

DANMARKS NATIONALBANK

18 DECEMBER 2019 — NO. 29

Low prevalence of zombie firms in Denmark



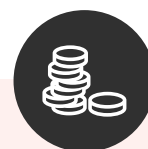
The prevalence of zombie firms is low

Weak firms, so-called “zombies”, account for less than 1.5 per cent of Danish firms, which is low compared with other countries. The prevalence of zombies fluctuates with the business cycle and tends to be slightly higher during economic downturns.

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Unchanged prevalence of zombies

The risk of remaining a zombie has not increased in the low interest rate environment of the post-crisis period. This indicates that lower interest rates and cheaper financing have not resulted in a higher prevalence of zombies.

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Zombies pay higher interest rates than other firms

The interest rates paid by zombies have declined in line with the interest rates paid by other firms. This indicates that banks have not eased conditions more for zombies than for other firms.

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Zombies may be detrimental to the economy

The concept of zombie firms covers weak firms that are not competitive for an extended period of time. Specifically, we apply the definition used by the OECD, among others, meaning that zombies are firms aged 10 years or older, that for three consecutive years have been unable to cover its interest expenses by operating profits.¹ When such firms survive and continue to operate, they are referred to as zombies.

A high prevalence of zombies may constitute a problem for the economy. They absorb labour and capital resources that could have been allocated to more productive uses elsewhere in the economy, thereby potentially reducing productivity and economic growth. From a socio-economic perspective, zombies should therefore exit or undergo substantial restructuring.

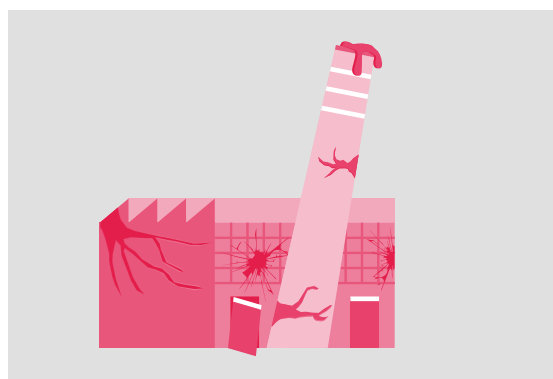
The prevalence of zombies may also be seen as an indicator of whether the financial system, including banks, is able to provide credit efficiently rather than supporting a large number of unprofitable firms. For a number of years, interest rates, both in Denmark and abroad, have been extraordinarily low by historical standards. In this context, several international organisations, including both the BIS and the OECD, have pointed out that low interest rates, and thus lower financing costs, could cause the prevalence of zombie firms to increase.

In Denmark, the prevalence of zombies is low and has been declining since 2011

In the wake of the financial crisis, the prevalence of zombie firms in the private non-primary sector in Denmark rose to just below 2 per cent, see Chart 1.²

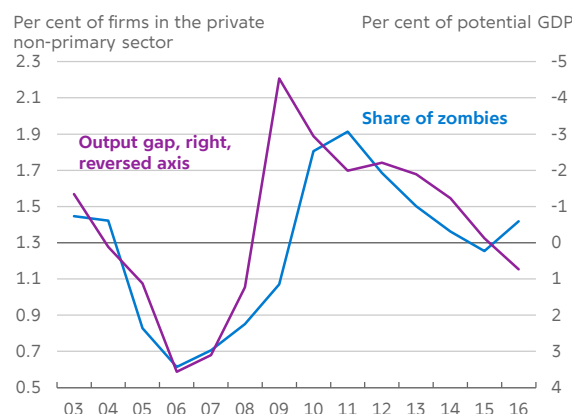
What is a zombie firm?

Zombies are firms that are unable to cover their interest payments with profits for an extended period of time. From a socio-economic perspective, zombies should therefore possibly exit or be restructured.



Low prevalence of zombie firms, fluctuating with the economy

Chart 1



Note: See Box 1 in the Appendix for the precise definition of zombie firms and Box 2 for a detailed description of data.
 Source: Danmarks Nationalbank and own calculations based on firm-level data from Statistics Denmark.

1 There are no objective criteria for when a firm should exit, but persistent negative profits are often used as an indicator, for instance by the BIS and the OECD. See Box 1 in the Appendix for den precise definition of zombie firms used in this analysis.
 2 The private non-primary sector covers private firms excluding financial corporations and primary industries, including agriculture. Agriculture is suffering from structural challenges, but has been excluded from this analysis due to data limitations.

Since then, the prevalence declined to 1.4 per cent in 2016. This is in line with the cyclical position of the Danish economy but different from global developments, as the share of global zombie firms has increased since 2011.³

The average zombie is slightly larger than other firms, and therefore, measured in terms of employment and balance sheet totals, zombies account for slightly more than other firms, i.e. about 3 per cent in 2016, see Chart 2. Thus, they employ some 34,000 people and have aggregate balance sheets totalling kr. 133 billion.

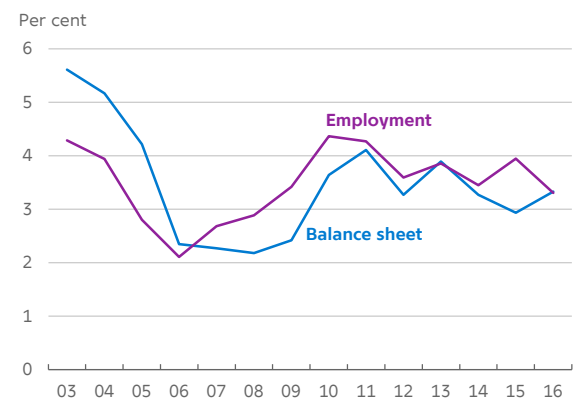
However, the share is still low compared with other countries. In Finland and Sweden, for instance, zombies accounted for 7 and 11 per cent, respectively, of corporate balance sheet totals in 2013, see Chart 3.⁴

There are several explanations for the lower prevalence of zombie firms in Denmark compared with other countries. The cyclical position of the economy is a key factor. The large share of zombies e.g. in Greece reflects the very deep, protracted recession in the country after the financial crisis, among other factors.

But factors of a more structural nature also play a part. As a case in point, Denmark provides a good framework for the resolution of weak firms, reducing the length of insolvency proceedings. This contributes to closing down unprofitable firms, and, thus, to containing the prevalence of zombie firms, see Chart 4.

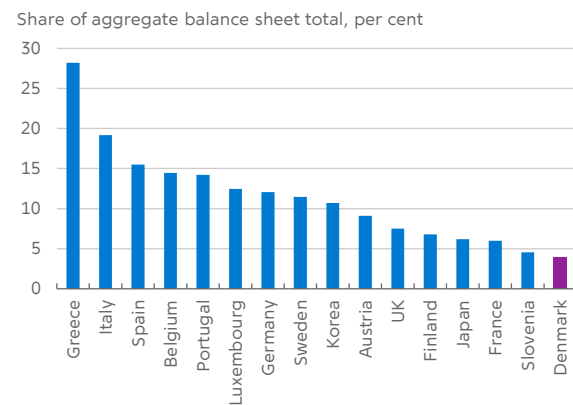
The high degree of income protection in Denmark may also reduce opposition against closing down a zombie firm, as the costs of the affected employees may be lower than in countries with less income protection. This makes it less unpopular for creditors to force a firm to close down.

Measured in terms of employment and balance sheet totals, zombies also account for a small part only Chart 2



Note: See the note to Chart 1.
 Source: Own calculations based on firm-level data from Statistics Denmark.

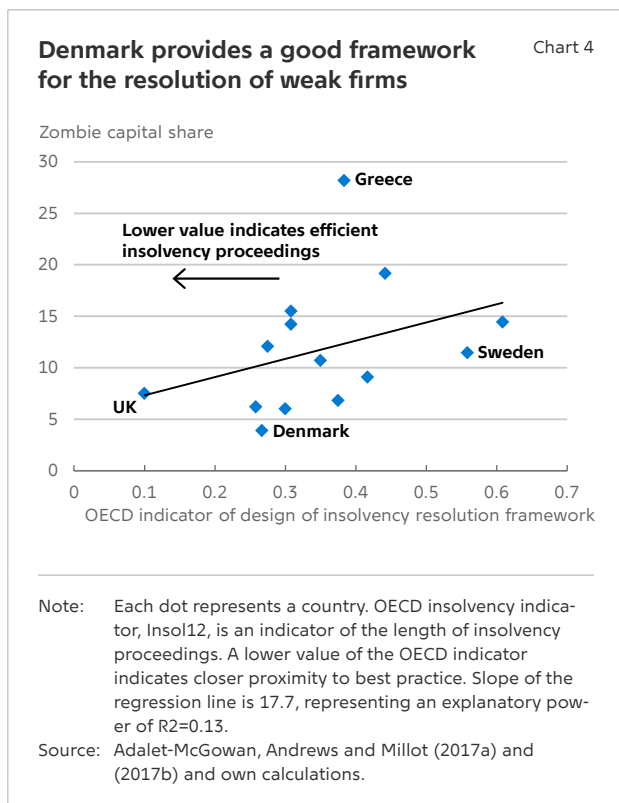
In Denmark, the zombie capital share is low compared with other countries Chart 3



Note: Data for 2013.
 Source: Adalet-McGowan et al. (2017a) and own calculations based on firm-level data from Statistics Denmark.

³ See e.g. Adalet-McGowan et al. (2017a) and Benerjee and Hofmann (2018).

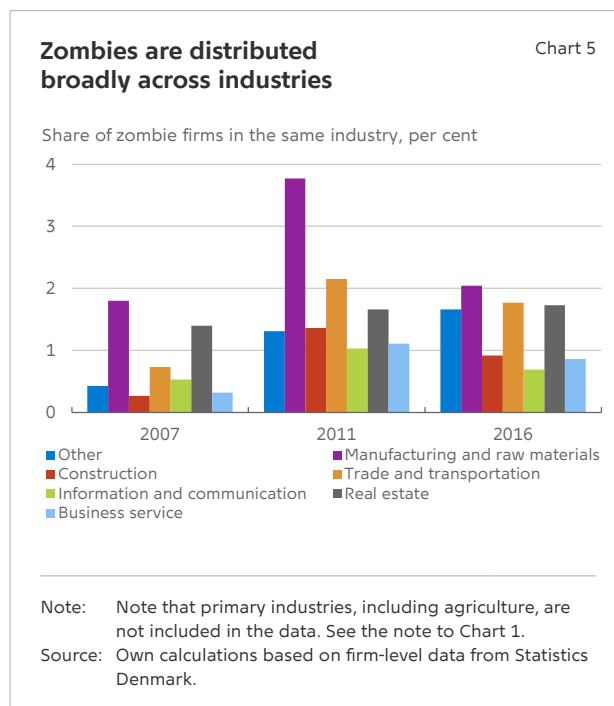
⁴ A cross-border definition is used. However, cross-border comparisons are still difficult, for instance due to different legislative and accounting regimes. Comparison of Danish data with OECD analyses is fraught with further uncertainty. As a case in point, there are probably minor differences in the data included, for instance the prevalence of sole proprietorships, including farms. Still, the prevalence of zombies in Denmark is believed to be relatively low compared with other countries. This also applies over time.



So, the low prevalence of zombies in Denmark compared with other countries points towards good framework conditions and an efficient public sector and financial system in Denmark.

Zombies are relatively large, can be found in all industries and have persistently negative profits

In Denmark, zombies are relatively large firms. In 2016, their average balance sheet total was about kr. 100 million, or more than double that of non-zombies. They also have more employees than non-zombies, about 30 in the average zombie and half that number in non-zombies. The larger size of zombies could reflect that small firms presumably exit more quickly – before becoming zombies.



Zombies are distributed broadly across industries, see Chart 5, albeit with a small overweight in manufacturing and trade and transport.

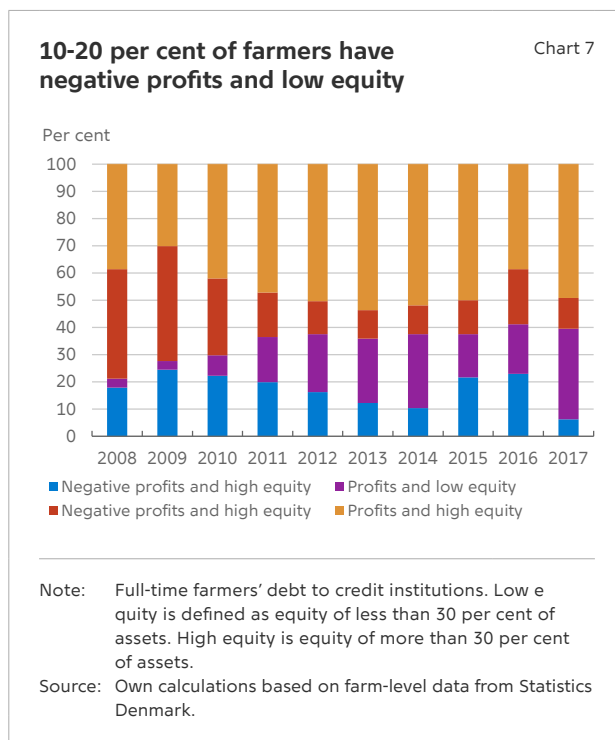
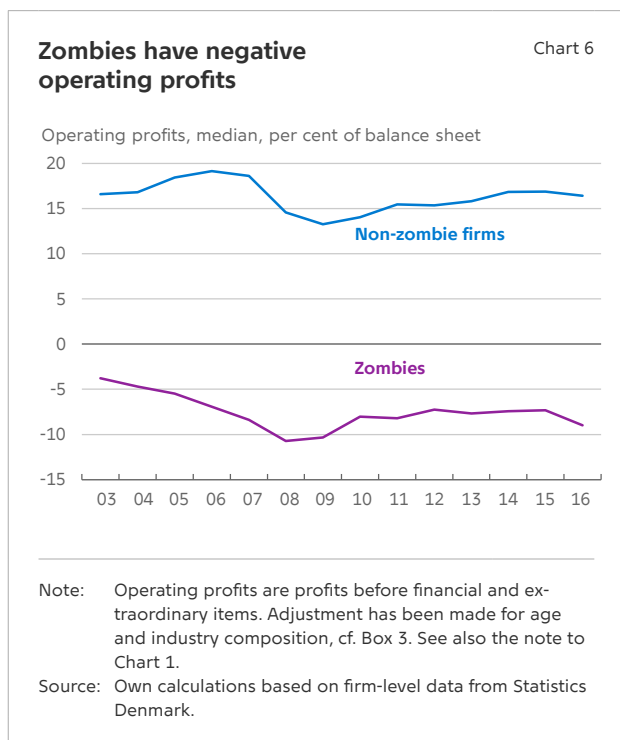
Zombies are also identified by low earnings before interest payments, i.e. low operating profits. So, the operating profits of zombies are obviously lower than those of other firms, but actually zombies tend to have negative operating profits, see Chart 6. This demonstrates that the identified group of firms is actually quite weak.⁵

Agriculture is suffering from structural challenges

Primary industries, including agriculture, are not included in the analysis. The reason is that in the dataset applied, it is not possible to identify whether a farm meets the zombie criteria.

However, agriculture is obviously suffering from structural challenges. The financial position of many

⁵ It should be noted that in this analysis, zombie firms are aged 10 years or older. In other words, start-ups, which often sustain initial negative profits, are not involved.



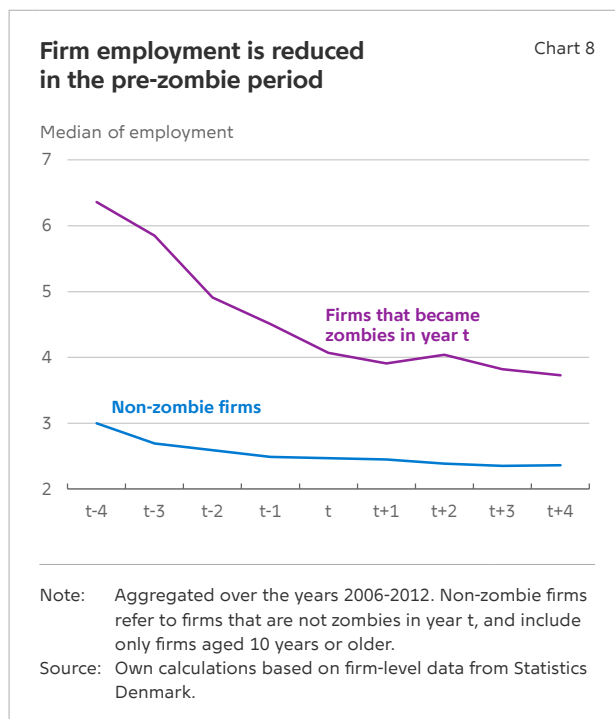
farmers is so poor, both in terms of negative profits and low equity, that it is doubtful whether their business is viable, see Chart 7.⁶

Firms may turn into zombies when sales fail

Firms may end up as zombies if their sales fail, for instance if they lose a big client. With lower earnings, the firm's productivity declines and it will have negative profits if staff and other costs are not reduced quickly.⁷

In the pre-zombie period, the firm actually reduces staff numbers substantially – typically by 30-40 per cent, see Chart 8.

However, the reduction in staff numbers is slower than the decline in earnings, leading to a substantial



6 See Danmarks Nationalbank (2018).

7 Productivity is measured as nominal value added per full-time equivalent employee.

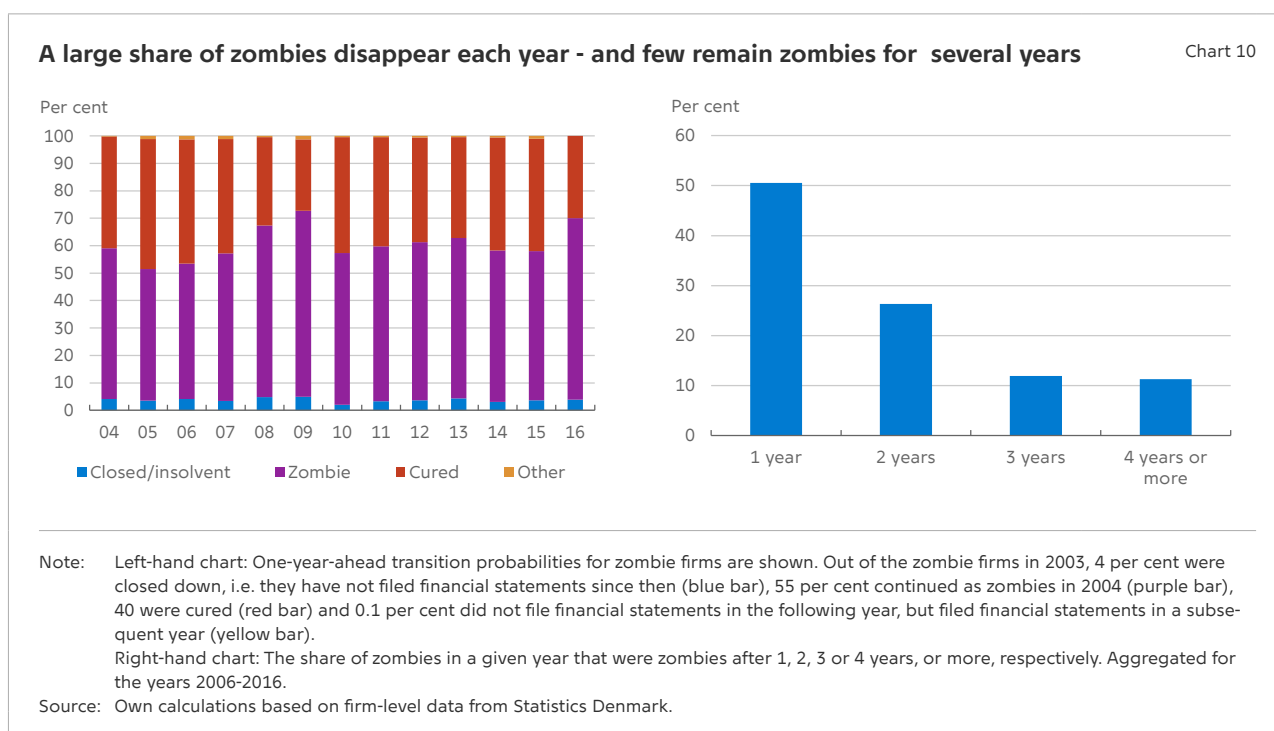
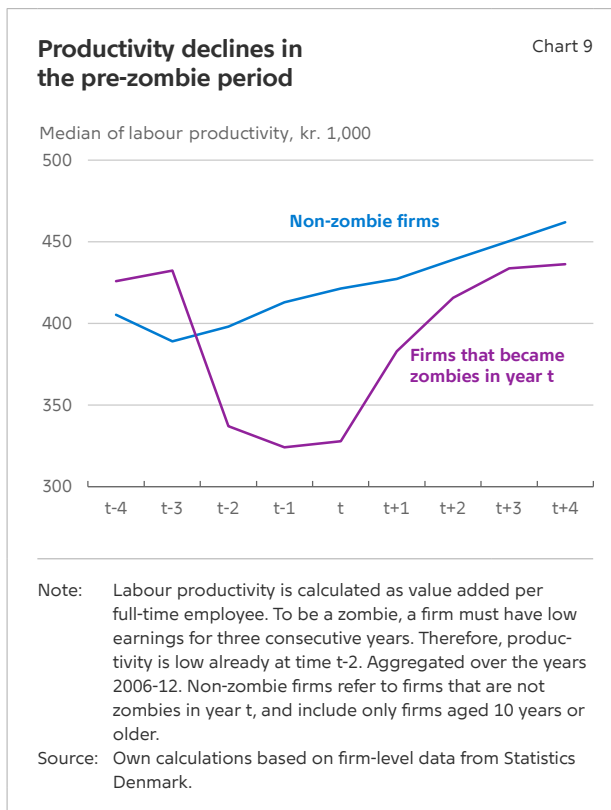
slowdown in productivity relative to other firms, see Chart 9.

But in the surviving firms, productivity is typically restored relatively quickly, driven especially by increased earnings. This does not reflect a sharp reduction in staff numbers other than the reduction in the pre-zombie period.

Due to their restored productivity, the surviving firms tend to be zombies for a short period of time only. Among firms that become zombies in any given year, only slightly more than half of them remain zombies in the following year, see Chart 10, left. After two years, the share has typically decreased to 25 per cent, and only about 10 per cent are zombies for four years or more, see Chart 10, right.

However, a number of loss-making years eat into equity. Zombies typically stand to lose almost all equity, see Chart 11. For zombies that survive and are possibly cured, i.e. return to productivity and profitability, rebuilding equity takes a long time. This means that there are often long-term negative effects of being a zombie, for instance in the form of a protracted period of difficult and expensive access to finance.

But the relatively fast restoration of productivity does illustrate that firms should not necessarily be closed



down immediately when becoming zombies. Resolution or insolvency proceedings may entail considerable costs, and consequently continued operations may be preferable for both owners, creditors and society despite a number of years with negative profits.

Unchanged prevalence of zombie firms despite low interest rates

International organisations such as the OECD and the BIS have expressed concern that very low interest rates could cause the prevalence of zombies to increase. The reason is that low interest rates could enable zombies to survive longer than they would otherwise due to lower financing costs or bank forbearance, for instance because the alternative for the banks would be to invest the funds at negative interest rates in the money market.⁸ So, an undesirable side effect of low interest rates could be an increase in zombie firms, which will cause productivity in the economy to slow down.⁹

To assess whether surviving as a zombie has become easier as interest rates have declined, the probability of remaining a zombie for instance one or two years later can be calculated.

The risk of remaining a zombie is not constant over time, but fluctuates in line with the business cycle, among other factors. During boom periods, the risk of remaining a zombie decreases. This was seen e.g. during the overheating of the economy 2005-07, at which time the risk of remaining a zombie was very low, see Chart 12.

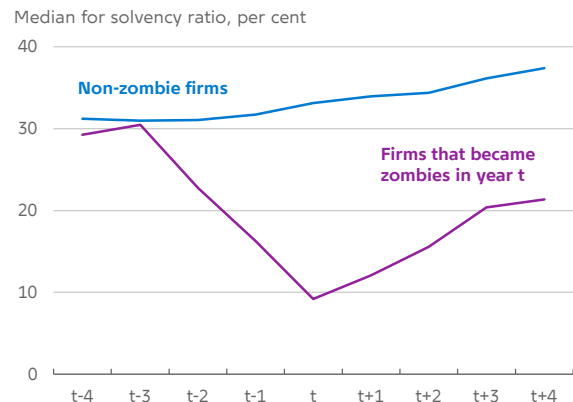
Based on available data, it is not possible to examine the causal relationship between interest rate changes and the prevalence of zombies. But it can be

⁸ Low interest rates create incentives for greater risk-taking (search-for-yield). Bank forbearance may also be due to the fact that weakly capitalised banks are less inclined to realise losses (ever greening). In this case, forbearance is not due to low interest rates, but rather to bank capital shortages.

⁹ Mechanically, lower interest rates mean that meeting the zombie criteria becomes more difficult (interest payments higher than operating profits). But the impact is very small and may be ignored as interest payments as a percentage of the balance sheet total tend to be low.

It takes several years for zombies to rebuild equity

Chart 11

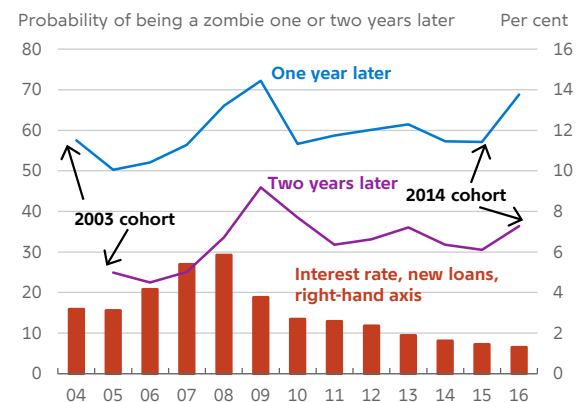


Note: Aggregated over the years 2006-12. Non-zombie firms refer to firms that are not zombie firms in year t, and include only firms aged 10 years or older. The solvency ratio has been calculated as the ratio of equity to total assets.

Source: Own calculations based on firm-level data from Statistics Denmark.

The risk of remaining a zombie has not increased during the period of falling interest rates

Chart 12



Note: Annual interest rates on new loans to non-financial corporations. For zombie firms in 2003 (the 2003 cohort), just under 60 per cent were still zombies in 2004 (2004 observation on the blue line). About 25 per cent of the zombies of the 2003 cohort were still zombies two years later, i.e. in 2005 (purple line).

Source: Own calculations based on firm-level data from Statistics Denmark.

noted that since 2008, during which period interest rates have declined substantially, the risk of surviving as a zombie has not increased, see Chart 12. This indicates that as far as Danish firms are concerned, low interest rates have not increased the risk of remaining a zombie for many years. Presumably, this also means that low interest rates have not had a negative impact on productivity through this channel.

No clear signs that Danish banks are showing forbearance to zombies

When equity is lost, the ratio of debt to total assets increases, i.e. the firm's debt ratio. Consequently, zombies have substantially higher debt ratios than other firms, see Chart 13. Moreover, non-zombie firms have typically reduced their debt ratios, especially in the post-crisis period.

Over time, the debt ratio of the typical zombie fluctuates with the economy around a stable trend. It peaked in 2010, but has fallen since then. However, the debt ratio of relatively more leveraged zombies, i.e. the 75th percentile, has continued to rise after 2010.

It is difficult to establish the exact cause of this development. Part of the increase is driven by sole proprietorships, which are typically small firms, the owner being personally liable for the loans of the firm. Therefore, these firms may have large loans relative to their balance sheets.

Interest rate developments do not reflect forbearance to zombie firms

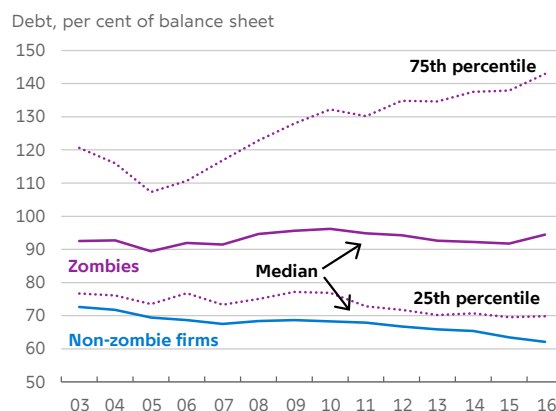
The high debt ratios among zombies mean that lending to these firms is riskier than lending to other firms, which is reflected in the interest rates paid by zombies. Hence, during the period from 2003 to 2016, the interest rates paid by zombies were close to 1 percentage point higher than those paid by other firms, see Chart 14.

Moreover, the interest rate differential widened slightly towards the end of the period, indicating that creditors, including banks, did not offer zombies more favourable conditions than other firms.

Overall, the Danish financial system, including banks, does not seem to show forbearance to unprofitable

Zombies are more leveraged

Chart 13

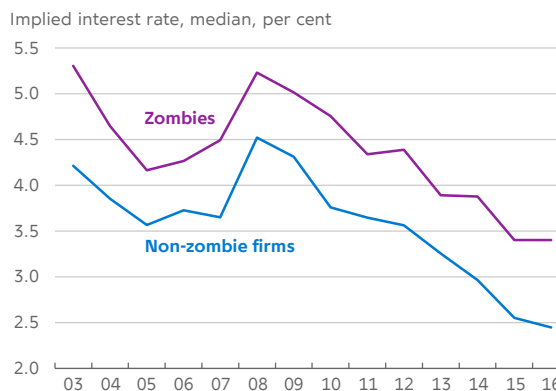


Note: Debt is defined as the sum of all short-term and long-term liabilities. Also see the note to Chart 1. When debt exceeds 100 per cent of the balance sheet total, equity is negative. Non-zombie firms only include firms aged 10 years or older.

Source: Own calculations based on firm-level data from Statistics Denmark.

Zombies pay higher interest rates

Chart 14



Note: The implied interest rate is calculated as interest payments divided by total debt. Adjustment has been made for age and industry composition, cf. Box 3.

Source: Own calculations based on firm-level data from Statistics Denmark.

zombie firms in the private non-primary sector. This is probably one reason why the prevalence of zombies in Denmark has not increased. In other words, a well-functioning financial system in Denmark helps to ensure optimal resource allocation, underpinning economic growth. The structural challenges faced by the agricultural sector could lead to losses for some financial corporations, but such losses will be relatively small for the financial sector overall.

Literature

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Appendix 1

Definition of zombie firms

Box 1

Zombies are basically firms that should exit or be restructured because they are unable to generate operating profits. Therefore, their human and capital resources could be allocated to more productive uses elsewhere in the economy. There are no objective criteria for when a firm should exit, but persistent negative profits are believed to be a good indicator and used by the OECD and the BIS, among others.

In this analysis, a firm is defined as a zombie if the following conditions are met:¹

1. The firm is aged 10 years or older
2. The firm's earnings before interest payments have been lower than its net interest payments for three consecutive years
3. The firm has positive net interest expenses

This means that the firm has negative profits except for extraordinary income, for instance from divestment of parts

of its assets. Start-ups are not included because they often have negative profits for a period of time while expanding and building a client base. Large outlier firms are also excluded, i.e. firms larger than 100 times the 99th percentile of the size distribution in terms of employment or assets. These giant firms are parts of global conglomerates, so their financial statements may fluctuate considerably depending on how the conglomerate chooses to organise itself.

This definition captures generally weak firms, but may also include some firms which, from a socio-economic perspective, should not necessarily be closed down. For instance firms that have negative profits for a number of years while working to develop a new product that may later generate solid profits. But, in general, the definition is assessed to identify weak firms that should either be closed down or restructured.

¹ The definition is in line with Adalet-McGowan et al. (2017a).

Data basis

Box 2

The data consists of annual accounting data for about 100,000 public and private limited liability companies, sole proprietorships and partnerships distributed across all industries except firms in the primary industries, the financial sector, energy and water supply and parts of the transport industry (ports, railway and bus transport). Data has been compiled by Statistics Denmark for its "Firm Accounts Database covering all private non-primary and non-financial firms" and covers the period 2001-16. Data is based on questionnaires and tax reportings, and comprises about 90 per cent of total turnover of Danish firms.

For scaling-up to the population of Danish firms, it is generally assumed that the firms in the sample are representative of the entire population of firms in Denmark. One exception is the calculation of transition probabilities and survival rates in Chart 11. For these purposes, information about all Danish firms for the individual years is applied.

The data basis of Chart 7 is data at farm-level from Statistics Denmark's "Accounts statistics for agriculture".

Adjustment for age and industry composition

Box 3

Charts 6, 7, 8, 10 and 11 compare medians of zombie and non-zombie firms based on various characteristics such as productivity and firm size. In this context, medians are more informative than means because means are strongly affected by extreme observations. However, differences in the medians of the two groups could reflect that the composition of the groups is not identical. For instance, if a given year has many zombie firms in an industry with lower labour productivity than in other industries, a comparison of the medians of the two groups could overestimate differences between zombie firms and other firms. Moreover, the age composition of the groups could be significant, as, by definition, zombie firms must be aged 10 years or older.

Charts 7, 8 and 10 have been adjusted for the age composition, while Charts 6 and 11 have been adjusted for both age and industry composition using median regression. Median regression is a robust alternative to linear regression.¹ In median regression, the effect of explanatory variables is

estimated from the conditional median rather than the conditional mean as in a linear regression. We use the following median regression:

$$Q_Y(0.5|x) = \alpha + \sum_{t=2003}^{2016} \delta_t T_t + \sum_{t=2003}^{2016} \gamma_t T_t Z_{it} + \beta X_{it} + \varepsilon_{it}$$

where $Q_Y(0.5|x)$ refers to the median of Y (e.g. labour productivity) conditional on the right-hand-side variables, T_t are dummy variables for the individual years, Z_{it} is a zombie-firm indicator and X_{it} includes control variables, in this case the age of the firm and industry indicators (36 level), and ε_{it} is an error term. In the labour productivity model, the coefficients γ_t thus reflect the difference between median productivity for zombie and non-zombie firms in the same industry and age group in the individual years. The charts are based on these coefficients and the medians of non-zombie firms in the individual years.

¹ Median regression is a special case of quantile regression. See more in Koenker (2005).

ABOUT ANALYSIS



As a consequence of Danmarks Nationalbank's role in society we conduct analyses of economic and financial conditions.

Analyses are published continuously and include e.g. assessments of the current cyclical position and the financial stability.

The analysis consists of a Danish and an English version. In case of doubt regarding the correctness of the translation the Danish version is considered to be binding.

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This edition closed for
contributions on
1 December 2019

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