	197	173	149	123	75	432
<i>Zombification</i>	<i>19.4%</i>	<i>18.6%</i>	<i>18.2%</i>	<i>18.2%</i>	<i>17.0%</i>	<i>14.9%</i>	<i>12.8%</i>	<i>10.6%</i>	<i>6.5%</i>	<i>37.2%</i>

Table 21: Public data set zombie analysis with the criteria from the bank of Korea, 2013 applied. Source: Our own calculation based on Refinitiv Eikon.

4.4 Summary statistics of the private data set

Analogous to the public data set, we gather data on private companies and apply similar filters to the public data set. We use the Orbis database to gather the company information. Due to data availability restrictions, we adjust or remove certain filters. In line with the public data set, we apply an interest coverage, revenue growth, and asset turnover criterion. Due to data availability issues, we apply an EBIT (operating profit) criterion instead of an operating cashflow criterion. Furthermore, due to data availability issues, we have to remove the Z-Score criterion. Lastly, the Tobin's Q criterion is removed as the market price of equity is not readily available for private companies. We continue to focus on French, Swiss, and German companies and exclude companies operating in the financial and real estate sectors. Out of around 25 million French, Swiss, and German companies in the database, we have sufficient data in at least one year for 90,696 companies. In this sample of 90,696 companies, the average company is 28.5 years old, and the median company is 24.0 years old. Therefore, the average and median privately held company is far younger than the average or median publicly-traded company. Below Figure 7 details the distribution and shows similar to the publicly traded data set, a rightwards skewness. Furthermore, we find that in the private data set there are 78,755 French companies, 11,924 German companies, and only 17 Swiss companies (c.f. Table 30).

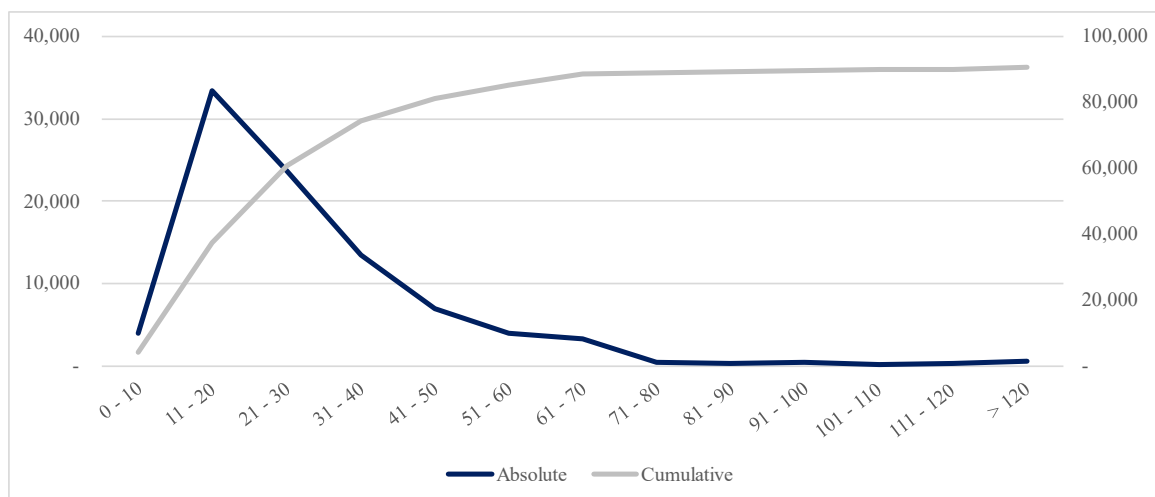


Figure 7: Number of private firms categorized by company age.
Source: Orbis.

In the private data set, the NACE Rev. 2 industry classification is available and hence used. Table 22 details the industry breakdown of the whole data set.

Industry	Total
Wholesale and retail trade; repair of motor vehicles and motorcycles	24,827
Manufacturing	15,503
Construction	9,586
Professional, scientific, and technical activities	9,018
Accommodation and food service activities	5,396
Financial and insurance activities	5,049
Transportation and storage	4,093
Administrative and support service activities	3,789
Human health and social work activities	3,119
Information and communication	2,736
Electricity, gas, steam, and air conditioning supply	2,671
Other service activities	1,323
Water supply; sewerage, waste management and remediation activities	947
Arts, entertainment, and recreation	868
Agriculture, forestry, and fishing	779
Education	647

Mining and quarrying	38
Public administration and defence; compulsory social security	5
Activities of extraterritorial organisations and bodies	4
Not specified	298
Total	90,696

Table 22: Private companies classified by industry.

Source: Orbis.

Furthermore, we gather data on the number of employees. Orbis has data available on 44,536 companies, representing 49.1% of the data set. The average and median company employs 376 and 43 employees, respectively. Analogous to the market capitalization for publicly traded companies, this implies a rightwards skewness with a lot of small companies and a few exceptionally large companies. Figure 8 below details the distribution.

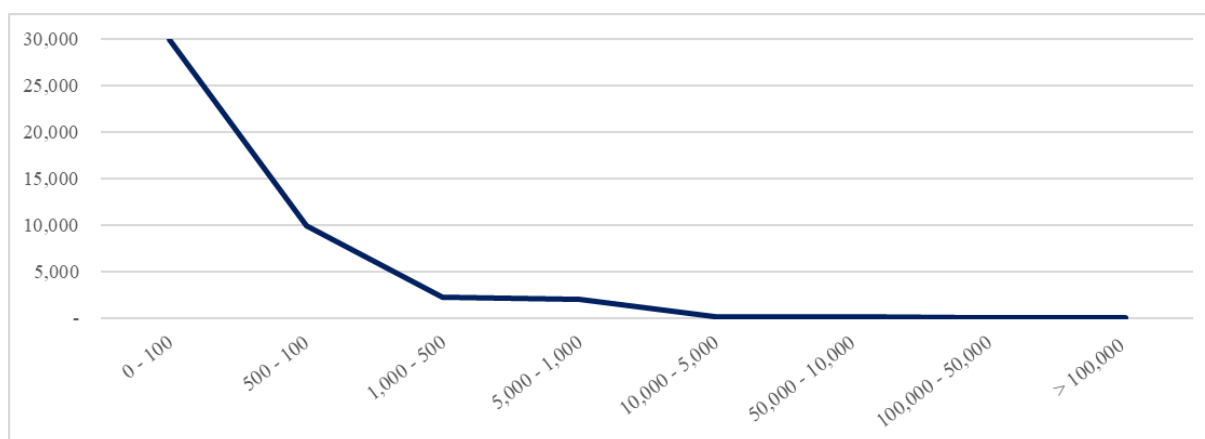


Figure 8: Number of private firms categorized by number of employees.

Source: Orbis.

Orbis provides us with data from 2019 to 2017. The below tables summarize the privately traded data set in the financial years 2019 to 2017.

	Asset turnover			EBIT (in EURm)		
	2019	2018	2017	2019	2018	2017
Min	0.0x	0.0x	0.0x	(1,135.1)	(591.0)	(571.0)
25% Quartile	1.4x	1.4x	1.4x	0.0	0.0	0.0
Median	2.8x	2.9x	2.9x	0.1	0.1	0.1
Average	5.8x	5.9x	5.9x	2.3	2.5	2.7
75% Quartile	5.5x	5.6x	5.7x	0.5	0.5	0.5
Max	996.7x	985.0x	991.0x	4,668.0	5,516.0	5,982.0
<i>Data available abs</i>	<i>87,307</i>	<i>87,425</i>	<i>87,455</i>	<i>90,511</i>	<i>90,502</i>	<i>90,528</i>
<i>Data available %</i>	<i>96.3%</i>	<i>96.4%</i>	<i>96.4%</i>	<i>99.8%</i>	<i>99.8%</i>	<i>99.8%</i>

Table 23: Descriptive statistics of the asset turnover and EBIT in the private data set.
Source: Orbis.

Instead of the operating cashflow criterion, we use EBIT as an approximation due to missing data on operating cashflows. Alternatively, Orbis provided us with sufficient data on the total cashflow. We consciously decided against using the total cashflow as an approximation as troubled companies which may be classified as zombie company oftentimes raise cash in order to avoid bankruptcy. Hence, the total cashflow would be especially distorted for the subset of companies (struggling companies) that we want to analyze. The median private company has an EBIT of around 0.1 EURm. The average EBIT is around 2.3 EURm, which is not only significantly higher than the median but even higher than the 75% quartile company and hence implies a strong rightwards skewness. This compares to average and median operating cashflows of 14.2 EURm and 357.8 EURm in the publicly traded data set in 2019.

	EBITDA (in EURm)			ICR		
	2019	2018	2017	2019	2018	2017
Min	(984.0)	(570.0)	(554.0)	(100.0x)	(100.0x)	(100.0x)
25% Quartile	0.0	0.0	0.0	1.0x	1.0x	1.2x
Median	0.2	0.2	0.2	9.8x	9.0x	9.0x
Average	4.6	4.3	4.4	50.9x	42.2x	42.4x
75% Quartile	0.9	0.8	0.8	44.4x	38.7x	37.1x
Max	19,024.6	9,729.0	8,873.0	999.5x	997.3x	999.6x
<i>Data available abs</i>	<i>90,511</i>	<i>90,502</i>	<i>90,528</i>	<i>90,509</i>	<i>90,500</i>	<i>90,526</i>
<i>Data available %</i>	<i>99.8%</i>	<i>99.8%</i>	<i>99.8%</i>	<i>99.8%</i>	<i>99.8%</i>	<i>99.8%</i>

Table 24: Descriptive statistics of the EBITDA and ICR in the private data set.
Source: Orbis.

Similar to EBIT, EBITDA and ICR show a rightwards skewness as well. EBITDA and EBIT are on average and at median smaller in the private data sample. However, interestingly, the interest coverage ratio in the private data sample is on average and at median higher than in the publicly listed data set.

This may indicate higher levels of leverage in the public data set, which could be supported by easier financing access for publicly traded companies. However, due to the lack of data on the debt levels of private companies, we cannot further analyze this hypothesis.

	Revenue (in EURm)			Revenue growth (in %)		
	2019	2018	2017	2019	2018	2017
Min	(0.4)	(4.4)	(0.2)	(9,787.0)	(8,734.8)	(4,961.1)
25% Quartile	1.0	1.0	1.0	(4.4)	(3.5)	(2.9)
Median	3.4	3.3	3.1	2.4	3.2	3.6
Average	63.0	61.6	59.6	699.3	3,622.3	926,009.1
75% Quartile	17.6	17.0	16.3	10.0	11.3	12.1
Max	91,929.6	96,277.0	89,669.6	36,577,600.0	87,354,400.0	54,008,213,900.0
<i>Data available abs</i>	<i>90,511</i>	<i>90,502</i>	<i>90,528</i>	<i>90,501</i>	<i>90,528</i>	<i>83,079</i>
<i>Data available %</i>	<i>99.8%</i>	<i>99.8%</i>	<i>99.8%</i>	<i>99.8%</i>	<i>99.8%</i>	<i>91.6%</i>

Table 25: Descriptive statistics of revenue and revenue growth in the private data set.
Source: Orbis.

The distribution of revenue shows a rightwards skewness as well. Following the explanation for the publicly listed data set, revenue growth almost has a natural border at (100.0%). In the private data sample, we see minimum revenue growth rates of below (100.0%). The reason for this is some companies turning from revenue positive to negative revenue and then back to positive revenue in the following year. Mathematically, this leads to negative revenue growth rates smaller than (100.0%) for the second and third year.

4.5 Analysis of zombie companies in the private data set

To be classified as a zombie company, the following the criteria in the private data set needed to be fulfilled simultaneously:

Criterion	Specification
Company age (years)	> 10
EBIT smaller than	0.00 EURm
ICR below	1.00x
Revenue growth below	3.00%
Asset turnover below	0.01x

Table 26: Criteria to classify private zombie companies.

Analogous to the publicly listed data set, these criteria need to be fulfilled for 3 or 2 consecutive years. Over the 3-year rolling window, we find 3,276 companies, over the 2-year rolling window, 10,243 companies that ever fulfill these criteria. Table 27 and Table 28 below show the breakdown of the

zombification over time. The zombification in the private data set is comparatively higher than in the public data set, however still at a moderately low level. In the public data set, the most restrictive criteria are the Z-Score, followed by the operating cashflow and Tobin's Q. For the private data set, we have to remove the Z-Score and Tobin's Q criteria altogether and approximate the operating cashflow criterion through EBIT. This may strongly influence our results and increase the zombification observed in any given period. Similar to the public data set, we find a low level of zombie companies ceasing operations, with 184 companies not reporting financial figures in 2019 anymore. However, it has to be mentioned that there are cases where companies stopped reporting financial figures for some years and later started reporting again. Furthermore, we note that only companies with financial data available in the Orbis database are included in our data sample and not the full private company population. The median and average zombie company applying the 3-year rolling window is 30.0 and 34.3 years old, respectively. Applying a 2-year rolling window, the median and average company is 29.0 and 32.8 years old, respectively.

3-year window	19–17	18–16	17–15	16–14	15–13	14–12	Ever Zombie
Total	1,113	888	749	799	856	804	3,276
Zombification	1.2%	1.0%	0.8%	0.9%	0.9%	0.9%	3.6%
<i>Compare to: public data set</i>	<i>0.1%</i>	<i>0.0%</i>	<i>0.0%</i>	<i>0.0%</i>	<i>0.1%</i>	<i>0.2%</i>	<i>0.4%</i>

Table 27: Zombification in the private data set over time applying a 3-year criteria window.
Source: Our own calculation based on Orbis.

2-year window	19–18	18–17	17–16	16–15	15–14	14–13	13–12	Ever Zombie
Total	3,328	2,571	2,125	2,047	2,141	2,118	2,040	10,243
Zombification	3.7%	2.8%	2.3%	2.3%	2.4%	2.3%	2.2%	11.3%
<i>Compare to: public data set</i>	<i>0.3%</i>	<i>0.2%</i>	<i>0.0%</i>	<i>0.2%</i>	<i>0.3%</i>	<i>0.4%</i>	<i>0.3%</i>	<i>1.5%</i>

Table 28: Zombification in the private data set over time applying a 2-year criteria window.
Source: Our own calculation based on Orbis.

Table 29 below details the distribution across industries of the zombie companies. Notably, the 4 most frequent industries in which zombie companies operate are manufacturing, wholesale and retail trade, professional, scientific, and technical activities, as well as transportation and storage. This is mostly in line with the prevalence of industries in the whole sample. Appendix C compares the prevalence of any given industry in the whole sample with the prevalence in the subsample of zombie companies.

Industry	3-year rolling window	2-year rolling window
Wholesale and retail trade; repair of motor vehicles and motorcycles	948	2,667
Manufacturing	682	2,149
Professional, scientific, and technical activities	286	876
Financial and insurance activities	253	734
Transportation and storage	205	615
Accommodation and food service activities	204	699
Construction	177	833
Information and communication	111	319
Human health and social work activities	96	290
Administrative and support service activities	77	298
Water supply; sewerage, waste management and remediation activities	49	127
Arts, entertainment, and recreation	48	145
Other service activities	42	156
Electricity, gas, steam, and air conditioning supply	35	91
Education	27	91
Agriculture, forestry, and fishing	27	124
Mining and quarrying	1	5
Not specified	8	24
Total	3,276	10,243

Table 29: Private zombie companies classified by industry.
Source: Our own calculation based on Orbis.

Table 30 below details the breakdown of the zombie companies by country.

Country	Total	Ever Zombie 3yr	Ever Zombie 2yr
France	78,755	2,921	9,116
Germany	11,924	354	1,123
Switzerland	17	1	4
Total	90,696	3,276	10,243

Table 30: Country distribution of zombie companies in the private data set.

Deviating to the public data set, the average and median zombie company in the private data set is not comparably small. We find that when applying a 3-year window, 3.6% of all companies, and 11.3% of all companies, when applying a 2-year window, are a zombie company at least once over the period under observation. In terms of revenue and number of employees we find that the zombie company subsample roughly represents this share as well (c.f. Table 31).

	Employees (in '000)		Revenue 2019 (in EURm)		Revenue 2018 (in EURm)		Revenue 2017 (in EURm)	
	Abs	%	Abs	%	Abs	%	Abs	%
3yr window Ever zombie	569.0	3.4%	201,267	3.5%	200,594	3.6%	206,762	3.8%
2yr window Ever zombie	1,705.8	10.2%	792,942	13.9%	799,872	14.3%	769,083	14.2%
Whole sample	16,651.4	100.0%	5,710,335	100.0%	5,585,373	100.0%	5,407,033	100.0%

Table 31: Representation of zombie companies the private data set.

Source: Our own calculations based on Orbis.

Analogous to the public data set, the characteristics of the zombie companies are bounded by their zombie classification criteria. For example, the average and median EBIT of the zombie company subsample will always be lower than 0.0 EURm as we use this as a criterion to classify zombie companies. In line with expectations, the zombie companies in the private data sample are a lot more unprofitable than the non-zombie companies in the private data set. Surprisingly, and differing to the public data set, in terms of revenue the average and median zombie company in the private data set has a similar turnover than the average and median non-zombie company.

3-year window	Average			Median		
	2019	2018	2017	2019	2018	2017
# Zombie companies	1,113	1,547	1,950	1,113	1,547	1,950
Asset turnover	7.7x	6.2x	6.6x	2.2x	2.3x	2.4x
EBITDA (in EURm)	(2.6)	(1.9)	(1.1)	(0.0)	(0.0)	(0.0)
ICR	(19.8)	(17.5)	(14.9)	(12.0)	(10.4)	(7.8)
EBIT (in EURm)	(4.1)	(3.2)	(2.5)	(0.1)	(0.1)	(0.1)
Revenue (in EURm)	64.1	58.5	59.7	2.1	2.3	2.6
Revenue growth	(10.6%)	(9.9%)	(9.4%)	(5.3%)	(4.9%)	(4.9%)

Table 32: Descriptive statistics of the private zombie companies applying a 3-year criteria window.
Source: Our own calculation based on Orbis.

2-year window	Average			Median		
	2019	2018	2017	2019	2018	2017
# Zombie companies	3,328	4,786	3,808	3,328	4,786	3,808
Asset turnover	8.2x	6.6x	7.1x	2.5x	2.5x	2.5x
EBITDA (in EURm)	(1.8)	(1.0)	(0.7)	(0.0)	(0.0)	(0.0)
ICR	(18.7)	(16.3)	(15.0)	(10.7)	(8.6)	(7.6)
EBIT (in EURm)	(3.4)	(2.4)	(1.8)	(0.1)	(0.1)	(0.1)
Revenue (in EURm)	68.6	58.8	43.3	2.2	2.3	2.4
Revenue growth	(11.1%)	(11.3%)	(10.8%)	(5.6%)	(5.9%)	(5.7%)

Table 33: Descriptive statistics of the private zombie companies applying a 2-year criteria window.
Source: Our own calculation based on Orbis.

We analyze the development of the zombie companies over time. Table 34 and Table 35 below detail the transition of zombie companies into either recovery or not reporting data anymore. Year +X describes the number of years after first being classified as a zombie company. For example, if a company is classified as a zombie company for the period 2013 to 2015, we take 2013 as the first year of zombification. Logically, this company will be a zombie company in Year +1 and Year +2 as these two years are still included in the 3-year rolling window. Furthermore, this company will transition into the out of time frame category in Year +7 as we only classify zombie companies until the period ending 2019 and hence the assessment of its zombie status in Year +7 is out of our time frame. We find that roughly half of the companies transition out of their zombie status within two years of the end of their zombie period. Only a small portion stays a zombie company two years after their initial zombie period ends with some 1% to 3% relapsing into zombie status (c.f. Table 34 and Table 35).

3-year window	Year +1	Year +2	Year +3	Year +4	Year +5	Year +6	Year +7
Zombie	3,276	3,276	1,163	451	235	129	71
thereof: newly relapsed into zombie status	-	-	-	31	27	-	-
Not a zombie anymore	-	-	1,431	1,633	1,477	1,160	733
No data reported	-	-	56	49	-	-	-
Out of time frame	-	-	626	1,143	1,564	1,987	2,472
<i>Zombie</i>	<i>100.0%</i>	<i>100.0%</i>	<i>35.5%</i>	<i>13.8%</i>	<i>7.2%</i>	<i>3.9%</i>	<i>2.2%</i>
<i>thereof: newly relapsed into zombie status</i>	<i>0.0%</i>	<i>0.0%</i>	<i>0.0%</i>	<i>0.9%</i>	<i>0.8%</i>	<i>0.0%</i>	<i>0.0%</i>
<i>Not a zombie anymore</i>	<i>0.0%</i>	<i>0.0%</i>	<i>43.7%</i>	<i>49.8%</i>	<i>45.1%</i>	<i>35.4%</i>	<i>22.4%</i>
<i>No data reported</i>	<i>0.0%</i>	<i>0.0%</i>	<i>1.7%</i>	<i>1.5%</i>	<i>0.0%</i>	<i>0.0%</i>	<i>0.0%</i>
<i>Out of time frame</i>	<i>0.0%</i>	<i>0.0%</i>	<i>19.1%</i>	<i>34.9%</i>	<i>47.7%</i>	<i>60.7%</i>	<i>75.5%</i>

Table 34: Zombification matrix of the private data set applying a 3-year window.

Source: Our own calculation based on Orbis.

2-year window	Year +1	Year +2	Year +3	Year +4	Year +5	Year +6	Year +7
Zombie	10,243	3,100	1,452	995	712	515	271
thereof: newly relapsed into zombie status	-	-	339	246	175	158	-
Not a zombie anymore	-	5,108	5,340	4,660	3,926	2,838	1,767
No data reported	-	208	185	131	1	1	2
Out of time frame	-	1,827	3,266	4,457	5,604	6,889	8,203
<i>Zombie</i>	<i>100.0%</i>	<i>30.3%</i>	<i>14.2%</i>	<i>9.7%</i>	<i>7.0%</i>	<i>5.0%</i>	<i>2.6%</i>
<i>thereof: newly relapsed into zombie status</i>	<i>0.0%</i>	<i>0.0%</i>	<i>3.3%</i>	<i>2.4%</i>	<i>1.7%</i>	<i>1.5%</i>	<i>0.0%</i>
<i>Not a zombie anymore</i>	<i>0.0%</i>	<i>49.9%</i>	<i>52.1%</i>	<i>45.5%</i>	<i>38.3%</i>	<i>27.7%</i>	<i>17.3%</i>
<i>No data reported</i>	<i>0.0%</i>	<i>2.0%</i>	<i>1.8%</i>	<i>1.3%</i>	<i>0.0%</i>	<i>0.0%</i>	<i>0.0%</i>
<i>Out of time frame</i>	<i>0.0%</i>	<i>17.8%</i>	<i>31.9%</i>	<i>43.5%</i>	<i>54.7%</i>	<i>67.3%</i>	<i>80.1%</i>

Table 35: Zombification matrix of the private data set applying a 2-year window.

Source: Our own calculation based on Orbis.

Analogous to the public data set, we test the restrictiveness of our criteria in the private data set as well, acknowledging that the removal and adjustment of some criteria has already reduced the overall restrictiveness of our criteria.

3-year rolling window	19–17	18–16	17–15	16–14	15–13	14–12	13–11
Total companies	90,696	90,696	90,696	90,696	90,696	90,696	90,696
Asset turnover > 0.01	84,886	77,386	73,093	69,455	70,738	70,807	71,141
Rev growth < 3.00%	12,290	11,686	12,098	14,133	14,495	13,735	
ICR < 1.00	10,444	9,075	8,075	7,658	7,924	8,089	7,773
Operating profit < 0.00	7,952	7,112	6,548	6,405	6,670	7,055	6,838
<i>Asset turnover > 0.01</i>	<i>93.6%</i>	<i>85.3%</i>	<i>80.6%</i>	<i>76.6%</i>	<i>78.0%</i>	<i>78.1%</i>	<i>78.4%</i>
<i>Rev growth < 3.00%</i>	<i>13.6%</i>	<i>12.9%</i>	<i>13.3%</i>	<i>15.6%</i>	<i>16.0%</i>	<i>15.1%</i>	
<i>ICR < 1.00</i>	<i>11.5%</i>	<i>10.0%</i>	<i>8.9%</i>	<i>8.4%</i>	<i>8.7%</i>	<i>8.9%</i>	<i>8.6%</i>
<i>Operating profit < 0.00</i>	<i>8.8%</i>	<i>7.8%</i>	<i>7.2%</i>	<i>7.1%</i>	<i>7.4%</i>	<i>7.8%</i>	<i>7.5%</i>

Table 36: Restrictiveness of criteria applying a 3-year criteria window in the private data set.
Source: Our own calculation based on Orbis.

2-year rolling window	19–18	18–17	17–16	16–15	15–14	14–13	13–12	12–11
Total companies	90,696	90,696	90,696	90,696	90,696	90,696	90,696	90,696
Asset turnover > 0.01	85,646	85,786	78,087	73,744	74,357	74,337	75,463	74,085
Rev growth < 3.00%	24,533	21,079	20,817	23,020	25,027	24,885	23,298	
ICR < 1.00	14,477	14,055	12,045	11,080	11,371	11,663	12,019	11,307
Operating profit < 0.00	11,579	10,957	9,810	9,477	9,756	10,078	10,670	10,167
<i>Asset turnover > 0.01</i>	<i>94.4%</i>	<i>94.6%</i>	<i>86.1%</i>	<i>81.3%</i>	<i>82.0%</i>	<i>82.0%</i>	<i>83.2%</i>	<i>81.7%</i>
<i>Rev growth < 3.00%</i>	<i>27.0%</i>	<i>23.2%</i>	<i>23.0%</i>	<i>25.4%</i>	<i>27.6%</i>	<i>27.4%</i>	<i>25.7%</i>	
<i>ICR < 1.00</i>	<i>16.0%</i>	<i>15.5%</i>	<i>13.3%</i>	<i>12.2%</i>	<i>12.5%</i>	<i>12.9%</i>	<i>13.3%</i>	<i>12.5%</i>
<i>Operating profit < 0.00</i>	<i>12.8%</i>	<i>12.1%</i>	<i>10.8%</i>	<i>10.4%</i>	<i>10.8%</i>	<i>11.1%</i>	<i>11.8%</i>	<i>11.2%</i>

Table 37: Restrictiveness of criteria applying a 2-year criteria window in the private data set.
Source: Our own calculation based on Orbis.

Both, on a 3-year and 2-year rolling window basis, the operating profit criterion is stand-alone by far the most restrictive. Analogously to the public data set, we remove the operating profit criterion to test whether only one criterion mostly drives our results or the combination of our criteria. Table 38 below details the zombification after removing the operating profit criterion.

3yr window	19–17	18–16	17–15	16–14	15–13	14–12	Ever Zombie	
# of Zombies	1,433	1,186	1,061	1,140	1,230	1,159	4,430	
Zombification	1.6%	1.3%	1.2%	1.3%	1.4%	1.3%	4.9%	

2yr window	19–18	18–17	17–16	16–15	15–14	14–13	13–12	Ever Zombie
# of Zombies	3,958	3,096	2,671	2,623	2,788	2,752	2,732	12,425
Zombification	4.4%	3.4%	2.9%	2.9%	3.1%	3.0%	3.0%	13.7%

Table 38: Sensitivity analysis of zombification with modified operating profit criterion in the private data set.

Source: Our own calculation based on Orbis.

Without applying the operating profit criterion, the zombification rate increases mildly. We therefore conclude that the results are mostly driven by the combination of our criteria and not a single criterion alone.

5. Discussions

5.1 Limitations of Analysis

It is important to highlight that the prevalence of zombie companies in our public and private datasets is not comparable in the first instance as we do not have access to information to the same extent for both datasets. As we use additional restrictions such as the Z-Score and the Tobin's Q ratio in our public dataset, we can reasonably presume that we will classify fewer companies in our public dataset as zombies. Ultimately, we perform a sensitivity analysis on our public data set, which shows that our findings are roughly comparable across the public-private status.

Furthermore, it is noteworthy that the Tobin's Q ratio and the Z-Score are only proxies to measure the future expected profits and the probability of companies exiting the market. Hence, these two variables potentially misclassifying companies as "zombie" or "healthy" companies.

Furthermore, an important limitation of our analysis of zombie companies in our private dataset is the low availability of firm-level data. Originally, we find around 25 million companies in Germany, France, and Switzerland. But after filtering for companies that have the firm-level data used in at least one year from 2011 to 2019 available, we ended up with around 90,000 companies. Such a strong decrease in sample size potentially introduces significant biases such as underrepresentation of different characteristics (e.g., countries, sector, size, age, profitability, etc.) of companies. The most obvious underrepresentation is the prevalence of Swiss companies (17 out of 90,000) in the dataset of private companies because, unlike France and Germany, Switzerland does not have a public register for annual reports of private companies.

Our definition of zombie companies for our private and public datasets is, compared to the prevailing literature, on the stricter end which consequently explains the comparably low percentage of zombie companies identified in our analysis. By applying the definition of the literature, we find a similar prevalence of zombie companies.

A drawback of our analysis is that it does not take into account any subsidized credits offered to companies keeping them artificially alive. The reason for this is the lack of information available for both, private and public companies. It is essential to fully consider any type of subsidy and to not only take into account financial help but also non-financial subsidies. Furthermore, this analysis requires to analyze each credit and loan portion and the corresponding interest expense individually. Subsequently, this would require determining whether a subsidy has been granted or not, which in our opinion is not always perfectly clear. The literature so far that focused on subsidized credits was only able to approximate the number of companies benefiting from subsidized credits.

Nevertheless, according to Gouveia & Osterhold (2018), it is important to keep in mind that although the share of zombie companies varies depending on the applied criteria, the dynamics of zombie prevalence across industries and time remain similar independent of the definition. This contradicts our finding of a stable, almost non-existing level of zombification.

5.2 Suggestions for further research

The focus of this thesis is to reflect on a way to define and identify zombie companies. Furthermore, the thesis aims to analyze whether the increasing media attention to zombie companies, prior to the Covid-19 pandemic, claiming that the low-interest-rate environment leads to a zombification of the economy (c.f. Sharma (2019), Taylor (2019), Armstrong (2020)) is justified or not.

With the increasing media attention on zombie companies and in order to avoid a potentially unjustified negative sentiment about corporate lending with potentially negative further effects on firm financing, it would be useful to unify the definition of zombie companies in order to get a clearer scientific picture about the situation.

A qualitative analysis comprising for example interviews with CFOs of "zombie companies" and its lenders could potentially help us to better understand this topic as it provides a new angle on the topic, an angle quantitative data cannot provide us with.

Additional analysis on the interdependence between insolvency regimes and the share of zombie firms could further help governments improve their policies. Conducting a more detailed analysis covering shorter time intervals or even focusing on single events of insolvency-regime-changes could provide a more detailed picture of how specific policy changes affect the financing behaviour of creditors and debtors as well as what kind of environment triggers what kind of insolvency regime change. Particularly the time during and after the Covid-19 pandemic offers a great opportunity to analyze the interdependence between the prevalence of zombie companies and insolvency regimes as many governments introduced a lot of temporary insolvency policies to help companies postpone potential bankruptcy declarations.

6. Conclusion

To conclude, we believe companies should not be classified or called a "zombie company" easily. Recent news and press articles topic the subject frequently without any unified definition of what characterizes a zombie company. We define a set of criteria to classify zombie companies which is on the one hand side far more restrictive than the prevailing literature and on the other hand, captures what a zombie company is in our eyes more accurately. Zombie companies are in our eyes mature companies that persistently lack profitability, have poor expected future profits, and do not exit the market although they would be expected to do so. We gather data on publicly listed and privately held companies from the Refinitiv-Eikon platform (Thomson Reuter) and Orbis, respectively. For the public data set, we apply a more restrictive set of criteria as there is more data available. For the private data set, we remove some criteria due to data availability issues. In the public data set, with the more restrictive filter, we find a very low, basically non-existent level of zombification. With a less restrictive set of filters in the private data set, we find a slightly higher but still low level of zombification. To test what drives our result, we first remove the most restrictive individual criterion and find that rather the combination of our filters than one individual criterion drives our results. Secondly, we apply the filters used in the prevailing literature to our public data set to test whether the non-existing level of zombification is driven by data sample selection. Applying those filters, we obtain similar results as the prevailing literature. Hence, we conclude that the selection of our filter drives our results. Consequently, we argue that companies should not easily be classified as zombie companies due to potential adverse effects this negative publicity may have on an individual firm level. Also, the overall economy can endure adverse effects by spreading an unjustified negative sentiment. Lastly, we propose to intensify the discussion around how to classify zombie companies to unify a common minimum standard of criteria which could make research on zombie companies more comparable.

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Appendix

Appendix A: Full industry breakdown of the public data set.

Industry	Total	Ever Zombie 3yr	Ever Zombie 2yr	Industry	Total	Ever Zombie 3yr	Ever Zombie 2yr
Capital Markets	128	-	-	Technology Hardware, Storage & Peripherals	17	-	-
Real Estate Management & Development	115	-	-	Interactive Media & Services	17	-	2
Banks	39	-	-	Oil, Gas & Consumable Fuels	17	-	-
Software	79	1	2	Health Care Technology	17	-	-
Specialty Retail	26	-	1	Construction & Engineering	17	-	-
Industrial Conglomerates	60	-	-	Water Utilities	14	-	-
Biotechnology	6	-	1	Diversified Telecommunication Services	3	-	-
Health Care Equipment & Supplies	52	-	-	Food & Staples Retailing	13	-	-
Media	51	1	1	Road & Rail	12	-	-
Chemicals	44	-	-	Commercial Services & Supplies	35	-	1
Food Products	101	-	-	Containers & Packaging	11	-	-
Electrical Equipment	39	-	-	Life Sciences Tools & Services	11	-	-
Machinery	39	-	-	Diversified Financial Services	19	-	-
Hotels, Restaurants & Leisure	37	-	2	Automobiles	10	-	-
Leisure Products	35	-	2	Air Freight & Logistics	9	-	-
Equity Real Estate Investment Trusts (REITs)	12	-	-	Personal Products	8	-	-
Textiles, Apparel & Luxury Goods	32	-	1	Multi-Utilities	8	-	-
Internet & Direct Marketing Retail	31	-	-	Electric Utilities	7	-	-
Household Durables	30	-	-	Distributors	7	-	-
Entertainment	30	1	1	Pharmaceuticals	21	-	-
Building Products	23	-	-	Electronic Equipment, Instruments & Components	60	-	-
Professional Services	68	-	-	Paper & Forest Products	6	-	-
IT Services	26	1	2	Construction Materials	6	-	-
Semiconductors & Semiconductor Equipment	20	-	-	Airlines	5	1	1
Insurance	27	-	-	Thrifts & Mortgage Finance	4	-	-
Health Care Providers & Services	22	-	-	Consumer Finance	7	-	-
Diversified Consumer Services	4	-	-	Energy Equipment & Services	4	-	-
Communications Equipment	18	-	-	Marine	4	-	-
Beverages	10	-	-	Independent Power and Renewable Electricity Producers	14	-	-
Transportation Infrastructure	19	-	-	Household Products	3	-	-
Aerospace & Defense	23	-	-	Wireless Telecommunication Services	2	-	-
Metals & Mining	18	-	-	Multiline Retail	1	-	-
Auto Components	18	-	-	Gas Utilities	1	-	-
Trading Companies & Distributors	18	-	-	Total	1,690	5	17

Appendix B: Full sector breakdown and comparison of the public data sample.

Sector	Whole sample	% whole sample	3yr ever Zombie	% 3yr ever Zombie	2yr ever Zombie	% 2yr ever Zombie
Industrials	323	19.1%	1	20.0%	2	11.8%
Information Technology	269	15.9%	2	40.0%	4	23.5%
Financials	214	12.7%	-	0.0%	-	0.0%
Consumer Discretionary	213	12.6%	-	0.0%	6	35.3%
Health Care	183	10.8%	-	0.0%	1	5.9%
Real Estate	150	8.9%	-	0.0%	-	0.0%
Communication Services	114	6.7%	2	40.0%	4	23.5%
Materials	85	5.0%	-	0.0%	-	0.0%
Consumer Staples	82	4.9%	-	0.0%	-	0.0%
Utilities	33	2.0%	-	0.0%	-	0.0%
Energy	24	1.4%	-	0.0%	-	0.0%
Total	1,690	100.0%	5	100.0%	17	100.0%

Appendix C: Full industry breakdown and comparison of the private data sample.

Industry	Whole sample	% whole sample	3Yr ever zombie	% 3Yr ever zombie	2Yr ever zombie	% 2Yr ever zombie
Wholesale and retail trade; repair of motor vehicles and motorcycles	24,827	27.4%	948	28.9%	2,667	26.0%
Manufacturing	15,503	17.1%	682	20.8%	2,149	21.0%
Construction	9,586	10.6%	177	5.4%	833	8.1%
Professional, scientific and technical activities	9,018	9.9%	286	8.7%	876	8.6%
Accommodation and food service activities	5,396	5.9%	204	6.2%	699	6.8%
Financial and insurance activities	5,049	5.6%	253	7.7%	734	7.2%
Transportation and storage	4,093	4.5%	205	6.3%	615	6.0%
Administrative and support service activities	3,789	4.2%	77	2.4%	298	2.9%
Human health and social work activities	3,119	3.4%	96	2.9%	290	2.8%
Information and communication	2,736	3.0%	111	3.4%	319	3.1%
Electricity, gas, steam and air conditioning supply	2,671	2.9%	35	1.1%	91	0.9%
Other service activities	1,323	1.5%	42	1.3%	156	1.5%
Water supply; sewerage, waste management and remediation activities	947	1.0%	49	1.5%	127	1.2%
Arts, entertainment and recreation	868	1.0%	48	1.5%	145	1.4%
Agriculture, forestry and fishing	779	0.9%	27	0.8%	124	1.2%
Education	647	0.7%	27	0.8%	91	0.9%
Not specified	298	0.3%	8	0.2%	24	0.2%
Mining and quarrying	38	0.0%	1	0.0%	5	0.0%
Public administration and defence; compulsory social security	5	0.0%	-	0.0%	-	0.0%
Activities of extraterritorial organisations and bodies	4	0.0%	-	0.0%	-	0.0%
Total	90,696	100.0%	3,276	100.0%	10,243	100.0%

Appendix D: Top 25 private firms by 2019 revenue.

Rank by Revenue 2019	Company	Country	Employees	Revenue 2019 (in EURm)	Revenue 2018 (in EURm)	Revenue 2017 (in EURm)
#1	UNIPER GLOBAL COMMODITIES SE	DE	808	91,930	96,277	75,415
#2	PEUGEOT SA	FR	208,780	74,889	74,047	62,297
#3	PSA AUTOMOBILES SA	FR	45,877	66,141	62,965	59,061
#4	RENAULT SAS	FR	32,023	50,144	50,585	51,905
#5	STATKRAFT MARKETS GMBH	DE	139	25,367	25,596	17,474
#6	ITM ALIMENTAIRE INTERNATIONAL	FR	804	15,006	14,897	14,616
#7	CARREFOUR HYPERMARCHES	FR	59,885	14,883	15,218	15,322
#8	AUCHAN HYPERMARCHE	FR	45,488	12,504	12,720	12,950
#9	DISTRIBUTION CASINO FRANCE	FR	25,797	8,197	8,998	8,559
#10	SCHNEIDER ELECTRIC INDUSTRIES SAS	FR		5,831	5,754	5,559
#11	HAGEBAU HANDELSGESELLSCHAFT FUER BAUSTOFFE MBH & CO. KG	DE	1,449	5,611	5,805	5,499
#12	RENAULT RETAIL GROUP	FR	7,876	5,419	5,123	5,113
#13	AXPO HOLDING AG	CH	4,953	4,531	4,311	4,920
#14	ARCELORMITTAL FRANCE	FR	7,348	4,409	93	103
#15	PSA RETAIL FRANCE SAS	FR	4,645	3,836	3,748	3,707
#16	ALPIQ HOLDING AG	CH	1,226	3,815	5,534	6,174
#17	AIRBUS DEFENCE AND SPACE GMBH	DE	11,305	3,612	3,887	4,500
#18	DB CARGO AKTIENGESELLSCHAFT	DE	17,793	3,602	3,570	3,580
#19	ALLIANCE HEALTHCARE REPARTITION	FR	2,209	3,558	3,556	3,578
#20	ARKEMA FRANCE	FR	5,543	3,033	3,346	3,013
#21	ORANO DEMANTELEMENT	FR	7,541	3,010	3,020	1,307
#22	AUCHAN SUPERMARCHE	FR	9,700	3,007	3,216	3,313
#23	SIEMAG WEISS GMBH & CO. KG	DE	13,374	2,993	2,853	2,953
#24	SOCIETE MECANIQUE AUTOMOBILE DE L'EST	FR		2,892	3,052	3,375
#25	SUEZ EAU FRANCE	FR	7,447	2,816	2,602	2,512

Note: This includes companies that were formerly privately held and became a zombie when they were private.

Appendix E: Summary statistics of the largest private zombie companies applying a 3-year window.

3 year window	Employees	Revenue 2019 (in EURm)	Revenue 2018 (in EURm)	Revenue 2017 (in EURm)
Max	59,885.0	15,006.4	15,217.9	15,321.7
Avg of top 5%	4,214.1	962.7	953.5	987.4
95% percentil	1,118.9	167.9	171.8	172.3
Avg of top 10%	2,491.0	533.9	529.8	547.8
90% percentil	560.9	71.7	71.5	71.9
Average	45.0	3.3	3.4	3.4
Median	330.4	61.4	61.2	63.1

Note: This table includes companies that were at least once a zombie company over the period under observation. Hence, the average and median values differ from Table 32 which includes companies that were a zombie company in the respective year.

Appendix F: Summary statistics of the largest private zombie companies applying a 2-year window.

2 year window	Employees	Revenue 2019 (in EURm)	Revenue 2018 (in EURm)	Revenue 2017 (in EURm)
Max	208,780.0	91,929.6	96,277.0	75,415.0
Avg of top 5%	4,300.3	1,313.0	1,322.3	1,261.7
95% percentil	966.1	148.3	144.8	147.2
Avg of top 10%	2,501.2	703.4	708.7	678.4
90% percentil	503.4	63.6	64.1	63.9
Average	322.6	77.5	78.1	75.1
Median	43.0	2.9	2.9	3.0

Note: This table includes companies that were at least once a zombie company over the period under observation. Hence, the average and median values differ from Table 33 which includes companies that were a zombie company in the respective year.

Appendix G: Descriptive statistics of the public data set – operating cashflow.

Operating CF in EURm	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
Whole sample												
Min	(5,420.0)	(50,837.0)	(54,171.0)	(43,430.2)	(22,706.0)	(29,923.0)	(17,007.0)	(11,287.0)	(23,954.0)	(14,890.0)	(14,225.0)	(584.0)
25% Quartile	11.6	(0.1)	(0.4)	(0.1)	(0.1)	-	(0.0)	0.1	0.3	0.4	0.7	0.1
Median	170.8	14.2	8.7	9.9	11.1	10.7	8.2	9.2	9.2	8.7	9.5	5.4
Average	2,145.9	357.8	348.3	384.4	435.8	427.3	316.9	375.9	470.4	401.4	356.3	157.9
75% Quartile	987.0	135.1	99.4	90.9	108.4	91.8	73.1	80.8	94.7	79.6	84.3	30.5
Max	139,324.0	36,303.0	26,203.0	39,577.0	70,610.0	67,252.0	32,231.0	40,011.9	57,336.0	40,345.0	19,437.0	12,741.0
Data available abs	282	1,391	1,416	1,428	1,401	1,370	1,347	1,304	1,269	1,219	1,192	606
Data available %	16.7%	82.3%	83.8%	84.5%	82.9%	81.1%	79.7%	77.2%	75.1%	72.1%	70.5%	35.9%
Year of being a Zombie - 3yr window												
Average	n.a.	(0.6)	(1.4)	(0.1)	n.a.	(0.7)	(120.0)	(47.4)	(82.6)	(3.6)	(10.0)	n.a.
Ever Zombie - 3yr window												
Average	n.a.	(8.3)	0.6	(7.1)	(81.4)	(38.4)	(59.7)	(31.4)	(49.0)	(40.4)	(4.2)	25.6
Median	n.a.	(0.5)	(0.7)	(0.5)	(0.6)	(1.7)	(2.3)	(3.6)	(2.4)	(0.6)	(1.2)	0.0
Data available abs	-	5	5	5	6	6	6	6	5	5	6	5
Data available %	0.0%	83.3%	83.3%	83.3%	100.0%	100.0%	100.0%	100.0%	83.3%	83.3%	100.0%	83.3%
Year of being a Zombie - 2yr window												
Average	n.a.	(3.8)	(6.0)	(0.2)	(9.6)	(2.1)	(48.3)	(26.9)	(49.7)	(2.8)	(10.0)	n.a.
Ever Zombie - 2yr window												
Average	n.a.	(3.0)	(3.6)	(7.1)	(28.5)	(13.1)	(20.3)	(9.6)	(13.3)	(8.1)	0.4	11.4
Median	n.a.	(0.5)	(1.0)	(0.5)	(1.0)	(1.6)	(1.4)	(2.0)	(0.3)	(0.1)	(0.3)	0.0
Data available abs	-	17	18	19	20	20	20	20	18	18	17	14
Data available %	0.0%	85.0%	90.0%	95.0%	100.0%	100.0%	100.0%	100.0%	90.0%	90.0%	85.0%	70.0%

Appendix H: Descriptive statistics of the public data set – Z-Score.

Z-Score	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
Whole sample												
Min	(16.8)	(291.7)	(164.2)	(507.2)	(223.6)	(4,079.9)	(895.4)	(591.1)	(623.2)	(614.1)	(133.3)	(37.0)
25% Quartile	-	-	-	-	-	-	-	-	-	-	-	-
Median	2.1	2.2	2.4	2.4	2.1	2.0	1.8	1.7	1.5	1.2	1.3	-
Average	1.0	5.6	4.0	17.5	19.9	7.6	5.8	14.1	39.4	11.0	11.8	12.7
75% Quartile	-	4.1	4.4	5.1	4.5	4.2	3.9	3.8	3.5	3.4	3.5	1.2
Max	344.3	2,418.0	351.0	21,478.0	22,231.3	10,361.3	4,423.0	14,969.9	50,518.9	13,440.7	13,582.4	14,781.5
Data available abs	1,667	1,674	1,675	1,678	1,679	1,685	1,690	1,690	1,690	1,690	1,690	1,690
Data available %	98.6%	99.1%	99.1%	99.3%	99.3%	99.7%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Year of being a Zombie - 3yr window												
Average	n.a.	(16.3)	(7.6)	(4.1)	n.a.	(7.6)	(3.2)	(2.7)	(3.2)	(4.5)	(1.1)	n.a.
Ever Zombie - 3yr window												
Average	-	(5.8)	(2.6)	(2.1)	(3.2)	(2.8)	(0.5)	(2.1)	(2.9)	0.7	(1.6)	(0.1)
Median	-	(1.1)	(0.3)	(0.6)	(2.7)	(2.6)	(1.5)	(2.1)	(4.7)	(1.2)	(0.5)	-
Data available abs	6	6	6	6	6	6	6	6	6	6	6	6
Data available %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Year of being a Zombie - 2yr window												
Average	n.a.	(9.8)	(10.9)	(11.1)	(3.4)	(6.1)	(14.9)	(9.8)	(10.5)	(9.3)	(1.1)	n.a.
Ever Zombie - 2yr window												
Average	-	(12.3)	(4.9)	(3.8)	(3.9)	(3.2)	(6.7)	(4.6)	(3.8)	(1.8)	(1.3)	(0.3)
Median	-	(1.9)	(3.6)	(1.4)	(3.3)	(2.0)	(2.6)	(1.4)	(0.6)	-	-	-
Data available abs	18	19	19	20	20	20	20	20	20	20	20	20
Data available %	90.0%	95.0%	95.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Appendix I: Descriptive statistics of the public data set – revenue.

Revenue (in EURm)	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
Whole sample												
Min	-	(7.9)	(39.8)	(0.4)	(1.3)	(471.0)	(23.4)	(10.6)	-	(15.0)	(26.8)	(117.1)
25% Quartile	45.7	15.2	13.6	11.9	11.1	11.4	11.5	12.7	13.7	14.3	15.4	7.1
Median	320.1	127.1	113.0	103.0	95.0	92.8	88.2	91.3	91.6	93.3	90.3	42.7
Average	4,621.3	3,286.9	3,039.5	2,936.6	2,861.4	2,941.1	2,950.4	2,959.6	3,018.9	2,919.4	2,805.7	1,186.5
75% Quartile	2,208.0	820.7	751.3	695.5	681.1	643.0	618.5	619.3	629.7	636.1	638.4	222.5
Max	154,309.0	252,632.0	235,849.0	229,550.0	217,267.0	213,292.0	202,458.0	197,007.0	192,676.0	178,936.7	139,067.1	105,187.0
Data available abs	661.0	1,483.0	1,519.0	1,532.0	1,513.0	1,474.0	1,442.0	1,386.0	1,349.0	1,296.0	1,261.0	685.0
Data available %	39.1%	87.8%	89.9%	90.7%	89.5%	87.2%	85.3%	82.0%	79.8%	76.7%	74.6%	40.5%
Year of being a Zombie - 3yr window												
Average	n.a.	0.9	2.2	4.7	n.a.	1.7	1,419.9	1,068.6	1,478.2	77.2	132.8	n.a.
Ever Zombie - 3yr window												
Average	79.3	54.5	62.7	75.6	679.2	718.0	717.2	715.6	742.6	733.4	658.5	688.4
Median	79.3	2.4	4.0	8.8	44.2	31.7	21.0	18.8	18.2	16.5	16.1	5.7
Data available abs	1	5	5	5	6	6	6	6	6	6	6	5
Data available %	16.7%	83.3%	83.3%	83.3%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	83.3%
Year of being a Zombie - 2yr window												
Average	n.a.	30.4	29.7	3.4	58.8	73.2	556.4	537.0	887.4	51.5	132.8	n.a.
Ever Zombie - 2yr window												
Average	82.7	40.7	43.2	50.2	231.4	245.5	247.0	253.5	274.0	290.6	270.8	283.2
Median	52.7	16.3	13.7	13.1	10.8	13.4	11.7	12.2	18.2	23.0	24.9	16.0
Data available abs	4	18	18	19	20	20	20	20	20	19	19	16
Data available %	20.0%	90.0%	90.0%	95.0%	100.0%	100.0%	100.0%	100.0%	100.0%	95.0%	95.0%	80.0%

Appendix J: Descriptive statistics of the public data set – revenue growth.

Revenue growth	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
Whole sample												
Min	(94.3%)	(276.0%)	(352.8%)	(314.2%)	(139.0%)	(113.7%)	(96,879.2%)	(185.4%)	(100.0%)	(465.1%)	(160.4%)	(372.7%)
25% Quartile	(15.5%)	(2.9%)	(2.3%)	(3.2%)	(4.1%)	(2.4%)	(4.2%)	(6.5%)	(5.2%)	(2.8%)	0.8%	(19.5%)
Median	(5.1%)	4.8%	5.3%	4.9%	3.8%	6.7%	3.7%	1.5%	4.0%	6.2%	11.5%	(5.1%)
Average	226.8%	23.0%	154.6%	49.2%	67.2%	1,031.0%	(14.6%)	32.4%	39.1%	117.2%	181.4%	85.2%
75% Quartile	5.1%	14.3%	14.9%	15.4%	14.0%	17.7%	12.4%	10.0%	13.8%	16.7%	26.1%	6.7%
Max	142,624.2%	5,922.6%	121,183.9%	14,306.3%	15,279.2%	1,299,447.3%	34,523.2%	13,720.5%	15,464.5%	51,268.4%	128,287.9%	46,718.8%
Data available abs	656	1,438	1,456	1,442	1,414	1,380	1,342	1,309	1,264	1,231	1,197	1,172
Data available %	38.8%	85.1%	86.2%	85.3%	83.7%	81.7%	79.4%	77.5%	74.8%	72.8%	70.8%	69.3%
Year of being a Zombie - 3yr window												
Average	n.a.	(43.8%)	(51.4%)	(41.4%)	n.a.	(44.3%)	(3.6%)	(7.5%)	(8.5%)	(6.4%)	(9.1%)	n.a.
Ever Zombie - 3yr window												
Average	(9.3%)	(17.4%)	(22.0%)	(5.3%)	10.3%	12.8%	3.0%	(4.5%)	(2.7%)	11.5%	5.1%	40.1%
Median	(9.3%)	(18.2%)	(23.7%)	3.4%	1.6%	(7.9%)	3.1%	(5.1%)	(6.1%)	5.6%	6.9%	0.2%
Data available abs	1	5	5	5	6	6	6	6	6	6	6	6
Data available %	16.7%	83.3%	83.3%	83.3%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Year of being a Zombie - 2yr window												
Average	n.a.	(35.8%)	(29.2%)	(35.0%)	(19.5%)	(23.7%)	(12.6%)	(15.5%)	(11.6%)	(3.3%)	(9.1%)	n.a.
Ever Zombie - 2yr window												
Average	19.2%	5.7%	(8.8%)	(0.9%)	43.0%	21.5%	226.1%	(7.6%)	(12.6%)	18.9%	73.1%	7.0%
Median	4.7%	1.6%	(5.2%)	(5.0%)	1.4%	(10.1%)	(3.2%)	(18.8%)	(12.7%)	4.3%	15.1%	(6.4%)
Data available abs	4	17	17	18	19	19	19	20	19	19	19	19
Data available %	20.0%	85.0%	85.0%	90.0%	95.0%	95.0%	95.0%	100.0%	95.0%	95.0%	95.0%	95.0%

Appendix K: Descriptive statistics of the public data set – Tobin's Q.

Tobin's Q (P/B)	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
Whole sample												
Min	-126.3x	-516.7x	-69.1x	-783.9x	-313.8x	-114.5x	-625.3x	-417.7x	-375.7x	-2,682.9x	-10.9x	-31.4x
25% Quartile	1.0x	0.9x	0.9x	1.0x	1.0x	0.9x	0.8x	0.8x	0.7x	0.7x	0.8x	0.8x
Median	1.8x	1.6x	1.5x	1.7x	1.9x	1.6x	1.5x	1.4x	1.3x	1.3x	1.3x	1.3x
Average	3.6x	6.4x	3.2x	2.6x	2.8x	2.5x	2.8x	2.8x	2.8x	-0.1x	4.0x	2.3x
75% Quartile	3.7x	3.3x	2.9x	3.2x	3.4x	3.0x	2.7x	2.5x	2.2x	2.1x	2.2x	2.4x
Max	194.6x	2,969.0x	764.8x	545.6x	341.7x	201.5x	859.1x	923.4x	807.0x	162.3x	1,719.8x	105.9x
Data available abs	6	691	1,480	1,485	1,463	1,422	1,403	1,358	1,282	1,261	1,242	1,214
Data available %	0.4%	40.9%	87.6%	87.9%	86.6%	84.1%	83.0%	80.4%	75.9%	74.6%	73.5%	71.8%
Year of being a Zombie - 3yr window												
Average	n.a.	-0.5x	-0.3x	-0.1x	n.a.	-1.5x	-0.5x	-2.2x	-0.1x	0.1x	0.4x	n.a.
Ever Zombie - 3yr window												
Average	1.3x	-56.7x	-0.4x	-0.1x	3.8x	0.6x	2.0x	-1.2x	-1.6x	4.1x	18.9x	-10.2x
Median	1.3x	-0.2x	-0.2x	0.5x	0.7x	0.9x	0.5x	-0.1x	-0.2x	1.4x	0.5x	0.4x
Data available abs	1	5	5	5	5	5	6	6	6	6	6	3
Data available %	16.7%	83.3%	83.3%	83.3%	83.3%	83.3%	100.0%	100.0%	100.0%	100.0%	100.0%	50.0%
Year of being a Zombie - 2yr window												
Average	n.a.	-0.2x	-0.3x	0.2x	0.5x	-0.7x	-4.4x	-1.8x	-0.7x	-2.3x	0.4x	n.a.
Ever Zombie - 2yr window												
Average	0.8x	-24.7x	2.7x	1.9x	3.5x	-1.0x	-0.7x	-1.7x	0.8x	1.7x	11.5x	-1.0x
Median	1.5x	-0.2x	0.2x	0.4x	0.6x	0.4x	0.0x	-0.1x	0.4x	0.5x	0.5x	0.5x
Data available abs	4	17	18	18	19	19	19	19	19	16	16	12
Data available %	20.0%	85.0%	90.0%	90.0%	95.0%	95.0%	95.0%	95.0%	95.0%	80.0%	80.0%	60.0%

Appendix L: Descriptive statistics of the public data set – interest coverage ratio.

ICR	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
Whole sample												
Min	(2,430.3x)	(33,313.0x)	(17,556.0x)	(36,637.0x)	(90,044.0x)	(27,015.0x)	(35,927.5x)	(289,298.0x)	(68,218.5x)	(50,772.5x)	(45,605.7x)	(14,279.3x)
25% Quartile	1.2x	(0.3x)	0.2x	0.6x	0.9x	0.7x	0.7x	0.6x	0.6x	1.0x	1.2x	(1.1x)
Median	5.6x	4.6x	5.4x	5.5x	5.5x	4.7x	4.5x	3.9x	4.1x	4.7x	4.7x	2.3x
Average	37.7x	7.0x	56.6x	2,470.1x	331.6x	45.9x	68.1x	1,401.8x	103.2x	398.3x	413.3x	177.9x
75% Quartile	18.5x	18.0x	22.6x	21.7x	18.8x	17.3x	16.6x	13.4x	13.4x	14.2x	16.1x	8.8x
Max	5,882.0x	44,084.8x	20,017.4x	3,304,848.0x	166,773.3x	68,991.5x	36,670.6x	1,843,305.0x	145,316.5x	279,564.0x	379,450.0x	64,015.9x
Data available abs	251	1,369	1,341	1,358	1,325	1,287	1,251	1,195	1,166	1,098	1,070	541
Data available %	14.9%	81.0%	79.3%	80.4%	78.4%	76.2%	74.0%	70.7%	69.0%	65.0%	63.3%	32.0%
Year of being a Zombie - 3yr window												
Average	n.a.	(21.4x)	(2,766.9x)	(40.5x)	n.a.	(10.8x)	(11.2x)	(20.7x)	(22.3x)	(32.4x)	(114.3x)	n.a.
Ever Zombie - 3yr window												
Average	n.a.	(11.4x)	(1,107.8x)	(17.7x)	(5.5x)	(9.9x)	(1.1x)	(9.0x)	(32.9x)	(1,466.0x)	(18.4x)	(30.7x)
Median	n.a.	(5.8x)	(8.2x)	(5.7x)	(5.3x)	(9.5x)	(3.5x)	(4.0x)	(3.1x)	(2.2x)	(0.5x)	(1.8x)
Data available abs	-	5	5	5	6	6	6	6	6	6	5	4
Data available %	0.0%	83.3%	83.3%	83.3%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	83.3%	66.7%
Year of being a Zombie - 2yr window												
Average	n.a.	(12.1x)	(941.9x)	(297.9x)	(8.3x)	(8.8x)	(15.6x)	(41.2x)	(15.3x)	(24.0x)	(114.3x)	n.a.
Ever Zombie - 2yr window												
Average	n.a.	(13.1x)	(154.8x)	(65.0x)	(3.6x)	(13.7x)	(4.1x)	(21.1x)	(14.2x)	(498.1x)	(14.9x)	(9.5x)
Median	n.a.	(3.1x)	(4.3x)	(4.9x)	(5.2x)	(10.8x)	(7.7x)	(7.7x)	(1.4x)	(0.6x)	(0.5x)	0.1x
Data available abs	-	16	15	17	17	19	19	20	17	18	17	13
Data available %	0.0%	80.0%	75.0%	85.0%	85.0%	95.0%	95.0%	100.0%	85.0%	90.0%	85.0%	65.0%

Appendix M: Descriptive statistics of the public data set – asset turnover.

Asset turnover	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
Whole sample												
Min	0.0x	(0.0x)	(0.0x)	-	(0.0x)	(0.0x)	(0.0x)	(0.0x)	-	(0.0x)	(0.0x)	(0.0x)
25% Quartile	0.3x	0.3x	0.3x	0.3x	0.3x	0.3x	0.3x	0.4x	0.4x	0.4x	0.4x	0.3x
Median	0.6x	0.7x	0.7x	0.8x	0.8x	0.8x	0.8x	0.8x	0.9x	0.9x	0.9x	0.7x
Average	0.8x	0.8x	0.8x	0.9x	0.9x	0.9x	0.9x	0.9x	0.9x	1.0x	1.0x	0.8x
75% Quartile	1.0x	1.1x	1.2x	1.2x	1.2x	1.2x	1.2x	1.3x	1.3x	1.3x	1.2x	1.1x
Max	8.4x	13.5x	13.6x	11.6x	7.5x	17.4x	8.0x	12.5x	16.5x	18.6x	23.2x	18.5x
Data available abs	280	1,429	1,459	1,455	1,423	1,392	1,345	1,306	1,258	1,213	1,189	645
Data available %	16.6%	84.6%	86.3%	86.1%	84.2%	82.4%	79.6%	77.3%	74.4%	71.8%	70.4%	38.2%
Year of being a Zombie - 3yr window												
Average	n.a.	0.1x	0.2x	0.2x	n.a.	0.6x	1.2x	1.3x	1.3x	1.0x	0.5x	n.a.
Ever Zombie - 3yr window												
Average	n.a.	0.4x	0.5x	0.5x	0.9x	0.8x	0.9x	1.0x	1.1x	1.1x	1.3x	1.2x
Median	n.a.	0.3x	0.4x	0.5x	0.5x	0.6x	0.7x	0.8x	1.0x	1.1x	1.3x	1.1x
Data available abs	-	5	5	5	6	6	6	6	6	6	6	5
Data available %	0.0%	83.3%	83.3%	83.3%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	83.3%
Year of being a Zombie - 2yr window												
Average	n.a.	0.4x	0.4x	0.5x	0.8x	0.8x	1.2x	1.0x	0.8x	0.7x	0.5x	n.a.
Ever Zombie - 2yr window												
Average	n.a.	0.8x	0.8x	0.8x	0.9x	1.0x	0.8x	0.7x	0.9x	1.0x	1.0x	0.8x
Median	n.a.	0.9x	0.6x	0.7x	0.5x	0.6x	0.6x	0.7x	0.7x	0.8x	0.8x	0.6x
Data available abs	-	17	17	18	19	19	19	20	19	19	19	16
Data available %	0.0%	85.0%	85.0%	90.0%	95.0%	95.0%	95.0%	100.0%	95.0%	95.0%	95.0%	80.0%

Appendix N: Descriptive statistics of the public data set – ND/EBITDA.

ND/EBITDA	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
Whole sample												
Min	0.0x	0.0x	0.0x	0.0x	0.0x	0.0x	0.0x	0.0x	0.0x	0.0x	0.0x	0.0x
25% Quartile	1.2x	1.3x	1.1x	0.9x	1.0x	1.0x	1.0x	0.9x	0.9x	0.9x	1.0x	1.0x
Median	2.4x	2.6x	2.4x	2.2x	2.2x	2.1x	2.0x	2.3x	2.3x	2.3x	2.1x	2.4x
Average	5.3x	7.9x	6.0x	7.0x	36.8x	6.1x	5.8x	5.7x	7.4x	5.2x	6.1x	5.9x
75% Quartile	4.3x	5.6x	5.2x	4.9x	5.1x	5.4x	5.2x	4.9x	5.1x	4.4x	4.8x	6.1x
Max	208.1x	1,239.0x	337.0x	377.7x	14,773.1x	653.2x	192.0x	201.0x	821.3x	208.5x	228.6x	174.2x
Data available abs	280	1,429	1,459	1,455	1,423	1,392	1,345	1,306	1,258	1,213	1,189	645
Data available %	16.6%	84.6%	86.3%	86.1%	84.2%	82.4%	79.6%	77.3%	74.4%	71.8%	70.4%	38.2%
Year of being a Zombie - 3yr window												
Average	n.a.	9.7x	n.a.	n.a.	n.a.	n.a.	n.a.	6.4x	n.a.	4.4x	n.a.	n.a.
Ever Zombie - 3yr window												
Average	4.5x	6.1x	0.8x	2.6x	14.2x	n.a.	1.6x	6.4x	33.2x	106.4x	1.3x	n.a.
Median	4.5x	6.1x	0.8x	2.6x	14.2x	n.a.	1.6x	6.4x	33.2x	106.4x	1.3x	n.a.
Data available abs	1	2	1	1	1	-	1	1	1	2	1	-
Data available %	16.7%	33.3%	16.7%	16.7%	16.7%	0.0%	16.7%	16.7%	16.7%	33.3%	16.7%	0.0%
Year of being a Zombie - 2yr window												
Average	n.a.	9.7x	n.a.	n.a.	1.5x	9.9x	n.a.	6.4x	33.2x	4.4x	n.a.	n.a.
Ever Zombie - 2yr window												
Average	3.1x	13.7x	10.2x	46.1x	6.6x	9.9x	4.5x	4.3x	8.7x	33.7x	2.9x	4.3x
Median	3.1x	6.6x	9.7x	2.6x	4.2x	8.5x	4.5x	3.2x	4.5x	5.6x	2.4x	3.5x
Data available abs	2	6	4	3	3	3	2	3	6	7	7	6
Data available %	10.0%	30.0%	20.0%	15.0%	15.0%	15.0%	10.0%	15.0%	30.0%	35.0%	35.0%	30.0%

Appendix O: Descriptive statistics of the public data set – net debt.

Net Debt (in EURm)	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
Whole sample												
Min	(170,986.0)	(272,284.0)	(242,929.0)	(224,185.0)	(147,007.0)	(137,385.0)	(119,630.0)	(248,913.0)	(225,545.0)	(48,032.0)	(72,783.0)	(4,407.8)
25% Quartile	(4.0)	(4.2)	(8.1)	(10.7)	(8.8)	(8.8)	(7.7)	(6.3)	(6.3)	(7.4)	(7.2)	(6.3)
Median	162.2	6.9	2.6	1.2	1.1	1.3	0.8	1.1	1.5	1.6	1.4	0.4
Average	2,603.3	1,134.9	846.9	744.3	821.3	898.6	962.1	776.2	1,012.2	1,150.8	1,218.7	435.6
75% Quartile	1,965.7	173.0	107.2	78.8	78.3	76.0	79.5	71.5	74.5	80.0	75.0	31.9
Max	123,365.0	143,502.0	133,279.0	131,485.0	143,099.6	173,762.7	222,583.0	286,482.0	346,676.0	248,155.0	245,415.0	53,730.0
Data available abs	315	1,533	1,575	1,594	1,574	1,534	1,503	1,448	1,410	1,354	1,319	700
Data available %	18.6%	90.7%	93.2%	94.3%	93.1%	90.8%	88.9%	85.7%	83.4%	80.1%	78.0%	41.4%
Year of being a Zombie - 3yr window												
Average	n.a.	1.9	7.1	5.4	n.a.	1.7	320.0	210.7	273.2	11.0	29.4	n.a.
Ever Zombie - 3yr window												
Average	n.a.	43.2	45.7	46.5	235.5	197.3	158.6	141.9	137.5	142.1	89.0	123.0
Median	n.a.	2.7	2.4	2.3	8.4	10.2	3.8	6.8	7.1	9.1	7.8	12.7
Data available abs	-	5	5	5	6	6	6	6	6	6	6	5
Data available %	0.0%	83.3%	83.3%	83.3%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	83.3%
Year of being a Zombie - 2yr window												
Average	n.a.	30.6	35.7	2.7	26.8	23.0	125.3	105.8	166.2	7.4	29.4	n.a.
Ever Zombie - 2yr window												
Average	n.a.	32.0	30.9	25.4	83.7	66.0	57.0	53.0	52.9	53.2	36.6	50.7
Median	n.a.	2.4	2.3	2.3	8.4	3.9	1.3	4.1	4.5	4.0	2.3	8.6
Data available abs	-	18	18	19	20	20	20	20	20	19	19	16
Data available %	0.0%	90.0%	90.0%	95.0%	100.0%	100.0%	100.0%	100.0%	100.0%	95.0%	95.0%	80.0%

Appendix P: Descriptive statistics of the public data set – EBITDA.

EBITDA (in EURm)	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
Average	1,625.4	643.6	544.2	544.5	518.1	499.2	509.6	486.3	556.3	513.9	466.9	141.9
Min	(12,395.0)	(1,865.6)	(13,226.5)	(1,436.6)	(847.7)	(21,335.0)	(269.6)	(7,340.3)	(115.5)	(154.5)	(15,321.1)	(138.2)
25% Quartile	14.8	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.8	1.2	1.5	0.1
Median	186.0	16.8	13.9	14.2	12.2	12.1	11.7	12.3	12.6	13.2	13.6	4.3
75% Quartile	930.6	156.5	136.6	117.3	118.7	108.7	104.4	100.3	117.7	112.0	109.6	31.1
Max	41,875.0	45,145.7	40,295.0	46,547.9	40,966.0	37,921.0	40,517.4	28,844.8	41,124.7	33,905.0	27,202.4	10,358.0
Data available abs	319	1,524	1,562	1,581	1,556	1,520	1,487	1,436	1,396	1,338	1,304	692
Data available %	18.9%	90.2%	92.4%	93.6%	92.1%	89.9%	88.0%	85.0%	82.6%	79.2%	77.2%	40.9%
Year of being a Zombie - 3yr window												
Average	n.a.	(1.5)	(1.8)	(1.7)	n.a.	(1.1)	(70.1)	(42.9)	(29.0)	(3.5)	(3.5)	n.a.
Ever Zombie - 3yr window												
Average	n.a.	(4.5)	(0.0)	15.9	(79.6)	(49.8)	(34.7)	(28.3)	(14.2)	(26.5)	9.5	23.2
Median	n.a.	(0.5)	(1.1)	(0.5)	(0.9)	(1.4)	(0.7)	(1.1)	(1.0)	(0.3)	0.5	0.1
Data available abs	-	5	5	5	6	6	6	6	6	6	6	5
Data available %	0.0%	83.3%	83.3%	83.3%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	83.3%
Year of being a Zombie - 2yr window												
Average	n.a.	(3.6)	(3.8)	(1.2)	8.7	3.8	(31.9)	(25.3)	(17.4)	(2.4)	(3.5)	n.a.
Ever Zombie - 2yr window												
Average	n.a.	(1.5)	(1.3)	2.4	(23.9)	(16.0)	(12.9)	(8.6)	(2.6)	(5.0)	7.2	9.6
Median	n.a.	(0.3)	(0.4)	(1.1)	(0.9)	(1.2)	(0.9)	(1.1)	(0.2)	0.8	0.9	0.2
Data available abs	-	18	18	19	20	20	20	20	19	19	19	16
Data available %	0.0%	90.0%	90.0%	95.0%	100.0%	100.0%	100.0%	100.0%	95.0%	95.0%	95.0%	80.0%

Appendix Q: Descriptive statistics of the public data set – market capitalization.

Market Capitalization (in EURm)	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
Average	6,201.2	3,810.4	3,097.4	3,312.4	3,180.1	3,097.0	2,848.1	2,809.9	2,373.0	2,060.3	2,254.2	761.1
Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
25% Quartile	47.8	27.3	23.5	24.3	24.8	20.7	18.7	17.2	15.9	15.4	15.9	11.7
Median	367.7	152.8	130.1	130.4	134.1	116.8	98.5	93.2	78.8	67.3	70.9	46.1
75% Quartile	2,715.0	992.1	814.6	893.8	879.3	783.0	677.2	642.9	490.0	422.2	500.0	202.0
Max	277,304.7	287,341.3	217,187.9	223,139.3	212,467.0	220,826.4	207,920.4	175,173.2	159,292.2	146,821.1	152,691.7	51,899.9
Data available abs	777	1,582	1,596	1,574	1,527	1,485	1,450	1,381	1,347	1,319	1,297	695
Data available %	46.0%	93.6%	94.4%	93.1%	90.4%	87.9%	85.8%	81.7%	79.7%	78.0%	76.7%	41.1%
Year of being a Zombie - 3yr window												
Average	n.a.	2.7	1.5	2.7	n.a.	5.8	33.0	20.0	35.1	22.0	47.0	n.a.
Ever Zombie - 3yr window												
Average	16.2	38.2	42.1	41.0	34.6	36.0	26.2	19.4	26.8	34.4	38.4	91.2
Median	16.2	15.9	11.8	6.2	5.4	7.9	9.5	18.9	17.3	22.0	22.9	76.0
Data available abs	1	5	5	5	6	6	6	6	6	6	6	3
Data available %	16.7%	83.3%	83.3%	83.3%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	50.0%
Year of being a Zombie - 2yr window												
Average	n.a.	12.3	4.2	1.5	55.2	9.3	22.8	12.3	21.4	15.0	47.0	n.a.
Ever Zombie - 2yr window												
Average	45.2	34.3	32.9	33.8	44.3	38.7	40.2	27.5	24.7	28.4	31.8	51.2
Median	33.5	15.4	12.0	17.0	13.3	7.4	12.4	6.4	12.0	12.5	17.3	27.6
Data available abs	4	18	18	19	20	20	20	20	19	18	19	14
Data available %	20.0%	90.0%	90.0%	95.0%	100.0%	100.0%	100.0%	100.0%	95.0%	90.0%	95.0%	70.0%

Appendix R: Descriptive statistics of the private data set – asset turnover.

Asset turnover	2019	2018	2017	2016	2015	2014	2013	2012
Whole sample								
Min	-	-	-	-	-	-	-	-
25% Quartile	1.4x	1.4x	1.4x	1.4x	1.5x	1.5x	1.5x	1.6x
Median	2.8x	2.9x	2.9x	3.0x	3.1x	3.2x	3.3x	3.4x
Average	5.8x	5.9x	5.9x	6.1x	6.2x	6.6x	6.9x	7.3x
75% Quartile	5.5x	5.6x	5.7x	5.8x	6.0x	6.3x	6.6x	6.7x
Max	996.7x	985.0x	991.0x	980.1x	991.2x	901.1x	988.4x	992.8x
Data available abs	87,307	87,425	87,455	79,649	79,835	79,132	80,288	79,671
Data available %	96.3%	96.4%	96.4%	87.8%	88.0%	87.2%	88.5%	87.8%
Year of being a Zombie - 3yr window								
Average	7.7x	6.2x	6.6x	6.7x	6.7x	8.6x	8.9x	6.9x
Ever Zombie - 3yr window								
Average	7.2x	6.6x	7.2x	6.7x	6.6x	7.2x	7.2x	6.3x
Median	2.7x	2.7x	2.8x	2.7x	2.8x	2.9x	2.8x	2.9x
Data available abs	3,094	3,137	3,191	3,127	3,130	3,157	3,144	3,108
Data available %	94.4%	95.8%	97.4%	95.5%	95.5%	96.4%	96.0%	94.9%
Year of being a Zombie - 2yr window								
Average	8.2x	6.6x	7.1x	6.6x	7.4x	9.0x	9.0x	7.7x
Ever Zombie - 2yr window								
Average	7.0x	6.7x	6.8x	6.5x	6.8x	7.2x	7.1x	6.8x
Median	2.8x	2.8x	2.8x	2.9x	2.9x	3.0x	3.0x	3.0x
Data available abs	9,751	9,869	9,940	9,433	9,515	9,520	9,612	9,505
Data available %	95.2%	96.3%	97.0%	92.1%	92.9%	92.9%	93.8%	92.8%

Appendix S: Descriptive statistics of the private data set – EBIT.

EBIT (in EURm)	2019	2018	2017	2016	2015	2014	2013	2012
Whole sample								
Min	(1,135.1)	(591.0)	(571.0)	(1,353.0)	(1,834.3)	(1,488.2)	(1,316.7)	(1,781.7)
25% Quartile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Average	2.3	2.5	2.7	2.4	2.0	1.9	1.9	1.9
75% Quartile	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.3
Max	4,668.0	5,516.0	5,982.0	5,397.0	5,281.0	4,753.0	4,850.0	4,794.0
Data available abs	90,511	90,502	90,528	83,023	83,431	82,961	84,417	84,072
Data available %	99.8%	99.8%	99.8%	91.5%	92.0%	91.5%	93.1%	92.7%
Year of being a Zombie - 3yr window								
Average	(4.1)	(3.2)	(2.5)	(3.4)	(3.9)	(3.2)	(2.8)	(2.3)
Ever Zombie - 3yr window								
Average	(2.0)	(2.2)	(0.2)	(2.3)	(2.4)	(1.9)	(1.4)	(0.3)
Median	(0.0)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.0)	(0.0)
Data available abs	3,276	3,276	3,276	3,198	3,181	3,187	3,194	3,175
Data available %	100.0%	100.0%	100.0%	97.6%	97.1%	97.3%	97.5%	96.9%
Year of being a Zombie - 2yr window								
Average	(3.4)	(2.4)	(1.8)	(3.0)	(3.4)	(2.8)	(3.0)	(3.7)
Ever Zombie - 2yr window								
Average	(0.6)	(0.6)	0.7	(0.5)	(1.1)	(1.1)	(1.0)	(0.6)
Median	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
Data available abs	10,243	10,243	10,243	9,719	9,759	9,735	9,838	9,779
Data available %	100.0%	100.0%	100.0%	94.9%	95.3%	95.0%	96.0%	95.5%

Appendix T: Descriptive statistics of the private data set – EBITDA.

EBITDA (in EURm)	2019	2018	2017	2016	2015	2014	2013	2012
Whole sample								
Min	(984.0)	(570.0)	(554.0)	(1,333.0)	(1,064.6)	(1,297.9)	(1,125.8)	(1,563.1)
25% Quartile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1
Average	4.6	4.3	4.4	4.1	3.6	3.5	3.4	3.3
75% Quartile	0.9	0.8	0.8	0.8	0.7	0.7	0.6	0.6
Max	19,024.6	9,729.0	8,873.0	8,184.0	6,875.0	7,189.0	6,921.0	6,731.0
Data available abs	90,511	90,502	90,528	83,022	83,434	82,964	84,416	84,073
Data available %	99.8%	99.8%	99.8%	91.5%	92.0%	91.5%	93.1%	92.7%
Year of being a Zombie - 3yr window								
Average	(2.6)	(1.9)	(1.1)	(1.2)	(1.3)	(0.3)	(0.5)	(0.3)
Ever Zombie - 3yr window								
Average	(0.4)	(0.6)	1.3	(0.6)	(0.4)	0.3	0.7	1.6
Median	0.0	(0.0)	0.0	0.0	0.0	0.0	0.0	0.0
Data available abs	3,276	3,276	3,276	3,198	3,180	3,187	3,194	3,175
Data available %	100.0%	100.0%	100.0%	97.6%	97.1%	97.3%	97.5%	96.9%
Year of being a Zombie - 2yr window								
Average	(1.8)	(1.0)	(0.7)	(0.8)	(1.0)	(0.3)	0.4	1.6
Ever Zombie - 2yr window								
Average	1.3	1.2	2.4	1.4	0.9	1.0	1.1	1.8
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Data available abs	10,243	10,243	10,243	9,718	9,758	9,735	9,838	9,779
Data available %	100.0%	100.0%	100.0%	94.9%	95.3%	95.0%	96.0%	95.5%

Appendix U: Descriptive statistics of the private data set – interest coverage ratio.

ICR	2019	2018	2017	2016	2015	2014	2013	2012
Whole sample								
Min	(100.0x)	(100.0x)	(100.0x)	(100.0x)	(99.9x)	(100.0x)	(99.5x)	(99.9x)
25% Quartile	1.0x	1.0x	1.2x	1.1x	1.1x	0.9x	0.8x	0.6x
Median	9.8x	9.0x	9.0x	7.7x	6.7x	5.8x	5.4x	4.8x
Average	50.9x	42.2x	42.4x	35.2x	32.5x	30.0x	28.8x	27.2x
75% Quartile	44.4x	38.7x	37.1x	30.2x	25.9x	22.5x	20.9x	18.8x
Max	999.5x	997.3x	999.6x	997.7x	997.2x	999.1x	998.6x	997.3x
Data available abs	90,509	90,500	90,526	79,092	77,631	75,965	75,985	74,475
Data available %	99.8%	99.8%	99.8%	87.2%	85.6%	83.8%	83.8%	82.1%
Year of being a Zombie - 3yr window								
Average	(19.8x)	(17.5x)	(14.9x)	(13.3x)	(11.9x)	(11.5x)	(11.6x)	(11.1x)
Ever Zombie - 3yr window								
Average	0.2x	(5.4x)	(7.5x)	(5.7x)	(4.2x)	(2.5x)	(0.7x)	2.9x
Median	(3.6x)	(4.9x)	(4.7x)	(3.5x)	(3.0x)	(2.8x)	(1.8x)	(0.8x)
Data available abs	3,276	3,276	3,276	3,131	3,082	3,072	3,034	2,963
Data available %	100.0%	100.0%	100.0%	95.6%	94.1%	93.8%	92.6%	90.4%
Year of being a Zombie - 2yr window								
Average	(18.7x)	(16.3x)	(15.0x)	(13.7x)	(12.7x)	(12.0x)	(12.1x)	(10.6x)
Ever Zombie - 2yr window								
Average	5.4x	(0.9x)	0.9x	0.7x	1.4x	2.7x	3.3x	7.3x
Median	(1.9x)	(3.0x)	(1.4x)	(1.3x)	(1.1x)	(0.9x)	(0.7x)	(0.0x)
Data available abs	10,243	10,243	10,243	9,419	9,354	9,251	9,260	9,066
Data available %	100.0%	100.0%	100.0%	92.0%	91.3%	90.3%	90.4%	88.5%

Appendix V: Descriptive statistics of the private data set – revenue.

Revenue (in EURm)	2019	2018	2017	2016	2015	2014	2013	2012
Whole sample								
Min	(0.4)	(4.4)	(0.2)	(0.4)	(0.2)	(0.9)	(5.1)	(3.8)
25% Quartile	1.0	1.0	1.0	0.9	0.9	0.9	0.8	0.8
Median	3.4	3.3	3.1	3.2	3.0	2.9	2.7	2.6
Average	63.0	61.6	59.6	58.3	53.8	54.3	52.5	50.8
75% Quartile	17.6	17.0	16.3	16.4	15.1	14.2	13.5	12.6
Max	91,929.6	96,277.0	89,669.6	74,945.0	60,471.0	110,261.0	126,128.9	146,113.8
Data available abs	90,511	90,502	90,528	83,321	83,640	83,066	83,842	83,356
Data available %	99.8%	99.8%	99.8%	91.9%	92.2%	91.6%	92.4%	91.9%
Year of being a Zombie - 3yr window								
Average	64.1	58.5	59.7	68.3	59.6	66.0	67.5	75.9
Ever Zombie - 3yr window								
Average	61.4	61.2	63.1	63.3	59.1	66.0	67.0	65.8
Median	3.3	3.4	3.4	3.5	3.7	3.8	4.0	4.0
Data available abs	3,276	3,276	3,276	3,204	3,189	3,195	3,192	3,169
Data available %	100.0%	100.0%	100.0%	97.8%	97.3%	97.5%	97.4%	96.7%
Year of being a Zombie - 2yr window								
Average	68.6	58.8	43.3	59.6	59.6	88.9	97.8	125.8
Ever Zombie - 2yr window								
Average	77.4	78.1	75.1	73.4	64.7	77.5	79.5	82.0
Median	2.9	2.9	3.0	3.1	3.1	3.2	3.2	3.2
Data available abs	10,243	10,243	10,243	9,757	9,796	9,772	9,824	9,753
Data available %	100.0%	100.0%	100.0%	95.3%	95.6%	95.4%	95.9%	95.2%

Appendix W: Descriptive statistics of the private data set – revenue growth.

Revenue growth	2019	2018	2017	2016	2015	2014	2013	2012
Whole sample								
Min	(9,787.0%)	(8,734.8%)	(4,961.1%)	(6,324.4%)	(258,999.1%)	(37,402,900.0%)	(1,660,100.0%)	(6,086,469,100.0%)
25% Quartile	(4.4%)	(3.5%)	(2.9%)	(4.4%)	(4.9%)	(5.7%)	(5.3%)	(5.0%)
Median	2.4%	3.2%	3.6%	2.4%	1.9%	1.3%	1.8%	2.5%
Average	699.3%	3,622.3%	926,009.1%	113,603.8%	1,267,713.6%	42,312.5%	46,756.5%	744.5%
75% Quartile	10.0%	11.3%	12.1%	10.7%	10.2%	9.6%	10.5%	11.9%
Max	36,577,600.0%	87,354,400.0%	54,008,213,900.0%	6,035,634,600.0%	74,198,176,800.0%	1,551,149,000.0%	631,690,400.0%	1,037,689,900.0%
Data available abs	90,501	90,528	83,079	78,502	79,133	79,167	79,789	78,356
Data available %	99.8%	99.8%	91.6%	86.6%	87.3%	87.3%	88.0%	86.4%
Year of being a Zombie - 3yr window								
Average	(10.6%)	(9.9%)	(9.4%)	(9.3%)	(9.3%)	(8.8%)	(8.7%)	(8.7%)
Ever Zombie - 3yr window								
Average	16.2%	19,323.4%	30.8%	1,930,789.0%	4.3%	(0.8%)	18,138.4%	4.0%
Median	(0.9%)	(1.2%)	(2.1%)	(2.1%)	(2.4%)	(3.2%)	(2.6%)	(1.6%)
Data available abs	3,274	3,275	3,204	3,126	3,126	3,128	3,117	3,043
Data available %	99.9%	100.0%	97.8%	95.4%	95.4%	95.5%	95.1%	92.9%
Year of being a Zombie - 2yr window								
Average	(11.1%)	(11.3%)	(10.8%)	(10.5%)	(10.5%)	(10.3%)	(10.0%)	(10.0%)
Ever Zombie - 2yr window								
Average	12.7%	7,281.8%	7,390.3%	644,066.3%	26,434.3%	1,470.6%	6,007.2%	140.8%
Median	(0.6%)	(1.1%)	(0.0%)	(0.8%)	(1.4%)	(1.9%)	(2.0%)	(0.8%)
Data available abs	10,234	10,239	9,751	9,414	9,478	9,489	9,511	9,362
Data available %	99.9%	100.0%	95.2%	91.9%	92.5%	92.6%	92.9%	91.4%