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Financial Conditions and Zombie Companies: International Evidence

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Abstract

Financial conditions eased after the global financial crisis and during the COVID-19 pandemic as policymakers across most countries adopted large scale monetary policy easing. This has increased concern amongst some that a prolonged period of accommodative financial conditions has fostered the growth of zombie companies − businesses that are consistently unable to meet their interest expenses from current profits. This paper finds that an easing in self-constructed measures of financial conditions is correlated with an increase in the share of resources sunk into zombie companies using a sample of listed companies across 20 OECD countries and 11 industries over the period 2003 to 2019. However, the size of this relationship is higher for countries with banking systems that are in poorer financial health. As a result, fears that accommodative financial conditions foster more capital being sunk into inefficient zombie companies is likely to be less of a concern for countries with healthy banking systems.

Keywords

Financial Conditions, Zombie Companies, Bank Health

JEL Classification

E44, E52, G21

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Financial Conditions and Zombie Companies: International Evidence.[†]

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Financial conditions eased after the global financial crisis and during the COVID-19 pandemic as policymakers across most countries adopted large scale monetary policy easing. This has increased concern amongst some that a prolonged period of accommodative financial conditions has fostered the growth of zombie companies – businesses that are consistently unable to meet their interest expenses from current profits. This paper finds that an easing in self-constructed measures of financial conditions is correlated with an increase in the share of resources sunk into zombie companies using a sample of listed companies across 20 OECD countries and 11 industries over the period 2003 to 2019. However, the size of this relationship is higher for countries with banking systems that are in poorer financial health. As a result, fears that accommodative financial conditions foster more capital being sunk into inefficient zombie companies is likely to be less of a concern for countries with healthy banking systems.

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1. Introduction

The proportion of firms that have been classified as zombies has risen, which in part has been attributed to the lowering of interest rates in most advanced economies (Banerjee and Hofmann, 2018). This has naturally raised concerns that monetary easing in response to an adverse economic shock may contribute to the growth of zombie businesses in the medium to longer-term. The potential adverse side-effect of monetary easing warrants the attention of policymakers as an extensive body of literature have highlighted that zombie companies weigh on the productivity and economic growth of countries (McGowan et al., 2018). The adverse impact of zombies occurs both directly, as these firms tend to exhibit lower levels of productivity, and indirectly, as they have been found to crowd out resources of more productive firms.

This paper adds to the literature in two ways. First, the chapter takes an integrated approach in examining how the relationship between financial conditions and the amount of capital sunk into zombie companies varies depending on country-level structural factors. These country specific structural factors include the health of their banking systems, strength of their insolvency frameworks and nature of their labour market regulations. Second, the paper uses a broader concept of financial conditions compared with monetary policy indicators alone to examine the link between financial conditions and the amount of capital sunk into zombie firms using a sample of 20 OECD countries.[1]

Understanding the extent to which an easing in financial conditions may generate adverse effects in the form of increasing share of resources being shifted towards zombie companies, and possible remedies, is important for policymakers. This is particularly pressing in the current environment as financial conditions have eased notably across most countries as policymakers in most OECD countries have engaged in large scale monetary policy stimulus amid the COVID-19 pandemic. Further, financial conditions are expected to remain accommodative for some time due to the large, albeit declining, degree of spare capacity in most advanced economies.

[1] The countries include Australia, Austria, Belgium, Canada, Finland, France, Germany, Greece, Ireland, Italy, Japan, South Korea, Mexico, Netherlands, Portugal, Spain, Sweden, Switzerland, United Kingdom and United States of America.

This paper is organised as follows. Section 2 provides a description of the literature on macroeconomic and structural causes of zombie companies. Section 3 describes the key research questions and methods. Section 4 explains the key data used and summary statistics. Section 5 analyses the results. Section 6 examines the robustness of the results. Section 7 discusses the limitations. Section 8 concludes by explaining the policy implications of this paper's empirical findings and outlines potential areas for future research.

2. Literature

The literature has highlighted several non-firm level causes of zombie companies. Some of the key factors that have been linked to the formation of zombie companies include the following: financial conditions/monetary policy, bank health, insolvency regimes and labour market regulation.

2.1 Financial conditions/monetary policy

The easing of global financial conditions, in part reflective of lower interest rates, has also been linked to a rise in the number of zombie firms since the 1980s (Banerjee and Hofmann, 2018). The ratcheting-down in the level of interest rates after each cycle has potentially reduced the financial pressure on zombies to restructure or exit (Borio et al., 2017). From a zombie firm perspective, lower interest rates increase the relative value in firms betting on their prospects improving by engaging in forbearance lending compared with the value derived from liquidation. From the banks perspective, loose monetary policy may make them more likely to gamble on poor performing firms via forbearance as they can borrow cheaply, and also if they expect that lower interest rates will improve the economic prospects for their customers (White, 2012).

The link between loose monetary policy and the amount of resources sunk into zombie companies has been reaffirmed in several studies. Caballero et al. (2008) show that under the zero interest rate policies the profits of Japanese (so-called zombie) companies became strongly dependent on the low-cost liquidity provision from the Bank of Japan via the banking system (zombie banks). In Europe, the effect of the European Central Bank's Outright Monetary Transactions (OMT) Program initiated in 2012 was linked to increased zombie lending motives, as banks sought to avoid losses on their loan book (Acharya et al., 2019). The paper further documents that creditworthy businesses in industries with a

prevalence of zombie firms suffered significantly from the misallocation of credit and that this slowed down the economic recovery. Within China, looser monetary policy was found to increase zombie firms access to equity financing and trade credit to a greater extent compared with viable firms (Lu et al., 2020).

The misallocation of capital when interest rates are low was also highlighted by Hong et al. (2021), who analysed the impact of unconventional monetary policy on the investment decisions of Japanese firms using a bank-firm level dataset. They found that financially vulnerable firms take advantage of a decline in long-term yields to refinance without increasing investment, potentially reflecting their efforts to strengthen their balance sheets. In contrast, healthy firms increased capital spending.

More broadly, research has also shown that interest rate sensitivity of loan-loss provisions rise when interest rates are at low levels, which may reflect banks keeping weaker borrowers afloat (Borio et al., 2017) (Lepetit et al., 2012). However, the relationship between interest rates and loan-loss provisions may also reflect default probabilities rising during periods in which monetary conditions are eased.

A less explored avenue in the existing literature is the exploration of the relationship between the broader concept of financial conditions and zombie companies. Financial conditions are a broader concept that encapsulates the relative ease and cost with which corporations and/or individuals can access finance. It is plausible that the relationship between financial conditions and zombie companies is likely to be stronger compared with examining monetary policy alone, as it is likely to better reflect the financing conditions faced by zombie companies. For example, zombie companies that have underlying assets in the form of property or stocks may find it easier to raise funds required to be kept in operation in environments whereby their underlying collateral is increasing in value (i.e. property market or stock market). This effect could be greater following periods of economic stress, as Garvin et al. (2021) found that credit shifts from uncollateralised to collateralised lending, following an exogenous shock.

2.2 Bank health

The literature suggests that the prevalence of zombie companies, or capital sunk into zombie firms, may be higher for countries with banking systems that are in weaker financial health.

This sentiment has been echoed by the following statement from the former President of the European Central Bank, Draghi (2014):

"Frontloading banking sector repairs…should in turn facilitate the Schumpeterian process of creative destruction in the economy at large – and not only by helping credit flow to younger firms, but also by facilitating debt resolution for older ones."

From a bank's perspective, they have the choice to provide additional credit to impaired borrowers given a certain probability that the zombie firms recover or pursue liquidation. Because of limited liability, banks in a weak financial position have the perverse incentive to provide additional credit to impaired borrowers to avoid the realisation of losses on their balance sheet (i.e. cost of liquidation is higher) (Bruche and Llobet, 2014) (Peek and Rosengren, 2005) (Fukuda et al., 2006). Zombie lending can in turn help banks maintain, or avoid a reduction in, their capital adequacy rates (Schivardi et al., 2017).

Banks may also continue to lend to insolvent firms with the hope that the borrower would get bailed out by the government in the event of severe repayment difficulties, thereby contributing to the softening of budget constraints of enterprises (Berglöf and Roland, 1995) (Hanazaki and Horiuchi, 2003). The rolling over of loans can help prevent further losses from fire sales. Jaskowski (2015) argues that zombie lending may be the only strategy that can prevent fire sales and cascade of defaults and collateral liquidations.

Research suggests that zombie firms are more likely to be affiliated or connected with weaker banks. In Italy, it was found that under capitalised banks were less likely to cut lending to zombie firms and that credit misallocation increased the failure rate of healthy firms while reducing the failure rate of zombie firms (Schivardi et al., 2017). In 11 European countries it was found that zombie firms are more likely to be connected to weak banks, suggesting that the zombie problem in Europe may at least partly stem from bank forbearance (Andrews and Petroulakis, 2017). Andrews and Petroulakis (2017) results suggest around one-third of the impact of zombie congestion on capital misallocation can be directly attributed to bank health.

Forbearance lending practices matter as they have also been found to contribute to lower output growth across the euro area following the onset of the sovereign debt crisis in 2011

(Tracey, 2019). The Bank of England has expressed concern about potential forbearance lending in the United Kingdom, and noted that its true nature and extent was difficult to quantify due to insufficient information (BOE, 2011).

More broadly, a well-functioning financial system is important to support the efficient allocation of capital (Keuschnigg and Kogler, 2019). Countries with a developed financial sector are better able to reallocate investment towards more productive and fast-growing industries, and away from declining sectors (Wurgler, 2000). Banking reforms can help improve the efficiency of capital allocation (Acharya et al., 2010) (Bertrand et al., 2007).

2.3 Insolvency regimes

An efficient insolvency regime can help ensure poor performing enterprises exit or restructure in a timely manner and at minimal cost. Efficient and timely insolvency frameworks can reduce the costs for both zombie firms and their creditors to pursue liquidation, which are likely to make creditors and zombie firms less likely to gamble on resurrection.

The insolvency regimes differ notably across countries, particularly with respect to how they treat failed enterprises and the ease of corporate restructuring (McGowan and Andrews, 2018). McGowan and Andrews (2018) suggest that the international best practice of insolvency design have several features. These include minimal time to discharge and few exemptions, early warning mechanisms, pre-insolvency regimes, special insolvency procedures for small and medium-sized enterprises, creditors' ability to initiate restructuring, low degree of court involvement and clear distinction between honest and fraudulent bankruptcy. Reforms to the insolvency frameworks within countries that reduce barriers to corporate restructuring and the costs associated with bankruptcies may reduce the extent to which capital is invested in zombie firms (McGowan et al., 2017).

Across countries, Portugal has shown one of the largest reductions in barriers to exit and restructuring of all OECD countries. This follows major changes in 2012 amid their 2011-14 Economic Adjustment Program, which shifted Portugal's insolvency framework in a direction that helped foster the recovery of viable firms and the liquidation of non-viable companies (EC, 2014). The reduction in exit and restructuring barriers has been found to

promote a more effective exit channel and fosters the restructuring of the most productive zombies (Osterhold and Gouveia, 2020). Research has also shown that the combination of weak financial systems with inefficient insolvency regimes has been argued as being a potential explanation behind the close relationship between non-performing loans and zombie shares in Italy (Garrido et al., 2016).

2.4 Labour market regulation

A less explored factor is the relationship between labour market regulation and zombie companies. Labour market regulation captures the time, costs, and complexity in procedures in dismissing workers or group of workers. Countries with flexible labour market regulation may make it more difficult for zombie firms to remain in operation, as staff are able to shift towards more productive firms more readily. Further, flexible labour market regulation can make it easier for zombie firms to restructure, which can help some of these firms recover whilst reducing the amount of resources sunk into inefficient firms. This follows from empirical findings in which the recovery of zombie companies is supported by firms reducing their employee numbers (Fukuda and Nakamura, 2011).

The benefits of a well-designed labour market regulations that do not overly penalise business failure are well founded. In particular, flexible labour market regulations have been found to reduce skills mismatch and can help boost labour productivity (McGowan and Andrews, 2015). Research has also shown that labour market regulations that reduce the fluidity of labour has harmful consequences for productivity, real wages, employment and business dynamism (Davis and Haltiwanger, 2014) (Bottasso et al., 2017).

Andrews and Saia (2017) argue that flexible labour markets have also been found to reduce the costs of creative destruction, as they can help aid the re-employment prospects of displaced workers. In particular, flexible labour market regulations can help improve regional mobility, which is a key channel through which workers who lose their job due to business closure become re-employed. More broadly, their research highlights the importance of public policy in dealing with reemployment issues.

3. Research Questions and Methods

This paper addresses the key question on whether the relationship between financial conditions and zombie companies is contingent on country-specific structural factors (i.e. bank health, insolvency framework and labour market regulation). More specifically, the relationship between financial conditions on the amount of capital sunk into zombie companies is examined using the following fixed-effects specification

$$ZombieShare_{sct} = a + \beta_1 FCI_{ct-1} + \beta_2 BankHealth_{ct-1} + \beta_3 InsolvencyFWRK_{ct-1} + \beta_4 LabourMarketReg_{ct-1} + \delta_s \times \delta_c + \delta_t + \varepsilon_{sct} \quad (1)$$

Whereby $ZombieShare$ is the proportion of capital into zombie firms in industry *s*, country *c* and time *t*. Zombie companies are defined as those businesses whose earnings before interest and tax are insufficient to meet their interest expense for three consecutive years and whose Tobin Q is less than their country-industries median (market capital/book value). The latter criteria exclude classifying firms who have a comparatively high expected future growth from being classified as a zombie. *FCI* is the financial conditions index across countries. An increase in the FCI reflects a tightening in financial conditions. *BankHealth* is proxied by the proportion of non-performing loans to gross loans across countries. *Insolvency framework* is an index that captures the strength of countries' insolvency regimes as measured by the World Bank (the higher the index indicates the insolvency frameworks are stronger). *LabourMarketReg* is an index that measures the relative flexibility of strictness of employment protection across countries (higher the index indicates that employment protection measures are stronger). A detailed description of the structural indices is provided in Section 4. All structural factors are lagged by one year due to the time lags for capital to respond to respond to changes in financial conditions. The results are robust if longer lags are used.

The baseline model also includes industry, country and time fixed effects to help control for unobservable factors. The fixed effects specification means that the identification is driven by temporal variation at the industry level within each country. This may be problematic for identifying the impact of the insolvency framework or labour market regulation, which do not vary much over time. In turn, the lack of temporal variation of some variables will mean the level effect of the indicator may be absorbed by the industry/country fixed effect.

The coefficient of interest in the baseline model is β_1, which measures the conditional correlation between financial conditions on the amount of capital sunk into zombie firms. Given the existing literature, my prior is that a tightening (loosening) in financial conditions will result in a decrease (increase) in the share of capital sunk into zombie companies.

The baseline model is extended to assess whether country-specific factors such as bank health, insolvency regimes and labour market regulation may affect the relationship between financial conditions on the share of resources sunk into zombie companies. In turn, the baseline model is extended to have the following specification:

$$ZombieShare_{sct} = a + \beta_1 FCI_{ct-1} + \beta_2 BankHealth_{ct-1} + \beta_3 InsolvencyFWRK_{ct-1} + \beta_4 LabourMarketReg_{ct-1} + \beta_5 FCI \times (BankHealth|InsolvencyFWRK|LabourMarketReg)_{ct-1} + \delta_s \times \delta_c + \delta_t + \varepsilon_{sct} \quad (2)$$

Whereby $FCI \times (BankHealth|InsolvencyFWRK|LabourMarketReg)_{ct-1}$ is the interaction effect between the financial conditions index on various structural factors by country and lagged by one year. The interaction effect between the financial conditions index and on the various structural factors are estimated separately. The interaction term can help measure the extent to which the impact of financial conditions on the share of resources sunk into zombie firms differ depending on structural factors. The identification of some of the structural factors that does not vary much over time is also aided by examining their interaction effects.

The coefficient of interest in the extended model (2) is β_5. My prior is that the impact of financial conditions on the amount of capital sunk into zombie firms is likely to differ across countries depending on the heath of their banking system, strength of their insolvency frameworks and flexibility in their labour market regulation. In particular, the impact of a tightening (loosening) in financial conditions has a larger impact at decreasing (increasing) the amount of capital sunk into zombie firms. However, this effect is higher for those countries with banking systems that are in poorer financial health, weaker insolvency regimes and stricter employment protection measures.

4. Data

The analysis utilises annual data from 2003 to 2019 (17 years). Analysis using data prior to 2003 is not feasible as measures of insolvency frameworks are unavailable. The sample

includes 20 countries across 11 industries.[2] The 20 countries are selected based on data constraints. The construction of the financial conditions index is restricted to a subset of countries that have historical data on various interest rates and asset prices. The sample is further restricted to include only those countries with sizeable equity markets, which is required to assess the proportion of capital and labour sunk into zombie companies by industry.[3] A summary of the key variables is provided in the Table 1.

Table 1: Data Summary

Variable	Description	Source/s	Notes
Zombie share	Proportion of capital (fixed assets) sunk into zombie companies as a share of total capital in all companies in an industry across each country	Refinitiv Author's calculations	-Zombie company defined as having an interest coverage ratio less than one for three consecutive years and Tobin Q less than their industry median. -Financial firms are excluded. -Components of ICR estimation are winsorized at the 1 per cent level to limit the impact of outliers. -Largest one per cent of firms by fixed assets are also excluded to limit the influence of outliers.
FCI	Financial conditions index that is constructed using principal component analysis consisting of seven country-level variables	BIS IMF OECD Author's calculations	-Index based on seven variables: percentage change in the real effective exchange rate, short-term interest rates, long-term interest rates, bank lending rates, credit growth, stock market returns and house price growth. All variables are in real terms. -Further details of the index are provided in the appendix.
Bank health	Amount of non-performing loans to gross loans by country	IMF	-Sourced from the IMF's Financial Soundness Indicators.
Insolvency	Index that measures the strength of countries' insolvency framework	World Bank	-Index based on the time, cost and outcome of insolvency proceedings involving domestic entities as well as the strength of the legal framework applicable to judicial liquidation and reorganisation proceedings.
Labour market regulation	Index that measures the strictness of employment protection by country	OECD	-Based on the version 2 of the OECD measure of labour regulation.

Sources: Author's calculations; BIS; IMF; OECD; Refinitive; World Bank

The estimation on the proportion of capital sunk into zombie companies defines a zombie as those whose earnings before interest and tax is insufficient to meet their interest repayments

[2] The industries are based on GICS sector names include Communication Services, Consumer Discretionary, Consumer Staples, Energy, Health Care, Industrials, Information Technology, Materials, Real Estate and Other.

[3] The country of listed companies is based on the location of their respective headquarters.

for three consecutive years and their Tobin Q is below their industry median.[4] The latter criteria preclude firms who have a comparatively high expected future growth from being classified as zombies. Note that the estimation of the resources sunk into zombie firms by industry excludes firms in the financial industry. To limit the impact of outliers, the largest one per cent of firms by fixed assets are excluded.

The rest of this section of the paper provides a more comprehensive description of the key indices used in this paper. A description of the bank health proxy is excluded as it is simply the proportion of non-performing loans to gross loans.

4.1 Financial conditions index

The financial conditions index is constructed for each country based on seven variables: short-term interest rates, long-term interest rates, bank lending rates, real credit growth, real effective exchange rate, real stock market returns and real house price growth. A description of these variables along with sources are summarised in Table 2. These variables are synthesised using principal component analysis, a common statistical technique used to reduce the dimensionality of large data sets. In effect, the financial conditions index help summarise movements in interest rates, credit markets and asset markets. An increase in the index represents a tightening in financial conditions. The indices are constructed to have a zero mean over the sample, so they measure how financial conditions have evolved relative to previous years. As a result, the financial condition index is a relative measure that is not comparable across countries.

Table 2: FCI Data Description

Variable	Description	Source
Short-term interest rates	Short-term interest rates are the rate at which short-term government paper is issued or traded in the market. Short-term interest rates are based on three-month money market rates where available. The data is then transformed into real terms using the CPI measured in the IMF WEO database.	OECD; October WEO 2020
Long-term interest rates	Refer to government bonds maturing in ten years. Rates are generally averages of daily rates, measured as a percentage. The data is then transformed into real terms using the CPI measured in the IMF WEO database.	OECD; October WEO 2020
Bank lending rates	Lending rates sourced from IFS is the other depository corporations rate that usually meets the short-and medium-	International Financial

[4] Tobin Q is estimated as the market capital divided by the book value (total assets – total liabilities). The underlying Tobin Q continuous variables are winsorized at the one per cent level to limit the impact of outliers.

	term financing needs of the private sector (details here). Where available, data is also sourced from the ECB MFI Interest Rate Statistics (cost of borrowing related to non-financial corporates). In limited situations data is also sourced directly from the respective central banks of countries. The data is then transformed into real terms using CPI measured in the IMF WEO database.	Statistics (IFS); ECB; BOC; RBNZ; DNB; Riksbank; BOE; October WEO 2020
Credit growth	Credit to non-financial corporations from all sectors at market value (adjusted for breaks and in domestic currency). The data is then transformed into real terms using CPI measured in the IMF WEO database.	BIS; October WEO 2020
Real effective exchange rate	The difference log in the real effective exchange rate real (CPI-based) broad indices.	BIS
Stock market returns	Prices of common share of companies traded on national or foreign stock exchanged. they are usually determined by the stock exchange, using the closing daily values for the monthly data, and normally expressed as simple arithmetic averages of the daily data. The data is then transformed into real terms using CPI measured in the IMF WEO database.	OECD; October WEO 2020
House price growth	The real house price index is given by the ratio of the nominal house price index to the consumers' expenditure deflator in each country from the OECD national accounts database.	OECD

Source: Author's calculations

The financial conditions indices place considerable weight on interest rates (Table A1). These weightings are reaffirmed graphically, as the baseline FCI moves closely with short-term interest rate movements (Appendix A3). The financial conditions indices along with short-term interest rates suggest that financial conditions have eased over time across most countries in the sample. The baseline financial conditions index accounts for around 41 per cent of the variation in the underlying input variables (Table A2).

This paper also uses three additional measures of financial conditions metrics as a form of robustness test. First, a simple real short-term interest rates are used as a proxy for financial conditions. Second, utilises the first three principal components which captures around 80 per cent of the variation. The extended FCIs are constructed for each country by summing the selected principal components weighted by the share of total variability explained by them. The resulting indices are then further divided by the exact share of total variance cumulatively explained in each case. Similar method was adopted by Angelopoulou et al. (2014). Third, mitigates the extent to which changes in the financial conditions index are

driven by fluctuations in economic growth. This approach helps address the potential criticism that any empirical link between financial conditions on the share of resources sunk into zombie companies may simply be driven by cyclical variations. This is done by regressing each of the components by country with their contemporaneous real GDP growth and lag of real GDP growth. The residual for each component is then fed into the PCA. This method helps limit the impact of real GDP growth from the underlying components.

4.2 Insolvency framework index

The insolvency framework index is sourced from the World Bank.[5] The index aims to summarise the time, cost and outcome of insolvency proceedings that involve domestic entities and the strength of the legal framework applicable to judicial liquidation and reorganisation proceedings. The index is derived from questionnaire responses by local insolvency practitioners and verified using public information on insolvency systems.

To enable international comparisons, the questionnaire responses are based on a scenario. The central scenario assumes a business is a limited liability company, domestically owned, has 201 employees and 50 suppliers with a 10-year loan agreement with a domestic bank secured by a mortgage over the hotel's real estate property. The business is experiencing liquidity problems. The company has too many creditors to negotiate an informal out-of-court workout. The following options are available: a judicial procedure aimed at the rehabilitation or reorganization of the company to permit its continued operation; a judicial procedure aimed at the liquidation or winding-up of the company; or a judicial debt enforcement procedure (foreclosure or receivership) against the company.

4.3 Labour market regulation index

The labour market regulation index is sourced from the OECD (version 2) and measures the procedures and costs involved in dismissing workers or group of workers and the procedures for hiring employees.[6] In particular, the index incorporates various aspects involved with the dismissal of individual workers that have regular contracts including procedural

[5] For further information on how the index is constructed see: https://www.doingbusiness.org/en/methodology/resolving-insolvency

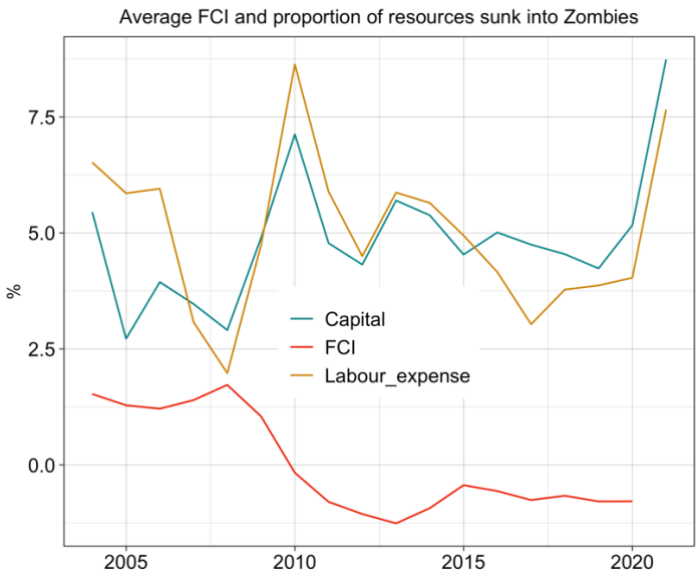
[6] Further details on OECD's methodology can be found here: https://www.oecd.org/employment/emp/oecdindicatorsofemploymentprotection-methodology.htm

inconvenience (how difficult is it for employers), notice periods and severance pay. The index also captures any additional costs for collective dismissals, which in most countries entails additional delays, costs and procedures. An increase in the index indicates that the labour market regulation is tighter.

4.4 Summary statistics

The share of resources sunk into zombie companies has shifted higher alongside an easing in financial conditions following the global financial crisis (Graph 1). Policymakers responded to the global financial crisis in part using large-scale monetary easing, which has driven an easing in financial conditions in most countries since 2008. The decline in economic activity amid the global financial crisis is likely to have contributed to a transitory increase in the amount of resources sunk into zombie companies, as more firms typically meet the zombie definition during economic downturns. However, the amount of resources sunk into zombies appears to have shifted to a structurally higher level following the global financial crisis, while financial conditions have been consistently accommodative. More recently, the COVID-19 pandemic has also resulted in a sharp increase in the proportion of resources sunk into zombie firms in 2020.

Graph 1



*Zombie firm defined as those with an interest coverage ratio (EBIT/interest expenses) less than one for three consecutive year and their Tobin's Q (market capital/book value) is less than their industries median.
Sources: Author's calculations; IMF, OECD, Refinitiv, World Bank

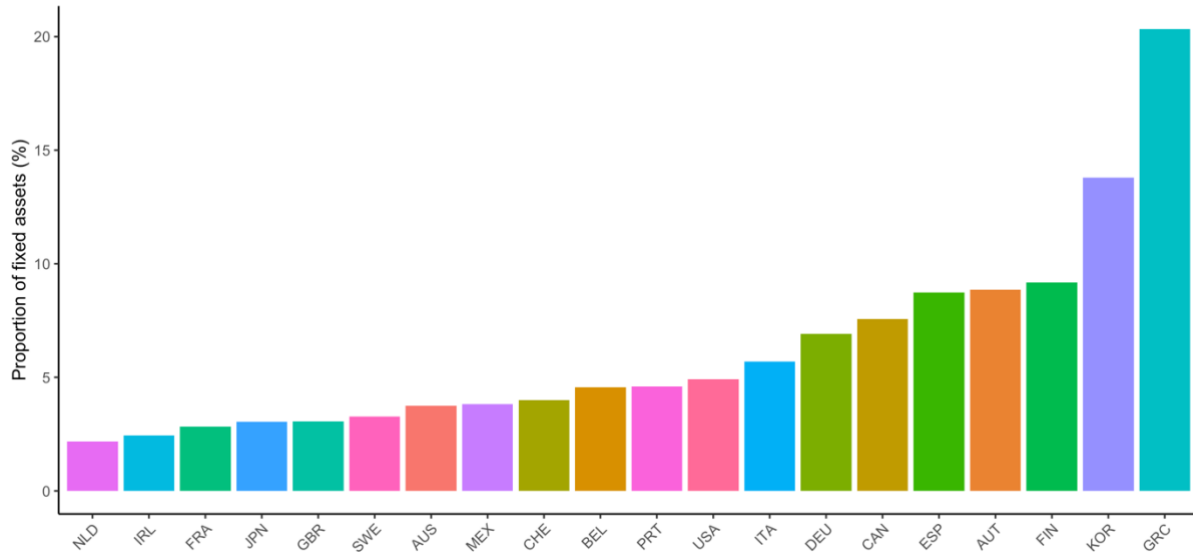
Across countries, the proportion of resources sunk into zombie companies has tended to be highest in Greece and Korea, whilst lowest in the Netherlands and Ireland (Graph 2). More

broadly, the share of resources sunk into zombie companies has tended to be higher among European countries and lower among countries in the Asia Pacific region.

Graph 2

Share capital sunk into zombie companies, by country

Average over the sample



*Zombie firm defined as those with an interest coverage ratio (EBIT/interest expenses) less than one for three consecutive year and their Tobin's Q (market capital/book value) is less than their industries median.

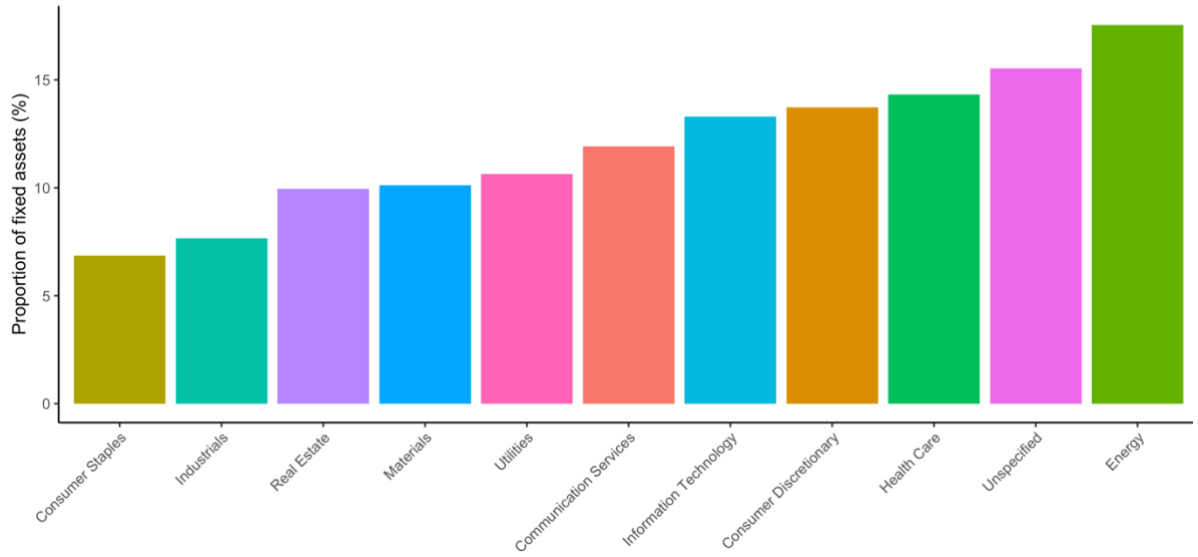
Sources: Author's calculations; Refinitiv

Across industries, the share of capital sunk into zombie firms is highest in the energy and health care sectors, whilst it is lowest among firms in the consumer staples and industrials sector (Graph 3).

Graph 3

Share capital sunk into zombie companies, by industry

Average over the sample



*Zombie firm defined as those with an interest coverage ratio (EBIT/interest expenses) less than one for three consecutive year and their Tobin's Q (market capital/book value) is less than their industries median.

Sources: Author's calculations; Refinitiv

The summary statistics of the key variables are provided in Table 3. The proportion of capital sunk into zombie firms has averaged 6.1 per cent, while the proportion of labour sunk into zombie companies has averaged 7.2 per cent. The FCI has mean of zero by construction. The proportion of non-performing loans to gross loans has averaged around 4.1 per cent and has varied considerably across countries. The insolvency index and labour market index vary across countries and does not vary much over time.

TABLE 3: SUMMARY STATISTICS

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Capital Sunk Zombies (ppt)	2,319	9.0	14.9	0.0	0.5	10.6	89.8
FCI	319	0.04	1.6	-5.1	-1.2	1.4	4.6
NPL to Gross Loans	319	4.2	6.3	0.1	0.9	4.0	45.6
Insolvency Index	319	77.1	11.9	36.4	73.7	83.8	93.9
Labour Market Regulation Index	319	2.4	0.7	0.7	1.9	2.8	4.1

5. Results

The baseline results indicate that a tightening in the FCI is correlated with a reduction in the proportion of capital sunk into zombie companies (column ,1 Table 4). This relationship is statistically significant at the ten per cent level. Or in other words, a loosening in the FCI is associated with an increase in the amount of capital sunk into zombie companies. A one standard deviation reduction in the financial conditions' indices is associated on average with an increase in the proportion of capital sunk into zombie companies of around 0.9 percentage points. This effect is economically significant as the proportion of capital sunk into zombie firms has a mean of around nine per cent.

The relationship between financial conditions and the amount of capital sunk into zombie companies is contingent on the health of countries' banking systems (column 2, Table 2). A tightening in financial conditions is correlated with a decline in the amount of capital sunk into zombie firms, but this relationship is greater for countries with banking systems that are in poorer financial health. Conversely, an easing in financial conditions contributes to a rise in the amount of capital sunk into zombie companies and this effect is larger for those countries with weaker banking systems. The results are economically significant. The marginal impact of a one standard deviation increase in the FCI is associated with a one percentage point reduction in the proportion of capital sunk into zombie companies for

countries with an average level of NPLs to gross loans ratio. The marginal impact of a one standard deviation increase in the FCI increases to 3.1 percentage points for those countries with NPLs to gross loans ratio that are one standard deviation above average.

The conditional correlation between financial conditions on the amount of capital sunk into zombie firms does not appear to vary across countries with different measures of insolvency framework and labour market regulation strength. The interaction terms have their expected sign though. The positive coefficient on the insolvency framework strength interaction term indicates that the impact of a tightening in the FCI on the amount of capital sunk into zombie firms is lessened the stronger a countries' insolvency framework. Further, the negative interaction term on the labour market regulation term suggests countries with tighter labour market regulation (indicated by increase in the index) are associated with financial conditions having a larger affect in reducing the amount of capital sunk into zombie companies.

TABLE 4: BASELINE RESULTS

	Proportion capital sunk into zombies			
	(1)	(2)	(3)	(4)
FCI	-0.546*	0.221	-6.022*	0.990
	(0.276)	(0.181)	(3.426)	(0.881)
Bank Health	-0.073	-0.167**	-0.161	-0.084
	(0.073)	(0.068)	(0.110)	(0.064)
Insolvency	0.115	0.017	-0.075	0.063
	(0.134)	(0.087)	(0.070)	(0.117)
Labour Regulations	-2.239	-0.119	-1.945	-1.677
	(3.229)	(1.687)	(2.415)	(3.051)
FCI x Bank Health		-0.210***		
		(0.041)		
FCI x Insolvency			0.070	
			(0.041)	
FCI x Labour Regulation				-0.740
				(0.439)
Observations	2,319	2,319	2,319	2,319
R^2	0.438	0.447	0.444	0.441
Adjusted R^2	0.382	0.391	0.388	0.384
Residual Std. Error	11.734 (df = 2105)	11.643 (df = 2104)	11.677 (df = 2104)	11.711 (df = 2104)

Notes: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.
Standard errors are clustered at the country level and reported in the parenthesis. Firm and time fixed effects are included by not reported.

6. Robustness checks

The robustness of the results is examined along four dimensions: results are examined at the country level; real short-term interest rates are used to proxy financial conditions; alternative FCI construction method is adopted; and the FCI is cyclically adjusted. Each are discussed below.

First. the country level regressions indicate that the impact of changes in financial conditions on the amount of capital sunk into zombie firms is contingent on the countries' bank health, insolvency frameworks, and strength of their labour market regulation (Table A6). The latter two components are only statistically significant at the 10 per cent level. In particular, an easing in financial conditions is correlated with a larger increase in the amount of capital sunk into zombie companies for countries with weaker banking systems that are in poorer financial health, weaker insolvency regimes and amongst those with more stringent labour market regulation.

Second, the amount of capital sunk into zombie companies is not correlated with changes in the real short-term interest rates, in contrast with the baseline model (Table A7). The results highlight the potential importance of quantitative easing measures in the second half of the sample. Further, differences in the short-term interest rates results compared to the baseline model could also reflect the importance of asset markets and broader credit conditions in helping explain factors that support zombie companies.

Third, the results are assessed using a different financial conditions index construction methodology used in Angelopoulou et al. (2014). Further description on the alternative methodology is provided in Appendix 8.2 The results in the baseline estimation framework are robust to the alternative FCI construction method (Table A8). However, the alternative FCI also suggests that the relationship between financial conditions and the amount of capital

sunk into zombie companies is weaker for those countries with stronger insolvency frameworks.

Last, the results regarding the impact of bank health on the relationship between financial conditions on the amount of capital sunk into zombie companies is robust to the cyclically adjusted financial conditions indices (Table A9). One potential criticism with the baseline model is that the relationship between the financial conditions index and the resources sunk into zombie companies may be driven by common factors, such as GDP growth. For example, more capital may be sunk into zombie companies during periods of weak economic activity as more companies are likely to be classified as a zombie. The inclusion of time-fixed effects only partially controls for cyclical variations. While it is not possible to completely remove the impact of GDP fluctuations from the FCI, the effects are purged to an extent by taking the following two-step procedure. First, the inputs into the principle component analysis across all countries are regressed on the real GDP growth and lag of their real GDP growth. Second, the residuals from the first step above are then fed into the PCA instead of the raw inputs.

7. Limitations

There are two key limitations that are important to acknowledge when interpreting the results in this paper. First, the results of this paper are likely subject to a reasonable amount of measurement uncertainty. This regards to the uncertainty in measuring: the resources sunk into zombie companies using only a small subset of businesses (only listed companies), financial conditions, banking system health, labour market regulation and insolvency regimes.

Second, I caution against taking a causal interpretation of these results. In particular, the results may be driven by a common unobservable factor. For example, a slowing in GDP growth may simultaneously lead to an easing in financial conditions, as policymakers respond, and increase the share of resources sunk into zombie companies (mechanical consequence of more companies being classified as a zombie) (Schivardi et al., 2020).

8. Conclusion

This note finds evidence that a loosening in financial conditions is correlated with an increase in the amount of capital sunk into zombie companies. However, there is strong evidence that

this relationship is stronger for countries with banking systems that are in poorer financial health. These results may reflect the perverse incentives banks face to provide additional credit to impaired borrowers to avoid the realisation of losses on their balance sheet, as previously identified in the literature. The key findings in this paper are robust to numerous model extensions.

The results of this paper highlight that policymakers should be attune to the potential adverse effects associated with a prolonged period of loose financial conditions. However, concerns that a prolonged period of loose financial conditions results in more capital being sunk into zombie companies is likely to be less of an issue for countries with healthy banking systems.

Future research could consider expanding the analysis on the link between financial conditions and the amount of resources sunk into zombie companies along several dimensions. First, research could try to investigate a causal relationship using an IV approach, pending that data for a suitable instrumental variable is available. Second, further analysis using bank loan level data across one or more countries (beyond Europe) could help shed light on how banks contribute or respond to zombie companies. Third, the robustness of the results could be examined by using alternative means to measure each of the various structural factors, as measurement error in each of these factors is unavoidable. Fourth, similar analysis using larger sized datasets that captures non-listed companies could be examined pending data availability, as the results using listed company data may not be representative of the broader corporate sector.

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10. Appendix

Table A1: Loadings on Each Variable in Baseline Specification

	SRrates	LRrates	Lendrates	Creditgrth	REER	RealHP	RealSP
AUS	0.53	0.52	-0.54	0.23	0.18	0.25	0.08
AUT	0.55	0.51	-0.50	0.18	0.01	-0.38	-0.09
BEL	0.50	0.42	-0.48	0.42	0.23	0.12	-0.32
CAN	0.49	0.52	-0.39	-0.31	0.32	0.32	0.18
CHE	-0.58	-0.51	0.50	-0.17	-0.13	-0.25	0.18

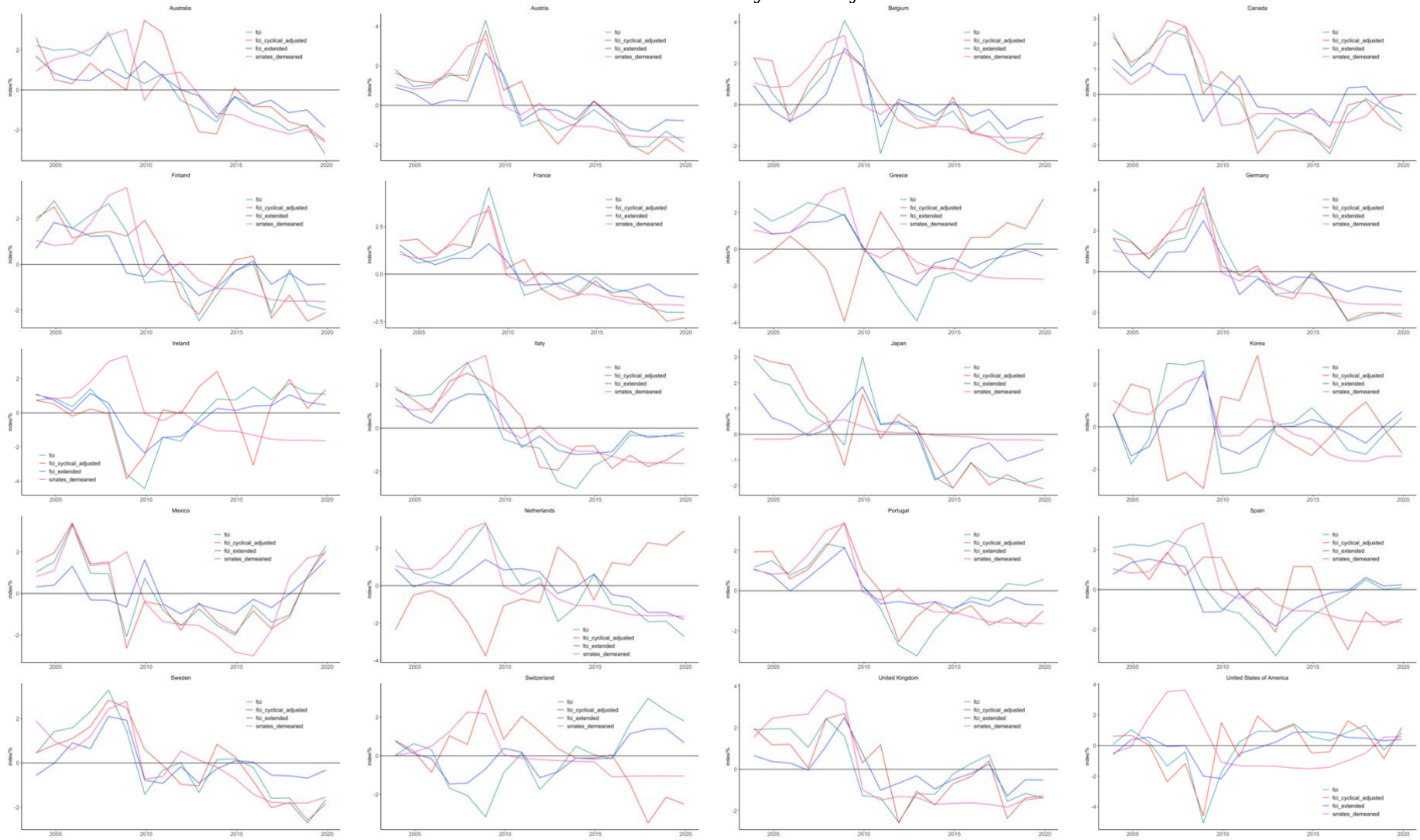
DEU	0.53	0.54	-0.34	-0.25	0.05	-0.48	-0.13
ESP	0.07	-0.37	-0.41	0.53	0.27	0.52	0.28
FIN	0.55	0.52	-0.35	0.37	0.10	0.37	0.14
FRA	0.57	0.51	-0.56	0.06	0.07	0.05	-0.29
GBR	0.60	0.52	-0.10	0.38	-0.29	0.34	-0.03
GRC	-0.01	-0.48	-0.48	0.42	0.33	0.43	0.24
IRL	-0.48	-0.44	0.38	0.08	0.18	0.43	0.46
ITA	0.37	-0.27	-0.49	0.53	0.14	0.51	-0.00
JPN	0.42	0.51	0.48	-0.28	-0.05	-0.48	-0.13
KOR	0.46	0.20	-0.47	0.49	-0.34	0.41	-0.04
MEX	0.57	0.55	-0.05	-0.41	0.25	0.28	0.26
NLD	0.56	0.55	-0.47	0.33	0.04	-0.07	-0.23
PRT	0.38	-0.49	-0.61	0.44	0.10	0.10	0.16
SWE	0.52	0.49	-0.49	0.31	-0.08	0.36	0.15
USA	-0.42	-0.43	0.55	-0.00	-0.06	0.42	0.39

Source: Author's calculations

Table A2: Share of Total Variance Explained by Principal Components

	PC1	PC2	PC3	Cumulative
AUS	0.45	0.26	0.15	0.87
AUT	0.44	0.21	0.17	0.82
BEL	0.44	0.21	0.15	0.80
CAN	0.35	0.23	0.21	0.79
CHE	0.38	0.23	0.18	0.79
DEU	0.45	0.25	0.14	0.83
ESP	0.44	0.23	0.15	0.82
FIN	0.44	0.25	0.17	0.86
FRA	0.39	0.22	0.19	0.80
GBR	0.36	0.35	0.16	0.87
GRC	0.51	0.20	0.15	0.86
IRL	0.45	0.23	0.17	0.85
ITA	0.41	0.22	0.15	0.77
JPN	0.43	0.28	0.16	0.86
KOR	0.43	0.25	0.14	0.82
MEX	0.36	0.23	0.21	0.81
NLD	0.40	0.21	0.19	0.81
PRT	0.36	0.31	0.16	0.83
SWE	0.38	0.29	0.17	0.83
USA	0.35	0.29	0.15	0.78
Average	**0.41**	**0.25**	**0.17**	**0.82**

Table A3: FCIs by Country



Notes: See appendix for details on the construction of the FCI's. An increase (decrease) in the indices reflects a tightening (loosening) in financial conditions. All variables are demeaned

2.4 Robustness test

TABLE A5: ROBUSTNESS CHECK - COUNTRY LEVEL

	Proportion capital sunk into zombies			
	(1)	(2)	(3)	(4)
FCI	0.079	0.629***	-4.012	0.925**
	(0.221)	(0.197)	(2.461)	(0.412)
Bank Health	0.086*	0.029	0.020	0.082*
	(0.047)	(0.053)	(0.075)	(0.043)
Insolvency	0.109	0.047	-0.029	0.087
	(0.123)	(0.086)	(0.077)	(0.115)
Labour Regulations	-2.794	-1.542	-2.708*	-2.422
	(1.755)	(1.108)	(1.378)	(1.793)
FCI x Bank Health		-0.138***		
		(0.042)		
FCI x Insolvency			0.053*	
			(0.030)	
FCI x Labour Regulation				-0.383*
				(0.185)
Observations	319	319	319	319
R^2	0.589	0.618	0.611	0.594
Adjusted R^2	0.534	0.564	0.557	0.537
Residual Std. Error	4.014 (df = 280)	3.881 (df = 279)	3.913 (df = 279)	4.002 (df = 279)

Notes: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.
Standard errors are clustered at the country level and reported in the parenthesis. Firm and time fixed effects are included by not reported.

TABLE A6: ROBUSTNESS CHECK - REAL SHORT-RUN RATES

	Proportion capital sunk into zombies			
	(1)	(2)	(3)	(4)

SR rates	0.159	-0.058	-1.319	0.650
	(0.251)	(0.233)	(1.567)	(0.543)
Bank Health	-0.061	-0.045	-0.093	-0.068
	(0.077)	(0.065)	(0.098)	(0.075)
Insolvency	0.141	0.159	0.078	0.129
	(0.149)	(0.152)	(0.133)	(0.149)
Labour Regulations	-1.923	-3.310	-1.959	-1.087
	(3.419)	(3.440)	(3.379)	(3.562)
SR rates x Bank Health		0.179*		
		(0.097)		
SR rates x Insolvency			0.018	
			(0.020)	
SR rates x Labour Regulation				-0.251
				(0.284)
Observations	2,319	2,319	2,319	2,319
R^2	0.436	0.439	0.437	0.437
Adjusted R^2	0.379	0.382	0.379	0.379
Residual Std. Error	11.754 (df = 2105)	11.729 (df = 2104)	11.754 (df = 2104)	11.754 (df = 2104)

Notes: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.
Standard errors are clustered at the country level and reported in the parenthesis. Firm and time fixed effects are included by not reported.

TABLE A7: ROBUSTNESS CHECK - ALTERNATIVE FCI CONSTRUCTION

	Proportion capital sunk into zombies			
	(1)	(2)	(3)	(4)
FCI alt	-0.906*	0.221	-10.663**	1.251
	(0.436)	(0.344)	(4.930)	(1.137)
Bank Health	-0.083	-0.237**	-0.178	-0.092

	(0.074)	(0.083)	(0.112)	(0.069)
Insolvency	0.112	0.024	-0.080	0.068
	(0.135)	(0.087)	(0.066)	(0.119)
Labour Regulations	-2.059	-0.124	-1.622	-1.426
	(3.204)	(1.686)	(2.391)	(3.018)
FCI alt x Bank Health		-0.361***		
		(0.098)		
FCI alt x Insolvency			0.123**	
			(0.058)	
FCI alt x Labour Regulation				-1.037
				(0.660)
Observations	2,319	2,319	2,319	2,319
R^2	0.438	0.445	0.444	0.440
Adjusted R^2	0.382	0.389	0.388	0.383
Residual Std. Error	11.734 (df = 2105)	11.665 (df = 2104)	11.675 (df = 2104)	11.720 (df = 2104)

Notes: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.
Standard errors are clustered at the country level and reported in the parenthesis. Firm and time fixed effects are included by not reported.

TABLE A8: ROBUSTNESS CHECK - CYCLICALLY ADJUSTED FCI

	Proportion capital sunk into zombies			
	(1)	(2)	(3)	(4)
FCI cyc	0.246	0.725*	0.473	0.021
	(0.233)	(0.402)	(1.100)	(1.059)
Bank Health	-0.084	0.012	-0.087	-0.087
	(0.088)	(0.055)	(0.096)	(0.098)
Insolvency	0.148	0.114	0.154	0.154
	(0.150)	(0.134)	(0.166)	(0.161)

Labour Regulations	-2.162	-0.011	-2.147	-2.325
	(3.510)	(2.827)	(3.463)	(3.859)
FCI cyc x Bank Health		-0.137**		
		(0.055)		
FCI cyc x Insolvency			-0.003	
			(0.015)	
FCI cyc x Labour Regulation				0.104
				(0.443)
Observations	2,319	2,319	2,319	2,319
R^2	0.437	0.441	0.437	0.437
Adjusted R^2	0.380	0.384	0.380	0.380
Residual Std. Error	11.750 (df = 2105)	11.711 (df = 2104)	11.753 (df = 2104)	11.752 (df = 2104)

Notes: ***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Standard errors are clustered at the country level and reported in the parenthesis. Firm and time fixed effects are included by not reported.