

Mountains of debt and investment flows: what can we learn from SMEs' investment behaviour during and after the global financial crisis?

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Executive summary

Many UK firms weathered the Covid-19 (Covid) shock by taking on debt. Small and medium-sized enterprises (SMEs) in particular borrowed at an unprecedented rate and their debt increased by around a quarter since end 2019. But debt that allowed SMEs to survive the pandemic could now hamper the recovery as indebted firms may struggle to invest and grow. Debt burdens on SMEs' balance sheets could also make firms more vulnerable to future shocks and amplify downturns if indebted firms reduce investment more following shocks. To understand how investment might evolve in the future, this paper examines the effect of leverage on SME investment during and after the global financial crisis (GFC) and discusses regulatory and other changes since the GFC that could have altered debt-investment sensitivities.

Debt can help firms bridge liquidity shortfalls and finance productive investment. But it can also make highly leveraged firms vulnerable and lead them to cut investment expenditure more than firms with less leverage following shocks. Leveraged firms with high debt service burdens may not be able to fund investment during downturns when earnings fall and credit conditions tighten; this is especially the case for riskier borrowers. But credit supply might not be the only constraint that leveraged firms face. Demand-side factors could also reduce investment by leveraged firms: firms with more leverage may suffer from 'debt overhang' and be reluctant to invest if the returns on investment accrue to debtors. The debt overhang problem can be aggravated when returns on investment are lower. Highly indebted firms may also choose to forego investment in order to deleverage and rebuild their balance sheets when vulnerabilities from indebtedness are exposed.

Using balance sheet data of around 35,000 UK SMEs, we assess how leverage ratios of firms at the onset of the GFC affected their fixed asset growth during the crisis and during the recovery period up until the year 2014. We find that SMEs with more leverage at the onset of the GFC invested less than firms with less leverage, both during the crisis and the

¹ We thank Jelle Barkema and Lewis Kirkham who were involved in this analysis during earlier stages of the project. We would also like to thank colleagues and referees at the Bank of England for helpful comments and suggestions.

subsequent recovery period. The negative impact of leverage on investment was persistent and increased over time up until 2014.

In further tests, we show that the negative relationship between leverage and investment was driven by relatively capital-intensive SMEs. We also assess the effect of different types of leverage on investment, and find that firms' investment was particularly sensitive to short-term liabilities and short-term bank loans. This is likely due to firms with short-term debt being exposed to rollover risk and the risk that the terms or the availability of credit would deteriorate.

Our evidence also suggests that lower investment by firms with higher leverage was accompanied by balance sheet repair. SMEs with higher leverage at the onset of the crisis subsequently deleveraged more and built cash buffers. Prolonged balance sheet repair by firms could explain our finding that pre-crisis balance sheet vulnerabilities had a long-run effect on investment.

Our final set of results addresses the question of whether the negative debt-investment relationship was driven by the inability of SMEs with high leverage to fund investment, or whether leveraged firms were less willing to invest and debt therefore constrained demand. Identifying the supply and demand channels is important for assessing future risks from potential underinvestment in the face of a shock. Regulatory changes introduced after the GFC improved the capitalisation of banks. A well-capitalised banking sector should be able to absorb shocks and lender-based tools should prevent sharp contractions in credit supply during future downturns. But demand-driven underinvestment might instead require borrower-based macroprudential tools targeting corporate borrowers, which are currently not part of the macroprudential toolkit in the UK.

We find indicative evidence that investment by indebted firms was constrained by credit supply. We find that deleveraging by SMEs with higher initial debt was accompanied by increases in the cost of credit to these firms, which is consistent with a reduction in credit supply. Furthermore, we find larger debt-investment sensitivities for SMEs that were customers of banks with weaker balance sheets at the onset of the crisis. Leveraged firms borrowing from banks which had lower liquidity ratios, larger increases in write-offs and higher leverage ratios reduced investment more after the crisis. However, the presence of supply-side effects does not imply that demand-side factors did not also play a role, but unfortunately our data set does not allow us to identify the channels working through demand-side effects

Unlike the GFC, the Covid crisis was not accompanied by a banking crisis and government loan schemes allowed firms to access financing to weather the shock. For the majority of SMEs, it is therefore unlikely that a contraction in credit supply interacted with prior leverage to depress investment since the start of the pandemic. However, if demand-side channels are important in explaining debt-investment sensitivities, elevated debt levels at the onset of the

Covid crisis and additional debt taken on during the pandemic could weigh on investment and slow down the recovery. Sluggish business investment during the recovery from the Covid shock could partly reflect reduced investment demand by firms that took on additional debt during the pandemic.

Going forward, both demand and supply-side factors could make highly indebted firms vulnerable to future shocks and lead these firms to cut investment more, amplifying potential downturns. Supply-side risks could be mitigated by macroprudential regulation introduced after the GFC, which are expected to prevent sharp contractions in loan supply following shocks. Furthermore, SME investment may be less constrained by debt relative to the GFC since much of the additional debt taken on during the pandemic was provided through government loan schemes, which offer low interest rates and have longer maturities.

1: Introduction

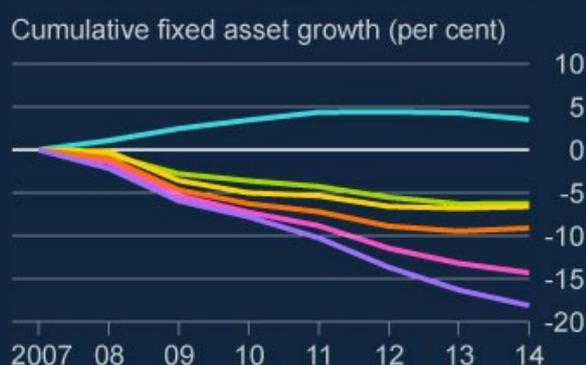
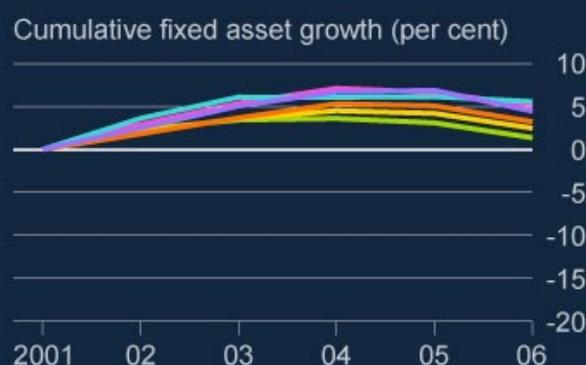
Many firms weathered the Covid shock by taking on debt. Small and medium-sized enterprises (SMEs) in the UK borrowed at an unprecedented rate during the pandemic and their debt increased by 25% since the onset of the shock. But debt that allowed SMEs to survive during the pandemic could now hamper the recovery as highly indebted firms may struggle to invest, hire and grow. Debt burdens on SMEs' balance sheets could also make firms more vulnerable to shocks in the future and amplify downturns if indebted firms cut investment and employment more than firms with less leverage in response to shocks. To understand how investment by SMEs might evolve in the future, we examine the effect of leverage on SME investment during and after global financial crisis (GFC). Using firm balance sheet data, we assess which types of debt affect investment most and shed light on the channels underlying the relationship between leverage and future investment.

If we classify SMEs by their leverage at the onset of the global financial crisis and trace out average investment paths of firms in different leverage buckets over subsequent years, a clear pattern emerges: Firms with higher initial leverage invested less, not only during the global financial crisis but also during the subsequent recovery period (Chart 1, Panel 2). Differences in fixed asset growth across firms with different leverage ratios during the crisis subsequently amplified, resulting in large gaps in firms' capital stocks by the end of the period in 2014. Firms with leverage ratios below 20% continued to build their stock of fixed assets and invested more than the amounts needed to replace depreciating capital. By contrast, firms with leverage ratios above 20% saw their stock of fixed assets fall over time. Among those, the capital stock of firms in higher leverage buckets decreased more on average. The decline was most pronounced for firms that entered the crisis in negative equity ie with a leverage ratio of over 100%. Their stock of fixed assets fell by almost 20% between 2007 and 2014.

Investment patterns were very different during the pre-crisis period: the fixed asset stock of SMEs grew over the period between 2001 and 2006, irrespective of firms' initial leverage in 2000/1 (Chart 1, Panel 1). Furthermore, there was no clear relationship between firms' initial leverage and the strength of their subsequent investment. This suggests that the relationship between debt and investment changes during economic downturns.

Chart 1: Average investment of SMEs before and after the GFC, by initial leverage

— Leverage ratio 0%–20% — Leverage ratio 60%–80%
— Leverage ratio 20%–40% — Leverage ratio 80%–100%
— Leverage ratio 40%–60% — Leverage ratio >100%

Panel 1: During and after the GFC

Panel 2: Before the GFC


Note: The charts show average cumulative fixed asset growth of SMEs in different initial leverage buckets where leverage is measured by total liabilities to total assets in 2006/07 (Chart 1, Panel 1) and in 2000/1 (Chart 1, Panel 2). Investment horizons range from 2007–08 to 2007–14 (Chart 1, Panel 1) and from 2001–02 to 2001–06 (Chart 1, Panel 2).

Debt can help firms bridge liquidity shortfalls and finance investment, allowing them to build capital stock faster than they could do if they only relied on cash holdings, earnings or equity finance. But corporate debt can also make firms vulnerable to adverse shocks and lead them to cut investment expenditure by more than firms with less leverage following downturns (see for example evidence by Giroud and Mueller (2017) and Santos and Blickle (2020) for the US, and evidence by Kalemli-Ozcan et al (2018), Buera and Karmakar (2021), de Socio and Sette (2018), Gebauer et al (2017) for European countries). Leveraged firms with high debt service burdens may not be able to fund investment during downturns when earnings fall and credit conditions tighten, especially for riskier borrowers. Firms may also be reluctant to invest if the benefits of investment accrue to debtors and investment by leveraged firms may therefore be constrained by ‘debt overhang’ (Myers (1977); Jensen and Meckling (1976)). The debt overhang problem can be aggravated during downturns when returns on investment are lower (Lamont (1995)). And firms may forego investment in order to deleverage and to rebuild their balance sheets when vulnerabilities from high indebtedness get exposed during a shock.

Our study concentrates on the impact of SME debt in the UK. We focus on SMEs because of their importance for the UK economy and because SMEs have taken on large amounts of additional debt during the pandemic. In the UK, SMEs account for roughly 60% of private sector employment, 50% of turnover and around a third of aggregate investment. During the

pandemic, SME debt increased by a quarter, supported by government-backed loan schemes. Higher debt could make SMEs more vulnerable in the future.

For our analysis, we focus on firms with total assets in 2006 of less than or equal to £11.4 million which is the SME threshold for total assets set out by the 2006 Companies Act. We study the relationship between SME debt and investment during the GFC rather than the pandemic since firm-level balance sheet data covering the Covid-shock are not yet available for the vast majority of smaller firms. In light of the finding of Joseph et al (2021) that the initial strength of a firm's balance sheet can have persistent effects after crises, we assess both the short and the long-run effects of firms' leverage ratios at the onset of the crisis.

We find that SMEs with more leverage at the onset of the GFC invested less than firms with less leverage, both during the crisis and the subsequent recovery period. The effect of leverage was persistent and increased over time up until 2014. Our evidence suggests that an increase in pre-crisis leverage, defined as total liabilities as a share of total assets in 2006/07, by 10 percentage points is associated with a reduction in fixed asset growth during the crisis (2007–09) by almost half a percentage point and by 0.7 percentage points between 2007 and 2014.

We also find that the negative relationship between leverage and investment was driven by relatively capital-intensive SMEs. For these firms, an increase in the leverage ratio by 10 percentage points is associated with a reduction in fixed asset growth by 0.7 percentage points during the crisis and by 1.6 percentage points between 2007 and 2014. This heightened sensitivity to balance sheet vulnerabilities could be due to the scale, and possibly the lumpiness of the investment expenditure of capital-intensive firms which have to maintain a larger stock of capital and are therefore more likely to be dependent on external sources of finance. Capital-intensive firms make up for the bulk of investment in our sample and their impact on aggregate demand is therefore more significant.

When assessing the effects of different types of leverage on investment, we find that investment of firms was particularly sensitive to short-term liabilities and short-term bank loans. Firms with short-term debt were exposed to rollover risk and faced the risk that the terms or the availability of credit would deteriorate.

Our evidence also suggests that lower investment by firms with higher leverage was accompanied by balance sheet repair. SMEs with higher leverage at the onset of the crisis subsequently deleveraged more and built cash buffers. Persistent deleveraging by firms could explain our finding that pre-crisis balance sheet vulnerabilities had a long-run effect on investment.

Our final set of results addresses the question whether the negative debt-investment relationship was driven by the inability of SMEs with high leverage to fund investment, or whether leveraged firms were less willing to invest and debt therefore constrained demand.

Identifying the supply and demand channels is important for assessing future risks from potential underinvestment in the face of a shock. Regulatory changes introduced after the GFC improved the capitalisation of banks. A well-capitalised banking sector should be able to absorb shocks and lender-based tools should prevent sharp contractions in credit supply during future downturns. But demand-driven underinvestment might instead require borrower-based macroprudential tools targeting corporate borrowers, which are currently not part of the macroprudential toolkit in the UK.

Our data set does not allow us to identify the channels working through demand-side effects, but we find indicative evidence that investment by indebted firms was constrained by credit supply. We find that deleveraging by SMEs with higher initial debt was accompanied by increases in the cost of credit for those firms, which is consistent with a reduction in credit supply. Furthermore, when we match firms with the banks they had lending relationships with before the GFC, we find that investment is more sensitive to debt for firms associated with banks that had weaker balance sheets going into the crisis. We find that leveraged SMEs that were customers of banks with lower liquidity ratios, larger increases in write-offs and higher leverage ratios cut investment more after the crisis. However, the presence of supply-side effects does not imply that demand-side factors did not also play a role.

Finally, our evidence shows that SMEs that went into the GFC with higher leverage had lower employment growth than firms with less leverage. As a result, capital-labour ratios and labour productivity increased more for firms with more initial leverage. However, it should be noted that these results are based on a small sample of firms that report employment and employment is therefore not the focus of this paper.

Unlike the GFC, the Covid crisis was not accompanied by a banking crisis and government loan schemes allowed firms to access financing to weather the shock. For the majority of SMEs, it is therefore unlikely that a contraction in credit supply interacted with prior leverage to depress investment since the start of the pandemic. However, if demand-side channels are important in explaining debt-investment sensitivities, elevated debt levels at the onset of the Covid crisis and additional debt taken on during the pandemic could weigh on investment and slow down the recovery. Business investment for all firms fell by 11% between 2019 and 2020 and was 13% lower in 2021 Q2 than the pre-pandemic level in 2019 Q4 (ONS, Business Investment in the UK). Sluggish investment was likely driven by several factors including high uncertainty due to Covid and Brexit, but could also reflect reduced investment demand by firms that took on additional debt during the pandemic.

Going forward, both demand and supply-side factors could make highly indebted firms vulnerable to future shocks and lead these firms to cut investment more, amplifying potential downturns. Compared to the effects for the GFC that we document in this paper, risks could be mitigated by macroprudential regulation introduced after the GFC which should prevent sharp contractions in loan supply following shocks. Furthermore, debt may constrain SME

investment less than after the GFC since much of the additional debt taken on during the pandemic was provided through government loan schemes. Loans provided through the schemes have low interest rates and are long term. Besides, SMEs that started repaying their scheme loans can make use of the government's Pay-As-You-Grow (PAYG) scheme to extend the loan term and reduce repayments during half-yearly windows.

2: Corporate debt can pose risks to financial stability, amplify shocks and slow down recoveries

High levels of debt can make firms and the economy more vulnerable to adverse shocks. Corporate debt can amplify shocks to the economy and slow down recoveries for several reasons:

- **Distress:** Higher leverage increases firms' vulnerability to interest rate increases or shortfalls in earnings. Highly indebted and hence riskier firms are less likely to be able to access finance to bridge liquidity shortfalls. As a result, debt burdens increase the likelihood of corporate distress (eg Altman (1993); Shumway (2001); Campbell et al (2008)), especially during economic downturns and periods of financial stress (Molina (2005); Carling et al (2007); Bonfim (2009); Loffler and Maurer (2011); Bonaccorsi di Patii et al (2015)). If defaults materialise on a large scale, this can threaten the resilience of creditors and trigger a general tightening of credit conditions.
- **Asset prices:** Asset price spirals are more likely when firms are highly indebted. Firms in distress may disinvest and sell assets, putting downward pressure on prices of commercial real estate and capital. Furthermore, investors who hold risky corporate debt may sell their holdings in response to negative shocks or higher uncertainty, potentially triggering asset price spirals. Lower asset prices reduce the value of collateral and the borrowing capacity of other firms (Bernanke et al (1999); Kiyotaki and Moore (1997)).
- **Investment, employment and production:** Investment of leveraged firms during and after shocks may be sub-optimally low, leading firms to reduce employment and production. Low investment by indebted firms also affects the household sector through employment cuts and can have knock-on effects to the wider corporate sector through supply chains.

Whether highly indebted firms cut investment (and employment) more after shocks has not been explored for the UK yet but evidence for the US (see for example Giroud and Mueller (2017), and Santos and Blickle (2021)) and for European countries (see for example Kalemli-Ozcan et al (2019), Buera and Karmakar (2019), de Socio and Sette (2018), Gebauer et al (2017), and Barbiero et al (2020)) points to a negative relationship between debt and investment after a shock. A parallel strand of literature shows that households with high levels of debt amplify shocks to the economy by cutting back on spending, putting downward pressure on economic activity (see for example Andersen et al (2016), Baker (2018), Dynan (2012), Kovacs et al (2018), Mian and Sufi (2010), and Mian et al (2013)).

Highly leveraged firms may cut investment more during downturns due to supply or demand-side factors:

- **Supply-side factors:** Highly indebted firms might be unable to fund investment. Lower cash flows during a downturn and high debt servicing costs might imply that leveraged firms lack internal funds for business investment. In an environment with high uncertainty, higher risk aversion and deteriorating balance sheets of lenders and investors, a 'flight to quality' may set in and risky, highly indebted firms may face tighter credit conditions during crises. As a result, highly indebted firms could struggle to raise new funding for investment or to roll over existing debt. Falls in the value of collateral during crises can also contribute to this (Kiyotaki and Moore (1997)).
- **Demand-side factors:** Highly indebted firms may also be unwilling to fund new investment and investment could therefore be constrained by demand-side factors rather than credit supply. Shareholders of leveraged firms may not have incentives to invest if the benefits of this investment accrue to debtors. This debt overhang problem (Myers (1977); Jensen and Meckling (1976)) can be aggravated during downturns when returns on investment are lower (Lamont (1995)). Higher uncertainty around future cash flows during downturns and concerns about the ability to service debt or borrowing capacity when credit conditions tighten can also induce indebted firms to deleverage and to build cash reserves rather than to invest.

Whether the current regulatory framework would address the aggregate demand externality from underinvestment and downsizing by highly indebted firms depends on whether this response to shocks by highly indebted firms is driven by supply-side or demand-side factors. Credit contractions as the key supply-side factor should be limited if the banking system is well-capitalised and liquid. But changes to the regulatory framework introduced after the GFC are less likely to address cut-backs in investment spending by heavily indebted firms if these are driven by demand-side factors.

Box A: Data and methodology

Building on the methodology of Joseph et al (2021), we use local projections (Jorda (2005)) to assess how leverage at the onset of the global financial crisis affected SMEs' investment during the crisis and afterwards. Local projections allow us to estimate how investment by firm i , measured as cumulative fixed asset growth over different time horizons from 2007 to 2014, responds to the crisis conditional on the firm's leverage in 2006:

$$\Delta \ln FA_{i,07+j} = \beta_j \text{Leverage}_{i,06} + \gamma_j X_i + \sum_{k=0}^1 \theta_{kj} \Delta \ln FA_{i,07-k} + \rho_s + \vartheta_r + \varepsilon_{i,j} \quad (1)$$

The dependent variable is the change in the log of fixed assets between 2007 and the year 2007+ j where j ranges from one to seven years.² X_i includes a set of control variables that could affect investment and be correlated with leverage. We control for a firm's age by including two dummy variables for mature and old firms, a firm's operating profit to total assets as a measure of performance, a firm's capital-intensity based on the share of fixed assets in total assets, a firm's cash position which we measure as cash deposits as a share of total assets and firm size defined as the log of the total assets of the firm. All control variables are measured in the year 2006. Since investment can be lumpy or move in cycles, we control for pre-crisis investment by including two lags of annual fixed asset growth in our regressions. We also include four-digit SIC industry fixed effects, denoted as ρ_s and regional fixed effects, denoted as ϑ_r , in our regressions. These fixed effects absorb variation in investment opportunities, investment demand, changes in credit supply or productivity shocks that are specific to certain regions or industries.

The main variable of interest is leverage. The beta coefficients capture the sensitivity of firms' investment over horizon j to pre-crisis leverage. In our baseline specification, we measure this as total liabilities to total assets. Total liabilities include short-term and long-term debt as well other liabilities such as trade credit and tax or pension liabilities. We chose to focus on this measure of leverage because the reporting requirements for smaller UK firms are relatively basic and debt is not well reported. Focusing on debt rather than liabilities would have reduced our sample substantially. However, we also present results for the subset of firms that report different measures of debt in Section 3.2. UK firms are not required to submit their accounts during a specific month of the year and accounts therefore cover different 12-month periods depending on the reporting month. We assign accounts submitted in the first half of a year to the previous calendar year and reports submitted in the second half of a year to the current calendar year. Firms' initial leverage positions thus capture their leverage ratios from accounts submitted between July 2006 and June 2007.

² Fixed assets include tangible assets such as property, plant and equipment and intangible assets.

We use the firm-level data set of Bahaj et al (2020) sourced from BvD's FAME database. Firms that have a parent are excluded from the sample to avoid double-counting. We focus on SMEs using the total asset threshold specified in the SME definition of the 2006 Companies Act. Around 90% of the firms in our sample are classified as small (total assets not exceeding £2.8 million) and only 10% are medium-sized (total assets not exceeding £11.4 million). Firms are classified using four-digit codes of the UK Standard Industry Classification. We exclude firms that operate in financial services or industries dominated by the public sector. We focus on firms that survived throughout the crisis and the recovery period to ensure that differences in debt-investment sensitivities for different investment horizons are not driven by firm entry and exit. Furthermore, we exclude firms that never reported positive fixed assets over the sample period and which are therefore unlikely to be involved in the operational activities of a corporate group. This results in a sample of 33,872 SMEs in our baseline regressions.

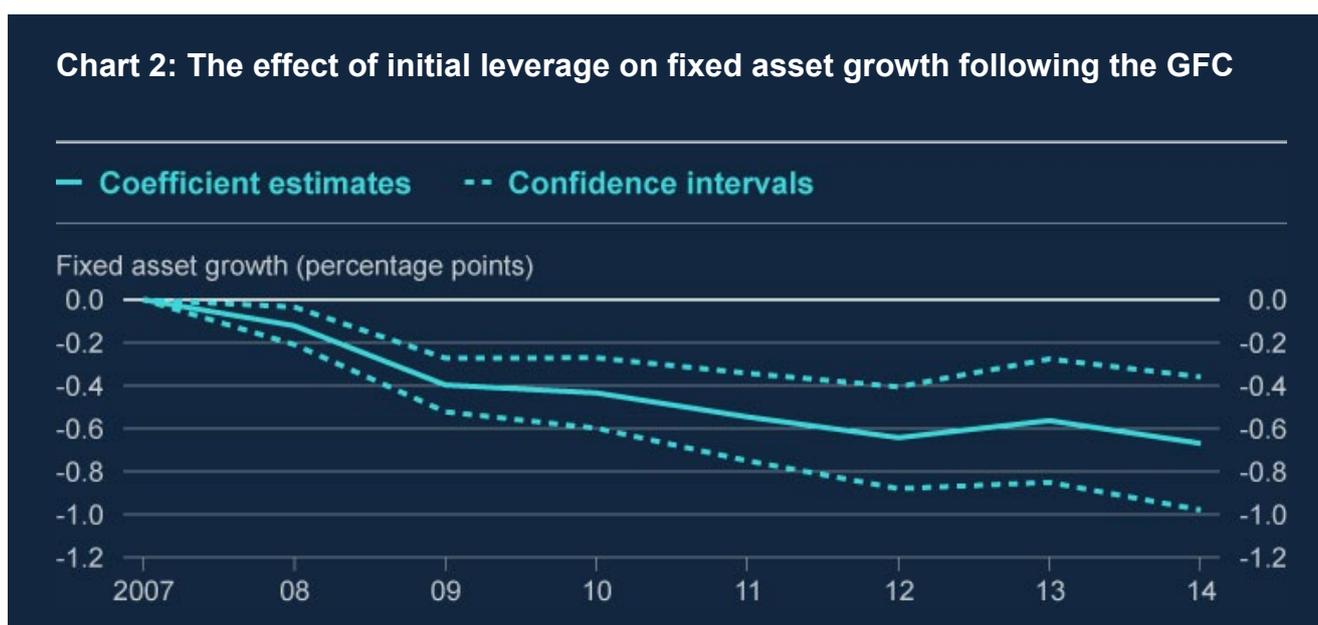
The final section of the paper attempts to capture credit supply constraints by matching firms with their lenders before the crisis. The FAME database contains the names of banks each firm has a secured loan with. Banks are required to register these loans with Companies House shortly after the loan has been created. If the bank fails to do so, it will be unable to seize the collateral in case the company defaults. Our data set allows us to match roughly a third of the firms in our sample with banks that they had a lending relationship with before the crisis. The vast majority of firms only had a borrowing relationship with one bank and we restrict our sample to these firms. SMEs in our sample were borrowing from 39 different banks. We merge our firm data with balance sheet information for these banks collected through the Bank of England's reporting forms for the year 2006 to assess in Section 4.2 whether debt-investment sensitivities of firms that were customers of banks with weaker balance sheets at the onset of the crisis were larger.

3: Investment behaviour of leveraged SMEs after the GFC

3.1: How did pre-crisis leverage impact corporate investment during and after the GFC?

The results from estimating equation (1) confirm our earlier observations. SMEs that entered the crisis with higher leverage invested less, both during the GFC and afterwards, than firms with less leverage.

These results are graphically presented in Chart 2. The solid line shows the effect of the initial leverage ratio on cumulative fixed asset growth over different investment horizons, starting with fixed asset growth between 2007 and 2008 up to fixed asset growth between 2007 and 2014. The dashed lines indicate 90% confidence intervals around the estimates.



Note: The solid line depicts the beta coefficients from estimating equation (1) for our sample of 33,872 SMEs for different investment horizons. Initial leverage is measured as total liabilities to total assets in 2006/07. The chart depicts the effect of a 10 percentage point increase in the initial leverage ratio on investment over different horizons. Ninety per cent confidence intervals around these estimates are shown as dashed lines.

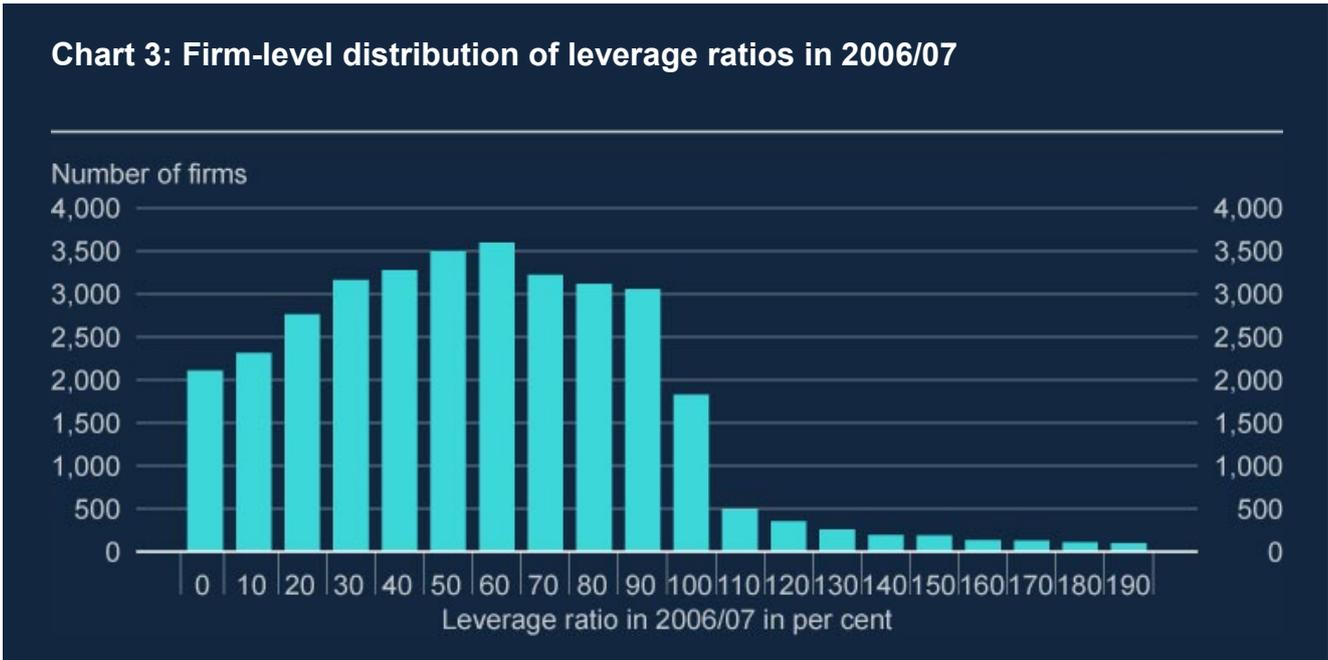
The negative effect of initial leverage did not only persist over time but increased up until 2012, despite the easing of credit conditions and the return of demand during the recovery period. Our estimates suggest that SMEs that entered the crisis with a 10 percentage points higher leverage ratio had almost half a percentage point lower fixed asset growth between 2007 and 2009. By 2014, their fixed asset growth was 0.7 percentage points lower compared to less leveraged firms.

These results are statistically significant and economically meaningful. Official statistics suggest that the capital stock of all private non-financial corporations increased by 5% between 2007 and 2009 and by 22% between 2007 and 2014.³ Higher leverage ratios at the onset of the crisis could have wiped out a significant share of fixed asset growth especially during the crisis period according to our estimates.

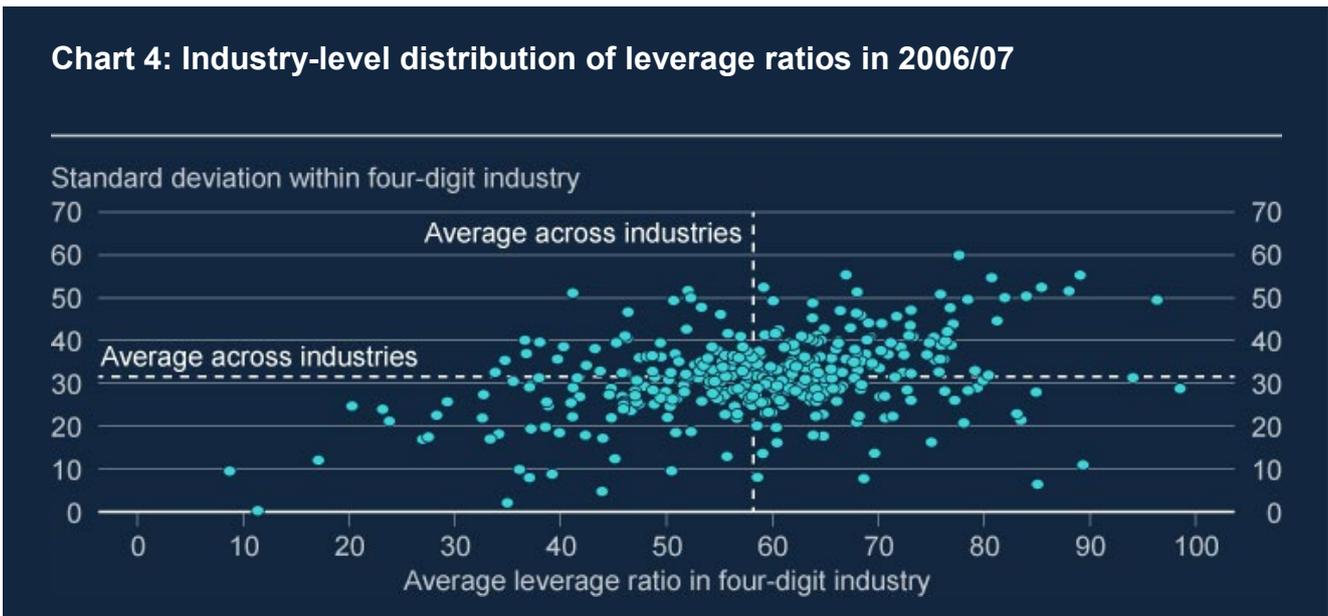
We present estimates for a 10 percentage point increase in leverage in Chart 2. In our sample of SMEs, 16% of firms had increased their leverage ratio by 10 percentage points or more, and more than a third of the firms had increased their leverage ratio by at least 5 percentage points in the year before the crisis.

But leverage ratios also vary a lot across firms and sectors, and we see large differences in leverage ratios even among firms which operate in the same sub-sector and should therefore have similar production technologies (Charts 3 and 4). Our estimates suggest that these differences in leverage ratios lead to different investment patterns both across and within sectors. Leverage ratios averaged across firms in four-digit sectors range from around 10% to nearly 100%. The standard deviation of the leverage ratio within four-digit industries in our sample exceeds 10% for 97% of the industries and the average of the standard deviation across all sectors in our sample is 32 percentage points.

³ Please see [ONS data on the capital stocks and fixed capital consumption](#) for private non-financial corporations (PNFCs). A breakdown by firm size is not available and we cannot extract the SME component. Also note that given that firms submit their reports at different times throughout the year, we assign reports submitted between mid-2007 and mid-2008 for example to the year 2007. ONS data by contrast refer to calendar years. Between calendar years 2008 and 2010 the capital stock of PNFCs only grew by 0.76% and between calendar years 2008 and 2014 it grew by 16.8%. Using these dates highlights the economic significance of the leverage effect further.



Note: Distribution of total liabilities to total assets in per cent in 2006/07. Leverage ratios are trimmed at 200%.



Note: Average of total liabilities to total assets in per cent in 2006/07 and standard deviations of leverage ratios within 386 four-digit sectors. Dashed lines show averages across sectors.

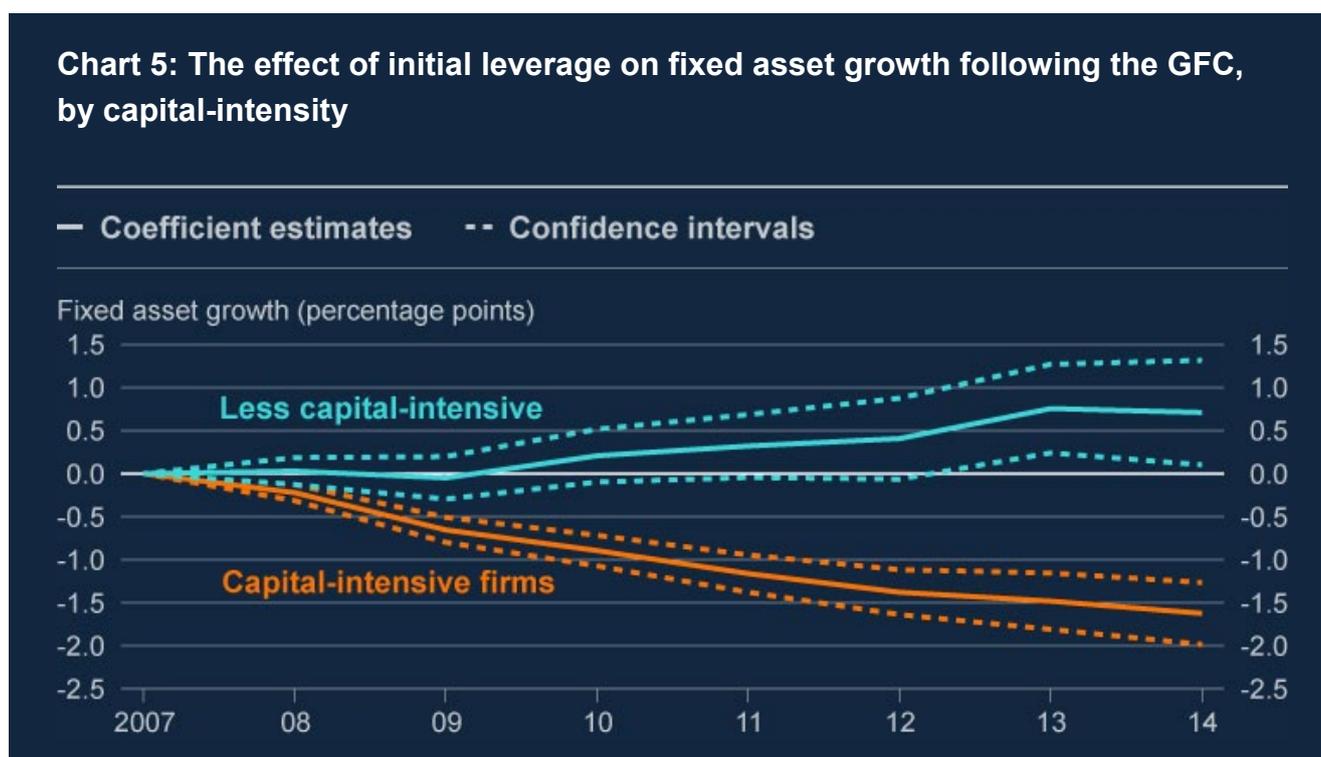
3.2: Which types of SMEs drove the relationship between debt and investment?

When assessing which types of firms drive the negative relationship between debt and investment, we find that the investment of capital-intensive firms in particular is very sensitive to initial leverage. We estimate that, compared to our baseline results, the negative effect of leverage on investment after the crisis was twice as large for relatively capital-intensive SMEs. These firms account for the bulk of the fixed asset stock in our sample and therefore

contributed most to the overall fixed asset growth of SMEs. Capital-intensive firms, defined here as firms with a fixed assets to total assets ratio greater than the sample median of roughly 30%, accounted for almost 90% of the total capital stock in our sample at the onset of the crisis.

To assess the sensitivity of capital-intensive SME's investment to pre-crisis leverage, we include in equation (1) an interaction term between 2006 leverage and a dummy variable that takes a value of one if the firm is capital-intensive and zero otherwise. Results are illustrated in Chart 5 where the orange line shows the effect of initial leverage for firms with high capital-intensity and the aqua line shows the effect for firms with low capital-intensity.

Chart 5: The effect of initial leverage on fixed asset growth following the GFC, by capital-intensity



Note: The solid line depicts the beta coefficients from estimating equation (1) for our sample of 33,872 SMEs with an interaction term between initial leverage and a dummy for capital-intensive firms. We also include leverage, defined as total liabilities to total assets in 2006/07, and a dummy variable which takes a value of 1 for capital-intensive firms and a value of 0 for less capital-intensive firms as stand-alone terms in the regressions. We drop the continuous control variable for capital-intensity in these regressions. Capital-intensive firms are defined as firms with a fixed assets to total assets ratio greater than the sample median of 0.28. The chart depicts the effect of a 10 percentage point increase in the initial leverage ratio for both types of firms. Ninety per cent confidence intervals around these estimates are shown as dashed lines.

Investment by capital-intensive SMEs in the crisis was much more sensitive to pre-crisis leverage than investment by firms with low capital-intensity. The impact of pre-crisis leverage on the investment of firms with low capital-intensity is not significantly different from zero for investment up until 2012 and only becomes marginally significant and positive over longer horizons. By contrast, the effect of leverage on the fixed asset growth of capital-intensive SMEs is significant and negative over the whole sample period. For capital-intensive firms, a

10 percentage points increase in the leverage ratio lowered fixed assets growth during the crisis (2007-2009) by 0.7 percentage points. The effect becomes more negative over longer investment horizons: Between 2007 and 2014, the stock of fixed assets of capital-intensive SMEs with 10 percentage points higher initial leverage fell 1.6 percentage points more than the fixed asset stock of capital-intensive firms with less leverage.

Our finding that investment by capital-intensive SMEs was more sensitive to leverage may be surprising given that capital-intensive firms have more fixed assets that they could post as collateral when they borrow from banks.⁴ The availability of collateral could have eased financial constraints and mitigated the effect of leverage on the investment of capital-intensive firms. Our evidence that capital-intensive firms have higher debt-investment sensitivities could be due to the possibility that maintaining the large stock of capital of capital-intensive firms requires larger and lumpier investments that are difficult to fund exclusively using internal sources of funds. When credit conditions tighten – particularly for riskier, more leveraged firms – investment by capital-intensive firms may become more constrained. Capital-intensive firms may also be more concerned about their future borrowing capacity if they are more reliant on external funding. These firms could therefore have chosen to repair their balance sheets and to deleverage following the crisis. Firms with low capital-intensity have structurally lower fixed asset stocks and may not have to dedicate a significant portion of their funds to maintaining their capital. These firms are more likely to rely on internal sources of funds, such as cash reserves and revenue flows, to fund their investment. This might explain the absence of a significant relationship between leverage and investment for these firms.⁵

3.3: Which types of leverage mattered for investment during and after the GFC?

Next, we explore which types of leverage were the most important determinants of SME investment after a shock. This allows us to better understand risks associated with different types of liabilities and to understand the real economy effects of the maturity structure of corporate leverage.

To assess the sensitivity of investment to different types of debt, we replicate our analysis in the previous section but replace the total liabilities to total assets ratio in equation (1) with different measures of leverage in separate regressions. The different types of leverage we focus on are current liabilities, total bank debt, long-term bank debt, short-term bank debt,

⁴ According to Anderson et al (2018) and Bahaj et al (2020), around 75%–80% of SME loans are collateralised.

⁵ It is worth noting that capital-intensive and less capital-intensive firms as defined here do not differ significantly in terms of their other characteristics except in terms of their cash holdings which are larger for less capital-intensive firms. Leverage ratios are not significantly different across the two types of firms. We test this using normalised differences in means and apply the rule of thumb proposed by Imbens and Wooldridge (2009).

and total net debt. All leverage measures are scaled by total assets. Current liabilities include bank debt that falls due within a year as well other liabilities such as trade credit and corporation tax or social security and VAT payments, which are due within one year.

For SMEs for which we have coverage for all types of leverage measures, current liabilities account on average for 65% of total liabilities. Debt makes up for 46 % of total liabilities on average and consists of short-term debt (43% of total debt on average) and long-term debt (57% of total debt on average). Short-term debt includes short-term bank loans and overdrafts and lease/hire purchase payments that become payable in less than a year. Long-term debt consists of bank loans with a maturity of more than a year and lease/hire purchase payments that fall due in the longer term.

We also assess whether cash balances on firms balance sheets can offset the negative effect of gross debt on investment. Cash has been shown to have a significant positive effect on corporate investment, particularly during downturns (Joseph et al (2021)). To measure net debt, we subtract cash holdings from total debt.

The results are shown in Table A. Columns (1) and (2) of the table report the effect of leverage on fixed assets growth during the crisis (2007–09) and over the whole sample period (2007–14), respectively. It is worth noting that, when using total debt, long-term debt, and total net debt in our regressions, the sample size drops considerably, as indicated in column (3).

Table A: Debt-investment sensitivities using different leverage measures

	Fixed assets growth		Observations
	2007–09	2007–014	
Total liabilities/Total assets	-0.0397*** (0.008)	-0.067*** (0.019)	33,872
Current liabilities/Total assets	-0.070*** (0.009)	-0.116*** (0.024)	32,091
Long-term liabilities/Total assets	-0.002 (0.012)	-0.019 (0.039)	32,091
Total debt/Total assets	-0.002 (0.019)	-0.097* (0.058)	11,081
Short-term debt/Total assets	-0.063*** (0.015)	-0.128*** (0.023)	33,223
Long-term debt/Total assets	0.036 (0.025)	0.002 (0.062)	11,081
Total net debt/Total assets	-0.013 (0.015)	-0.055 (0.038)	11,175

Note: The table reports coefficients from estimating equation (1) using different measures of initial leverage in 2006/07. We report the effect of initial leverage on the change in the log of fixed assets between 2007 and 2009 and the change in the log of fixed assets between 2007 and 2014. Unlike in the charts, the table reports the effect of a 1 percentage point increase in the initial leverage ratio. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

The first row in Table A shows the coefficients for our baseline specification which we presented graphically in Chart 2. Within total liabilities, current liabilities (row 2) have a significant negative effect on investment while the effect of long-term liabilities is not significantly different from zero (row 3). Debt as a share of total assets has a significant negative effect on investment over the longer run only (row 4), likely because only the effect of short-term debt is significant (row 5) while more long-term debt on firms' balance sheet does not affect their subsequent investment behaviour (row 6). This sensitivity of investment to short-term debt has been documented before (eg Duchin et al (2010); Almeida et al (2012); Duval et al (2017)).

Firms with short-term debt are exposed to rollover risk and face the risk that the terms or the availability of credit deteriorate. We confirm below that credit after the GFC became more expensive for firms with more initial short-term debt. Short-term debt can also aggravate debt overhang problems as shown by Diamond and He (2014). Surprisingly, we find that net debt does not affect investment (row 7) even if cash and debt individually affect investment

patterns. Overall, the main conclusion from this analysis is that investment is more sensitive to short-term leverage, not only during the crisis but also during the recovery period.

4: Analysis of transmission channels from corporate leverage to investment

In this section, we investigate the underlying drivers of the negative relationship between corporate leverage and investment. Our aim is to understand the channels behind the effect of leverage and why it proved so persistent. As set out in Section 2, the negative relationship between leverage and subsequent investment could be driven by supply or demand-side effects. On the supply side, more indebted, riskier firms could struggle to raise new funding for investment or to roll over existing debt during and after the crisis. On the demand-side, more leveraged firms could be unwilling to invest and demand less credit due to debt overhang and concerns about debt service or their future borrowing capacity.

Both demand and supply-side channels imply that firms with more leverage at the onset of the crisis subsequently borrowed less than firms with less initial leverage. We first verify empirically that indebted firms deleveraged more during and after the GFC and then assess whether firms with more initial leverage also repaired their balance sheets by accumulating cash and other liquid assets.

Next, we test if this was driven by supply-side factors. To do so, we explore how funding costs evolved for SMEs with different initial leverage ratios. Less borrowing combined with more expensive credit for leveraged companies would point towards a contraction in credit supply for these companies. We also test if the investment response was larger for leveraged SMEs that had borrowing relationships with weaker banks at the onset of the crisis. Banks with weaker balance sheets were more likely to cut back credit during the crisis and we can therefore assess whether credit supply effects account for some of the negative relationship between leverage and investment.

Identifying supply and demand channels is important for the design of effective policy tools aimed at preventing potential underinvestment in the face of a shock. Better capitalisation of the banking sector after the GFC should prevent sharp contractions in credit supply during crises. Demand-driven underinvestment could potentially be mitigated through borrower-based macroprudential tools for the corporate sector.

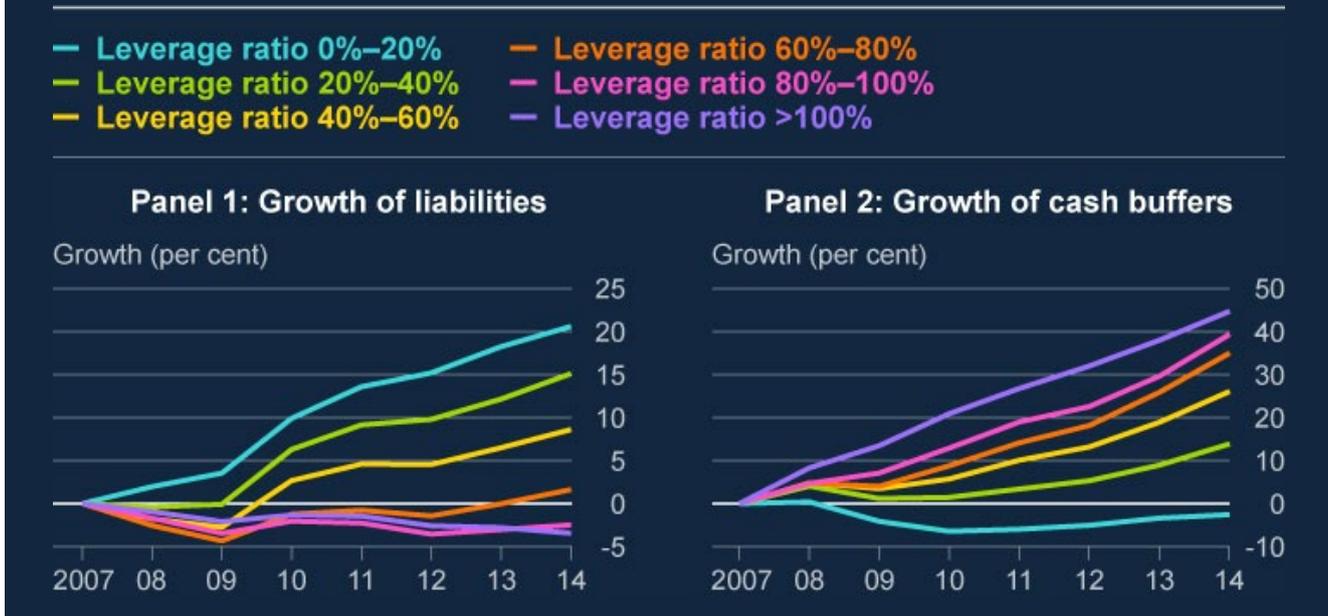
Deleveraging by firms and sustained balance sheet repair could also explain the persistence of the effect of leverage at the onset of the crisis on investment up until 2014. As discussed in more detail in Joseph et al (2021), a second potential channel through which initial balance sheet conditions can have lasting effects is through self-reinforcing competition dynamics. It is possible that leveraged SMEs that invested less during the crisis had lost productive capacity and market share when demand rebounded and the recovery set in. As a consequence, these firms could have generated less earnings for reinvestment, resulting in a

further worsening of their competitive positions and further investment cuts. We do not find evidence of this negative feedback loop working through competition dynamics and earnings and do not show the results in this paper.

4.1: How did SMEs adjust their balance sheets in response to the GFC?

Chart 6 sheds light on balance sheet adjustments of SMEs with different initial leverage ratios at the onset of the crisis. It shows the average cumulative growth rates of total liabilities (Chart 6, Panel 1) and cash holdings (Chart 6, Panel 2) of firms in different leverage buckets, analogous to the simple investment averages we presented in Chart 1. Firms with pre-crisis leverage ratios below 20% leveraged up both during the crisis (2007–09) and in the long run (2007–14). During the crisis, all other firms deleveraged. But by 2014, liabilities of firms with initial leverage ratios below 80% had increased relative to levels in 2007. Only the liabilities of firms with leverage ratios above 80% were still lower in 2014 than they had been in 2007. Balance sheet repair by highly leveraged firms in 2006/07 also involved the build-up of cash buffers (Chart 6, Panel 2). Firms with leverage ratios below 20% ran down their cash buffers over time but all firms with leverage ratios above 20% increased their cash holdings on average both during the crisis and afterwards. Firms with more pre-crisis leverage increased their cash holdings more. Firms that entered the crisis in negative equity saw the largest increase in cash buffers. Partly due to their low initial holdings their cash holdings grew by 45% between 2007 and 2014.

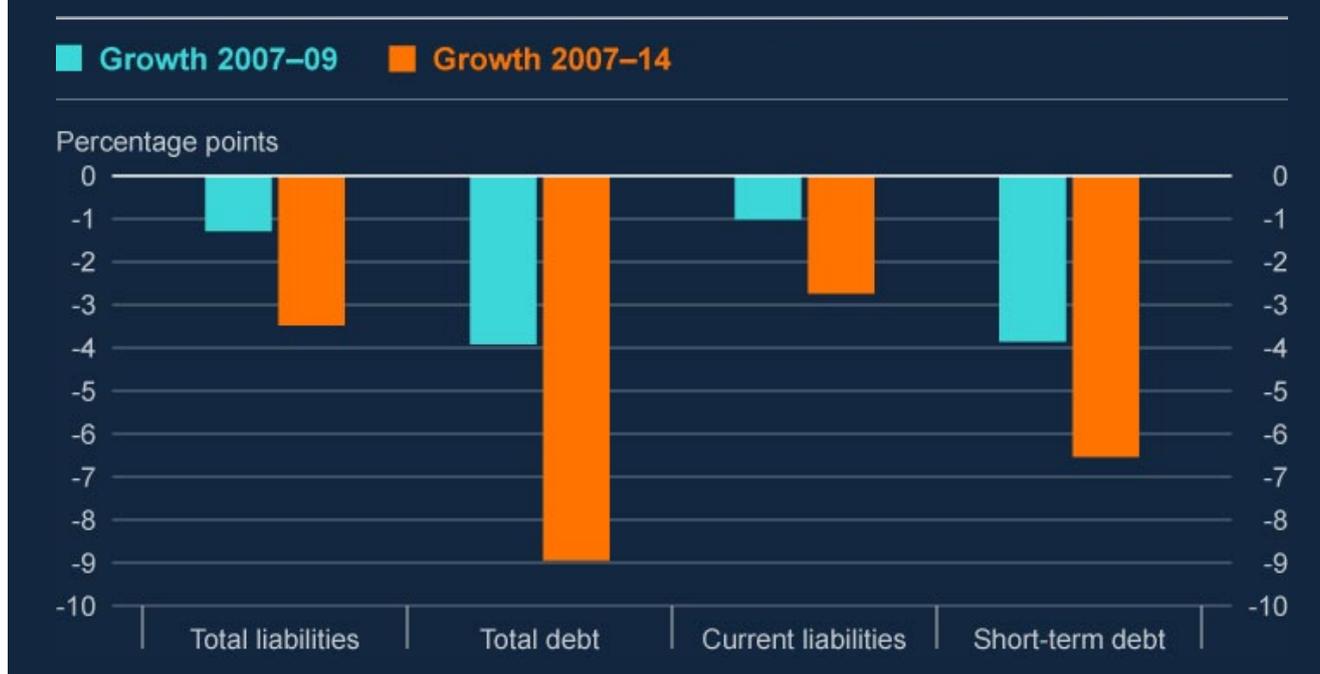
Chart 6: Average growth of liabilities and cash buffers of SMEs during and after the GFC, by initial leverage



Note: The chart shows average cumulative growth of total liabilities (Panel 1) and of cash holdings (Panel 2) for SMEs in different initial leverage buckets. Leverage is measured by total liabilities to total assets in 2006/07. Cumulative growth rates are calculated for increasing time horizons from 2007–08 up to 2007–14.

We examine balance sheet repair following the crisis more formally using local projections and control for other factors that could affect balance sheet adjustments so as to tease out the effect of higher pre-crisis leverage. Chart 7 depicts the association between higher initial leverage, captured by total liabilities to total assets, and subsequent deleveraging, measured as the growth rate of different types of liabilities (total liabilities, total debt, current liabilities and short-term debt). The aqua bars show that SMEs that had more leverage at the onset of the crisis deleveraged more during the crisis. Growth rates in debt and short-term debt were particularly sensitive to pre-crisis leverage. The orange bars show that SMEs with higher leverage at the onset of the crisis continued to deleverage more, also during the recovery period when credit conditions eased for the corporate sector as a whole. A 10 percentage point increase in the leverage ratio in 2006/07 was associated with a 3–4 percentage point drop in the growth rate of total liabilities and in current liabilities between 2007 and 2014, and with a 9 percentage point drop in total debt growth. Firms with a 10 percentage point higher initial leverage ratio also had lower short-term debt growth by 7 percentage points between 2007 and 2014.

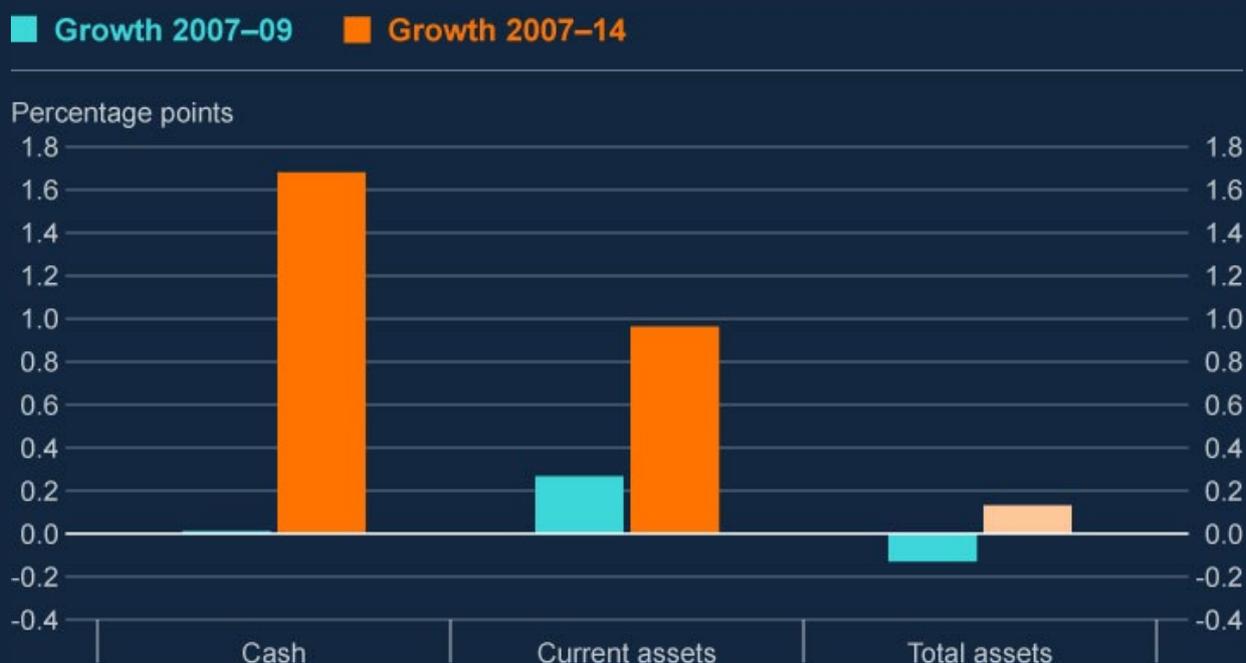
Chart 7: The effect of initial leverage on the growth rate of liabilities and of debt following the GFC



Note: The chart shows coefficients on initial leverage from estimating equation (1) using different measures of liability or debt growth as dependent variables. We use the change in the log of total liabilities, total debt, current liabilities and short-term debt between 2007 and 2009 and between 2007 and 2014 as dependent variables. The lagged dependent variables in equation (1) are replaced by the respective annual growth rates of leverage before the crisis. The key explanatory variable in these regressions is the ratio of total assets and total liabilities in 2006/07. The bars depict the effect of a 10 percentage point increase in this ratio. The effect of initial leverage is significant at least at the 10% level in all regressions.

Firms with more leverage also adjusted their assets (other than fixed assets) more in response to the shock. Chart 8 shows that while SMEs with high leverage did not change their cash holdings materially during the crisis, high leverage was associated with a substantial increase in cash buffers during the recovery period. A higher initial leverage ratio by 10 percentage points was associated with a 1.7 percentage point increase in cash buffers between 2007 and 2014. This build-up of cash buffers by more indebted firms also drives an overall increase in current assets, although the long-term effect is smaller than for the cash component. Finally, higher leverage was associated with lower total asset growth between 2007 and 2009, in line with the larger decline in the stock of fixed assets of these firms. Given the opposing effects of leverage on current assets and fixed asset growth, the effect on total asset growth over the entire period was insignificant as indicated by the light orange bar in Chart 8. This suggests that in the longer run, higher leverage led to a change in the composition of SMEs' balance sheets rather than a change in the size of these firms.

Chart 8: The effect of initial leverage on the growth rate of cash, all current assets and total assets following the GFC



Note: The chart shows coefficients on initial leverage from estimating equation (1) using different measures of asset growth as the dependent variable. We use the change in the log of cash, current assets and total assets between 2007 and 2009 and between 2007 and 2014 as dependent variables. Lagged dependent variables in equation (1) are replaced by the respective annual growth rates before the crisis. The key explanatory variable in these regressions is the ratio of total assets and total liabilities in 2006/07. The bars depict the effect of a 10 percentage point increase in this ratio. The effect is significant at least at the 10% level in all regressions, except for the total asset growth from 2007 to 2014 as indicated by the light orange bar.

Evidence of deleveraging and building cash buffers reported in this section shows that high initial leverage led firms to repair their balance sheets following the crisis. But deleveraging and the shift towards liquid assets that accompanied and potentially drove investment cuts by more indebted firms could have been caused by either demand-side or supply-side factors. Analysis in the next section tries to shed light on this.

4.2: Was the relationship between corporate leverage and investment driven by a contraction in credit supply?

In this section, we present indicative evidence suggesting that debt-investment sensitivities following the GFC were at least partly driven by supply-side effects.

First, we show that borrowing became more expensive for SMEs with higher initial leverage after the crisis than for less leveraged SMEs. Combined with our finding that SMEs with higher initial leverage deleveraged more, this suggests that initial leverage shifted the credit

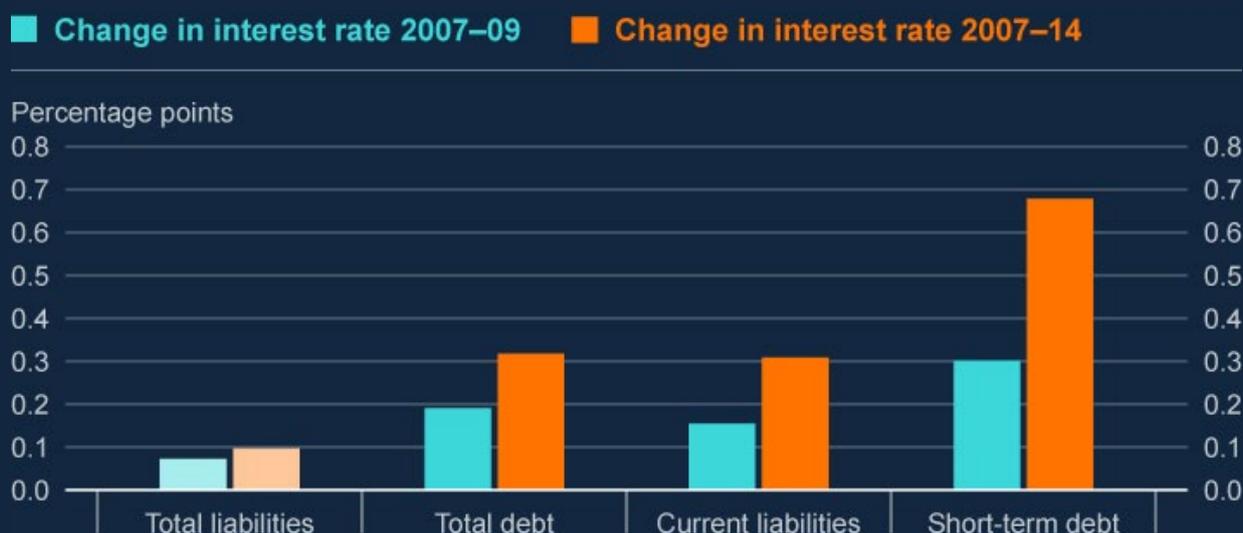
supply curve inwards and led to a tightening of credit conditions for these firms. Our results on changes in the cost and the quantity of credit suggest that the credit supply effect associated with higher initial leverage dominated the demand effect.

Second, we show that debt-investment sensitivities were higher for firms whose primary bank had a weaker balance sheet at the onset of the crisis and was therefore more likely to cut credit. However, the presence of credit supply effects does not rule out that demand effects also constrained investment. Demand effects are difficult to identify empirically and this paper does not provide evidence on the importance of this channel.

Our data set does not contain information on interest rates for individual firm loans but we have information on interest expenditures each year for a subset of around 1200 SMEs. We calculate borrowing costs by dividing annual interest expenses by the firm's stock of debt in any one year and use the difference between the resulting interest rates between 2007 and 2009 and between 2007 and 2014, respectively, as outcome variables.

On average, borrowing costs decreased for firms in our sample after the crisis, reflecting successive cuts in Bank Rate from the second half of 2007. But our evidence shows that declines in borrowing costs were less pronounced for firms with higher leverage. Chart 9 shows how 10 percentage points in additional, pre-crisis leverage impact changes in borrowing costs during the crisis and over the entire sample period. The results suggest that borrowing became more expensive for firms with higher initial leverage compared to firms with lower leverage, both during the crisis and afterwards. This could reflect that the higher perceived riskiness of indebted firms was priced into loans in the wake of the shock. Risk premia for more leveraged firms could have remained elevated for more leveraged firms during the recovery period when these firms reduced their stock of capital and had less collateral. Investment cuts may also have led banks to expect lower corporate earnings in the future with potential implications for firms' ability to service their debt. The effect of initial leverage on interest rates is significant for all types of initial leverage except for total liabilities as a share of total assets. The large effect of initial short-term debt may reflect that firms which had to refinance or roll over their debt were more likely to have higher perceived risk priced into their loans than for example firms with long-term debt and fixed interest rates.

Chart 9: The effect of different types of initial leverage on changes in SMEs' borrowing costs between 2007 and 2009 and between 2007 and 2014



Note: The chart shows coefficients on initial leverage from estimating equation (1) using the change in borrowing costs between 2007 and 2009 and between 2007 and 2014 as dependent variables. The lagged dependent variables in equation (1) are replaced by the annual changes in borrowing costs before the crisis. We show the effect of different types of leverage on the change in the cost of debt. We use total liabilities to total assets, total debt to total asset, current liabilities to total assets and short-term debt to total assets as explanatory variables as indicated on the horizontal axis. The bars depict the effect of a 10 percentage point increase in the respective ratio. The effect is significant at least at the 10% level in all regressions except for the effect of the total liabilities to total assets ratio as indicated by the bars in light colours.

Next, we assess whether SMEs that were customers of banks with weaker balance sheets at the onset of the crisis had larger debt-investment sensitivities. Banks with weaker balance sheets at the onset of the GFC cut credit supply more in response to the shock and could have been more averse to lending to risky, indebted firms. Being associated with a weak bank could therefore affect firms' ability to borrow unless they were able to switch to a more resilient bank. Most SMEs only have one bank they borrow from and switching banks is difficult (Franklin et al (2020)), particularly during crises. A larger effect of firm leverage on the investment of SMEs that were associated with weaker banks should therefore be indicative of credit supply effects.

As discussed in more detail in Box A, the BvD Fame database contains the names of lending banks for roughly a third of the firms in our sample. The firms in this subsample had lending relationships with 39 banks before the crisis and we collected balance sheet information for the year 2006 for these banks to construct indicators of bank resilience at the onset of the

crisis.⁶ To capture resilience, we focus on bank liquidity, as measured by the ratio of its liquid assets to total assets, the change in the ratio of loan write-offs as a share of risk-weighted assets, and finally the bank's leverage ratio captured by the ratio of assets to capital. The variables are described in more detail in Table A1 in the appendix. We divide our sample into firms that were associated with weaker versus stronger banks using the median of each of the four indicators of bank balance sheet strength as a threshold for the sample division. We estimate debt-investment sensitivities separately for each of the subsamples using the specification in equation (1).

The results are presented in Table B. Column (1) reports results for investment during the crisis period and column (2) for investment between 2007 and 2014. Debt-investment sensitivities of SMEs associated with banks that have low liquidity ratios and high liquidity ratios are shown in rows 1 and 2, respectively. The larger, negative effect of initial leverage on the investment of firms that were customers of less liquid banks suggests a contraction of credit supply played a role in driving debt-investment sensitivities. Similar conclusions emerge if we consider the results from sample splits using other indicators of bank resilience: SMEs associated with banks that experienced more write-offs (row 4) or were more leveraged (row 6) had higher debt-investment sensitivities. These findings suggest that credit constraints drive at least part of the relationship between debt and investment following a shock. However, it should be noted that our estimates are based on relatively small samples (column 3) given that not all firms could be matched with banks. Furthermore, differences in debt-investment sensitivities for firms associated with weaker and stronger banks tend not to be statistically significant. Finally, while we document that debt-investment sensitivities are higher for the subsamples of firms associated with weaker banks as captured by the three balance sheet indicators in Table B, this finding is not robust to some other indicators of lender resilience such as for example the size of banks' capital buffers. The findings presented here should therefore be seen as tentative.

⁶ We use the charges and the bank balance sheet data collected for the analysis of De Marco et al (2021) in this section.

Table B: Debt-investment sensitivities of SMEs, based on the balance sheet strength of associated banks at the onset of the crisis

	Fixed assets growth		Observations
	2007–09	2007–14	
Low liquidity ratio	-0.0849*** (0.0236)	-0.127** (0.0522)	3,940
High liquidity ratio	-0.0472* (0.0259)	-0.0843* (0.0445)	5,152
Low change write-offs	-0.0524 (0.0372)	-0.0256 (0.0698)	2,708
High change write-offs	-0.0624*** (0.0174)	-0.119*** (0.0400)	6,383
Low leverage ratio	-0.0391 (0.0297)	-0.0641 (0.0556)	3,635
High leverage ratio	-0.0745*** (0.0209)	-0.0962** (0.0444)	5,455

Note: The table shows the beta coefficients from estimating equation (1) using fixed assets growth between 2007 and 2009 and between 2007 and 2014 as dependent variables. Initial leverage is measured as total liabilities to total assets in 2006/07. We match firms with their primary bank during the pre-crisis period and split our sample using three different indicators of bank resilience at the end of 2006. The matched sample is split into firms associated with a bank with above or below median resilience based on the three bank balance sheet indicators. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Our evidence suggests that credit constraints played a role in driving the negative relationship between debt and investment. Due to data limitations, we could not investigate whether investment by more leveraged firms was also constrained by demand. In light of the importance of identifying demand effects for the design of macroprudential policy, more research is needed in this area.

5: Were employment and productivity impacted by high leverage?

Next, we examine whether other corporate outcome variables were impacted by elevated debt going into the GFC. We repeat the regressions in equation (1) using employment growth, the change in the capital-labour ratio, and the change in labour productivity during the crisis (2007–09) and over the entire period (2007–14) as dependent variables. Results for the subset of roughly 2,300 SMEs that report employment throughout the sample period are presented in Table C.

Table C: The effect of initial leverage on employment, input ratios and labour productivity

Dependent variable	Employment growth		Change in capital-labour ratio		Change in labour productivity	
	2007–09	2007–14	2007–09	2007–14	2007–09	2007–14
Total liabilities/Total assets	0.205*** (0.068)	-0.102* (0.062)	14.77** (7.252)	9.961 (8.981)	4.234*** (1.812)	1.809 (3.286)
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.203	0.170	0.272	0.275	0.253	0.222
Observations	2,273	2,273	2,322	2,322	2,187	2,187

Note: The table presents results from estimating equation (1) using employment growth, the change in the input ratio and labour productivity as dependent variables. We use the change in the log of employment, the change in fixed assets to employment and the change in remuneration and profit divided by employment between 2007 and 2009 and between 2007 and 2014 as dependent variables. The lagged dependent variables in equation (1) are replaced by lagged annual growth rates (employment) or changes in ratios (input ratios and productivity). The key explanatory variable in these regressions is the ratio of total assets and total liabilities in 2006/07 throughout. Unlike in the charts, the table reports the effect of a 1 percentage point increase in the initial leverage ratio. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

The results in column (1) suggest that SMEs that went into the GFC with a 10 percentage point higher leverage ratio had lower employment growth by 2 percentage points between 2007 and 2009. This material effect could have been due to downsizing and cost-cutting of leveraged firms. The effect of higher leverage on employment weakened during the recovery period but continued to be negative for the sample period overall: firms that went into the crisis with 10 percentage point higher leverage had weaker employment growth by 1 percentage points compared to their less leveraged rivals over the seven years since the beginning of the shock.

The repercussions from the shock to employment also drive the results for our two other outcome variables: capital-labour ratios of SMEs with higher leverage increased more during the crisis (column 3) given that adjustments to hiring and firing dominated adjustments to the stock of capital of these firms. This effect turns insignificant over longer horizons (column 4). Labour productivity, measured as operating profit over employment, also increased more for more leveraged firms as a result of employment cuts during the crisis but again, the effect was short-lived and disappeared during the recovery period (column 6).

6: Conclusions

We find that more leveraged SMEs invested less both during the GFC and the subsequent recovery period than firms with less leverage. The effect of leverage at the onset of the crisis was persistent and increased over time up until 2014. The negative relationship between corporate leverage and investment was driven by capital-intensive firms and by firms with short-term liabilities and short-term debt.

We also show that SMEs with higher pre-crisis liabilities deleveraged more and built up cash buffers, both during the crisis and the subsequent recovery period. Persistent deleveraging by firms could explain our finding that pre-crisis balance sheet vulnerabilities affected investment in the long run. Deleveraging and the accompanying decline in the stock of fixed assets could have been driven by the inability of firms with higher leverage to raise external financing to fund investment or by the unwillingness of firms with high leverage to invest. Consistent with the presence of credit constraints, we find that deleveraging of firms with higher initial debt was accompanied by higher borrowing costs for these firms. Furthermore, we find larger debt-investment sensitivities for firms that were customers of banks whose balance sheets were weaker at the onset of the crisis. SMEs that were customers of banks with lower liquidity ratios, larger write-offs and higher leverage ratios cut investment more after the crisis. This evidence suggests that supply-side effects were important in driving debt-investment sensitivities but it is possible that demand-side factors reinforced supply-side effects.

Possible underinvestment by highly indebted firms raises the question of whether macroprudential tools could limit the risk that highly indebted firms amplify shocks or dampen recoveries. Our finding of a negative relationship between initial leverage and SME investment during the GFC suggests that there may be a role for limiting indebtedness by SMEs although any policy intervention would need to be designed carefully to avoid underprovision of credit to these firms. It is not possible to draw definitive conclusions about the desirability or appropriate form of any macroprudential policy intervention from our GFC evidence for SMEs. Our evidence suggests that credit supply played an important role in driving debt-investment sensitivities during the GFC but post-GFC regulatory reform has materially reduced the likelihood of sharp credit contractions in response to shocks. Furthermore, we were not able to assess the extent to which pre-crisis leverage affected investment demand after the shock and distinguishing between supply and demand-driven investment sensitivities to leverage is important in determining the appropriate form of policy response. Finally, we focus on SMEs but the desirability and form of any macroprudential policy intervention would also need to take into account the relationship between leverage and investment of larger corporates, whose balance sheets tend to be much more complex given access to a broader range of market finance.

While government loans schemes ensured that SMEs were able to bridge liquidity shortfalls during the pandemic, demand-side channels could weigh on investment by SMEs with higher leverage and slow down the recovery. Higher debt burdens by SMEs could also make firms more vulnerable to possible future shocks. This risk is mitigated by macroprudential regulation introduced after the GFC which should prevent sharp contractions in credit supply. Post-Covid, SME debt could also be less of a drag on SME investment and economic growth than after the GFC given that credit has been supplied through government schemes on favourable terms. Credit granted to SMEs through the Bounce Back Loan Scheme and the Coronavirus Business Interruption Loan Scheme was relatively cheap and long-term. Finally, current low interest rates limit debt-servicing burdens for firms and much of the additional debt by SMEs has been taken on by healthy firms that experienced temporary turnover shocks during the Covid crisis but have good growth prospects going forward.

Appendix

Table A1: Variable definitions

Variable	Definition
Firm data (BvD FAME)	
Fixed assets	Fixed assets include tangible and intangible fixed assets.
Current assets	Current assets include stock and WIP, trade debt and deposits.
Cash	Bank deposits.
Total assets	Fixed assets and current assets.
Current liabilities	Current liabilities consist of trade credit, short-term loans and overdrafts, and other liabilities, eg corporation tax and dividends.
Long-term liabilities	Includes long-term loans, hire purchases and leases, accruals, deferred tax, pension liabilities.
Short-term debt	Includes short-term loans, overdrafts, hire purchases and leases.
Long-term debt	Includes long-term loans, hire purchases and leases.
Total debt	Short-term and long-term debt.
Net debt	Total debt minus cash.
Total liabilities	Current and long-term liabilities.
Mature firms	Firms aged 10–19 years in 2006.
Old firms	Firms aged 20 years or more in 2006.
Performance	Operating profit to total assets.
Size	Log of total assets.
Capital-intensity	Fixed assets to total assets (dummy is one if above sample median).
Capital-labour ratio	Fixed assets over employment.
Labour productivity	Remuneration and profit divided by employment.

Variable	Definition
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Bank level data (BSD3 and QFS forms)

Bank liquidity ratio	Liquid assets (government bonds and cash) to total bank assets.
Change write-offs	Annual change in write-off rate.
Bank leverage ratio	Total banking book assets divided by eligible capital.

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