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ZOMBI CÉGEK JELENLÉTE KÖZÉP-KELET-EURÓPÁBAN

**THE PRESENCE OF ZOMBIE FIRMS IN CENTRAL EAST EUROPEAN
COUNTRIES**

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I. INTRODUCTION

The economic crisis is a word that most people do not want to hear in their lives. This is probably because society has a tendency to prefer stability and computability and fear from changes. Indeed, a severe recession has a huge impact on every field and aspect of the human race. At the moment, both the government and ordinary actors are making great efforts to respond in the best possible way and to make the most of the situation without suffering significant losses during the process. Therefore, we can argue that distress and depression in the economy require an unbelievable commitment and attention from every participant of the world cycle that anyone would set aside if it were possible.

However, there are certain phenomena in the market in which recessions even have a positive influence feeling completely the opposite to what most experience. As an environment, the 21st century was an absolute paradise for those, as the economy had to suffer three major downturns, namely the so-called Dotcom Bubble Burst, the Great Financial Crisis, and most recently the recession connected to the COVID-19 pandemic. Consequently, there is increasing attention to things that are characteristic of crises on both the policy makers' and researchers' sides, especially if that something is a rather harmful sequel to the actual unfortunate turn of events.

The so-called zombie firms are perfect matches to the description above. Numbers of economists have proven by empirical research that their presence in the global market increases during recessions and falls in periods of expansion (Favara et al., 2021; Banerjee & Hofmann, 2020; Schivardi et al., 2020). The reason for that will be evident right after determining what exactly zombie firms are.

As for definition, it is extremely hard to come up with a term which fully covers everything about these complex companies. The novelty of the topic and the fact that they are relatively under-researched for the moment, makes it even more difficult. It should be said that most authors acknowledge the key characteristics, but a widely accepted statement has not yet been formed. In most explanations, it appears that they are unprofitable and inefficient, reflecting the inability to cover debt servicing costs from current profits over an extended period (Banerjee & Hofmann, 2018; Goto & Wilbur, 2019; McGowan et al., 2017). In connection with that, several researchers note that these companies are unviable and capable of surviving just by tapping banks and capital markets asking for more loans (Favara et al., 2021; Caballero et al., 2008). Therefore, they are highly leveraged due to continuous rollover loans given by financial

institutions (Favara et al., 2021). The main issue is that if the firm can survive by new credits, they will pay less attention to finding new, innovative ways of increasing profits, which can rapidly lead to a status of vegetation between proper operation and eventual bankruptcy (Chang et al., 2021).

After all, the conclusion is that zombie firms are in desperate need for external financing; otherwise, they will not be able to survive in the long term due to their unavailing economic activity. A recession itself does not mean real help in the lives of these companies, but conventional monetary policy decisions that are designed to mitigate the negative effects do. These measures usually start with the reduction of the nominal interest rates to stimulate the economy with cheap loans and a growing amount of new investment (Friedman, 1968). It is already a huge relief for zombies that the credit liabilities are at a lower mark. However, it is necessary to say that in most cases, one policy act is far from enough to leave the downturn behind, as was not the case with the event of the crisis related to the COVID-19 pandemic. Many governments also introduced schemes of credit guarantees for bank loans and other programs to fuel local companies with liquidity and protect them from going out of business (Schivardi et al., 2020). By doing that, the cabinets take on the risk that some zombie firms will be loaded with cash and kept alive, although they probably should have gone bankrupt in normal circumstances.

All this might seem like a storm in a teacup, as one could argue that zombies should not do too much harm to the economy with their behaviour itself. Unfortunately, historical experiences and current findings show a completely different picture. In the 1990s, Japan experienced a period of economic stagnation, which, according to academics, was a consequence of the prevalence of zombie firms. After the first research in Japan has seen daylight, the attention to this phenomenon has skyrocketed in developed countries. Many articles have been published that admit that since the early 2000s the share of zombies has been constantly increasing, and the trend was even strengthened by the Great Financial Crisis in 2008/2009 (Banerjee & Hofmann, 2018; Favara et al., 2021). In addition to that, Goto & Wilbur (2019) claim that these signs worry even the leading countries like the United States, the UK, and China as they expressed strong desire to stop the unprecedented spread of zombies.

Despite growing publicity around the topic since 2008 in Europe as well, scientific works have started to spawn only in very recent years. Not only are there still very few countries that have framed the scope of an analysis, but the identification techniques also differ greatly in almost every publication. Therefore, there are frankly limitless research opportunities to contribute to

general knowledge about zombies. In addition to the increasing concerns of the international general public, I have chosen to dig deep in this particular field because I am not aware that Hungary and the other Central East European countries were the basis of any related research.

The goal of the study is to determine the prevalence of zombie firms in the region in order to assess the embeddedness of the issue in the first place. Secondly, it is important to specify the country level tendencies in order to see if policy measures are needed in some nations to deal with this phenomenon. Thirdly, the research aims to explore those characteristics of the firm level data that causes differences between the results on the country level.

The structure of the study will progress by starting from the complex and approaching the details afterwards. In the next section, the related literature will be presented from developed countries and the origin of zombies. After evaluating the findings of conducted researches, the methodology of this analysis will be explained. Before starting the examination, the database and the characteristics of the sample will be reviewed first. In the end, the study will be finalized by the results and the conclusion.

II. RELATED LITERATURE

The following section aims to further understand the phenomenon of zombie firms by giving an overview of related academic literature from all over the world. As a first step, it is essential to figure out how these companies emerged seemingly out of nowhere. After getting the topic in context, significant empirical results will be presented on a timeline path. This structure is also appropriate to describe how the issue evolved over time and how it appears in different parts of the world. The findings also have to be separated not just on the matter of location, but as if the examination ground were SMEs or publicly listed firms for obvious reasons.

II.1. Origins of zombie firms

The concept of zombie firms was first mentioned by Kane (1987) in connection with American Savings and Loan Institutions (S&Ls), which had to face major difficulties during the 1970s and 1980s. They were sort of primitive commercial banks at the time handling the finances of the local public. The biggest and most important distinction was only that the regulations concerning banks were much less strict and sophisticated. The institutional supervisor was the Federal Savings and Loan Insurance Corporation (FSLIC), which was the insurer for both the bank and its clients. (Kane, 1987)

The issue started to rear its head when S&Ls issued huge amounts of mortgages to the public in a very short period of time. They financed those from low-interest deposits whose maturity was shorter than that of mortgages. Unfortunately for S&Ls, nominal interest rates changed multiple times and quite drastically in the wrong direction as well. The rise in interests eliminated the market value of the long-term mortgages, which quickly led to a point where the equity of S&Ls turned negative resulting from negative profits for years. (Kane, 1987)

Usually, if a company basically loses all of its equity, eventually the bankruptcy procedure should be initiated. Despite that, this is not what happened this time, because the responsible controlling body (FSLIC) has failed to recognize the unhealthy operations of the insured institutions and let them prolong their agony. In the end, this proved to be a costly mistake, since when the inevitable bankruptcies occurred, FSLIC could no longer bear the enormous debt. (Kane, 1987) It is fascinating to see that first banks were turning out to be zombies in the academic literature, which is unique considering the following flow of history. However, they

represent the same burden for the economy at a structural level as their corporate peers will later in time. Due to their unprofitable business activity, they use assets and workforce in a rather inefficient way, which raises the idea that those resources are basically wasted and stuck inside the corporation and would be much better utilised if it were allocated to a more effective location. As the example shows, zombies always need some kind of external support, like loose regulations, knowing that their operations are unsustainable in the current manner without help. (Juhász, 2019)

The next time, when economic conditions allowed zombie firms to exist for an extended period, occurred about a decade after the events in the US. Considering that the bankruptcy of the S&Ls relatively recently kicked the dust up, it is not at all surprising that the first publications unravelling the new zombie trends turned up in the American press. These preliminary articles emerged to describe some unexpected events that occurred in the Japanese economy, which deserved the attention of the banking sector and policy makers from all over the world. (Goto & Wilbur, 2019) Between 1991 and 2000, Japan experienced a period of weak economy. All started with financial speculation by investors that increased the prices of the real estate and stock market. At the same time, the infamous 'Plaza Agreement' was signed on a cross-country level in 1985 between Japan, the United States, the Federal Republic of Germany, France, and the United Kingdom, which caused the appreciation of the yen. The strong yen had several negative impacts on the economy, including dampening the export potential of the country. (Morikawa, 2012) This international pact and trends in the real estate market have played an important role in the development of the Japanese asset price bubble. Eventually, the bubble burst became unavoidable, which brought a dark period to the Japanese economy from the beginning of the 1990s, which we call the 'lost decades.'

The further events pretty much followed the pattern that we saw in case of the Savings and Loan crisis in the USA. The recession slowly started to make its mark by causing many corporations difficulties in maintaining business. According to the sample, there should now be an external factor that enables companies to survive in some way. However, there was one single difference. This time, they were not loose regulations and irresponsible controlling activities. Authorities were definitely aware of the issues and challenges they face, but to maintain the economy, they decided to support companies financially to protect them from failure. They executed the plan by renewing loans to underperforming companies. In some cases, banks even agreed to lower the payable interest rates or offer a temporary moratorium due to pressure from the government side. The motivation behind this act, on the one hand, was

the fear of banks that they will fall below capital standards if they must write off nonperforming loans. On the other hand, the cabinet supported the concept so that they could avoid public criticism and indignation. (Caballero et al., 2008)

In total, Japanese policymakers decided to cure the crisis with an inefficient program instead of handling it through structural reforms in the bank sector. Removing from the problem strongly favoured an unprecedented growth in the share of zombies in the national economy. The prevalence of vegetating companies caused a serious long-term problem by distorting the market in many ways. Firstly, zombies reduce the profits of their healthy peers only by their presence itself and also discourage new entry and investment to the respective industry by still carrying certain amount of market share. Consequently, those industries will be lacking productivity due to inefficient firms, and less jobs will be created without new entrants and investments to the market. On top of that, they have a bad influence on the competition as well by decreasing market prices and raising wages hanging on to employees, whose productivity declined. Taking the obvious reasons above into account, there is a univocal consensus in the academic literature that keeping zombies alive prolonged the Japanese economic stagnation. (Caballero et al., 2008; Ahearne & Shinada, 2005)

II.2. Researches in Japan

Due to the close involvement in the zombie issue, Japan is by far the richest in research deeply negotiating the topic. Basically, the Japanese wave gave the most significant papers from the early 2000s to the mid-2010s. Besides the results of the analyses one should observe how the zombie identification method evolved over the years as almost every economist rethought the previous one.

II.2.1. Publicly listed firms

The first publication that concentrated solely on zombies was the work of Hoshi (2006). Considering the common knowledge about the factors of the crisis in Japan, the author proceeds from the theory that zombie firms received financial support from the state in the form of discounted interest rates for their outstanding credits. Therefore, a theoretical minimum interest rate is determined, which would have been paid by the most creditworthy borrower at the time. The model classifies a firm zombie if the actual interest payment is less than the estimated minimum, which implies that a discounted interest rate was most probably in operation. After

identification, the focus has been on the characteristics of the chosen corporations. The results are legitimating the propriety of the model as the regressions show that classified zombies happen to be less profitable and more indebted than non-zombies. Furthermore, it turns out that zombies are concentrated in non-manufacturing industries such as construction and real estate, and they tend to come down outside of metropolitan areas. *It should be noted that the applied model raises some issues concerning setting up too broad criteria. The writer honestly admits that the theoretic framework might have falsely categorized healthy firms and missed actual zombies, which received financial support other than interest relief.* (Hoshi, 2006) *However, this would only be significant if the main goal were to determine the exact share of zombies in the economy. Nevertheless, the findings of Hoshi were so remarkable because he laid down the basics of following zombie identification models by proving the common characteristics of those companies.*

The scientific world had to wait 5 years for the revision of the highly respected pioneer study performed by Fukuda & Nakamura (2011), but from a slightly different angle. The co-authors claim in their respective study that despite the expectations and their dead-end condition, it was quite rare that zombies actually went out of business and actually most of them managed to recover in the first half of the 2000s. Their empirical results suggest that the bailout strategy was relatively simple, dismissing unnecessary workers and selling fixed assets to settle debts. They also added that the recovery was boosted by the necessity of corporate restructuring due to the financial crisis. (Fukuda & Nakamura, 2011)

The research was important as well because they criticised and reformed the identification method of Hoshi (2006), which was also applied in the study of Caballero et al. (2008), where Hoshi appeared as a co-author. Fukuda & Nakamura (2011) pointed out the issues that Hoshi himself already admitted in his respective work and added additional characteristics to the model. These parameters were unprofitability and increasing indebtedness ('evergreen lending'), which were empirically proven true for zombies by Hoshi (2006). The additional requirements address both of the previously emerged problems. The unprofitability criterion parries the risk that healthy firms get classified as zombies, while the growing indebtedness criterion takes care of those unhealthy firms that were misclassified as non-zombies by not missing forms of financial support other than interest relief. In detail, those corporations are unprofitable, whose EBIT does not exceed the hypothetical risk-free payments, while increasing indebtedness was met if a firm's total external debt was more than half of its assets

a year before the tested year and borrowings increased in the tested year. (Fukuda & Nakamura, 2011)

The new framework was finally suitable for estimating the share of zombie firms in the Japanese economy, as there were no obvious groups that were falsely classified or left out of the classification. The accuracy of the estimation was controlled by the nonperforming loan ratio of major Japanese banks, whose annual values were very close to the adjusted model values. The zombie share curve culminates in 2001 around about the 10% mark and carries on steeply dropping afterwards, which implies the main finding of the study that most zombies managed to recover in the first half of the 2000s. The study also pictures that the original method of Hoshi (2006) overestimates the number of zombies because it misidentifies healthy firms during the period of quantitative easing monetary policy. (Fukuda & Nakamura, 2011)

II.2.2. Small and medium-sized enterprises

Until the mid-2010s, the attention of scholars avoided small and medium-size enterprises (SMEs), as all the studies worked with a sample of publicly listed companies due to their more transparent and available communication of data. However, they are quite significant subjects of investigation as, for example, in Japan, they constitute more than 99 percent of the total number of Japanese firms. The first study that focused only on them was published by Imai (2016), which also contributed to the evolution of zombie identification methods. The author analysed the financial statements of 4090 SMEs between 1998 and 2008, neither on the path of Hoshi (2006) nor on the path of the Fukuda & Nakamura (2011) framework. He argued that there is also an imperfection in the model adjusted by the co-authors, which is the fact that it takes only one year into account for classification. This can easily cause mistakes as it is more than conceivable that healthy firms experience a worse year or zombie firms perform a better one. To fill this gap, Imai (2016) simply examines a longer period of time. The output of the study showed finally that many zombie companies existed in Japan in the given period of time, especially among the absolute smallest companies, where the ratio of zombies could reach the 20% mark. This opposed previous results that claimed that the presence of zombies was not significant among the smaller levels. (Imai, 2016)

The research of Imai (2016) was continued by Goto & Wilbur (2018) on SMEs, but on a much larger sample. The scholars find that the zombie firm ratio increases as firm size decreases, which is in accordance with the results published two years before. The analysis also concludes that zombies are more widespread in the manufacturing industries, which would differ from the

results of Hoshi (2006), but it is noted that one should be careful with that piece of information because the margin is small and mostly non-manufacturing microenterprises are missing from the observation. Concerning firm age, they find positive correlation with zombie formation, meaning that the older the company, the more likely it becomes a zombie. About exiting the zombie status, they state that the probability of that happening is higher for SMEs than for larger peers, which infers that corporates tend to be bailed out of difficult situations only if stakes are sky high for stakeholders. (Goto & Wilbur, 2018)

Study	Scope	Zombie identification	Main conclusions
Hoshi (2006)	publicly listed firms	discounted interest payments	Zombies are less profitable and more indebted than non-zombies.
Fukuda & Nakamura (2011)	publicly listed firms	1) profitability 2) Hoshi criterion or evergreen lending	Most zombies managed to recover in the first half of the 2000s.
Imai (2016)	SMEs	Fukuda & Nakamura, but profitability tested on a longer time period	Many zombie SMEs existed in Japan in the period of 1998-2008.
Goto & Wilbur (2018)	SMEs	Comparing the 3 previous methods	The older and the smaller the firm the more likely it becomes a zombie.

Table 1. Summary of related literature from Japan.

Source: Author's own editing based on the studies listed in the table.

II.3. Researches in the EU and the USA

Although the zombie issue in Japan was well known in the western part of the world already at the beginning of the current century, the topic did not interest the unrelated outside eye. Later, the Great Financial Crisis finally started to gather attention, but the breakthrough did not come entirely.

II.3.1. Publicly listed firms

The first comprehensive study came eventually in 2017 by McGowan, Andrews, and Millot on behalf of the OECD Economics Department. The academic work strongly deviated from its Japanese relatives mainly because of the nature of the sample. The three economists did not use financial statements only from one nation, but rather cross-country data. Furthermore, there was

no obvious event to which the appearance of zombies could be related, like the crisis in the 1990s and the provided massive financial support to firms in Japan. Therefore, the zombie identification frameworks must have been revolutionized and actualised to be suitable for being applicable for various OECD countries. Consequently, the criterion of discounted interest payments, for example, had to be eliminated from the model because of being too specific, and the co-authors had to concentrate on zombie characteristics instead. In the end, they came up with the requirements of the firm being at least 10 years old and the interest coverage ratio (ICR) being less than 1 for three consecutive years. (McGowan et al., 2017)

The purpose of the research was to determine how much zombie firms hamper the growth of labour productivity. As a result, industry analyses show that the higher the share of capital sunk in zombies, the more likely it is that the growth of a typical non-zombie firm will be crowded out. In numbers, the amount of liquidity invested in a non-zombie firm would have been on average 2 percent higher in 2013, if the zombie ratio had not risen compared to the 2007 level. (McGowan, 2017)

The OECD research has clearly opened up further questions as the follow-up has been published already a year after by Banerjee & Hofmann (2018) reflecting on the theory of McGowan et al. (2017). Although, the economists representing the Bank of International Settlements have featured the identification model of their ancestors, but at the same time they also improved upon it. As the scope is still publicly listed non-financial corporations, the co-authors have explored the possibility to consider low future profitability prospects as an aspect in terms of zombie identification. They came to the conclusion that the framework of McGowan et al. (2017) needs to be adjusted by actually applying the method on their sample and then comparing the stock market valuation of zombie and non-zombie firms. It turned out that the future profitability prospects of zombies are in fact better than those of non-zombies according to the behaviour of investors on the stock exchange. As far as expertise is concerned about these companies, this should not be right. To complete the new model accordingly, for the quantitative measurement of this criterion, the co-authors propose the implementation of the Tobin's q index (ratio of market capitalisation and total assets), which is supposed to be below the sector median in the given year. (Banerjee & Hofmann, 2018)

In their study, they examined financial data of companies from 14 different countries around the world over the period 1980-2017. Arguably this is the widest scope so far in the academic literature, which is appreciable, as the results imply conclusions referring to the whole world. It has been found that there is an increasing trend in the zombie ratio already from the 1980s,

which has been boosted by recessions as every time a significant upturn is depictable around the distressed periods. They claim that the rise of zombie firms has been driven by firms staying in the zombie state for longer, rather than recovering or exiting through bankruptcy. The proof of this is that the probability that a firm is remaining a zombie rose from 40% in the 1980s to 70% by 2017. The authors do not stop at this point, they also managed to figure out why corporate zombies survive longer than in the past. The proposed explanation for the phenomenon is none other than reduced financial pressure from the authorities. The hypothesis already formulated by Caballero et al. (2008) has been reaffirmed that one of the reasons for that is the role of weak banks, which were reluctant to write off nonperforming loans. Additionally, Banerjee & Hofmann (2018) find a correlation between the downward trend of the interest rates after the Great Financial Crisis and the increasing share of zombie firms. It makes perfect sense as decreasing interest not only eases the issues of distressed corporates, but also reduces the pressure on banks to clean up their balance sheets. (Banerjee & Hofmann, 2018)

In 2020, Banerjee & Hofmann further extended their respective research by literally going deeply into the anatomy of zombies analysing the same scope of countries and timeframe. In their study, they negotiate characteristics and life cycle. Firstly, concerning characteristics, they mostly affirm assumptions that the previous literature has already made. They report that zombie firms tend to be smaller in size, less productive, more leveraged, invest less in assets, issue less equity, and receive subsidized credit. So far nothing spectacular has been found. (Banerjee & Hofmann, 2020)

However, in the second section, we already have more revolutionary results in store. It turns out that the changes in the life cycle of zombies are usually visible in the last 2 years before sinking into the zombie status. In this period, they suffer obvious performance deterioration in the form of decreased profitability, productivity, and performance. This result is so important because it contradicts the ICR criterion in the identification methods Banerjee & Hofmann (2018) and McGowan et al. (2017) applied before, as they required the ratio to be below one for 3 consecutive years. Consequently, the co-authors decided to adjust their previous framework by eliminating the firm maturity criterion and requiring both the profitability and the low stock market valuation criteria for 2 consecutive years. In addition, they introduced the new framework for declassification, too, requiring persistence in performance improvement to consider a company recovered. The elimination of the age restriction is explained by claiming

that young firms can be unviable as well, and the low stock market valuation criterion protects promising young startups from being misclassified as zombies. (Banerjee & Hofmann, 2020)

Using the new method for the cross-country data, the authors observed the zombie ratios year by year from the 1980s until 2017 similarly to the 2018 article. The curve likewise shows an increasing trend throughout the whole, boosted by upward shifts linked to economic downturns. The novelty is that a persistent rise is experienceable due to the Great Financial Crisis, which is explainable by the unprecedented monetary response and the fact that it was a deeper recession than usual. Furthermore, the ‘probability of remaining a zombie’ curve that reaches 85% in 2017 implies that the share of zombies will also be high in the next few years. Following the analysis focusing on the sample as a whole, the zombie ratios were compared among the 14 countries next. As a result, Australia and Canada register the highest shares of zombies around 30%, but all Anglo-Saxon countries tend to have a higher ratio than the average. Continental European countries have lower numbers on average around 10-15%, while Japan represents the lowest bound with only about 3% in 2017. The differences come from three types of reasons, which are propensity to list on stock market, differences in sectoral level, and tax and insolvency regimes. More concretely, there is a higher propensity for SMEs to list on the stock market for in Anglo-Saxon countries, which is important because SMEs are more susceptible to zombification (vid. characteristics). The deviation is definite as 50% of listed firms are SMEs by Anglo-Saxon countries, while in the case of continental Europe and Japan this ratio is 28% and 15%. Secondly, sectoral differences are significant because in some sectors like commodity or healthcare, zombies are more represented, leading to a higher zombie ratio for countries like Canada and Australia, where a reasonable share of publicly listed firms operate in the named sectors. Thirdly, insolvency regimes can be differing in terms of keeping firms in zombie status, as poorly designed ones can prolong corporate bankruptcy. (Banerjee & Hofmann, 2020)

Economists from the USA have studied the zombie topic markedly less than their colleagues from other parts of the world. In the end, Favara and his co-authors (2021) have finally broken the silence on behalf of the Federal Reserve to answer the concerns suggesting that the unprecedented fiscal and monetary support during the COVID-19 crisis could fuel the financing of zombie firms. The study uses an ICR-based identification model; so is McGowan (2017) and Banerjee & Hofmann (2020). However, the similarity stops at that point, as the American economist defined a rather strict framework requiring zombie firms to have leverage above the sample annual median, interest coverage ratio (ICR) below one, and negative real sales growth over the preceding three years. Concerning publicly listed firms, they find that the zombie ratio

was between 6-14% in the period of 1995-2020, while the curve culminates in 2004 meaning that the trend is not that obviously increasing if we only examine the USA. They admit that their numbers show a lower share of zombies, which is explained by the fact that they added growth prospects to the identification criteria. (Favara et al., 2021)

II.3.2. Small and medium-sized enterprises

Concerning private firms, the same model has found about 5% of them to be zombies. (Favara et al., 2021) *This result is very unusual compared to the findings of other academic researches. To my knowledge, it has never been seen before that the zombie ratio among publicly listed firms is significantly higher than among private firms in a country. I believe that this is a consequence of a too narrow identification framework. The criterion of leverage above the sample annual median is especially harmful at this point, as it already rules out half of the firms, mostly smaller ones probably. Leverage can be relatively high for a smaller zombie firm, but it has no chance to be classified as zombie because it is likely that even a much bigger healthy firm will have higher leverage due to the size difference. This is a huge bias considering that other studies claim that SMEs are more susceptible to zombification.*

The professional literature also did not participate very much in the analysis of SMEs outside of Japan. The only study worth mentioning is the article by Storz and her co-authors (2017) on behalf of the European Central Bank. They test an aspect which has already been explored by Caballero et al. (2008) and Banerjee & Hofmann (2018), which is whether banks in distress delay the deleveraging of zombie firms. The scope is 7 Euro area countries from which 5 are periphery and 2 are core ones. (Storz et al., 2017)

The research indeed finds a partly positive answer to the research question, as the authors claim that an increase in bank stress is associated with an increase in firm leverage of zombie firms. The result is only partly positive, because the statement is only true for the 5 periphery countries, not for the core ones. This implies that in poorly performing economies, stressed banks tend to conduct risky lending and basically gamble. In terms of zombie identification, they set the requirements as negative return on equity, negative net investments, and lower debt servicing capacity (EBITDA/financial debt) than 5% for two consecutive years. The model shows similarities to the model of McGowan et al. (2017) with the debt servicing capacity criterion and to the framework of Banerjee & Hofmann (2020) with the observation of two consecutive years. (Storz et al., 2017)

Study	Firms	Countries	Zombie identification	Main conclusions
McGowan et al. (2017)	publicly listed firms	13 OECD members	ICR < 1 for 3 years and older than 10 years	Capital sunk in zombies crowds out the growth of non-zombies.
Banerjee & Hofmann (2018)	publicly listed firms	14 countries worldwide	McGowan et al. (2017) + Tobin's q is below the sector median	The downward trend in interest rates boosts the formation of zombie firms.
Banerjee & Hofmann (2020)	publicly listed firms	14 countries worldwide	ICR < 1 and Tobin's q below the sector median for 2 years	The changes in the life of cycle zombies are visible 2 years before zombification.
Favara et al. (2021)	publicly listed firms and SMEs	USA	leverage above the sample annual median, ICR < one, negative real sales growth for 3 years	Zombie firms are not a prominent feature of the U.S. economy.
Storz et al. (2017)	SMEs	7 Euro area countries	negative ROA, negative net investments, and lower debt-service capacity than 5% for 2 consecutive years	Increase in bank stress is associated with an increase in firm leverage of zombie firms.

Table 2. Summary of related literature from the Europe and the USA.

Source: Author's own editing based on the studies listed in the table.

III. ZOMBIE IDENTIFICATION

The history of zombie literature has seen countless types of zombie identification method, sometimes quite unique ones as well. This makes it even more difficult to navigate between them and to be able to choose the most appropriate one. For example, some economists have tried to identify a subsample of zombies that are in the most danger of going bankrupt. Blažková & Dvoutělý (2020) defined them as negative equity companies, which means that those firms had negative profits for such a long time that they managed to lose all of their equity. In addition, the study by Schivardi et al. (2020) and Broz & Ridzak (2017) used the so-called Altman Z-score, which is a formula for determining whether a company is heading to fate according to its current profitability, efficiency, funding sources, debt, and liquidity. However, the models that are the most sophisticated and most acknowledged by expertise are the ones aforementioned in the related literature. Consequently, the choice for this study will be made from this pool of frameworks.

In the process of opting for a model, I set up two requirements which will be followed. On the one hand, as the scope is 10 Central East European countries, it is very important for the method not to be too specific for the characteristics of one country because otherwise a bias would occur in the case of the other 9 nations in the sample. This criterion infers that the identification techniques appearing in the research papers conducted in Japan will not be selected. For starters, it already raises concerns that these frameworks were not applied in any of the studies made by American or European economists. In the first place, this observation is rather weird, because especially the works of Fukuda & Nakamura (2011) or Imai (2016) were not criticised that much. Certainly, the earlier opening essay by Hoshi (2006) had to face a number of contrary opinions, but the model has been softened, the mistakes have been corrected, and new criteria have been added to that. The gradual development resulted in a fully appropriate model without any bugs, first published by Imai (2016). However, if one digs deeper into that, it turns out that it contains some special features of the crisis in the 1990s, which caused the emergence of zombies in Japan. It prescribes zombies to have received a discount in their respective interest payments, which was proved right in the East Asian country. However, in Europe, there was no such widely accepted and squarely determinable event, to which economists can connect the emergence of zombies. There is an agreement that recessions boost the formation of zombies, but the zombie ratio has been increasing since the 1980s according to Banerjee & Hofmann (2020). Furthermore, the fact that banks were providing discounted interest payments was not

explicitly proved in Europe. Several scholars have successfully examined the effects of weak banks and persistently low interest rates, but typical measures of stressed financial institutions were not specified (Banerjee & Hofmann, 2018; Banerjee & Hofmann, 2020; Schivardi et al., 2018).

On the other hand, it is also essential that the criteria of the model are neither too broad nor too narrow. There are examples for both of the undesirable scenarios. Firstly, Banerjee & Hofmann (2018) have concluded that the ICR based method of McGowan et al. (2017) is not restrictive enough. Their analysis showed that the application of the model might result in a way that future profitability prospects of zombies are, in fact, better than those of non-zombies according, which is of course contrary to the well-known zombie characteristics. Consequently, they proposed the Tobin's q criterion to adjust the framework. Secondly, the model of Favara et al. (2021) seems to be too narrow in analysing the results in their study and the given requirements. It classifies suspiciously low amounts of SMEs, which is rather unusual, as expertise univocally agrees that smaller firms tend to be more likely to be zombies (Hoshi, 2006; Banerjee & Hofmann, 2020). The criterion of leverage above the sample annual median looks unnecessary at this point, as it already rules out half of the firms, mostly smaller ones. Leverage can be relatively high for a smaller zombie firm, but it has no chance to be classified as a zombie because it is likely that even a much bigger healthy firm will have higher leverage due to the size difference. Misidentification of SMEs can cause significant bias to the results.

As a consequence of the selection process, the two models of Banerjee & Hofmann have remained and survived from elimination. Both of them are suitable for cross-country database, as the co-authors have applied them on samples consisting of 14 countries worldwide. Equally, there are no concerns raised that either of the methods misidentifies a significant sub-sample of firms. Finally, I have chosen the Banerjee & Hofmann (2020) framework requiring zombies to be unprofitable and have low stock market valuation for 2 consecutive years, because it has been proven that signs of zombification are usually visible on a firm in the last 2 years before sinking into the zombie status.

IV. SAMPLE AND DATABASE

The downloaded sample contains annual observations from 1,746 publicly listed companies from Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovenia, and Slovakia, which are Central East European countries that joined the European Union in 2004, 2007, or 2013. The financial statements of the companies are available in the Orbis database of the Bureau van Dijk, which is the world's most powerful comparable data resource on private companies and contains information on more than 400 million companies worldwide. The financial statements of the firms are available from the last 10 years, so data from 2013-2022 will be used.

During the data clearing process, the presence of variables that are inevitable for zombie identification was required, which are the interest cover ratio (ICR) and the Tobin q value in the given year and the previous year. Consequently, more than half of the original sample had to be eliminated for almost every year of the examination period. The clarification also caused the Czech Republic to be left out of the final ground of the analysis due to an insufficiency of data. Ultimately, the studied sample contains 721 firms for 2014, 820 for 2015, 828 for 2016, 844 for 2017, 864 for 2018, 867 for 2019 and 876 for 2020 from 10 Central East European countries. It should be noted that although the Orbis database has provided firm-level data from 2013-2022, only the period of 2014-2020 has been examined. 2013 was not possible due to the criteria of the identification model, as observations from the previous year are always necessary for zombie classification, while for 2021 and 2022, the database is yet to be filled enough worthy for analysis.

About how the distribution of companies will influence the final results, it has to be admitted that the events specific to Poland and Romania will drive the results quite strongly due to the fact that they represent a relatively constant 50% and 20% of the sample, respectively.

Countries	Year						
	2014	2015	2016	2017	2018	2019	2020
Bulgaria	50 (6.9%)	84 (10.2%)	92 (11.1%)	97 (11.5%)	93 (10.8%)	90 (10.4%)	88 (10.0%)
Croatia	49 (6.8%)	51 (6.2%)	50 (6.0%)	52 (6.2%)	51 (5.9%)	52 (6.0%)	59 (6.7%)
Estonia	13 (1.8%)	14 (1.7%)	13 (1.6%)	12 (1.4%)	12 (1.4%)	14 (1.6%)	14 (1.6%)
Hungary	17 (2.4%)	17 (2.1%)	18 (2.2%)	18 (2.1%)	20 (2.3%)	21 (2.4%)	21 (2.4%)
Latvia	10 (1.4%)	10 (1.2%)	8 (1.0%)	8 (0.9%)	9 (1.0%)	8 (0.9%)	8 (0.9%)
Lithuania	19 (2.6%)	19 (2.3%)	20 (2.4%)	21 (2.5%)	23 (2.7%)	24 (2.8%)	24 (2.7%)
Poland	365 (52.0%)	426 (52.0%)	435 (52.5%)	450 (53.3%)	468 (54.2%)	476 (54.9%)	476 (54.3%)
Romania	153 (21.2%)	163 (19.9%)	162 (19.6%)	157 (18.6%)	164 (19.0%)	158 (18.2%)	160 (18.3%)
Slovenia	19 (2.6%)	19 (2.3%)	18 (2.2%)	18 (2.1%)	16 (1.9%)	16 (1.8%)	17 (1.9%)
Slovakia	16 (2.2%)	17 (2.1%)	12 (1.4%)	11 (1.3%)	8 (0.9%)	8 (0.9%)	9 (1.0%)

Table 3. Distribution of firms by country in the sample.

Source: Author's own editing.

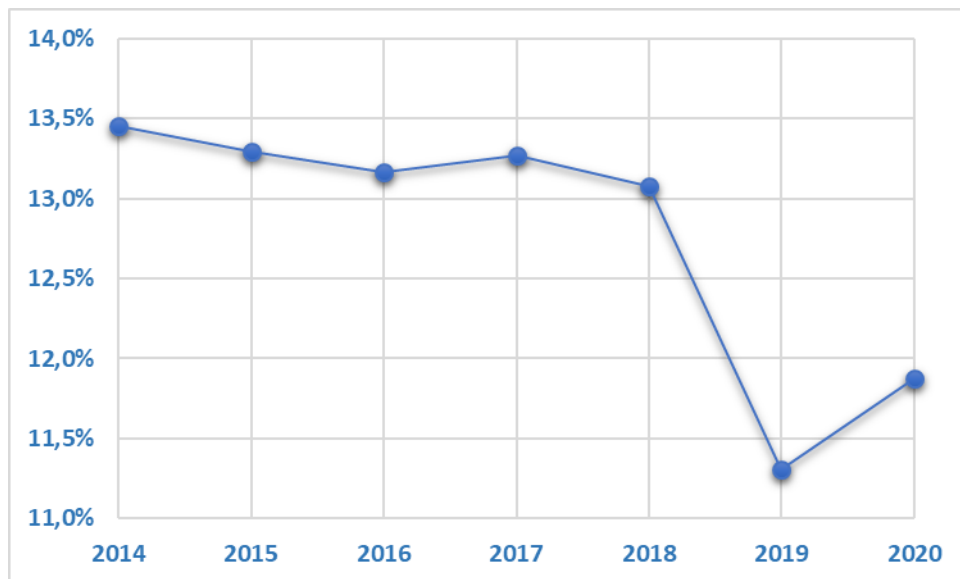
V. RESULTS

The findings of the study will be presented firstly concerning the whole region of Central East Europe. The trends and movements of the zombie ratio will be thoroughly explained and compared with studies conducted on scopes of data. Moreover, results will be shown on a country level as well. To interpret the differences between countries, structural factors will be tested, which was proposed by previous literature.

V.1. Central East Europe region

The identification model of Banerjee & Hofmann (2020) classifies a constant value of around 13% as the share of zombies between the years 2014-2018. The tendency is in accordance with the findings of the co-authors on the sample of 14 developed economies, as the curve also stagnates during the period of 2014-2017; however, the zombie ratio differs by about two percentage points wabbling around 15%. As 2017 is the last point, when a comparison is possible between the findings, it is important to conclude that the share of zombies was slightly higher among more developed countries in the mid-2010s.

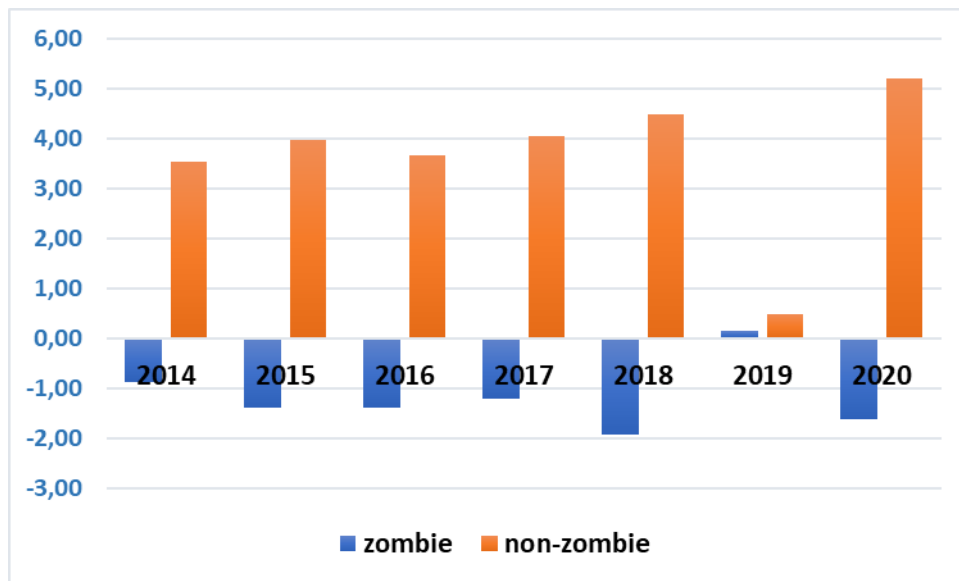
However, from 2018 to 2019 the consistent trend has been broken, as a significant decrease is observable. In a case like this the first implication is obviously that a number of zombies have disappeared during the course of one year. An event like this can be explained only by firms that have been classified as zombies in 2018 have either been recovered or gone out of business through bankruptcy.



Graph 1. Share of zombies from 2014-2020 in CEE countries – inconsistent movements after stagnation.

Sources: Orbis, author's calculations.

To determine which of the possible scenarios occurred, a closer look at the variables in the chosen identification framework should be taken. Tobin's q values do not show any notable differences from 2018 to 2019, so the reason for the drop in the zombie ratio is not caused by a structural change in stock market valuations. However, Graph 2 suggests that the situation is completely the opposite with the interest cover ratio, as a huge deviation is visible from 2018 to 2019. The median ICR of zombies increased by more than 2 points, while the value for non-zombies dropped by about 4 points. The fact that the two groups got closer to each other implies that the movement among the categories is and will be rather high in the next few years. Zombies will be more likely to recover, while non-zombies will be even more likely to sink into the zombie status, as the median of the ICR is below the threshold of the identification criterion, meaning that more than half of non-zombies are in the danger zone. This hypothesis gets verification in 2020, when the share of zombies starts to increase again probably due to those non-zombies in the distressed area a year earlier. Consequently, the approach of the two categories and that there was no reason in 2019 for companies to suddenly go bankrupt suggest that some zombies managed to recover and emerge from their peers.

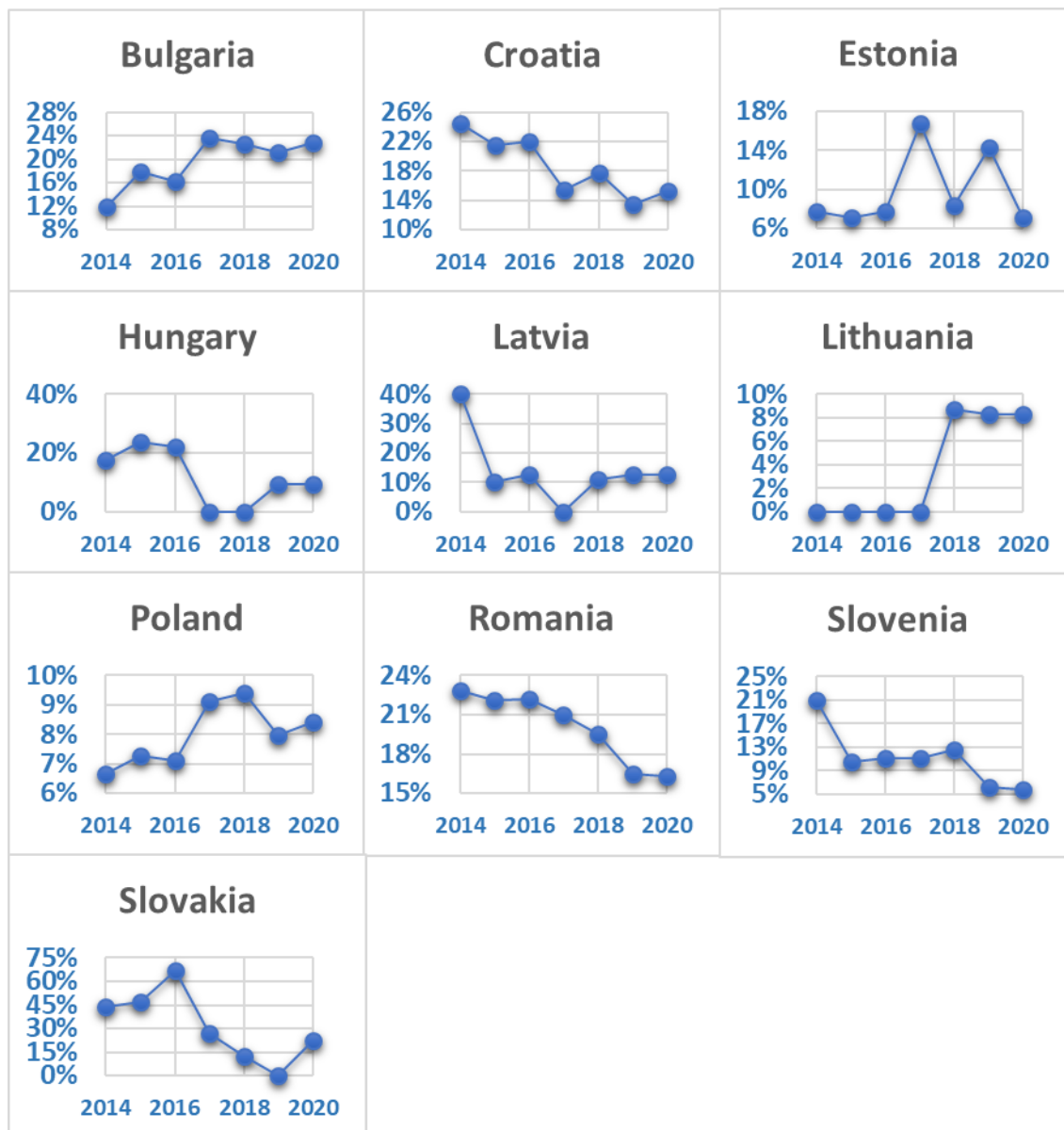


Graph 2. Median interest cover ratios (ICRs) of zombie and non-zombie firms – significant shift in 2019.

Sources: Orbis, author's calculations.

V.2. Differences on a country level

By looking at the whole sample, procedures of certain Central East European countries are not visible. That is why it is a necessity to break down the results to the country level as well. By this act, not only the deviations will be seen between them, but it will be also clear which events drive the changes on the aggregate data. As the sample and database section showed, Poland and Romania are dominating the progression of the cross-country findings, however, the effects of Bulgaria and Croatia could also be reasonable with their share of around 10% and 6% respectively. Graph 3 suggests that in either of the four most significant countries a serious decrease occurred especially in Romania and Croatia from 2018 to 2019 causing the negotiated drop after years of stagnation. However, the bounce back in 2020 was driven mostly by Bulgaria, Poland and Croatia as their zombie ratios started to increase again.



Graph 3. Share of zombies from 2014-2020 in CEE countries individually.

Sources: Orbis, author's calculations.

Confining strictly to the deviations in zombie shares between the examined nations, it is perceivable on Graph 3 that states being represented with lower weight in the sample tend to be extremely volatile concerning the share of zombies due to the shortage of data. It has also occurred that none of the companies were classified as zombies from a country in a certain year. As a matter of example, Slovakia reached 67% in share of zombies in 2016, which reduced to 0% during a period of only three years. In case of them, even the recovery or zombification of just one firm can cause definite movement on the zombie ratio curves. Consequently, it cannot really be judged what factors tend to have an influence on the country level change as it could be random as well. Therefore, the significant findings will also be limited to the four dominant countries.

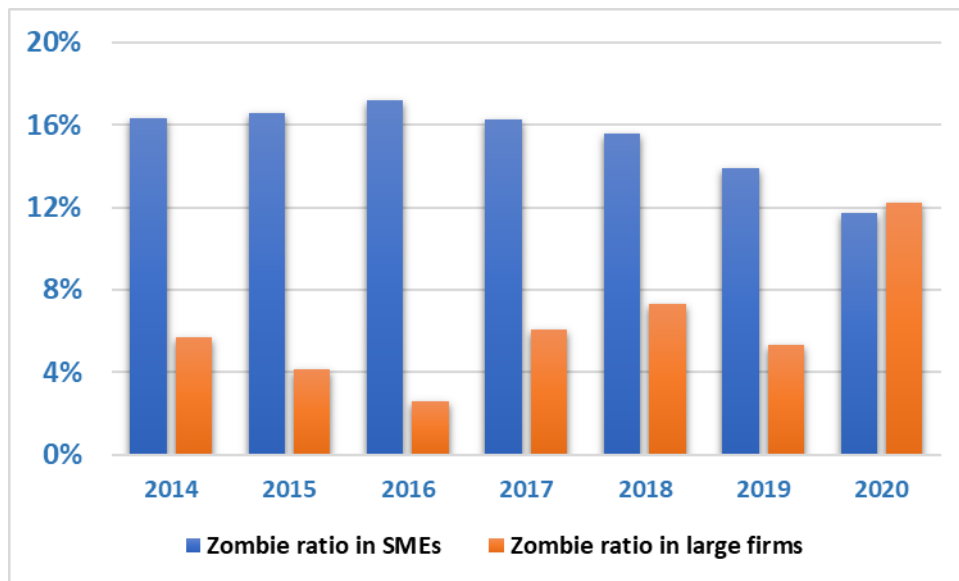
Bulgaria started on a low with only 12% of zombies, however the prevalence of these distressed companies started its rise after that point culminating around 23% in 2020. While the share of zombies was increasing, the propensity of listing on the stock exchange did the same thing as its weight in the sample reached even the 11% mark in 2016. Croatia, however, went on a completely different path starting on a high at 24.5%, but consistently dropping afterwards landing around 15% in the last year of the observation. Romania shows a lot of similarities to the events in Croatia as the zombie ratio carried on dropping from almost the 23% mark in 2014 to approximately 16% in 2020. Contrary to the others, Poland did not experience such high volatility staying between 6.5% and 9.5% during the observation of seven years.

V.3. Zombie characteristics

The differences between the four countries can obviously be explained by effects of business cycles and recessions. However, structural factors might also explain cross-country differences in zombie ratios (Banerjee & Hofmann, 2020). In this section the effects of three factors will be analysed.

Banerjee & Hofmann (2020) proposed the idea that the propensity of firms to list on the stock exchange is rather heterogeneous in different economies. Concerning this matter, the listing of SMEs is important in particular as many economists argued before that small firms tend to be more likely to be classified as zombies (Hoshi, 2006; Goto & Wilbur, 2018; Banerjee & Hofmann, 2020). Consequently, the share of SMEs among publicly listed companies in a country should be very important in terms of the zombie ratio.

Therefore, the hypothesis of smaller zombies has been tested on the sample, which gave somewhat surprising results. From 2014 to 2019, the theory was perfectly correct, however suddenly large firms overtook SMEs in terms of zombie ratio in 2020. One possible explanation for this is that the negative effects of the COVID-19 crisis have hurt even multinationals very badly.

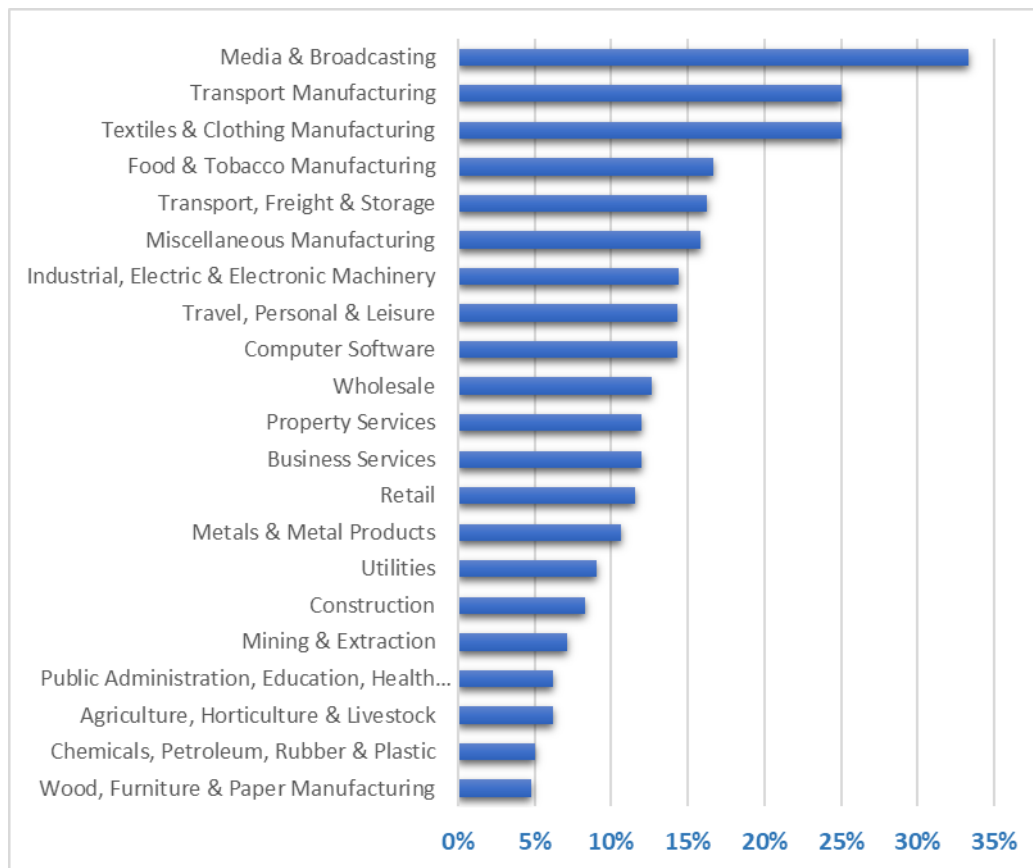


Graph 4. Large firms overtook SMEs in terms of zombie ratio by 2020.

Sources: Orbis, author's calculations.

Concerning the current analysis, it means that those countries having many SMEs among listed firms should have had higher zombie ratios between 2014 and 2019 than those states having less smaller firms in the stock exchange. About the four countries, it turns out that in Bulgaria and Romania the share of SMEs is around 80-85% over the years, while in Poland and Croatia this number is approximately 65-70% and 50-55%. This is on the one hand consistent with what is observable on the curves as the zombie ratio of Bulgaria and Romania was much higher than that of Poland. On the other hand, in spite that Croatia has smaller share of SMEs than Poland does, Croatia is still much richer in zombies. Consequently, size does not seem to have as significant correlation to the likelihood of zombification in Central East Europe as in more developed countries.

The other proposal of Banerjee & Hofmann (2020) is that differences at the sectoral level influence the country zombie shares. The co-authors have found that commodity sectors were characterised by relatively high zombie ratios in 2017, which contributed to the high share of zombies in Australia and Canada (Banerjee & Hofmann, 2020). The examination of our data shows that manufacturing industries contain the highest share of listed zombie firms in the region of Central East Europe.

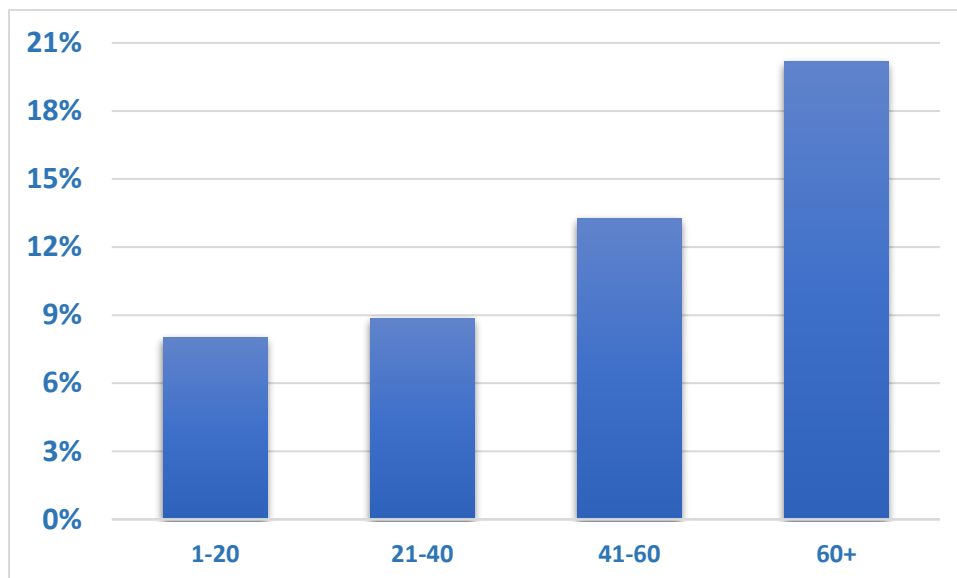


Graph 5. Zombie ratios by sector in 2020.

Sources: Orbis, author's calculations.

This does not seem to affect the zombie shares by country as the distribution of the countries are similar in these sectors to how much they are represented in the aggregate sample.

Lastly, McGowan et al. (2017) have examined how firm age is connected to the likelihood for a firm to be classified as a zombie. The co-authors have found on the sample of OECD countries that the older the company, the more likely it will be classified as a zombie (McGowan et al., 2017). The analysis on our sample shows a very similar result. Between the age of 1-20, the presence of zombies is around 8%, between 21 and 40 it is around 9%, between 41 and 60 it is around 13%, while among the oldest ones it is more than 20%.



Graph 6. Share of zombies in different firm age categories in 2020.

Sources: Orbis, author's calculations.

Considering Bulgaria, Croatia, Poland and Romania, this typical zombie characteristic manages to explain most of the differences on a country basis. In the two oldest categories, there are about 47% of Bulgarian firms, 63% of Croatian firms, 71% of Romanian firms and only 15% of Polish firms. The difference is definite between Poland and the other three countries, which deviation appears on the curves of Graph 3 as well.

VI. CONCLUSION

The topic of zombie firms is a trending topic in the developed countries, but it is only rarely researched in Central East Europe. Because of the lack of academic experience in the region, models of the Western world had to be considered. It turned out that the framework of Banerjee & Hofmann is the most appropriate one to analyse the cross-country data.

The model classified a constant 13% of zombies in the period of 2014-2018. From 2018 to 2019, a serious decrease was observable, which was caused by the recovery of companies, which were previously in the zombie state. In line with this, the group of zombies and non-zombies got closer to each other in terms of the debt and profitability indicator of the identification method. This implied that in the next years, the movement between the categories will be usual. In 2020, the share of zombies bounced back from the low point of 2019 accordingly.

The visualization of the zombie ratios on a country level made it possible analyse how the national procedures affect the aggregate result. It has been found that the decrease from 2018 to 2019 was driven by the countries with the highest weight of the sample (Bulgaria, Croatia, Poland, Romania). The author admitted that the differences by country will only be significant for these four countries due to the shortage of data and extreme volatility concerning the other countries.

In case of Bulgaria, a significant increasing trend was experienceable over the years from 12% to 23%, while for Romania and Croatia a similarly relevant decreasing could be seen landing at 16% and 15% in 2020. The most consistent curve was performed by Poland with little movements in the range of 6.5% and 9.5%.

The reasons behind the deviations were unfolded by testing structural factors Central East European sample. The propensity to list SMEs on the stock exchange aspect was found to be related to the results as from 2014-19, it was definite that SMEs are more likely to be zombies. However, during the application of the factor on the four countries did not turn out as a clear driver of differences. By examining the sectoral level, it has been proven that the prevalence of zombies is the highest in manufacturing industries in terms of the Central East European countries. Unfortunately, this factor does not affect the country level differences significantly, because the distribution of countries is similar in the manufacturing industries to the distribution of the aggregate sample. Finally, the firm age was found as the most important factor causing

deviation between countries. The smaller share of zombie companies in Poland is explained consequently by the fact that most publicly listed firms are relatively young being less likely to be classified as zombies.

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