Firm Expectations and Indebtedness[†]

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Some tables and graphs are missing in this version because they have not been cleared by the Bundesbank for publication.

This paper explores the link between business outlook and corporate debt. Previous research has found business outlook to be a key determinant of firm investment and firm investment to be a key reason for firms to take on debt. This implies a direct connection between outlook and debt. Indeed, panel regressions show a tight connection between business sentiment and firms' debt growth. A mediation analysis reveals that most of this effect runs through inventories and accounts receivable, whereas for net investment only a smaller effect can be found.

Keywords: Firm expectations, corporate finance, panel regression, mediation analysis.
JEL classification: C23, D22, E51, E52, G11, G21.

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1 Introduction

When and why do firms borrow? This question has been a key interest in economic research for a long time. This issue is, among other things, important because firm debt plays an important role in monetary policy transmission – at least theoretically. The interest rate channel postulates that when interest rates go down, more investment projects become profitable as external finance becomes cheaper. Hence, firms borrow more to invest more. The balance sheet channel, while not an independent channel by itself, postulated that firms' balance sheet quality serves as an accelerator of the effects described by the interest rate channel. However, empirical research has found investment to be rather insensitive to changes in the interest rate, mostly because most investment is financed via internal funds (Best et al. 2024; Sharpe and Suarez 2021). This raises the question: what, then, is driving firm debt?

An explanation for the credit and investment dynamics observed in developed economies that has lived in the shadows for a long time, but gained new attention in wake of the 2008 global financial crisis, is offered by Hyman Minsky's financial instability hypothesis (FIH). Minsky (1977, p. 24) clearly describes the interplay between investment, profits, sentiment, and debt:

> "The behavior of our economy therefore depends upon the pace of investment. In a capitalist economy the valuation that is placed upon capital-assets, which determines current investment, and the ability to fulfill contractual commitments, which determines financing possibilities, depend critically upon the pace of gross profits. Gross profits in turn are largely determined by investment. Thus the ability to debt-finance new investment depends upon expectations that that future investment will be high enough so that future cash flows will be large enough so that the debts issued today will be repaid or refinanced."

The present paper is an empirical test of Minsky's hypothesis that business sentiment is a key driver of firm debt and that the causal effect runs through firms' desire to expand their production when they are optimistic about their future income. To test the hypothesis, I run two sets of regressions. First, I apply fixed effects regressions on balance sheet data from individual firms to see how sentiment impacts debt growth and how the relationship changes when additional controls enter the equation. Second, I apply mediation analyses to zero in on the causal effects. This allows me to unveil through which balance sheet components – tangible assets, inventories, cash, or accounts receivable – the effect of sentiment on debt actually runs.

What are my main findings? My panel regressions show a large and statistically significant effect of sentiment on debt growth: the more optimistic firms are, the more debt they take in. However, the coefficient shrinks strongly once the respective changes in tangible assets, inventories, cash, and accounts receivable are added to the regression. This may be a first hint that those variables are the ones through which the effect of sentiment on debt growth runs. However, it could simply be that those variables and sentiment are spuriously correlated. Hence, we need a proper mediation analysis to decompose the total effect of sentiment on debt growth into a direct effect and an indirect effect through the mediator. The results do indeed reveal a large and statistically significant indirect effects mediated through inventories and accounts receivable. Investment, on the other hand, only has a comparatively small mediation effect.

Taken together, these results generally confirm the key statement of the FIH in that sentiment is a key determinant in production expansion which, in turn, determines debt growth. The role of investment is surprisingly small, though.

Literature. Best et al. (2024) and Sharpe and Suarez (2021) both use survey data to investigate how firms' investment react to changes in interest rates. Both find that interest rate sensitivity for firm investment is rather low, for very similar reasons: First, firms have sufficient internal funds. Second, there are no worthwhile investment projects in the first place or investment projects' return on investment is high enough anyway. The first aspect is important for the present study as it is consistent with the pecking order theory of investment: firms only borrow once their internal funds are insufficient to finance their desired level of investment. The second aspect is important because it indicates that future expectations play an important role in investment and hence in borrowing decisions. Gennaioli et al. (2015) provide direct evidence for that as they directly investigate the impact of CFO expectations on investment growth. Their key finding is that an increase in earnings growth expectations by one percentage point is associated with an increase in planned investment growth by 0.4 percentage points and an increase in actual investment growth by 0.6 percentage points over the following year. This result remains largely unchanged once cash flows of the past year are included in the regression, which are also statistically and economically insignificant by themselves. Gennaioli et al. (2015) interpret this as confirmation of earlier findings that financial constraints lose their explanatory power of firm investment once earnings expectations are taken into consideration. This indicates that there ought to be a direct link between expectations and debt.

Literature investigating this direct link, however, is scarce and, to the best of my knowledge, focused on loan supply and consumer confidence. Anecdotal evidence seems to suggest a rather strong connection between overall sentiment and firm debt growth, at

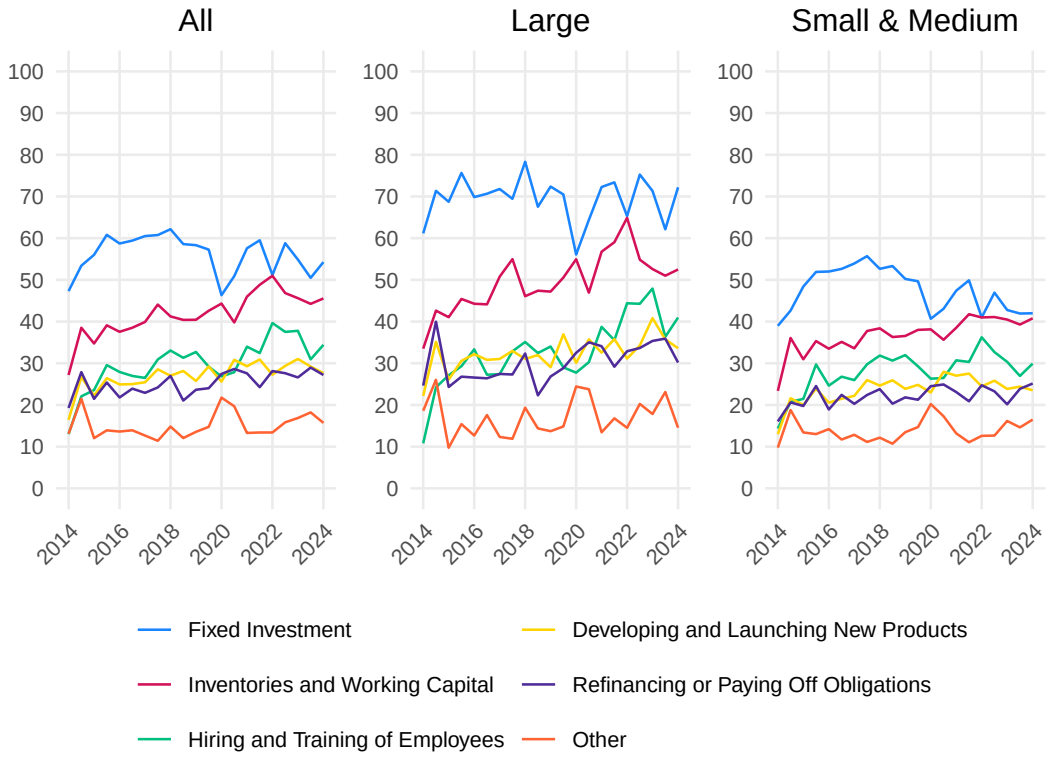
least in Germany (see section 2). The purpose of this paper is to see if this aggregate correlation also holds up to a more thorough econometric investigation at a more granular level.

Caglayan and Xu (2016) find a negative impact of both the level and the volatility of consumer and business sentiment on loan growth. Their explanation is that rising sentiment indicates an overheating economy and hence makes banks to cut their lending. Cubillas et al. (2021), in turn, find a positive impact of investor sentiment on bank lending and bank risk-taking. Delis et al. (2014) focus on anxious periods when sentiment is deteriorating even though the economy is not in a recession, finding that anxiety is associated with a drop in loan supply. Gric et al. (2022) decompose consumer sentiment into a rational and an irrational component and find a positive impact of both on consumer loans.

The contribution of the present paper is that it focuses on loan demand rather than supply. This is important as previous literature has found mixed evidence regarding the effect of bank supply shocks on the loan market. Banerjee et al. (2021), Bentolila et al. (2018), Bottero et al. (2020), Cingano et al. (2016), and Khwaja and Mian (2008), for instance, all use loan-level data to find various kinds of *negative* shocks to banks' balance sheets to make these banks cut loan supply; this, then, transmits to their firm customers who are unable to substitute for those loans and cut their borrowing and economic activity as a consequence. Evidence regarding *positive* shocks – quantitative easing in most cases – is less clear. Chakraborty et al. (2020), Jiménez et al. (2020), and Rodnyansky and Darmouni (2017) find that even if there are sizable effects on loan growth at loan level, these are much weaker or even nonexistent at firm level. Bowman et al. (2015) and Joyce and Spaltro (2014) and Paludkiewicz (2021) and Tischer (2018) all use bank-level data and while the latter two find economically noteworthy effects of QE on lending, the former do not. Amador and Nagengast (2016), building on Amiti and Weinstein (2018), explicitly find aggregate bank supply shocks to impact loan growth negatively and firm demand shocks to impact loan growth positively (see their figure 5). Altavilla et al. (2022) find that supply shocks (and risk factors) in the euro area affect loan conditions, whereas demand shocks seem to determine loan growth. Consequently, if one wants to unveil the determinants of loan growth, focusing on the demand side seems to be a prudent course of action.

This paper is structured as follows. Sections 3 and 4 present the data and the empirical approach, respectively. Section 5 shows the results. Section 7 concludes.

Figure 1: Purpose of External Finance



The graphs show the share of firms that state the respective aspect to be a purpose of borrowing. Multiple answers possible. Source: Survey on the access to finance of enterprises (SAFE).

2 Stylized Facts

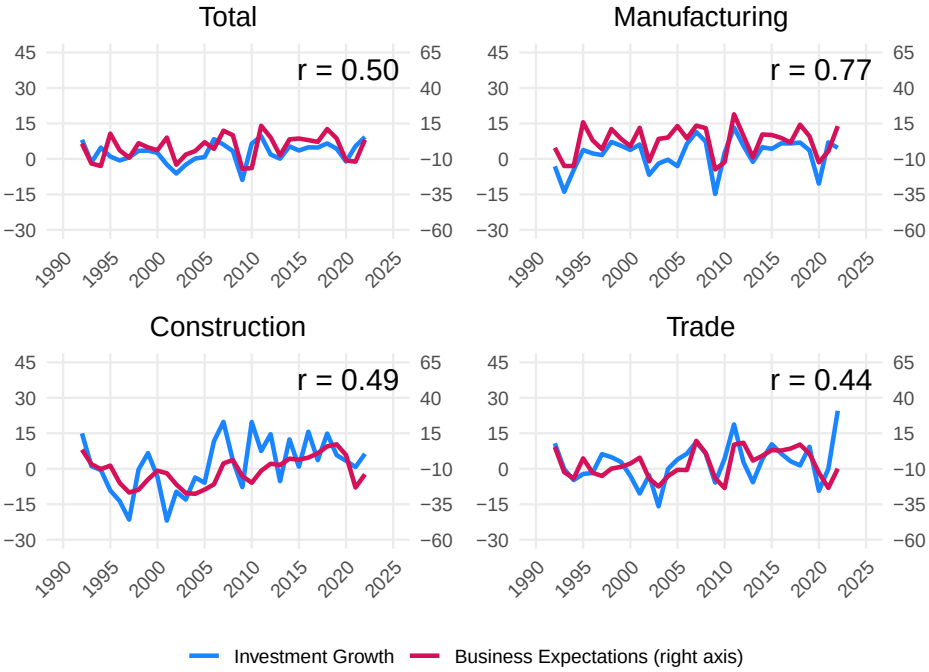
Figure 1 shows the reasons for firms to take in debt according to the survey on the access to finance of enterprises (SAFE), conducted by the ECB. Each line shows the share of respondents giving the respective aspect to have been a reason for borrowing during the past half-year. Since multiple answers are possible, the individual items can sum up to more than 100%. The left panel shows the responses over all firms, the middle panel for large firms, and the right panel for small- and medium-sized firms. Financing fixed investment and inventories and working capital are clearly the two dominant reasons for firms to take on debt, particularly among larger firms. Among the remaining reasons, hiring and training of employees tends to stand out a bit, at least among SMEs. These survey results nicely add up with theories like Minsky's (and others) that postulate a close link between debt and future production.

We have to be careful here, though. As has already been mentioned in the introduction, most investment is actually not debt-financed. Put differently: firms do not necessarily borrow to finance investment, but *if* they borrow a key reason is to finance investment. This distinction is important because it implies that drivers of investment are not neces-

Figure 2: Correlation with Economic Sentiment

(a) Bank Loan Growth

(b) Investment Growth



Loan Growth is the y-o-y growth rate of bank loans from German banks to German firms and economically independent households. Investment growth is the y-o-y growth rate of investment. Business Expectations is the one-year lag of balances between the respective shares of firms with positive and negative outlook. Sources: ifo institute, Bundesbank public database, German Federal Statistical Office.

sarily drivers of debt.

Figure 2 shows the correlation between one-year lag of business expectations and bank loan growth (panel a) respectively investment (panel b) in the German non-service economy (upper left panel), manufacturing (upper right), construction (lower left), and trade industries (lower right). The correlation coefficients between the two time series are depicted in the upper right corners. The graphs and coefficients clearly indicate a rather close relationship between sentiment and both loan growth and investment.

3 Data

In this study, I employ two levels of analysis (see section 4). One in which I use microdata from the ifo institute where I observe both balance sheet data and sentiment data at firm level. And a second one in which I use a much larger firm dataset from the Bundesbank and combine it with industry-level sentiment data.

3.1 ifo business sentiment data

3.1.1 Microdata

To conduct the first stage of my analysis, I use microdata of German companies provided by the Economics & Business Data Center (EBDC) of the ifo institute.[1] The EBDC provides various panels of individual firm data, in which balance sheet data from company databases Amadeus and Hoppenstedt have been linked with survey data from the ifo business surveys (IBS).[2] These datasets are provided in a ready-to-use state. Specifically, I use the business expectations panel (BEP). Before conducting my analysis, I undertake some data manipulations.

The survey responses are measured qualitatively rather than quantitatively. For instance, when asked about their business expectations over the next six months, possible responses are "rather more favorable [1]", "not changing [2]", and "rather less favorable [3]". I re-code all those variables so that an optimistic answer is indicated by $+1$, a neutral answer by 0, and a pessimistic answer by -1 to make the interpretation more intuitive.

Another issue is that the balance sheet data are available at annual frequency, whereas all the expectations survey data are monthly. Since my dependent variable comes from the balance sheet data, my regression analysis is at annual frequency. I transform the monthly variables into annual ones by computing the mean over the past twelve months

[1]Detailed information on the EBDC panels can be found under `https://www.ifo.de/en/ebdc`
[2]Detailed information on the ifo business surveys can be found in Sauer et al. (2023)

Table 1: Descriptive Statistics of ifo Business Expectations Panel

Variable	N	Mean	SD
	dependent variables		
d_total_debt_ta	1194	1.996	13.083
d_bank_debt_ta	1194	.714	8.884
	business sentiment indicators		
statebus	1194	.006	.559
prod	1083	-.004	.282
prices	1119	.004	.269
orders	1194	-.207	.48
comexp	1194	.040	.381
prodexp	1194	.026	.31
priceexp	1194	.076	.309
emplexp	1194	-.145	.377
fincond	527	-.129	.569
composite1	1194	.023	.373
composite2	1194	-.109	.305
	control variables		
d_tangible_assets_ta	1194	.735	8.06
d_inventories_ta	1194	.805	6.36
d_accounts_receivable_ta	1194	1.90	9.64
d_cash_ta	1194	.429	6.50
profits_ta	1194	2.87	9.55
total_debt_ta	1191	44.8	19.4

Descriptive statistics of firm-level variables derived from the ifo business expectations panel. Variable names are labeled in table 2. Source: ifo business expectations panel.

for each month in which the firm's balance sheet is available (which is not always December). This seems reasonable even without the frequency restriction because firms likely make decisions about their debt intake based on their general sentiment over the recent past, not just based on their stance in a single month.

Table 1 shows the descriptive statistics for the business expectations panel; N indicates the firm-years. Business sentiment survey data is available for over 40,000 firms from 1992 to 2022. Unfortunately, though, the balance sheet data is rather limited. Dropping all firm-years for which no balance sheet data is available reduces the panel size to a mere 396 firms, covering 1992 to 2017. After dropping outliers (where the year-on-year change in debt is more than 100% of the previous year's total assets) and all firms for which less than three observations are available, 173 firms respectively some 1,200 firm-years are left. To overcome this unfortunate data restriction, I undertake a second set of regressions in which I combine a much larger firm dataset from the Bundesbank with industry-level sentiment data which are described in the next subsection.

Table 2: Variable Labels

d_total_debt_ta	change in total debt over previous year's total assets
d_bank_debt_ta	change in bank debt over previous year's total assets
statebus	Current state of business
prod	Production in the past three months
prices	Sales prices in the past three months
orders	Assessment of order back log
comexp	Expected commercial situation in the next 6 months
prodexp	Expected production in the next 3 months
priceexp	Expected sales prices in the next 3 months
emplexp	Expected employment in the next 3 months
fincond	Assessment of banks' lending behavior
composite1	(statebus + comexp) / 2
composite2	(orders + prodexp + emplexp) / 3
d_tangible_assets_ta	change in tangible assets over previous year's total assets
d_inventories_ta	change in inventories over previous year's total assets
d_accounts_receivable	change in accounts receivable over previous year's total assets
d_cash_ta	change in cash over previous year's total assets
profits_ta	profits over previous year's total assets
total_debt_ta	total debt over total assets

Labels of variables in table 1. Data source: ifo business expectations panel.

3.1.2 Aggregate Data

The ifo institute also provides aggregate time series of its survey data at NACE-two-digit level.[3] These data are needed for the second stage of my regressions (see below). They show balances of the shares of positive and negative responses of all firms in the respective sector, whereas the responses of an individual firm receive an individual weight that represents its size. These weights are computed according to the formula $(log(x))^e$, with x being the number of employees (manufacturing, construction) or the turnover per year (trade, services). On top of that, the time series are seasonally adjusted. Details can be found in Sauer et al. (2023). The aggregate time series come at monthly frequency and again I transform the aggregate sentiment data into annual averages. Table 3 shows descriptive statistics.

3.2 Bundesbank data

Due to the limited scope of balance sheet data in the ifo business panel (see previous subsection), I run a second set of regressions using microdata of German non-financial corporations provided by the Research Data and Service Center (RDSC) of the Bundesbank. The Individual Financial Statements of Non-Financial Firms (Jahresabschlüsse-

[3]Some of those time series can also be obtained from the European Commission: `https://economy-finance.ec.europa.eu/economic-forecast-and-surveys/business-and-consumer-surveys_en`

Table 3: Descriptive Statistics of ifo Business Survey

Variable	N	Mean	SD
ORDERS	611	-2.08	23.68
PRODEXP	611	6.85	13.53
PRICEEXP	611	9.2	12.97
EMPLEXP	611	-1.12	15.88
COMPOSITE2	611	1.19	16.01

Descriptive statistics of NACE-two-digit industry-level variables. Variable names are labeled in table 2. Source: ifo business survey.

nicht-finanzieller- Unternehmen- Statistik – JANIS)[4] contains detailed balance sheet and income statement data of a total of over 440,000 firms, covering 1997 to 2023 in an unbalanced panel.

Table 4: Descriptive Statistics of Bundesbank Firm Dataset

Variable	N	Mean	SD
	– not yet cleared by Bundesbank –		

Descriptive statistics of firm balance sheet variables. Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, JANIS, 1999-2019, own calculations.

To prepare the JANIS dataset for regression analysis I undertake the following manipulations. First, I undertake plausibility checks to filter firms for which I have full information. This is necessary because in this dataset missing data are set to zero, i.e. we cannot distinguish between true zeros and missing values. Hence, I drop all firms in which the sum of sub-aggregates of a balance sheet item does not add up to the next-higher aggregate as reported in the dataset.[5] Second, I normalize the growth rates of individual balance sheet items by the total assets of the previous year to account for the huge variance in firm size. Third, I remove extreme values: (1) all firms which exhibit total asset growth of more than 200% in any year, (2) all firms whose profitability averaged more than 100% of total assets over the observation period, (3) all firms whose mean profitability is below 100% but whose profitability is more than twice as large as that mean in at least one year. Lastly, I only keep firms which are then left in the dataset for at least four consecutive years to ensure that I have at least four data points for each firm. These adaptions leave me with a total of more than 63,000 firms over my observation period of 1999 to 2019. Descriptive statistics are in table 4.

[4]DOI = 10.12757/Bbk.JANIS.9722.11.11; dataset description in Becker et al. (2023)

[5]For instance, assets (variable `A13000`) ought to be identical to the sum of intangible assets (`A13100`), tangible assets (`A13200`), and financial assets (`A13300`).

4 Empirical Strategy

My first set of regressions run on the ifo microdata, in which I observe both sentiment data raised from surveys and firm balance sheet data at the firm level. My specification looks as follows:

$$\Delta DEBT_{it} = \alpha_i + \beta * EXP_{it} + \gamma * A'_{it} + \epsilon_{it} \quad (1)$$

$\Delta DEBT_{it}$ is the change in debt in year t over total assets in year $t-1$ of firm i. α_i is a firm fixed effect. EXP_{it} is the annual mean business sentiment of firm i in year t. A'_{it} is a vector of control variables. It contains profitability (profits over total assets) lagged leverage (total liabilities over total assets), and the respective change in cash, tangible assets, inventories, and accounts receivables, all normalized by the previous year's total assets. The first two of those controls are included because they can be expected to be important confounding factors: the more internal funds a firm is generating, the lower should be the debt growth, at least according to the pecking order theory of firm finance; a larger pre-existing leverage can be expected to inhibit a firm's borrowing capacity. Hence, a negative coefficient is expected in both cases. The reason why I add the change in cash, tangible assets, inventories, and accounts receivable is because they are the key factors determining firm debt growth (see section 1). All four should have a positive coefficients in regression equation 1. ϵ_{it} is an error term.

The main reason why I normalize all variables by lagged total assets is to control for different firm sizes. A secondary advantage is that this specifications maintains the additivity of my main explanatory variables. This becomes important in the mediation analysis where I use the sum of them as mediator variable (see below). I do not use percentage rates of changes because individual components of the balance sheet could have extremely large growth rates even though they make up only a tiny fraction of total assets. However, the normalization by lagged total assets creates a possible problem: if sentiment is positively associated with absolute debt growth but at the same time also positively associated with equity – e.g. through retained earnings – this might bias the results. Hence, I later run a robustness check in which I use a normalized percentage growth rate.

My second set of regressions run on the Bundesbank microdata. As mentioned above, the sentiment variables now enter the firm-level regression as aggregates at NACE-two-digit level. This slightly changes the specification to the following:

$$\Delta DEBT_{it} = \alpha_i + \beta * EXP_{st} + \gamma * A'_{it} + \epsilon_{it} \quad (2)$$

This time, EXP_{st} is a dummy that is 1 if the annual mean of business sentiment at NACE-two-digit level is positive and 0 else.[6] To compute those means, I use the aggregate sentiment data provided by the ifo data as described in section 3.1.2. All other variables are defined as before. Using the industry-level sentiment has both advantages and disadvantages. The key disadvantage is that it leaves unobserved variance as we do not observe an individual firm's sentiment anymore while all other variables are still at firm level. One important advantage, however, is that using industry-level sentiment in a firm-level regression alleviates possible endogeneity concerns: firm-level variables like past production are known determinants of firm sentiment (Born et al. 2023), but it is unlikely that an individual firm will impact industry-level sentiment. In fact, when computing the aggregate time series, the ifo uses weights that account for firms' size but those weights are designed so that a particular industry-level time series is not determined by an individual firm (Sauer et al. 2023).

My third set of regressions is a mediation analysis. This allows for separating the total effect a treatment variable T has on an outcome variable Y into a direct and an indirect effect. To do so, two equations are estimated in the potential outcomes framework:

$$Y_{it} = \beta_i^Y + \beta_1^Y * M_{it} + \beta_2^Y * T_{it} + \beta_3^Y * B'_{it} + \epsilon_{it}^Y \tag{3}$$

$$M_{it} = \beta_i^M + \beta_1^M * T_{it} + \epsilon_{it}^M \tag{4}$$

The second equation is called the mediation equation and estimates the effect of T on the mediator variable M. The first equation, in turn, is called the outcome equation and regresses the outcome variable on the mediator, the treatment, and a set of control variables B'_{it}. The direct effect of T on Y is then β_2^Y. The indirect effect that runs from T to Y via M is equal to $\beta_1^M * \beta_1^Y$. It tells us how much Y changes due to a change in M which, in turn, goes back to a change in T.[7]

In my specific case, the outcome and treatment variables are defined as above: the change in debt over previous year's total assets respectively a dummy indicating industry-level sentiment. As a mediator variable I use the sum of the change in tangible assets, inventories, cash, and accounts receivable, all normalized by lagged total assets. B'_{it} contains all remaining control variables from equation 2. Additionally, the lagged value of the treatment variable enters both the outcome and the mediation equation as another control. Measuring the indirect effect then represents a direct test of Minsky's hypothesis: an

[6] I use a dummy here because the mediation analysis I undertake later requires a discrete treatment variable. A specification with the continuous version of EXP_{is} is in the robustness checks.

[7] When I run the mediation analysis, I also assume M and T to be interacted as debt growth can be expected to be particularly large for instances of strong tangible asset growth and high sentiment. I did not include this in the notation here for simplicity.

increase in tangible assets (and inventories), triggered by an increase in sentiment, leads to a growth in debt. Consequently, I expect $\beta_1^M \beta_1^Y$ to be positive and statistically significant.

Finally, on a technical note, I 'manually' prepare the dataset for regression by deducting the panel mean from each variable and then run an OLS regression rather than relying on Stata's `xtreg` command. The reason is that the firm-level data from the Bundesbank are unbalanced and are combined with industry-level sentiment data, i.e. multiple firms share the same sentiment variable. However, if those firms are available for different time periods, `xtreg` will compute different panel means for the sentiment variables as the panel variable is the firm ID. Consequently, the more prudent approach is to directly deduct the panel means from each variable at the proper aggregation level and then run `reg`.

5 Results

5.1 Debt growth in the ifo business panel

The first question when it comes to investigating the connection between business sentiment and business debt is which indicator is best suited for measuring business sentiment. The answer is not straightforward. As has been outlined above, the most important reasons for firms to take on debt is to finance fixed investment, to finance inventories and working capital, and to hire and train employees. This indicates that firms' expectations regarding their future production and employment should be the most adequate to explain debt intake. Both are directly raised by the ifo business surveys. However, broader measures like general business expectations or a composite indicator of production and employment expectations might perform better as they capture more than one aspect of credit demand. Also, the current business conditions might play a role. In order to test which indicator performs best, I run a series of regressions the results of which are shown in table 5.

As can be seen, the best performance as measured by R^2 is actually delivered by financing conditions (`fincond`). This variable must be taken with a grain of salt, though. Here, firms are asked about whether banks are accommodating, neutral, or restrictive in their lending behavior. However, until 2016 all firms answered this question, irrespective of whether they actually had entered credit negotiations with their banks. Since, in any given month, most firms do not enter negotiations with banks, the variable hence just catches some general belief of firms about banks' lending behavior. After 2016, only firms that actually had entered credit negotiations with banks answered this question. This, though, limits the number of firms for which this variable is available at all. Hence, I have decided to not consider it in further regressions.

Table 5: Impact of firm-level sentiment indicators on firm-level debt growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
statebus	1.643*										
	(0.947)										
	[0.083]										
prod		3.460**									
		(1.698)									
		[0.042]									
prices			-0.612								
			(1.847)								
			[0.740]								
orders				2.748***							
				(1.056)							
				[0.009]							
comexp					3.011**						
					(1.323)						
					[0.023]						
prodexp						4.561***					
						(1.582)					
						[0.004]					
priceexp							0.567				
							(1.711)				
							[0.740]				
emplexp								5.699***			
								(1.280)			
								[0.000]			
fincond									4.129***		
									(1.392)		
									[0.003]		
composite1										3.597**	
										(1.423)	
										[0.012]	
composite2											6.972***
											(1.631)
											[0.000]
N	1194	1083	1119	1194	1194	1194	1194	1194	527	1194	1194
N_g	173	157	159	173	173	173	173	173	100	173	173
r2	0.003	0.004	0.000	0.007	0.005	0.008	0.000	0.019	0.020	0.006	0.018

Regarding the other sentiment indicators, employment expectations (`emplexp`), followed by production expections (`prodexp`) and assessment of current order back log (`orders`) perform best – just as one might expect following the results from SAFE. The current state of business (`statebus`), current production (`prod`) and general commercial expectations (`comexp`) are doing a little worse and have smaller coefficients – which are still highly statistically significant, though. Current (`prices`) and expected (`priceexp`) sales prices have no statistically significant impact and the sign of `prices` is even negative. I have tested these two indicators as one might argue that rising (expected) sales prices might indicate strong demand for the firm's output, in which case we would expect a positive coefficient. On the other hand, however, rising sales prices might simply reflect rising profits which would reduce the need for external finance and lead to a negative coefficient. As a third alternative, rising sales prices reflect rising costs which are handed on to the customers, in which case the impact on borrowing is not clear.

Finally, I computed two composite indicators. `composite1` is the mean over `statebus` and `comexp` and reflects the ifo business climate index at firm level.[8] `composite2` is the mean over `orders`, `prodexp`, and `emplexp`. Both have larger coefficients and larger R^2 than any of their individual components. On the basis of these results, I consider `composite2` to be the best possible measure of business sentiment. It makes most sense economically as it covers the most relevant factors that arguably impact borrowing decisions and shows the best econometric performance.

Table 6 shows the result of the firm-level regression. In the first specification, I only include the sentiment indicator and its lagged value to control for the firms' longer-term stance. The coefficient of the contemporary value is statistically highly significant and economically large: an increase of `composite2` by one standard deviation increases total debt growth by 2.8% ($= 9.44 * 0.3$) of total assets. That is one fifth of the dependent variable's standard deviation and 1.4 times its sample mean! Adding profitability and lagged leverage (column 2) does not change the picture; profitability and leverage themselves are both economically meaningful and enter with the expected sign in all specifications.

Further adding the change in tangible assets, inventories, accounts receivable, and the change in cash (column 3) reduces the coefficient of sentiment by three quarters and the p-value drops below conventional levels of statistical significance, although it is not dramatically large ($p = 0.17$). Further adding the year-on-year growth rate of real output and the output deflator at NACE-two-digit level (column 4) reduces the effect strength

[8] To be precise, the ifo business climate index is calculated using a geometric mean while I use the arithmetic mean. The difference is negligible, though.

Table 6: Results of regression equation 1

Dependent variable:	d_total_debt_ta			
	(1)	(2)	(3)	(4)
composite2	9.440***	9.765***	2.092	1.635
	(2.050)	(1.996)	(1.528)	(1.851)
	[0.000]	[0.000]	[0.171]	[0.377]
l1.composite2	-0.313	-0.014	0.040	1.917
	(2.001)	(1.945)	(1.448)	(1.738)
	[0.876]	[0.994]	[0.978]	[0.271]
profits_ta		-0.095*	-0.338***	-0.255***
		(0.054)	(0.041)	(0.048)
		[0.076]	[0.000]	[0.000]
l1.total_debt_ta		-0.366***	-0.287***	-0.299***
		(0.051)	(0.038)	(0.044)
		[0.000]	[0.000]	[0.000]
d_tangible_assets_ta			0.518***	0.494***
			(0.046)	(0.050)
			[0.000]	[0.000]
d_inventories_ta			0.636***	0.615***
			(0.054)	(0.058)
			[0.000]	[0.000]
d_accounts_receivable_ta			0.657***	0.662***
			(0.038)	(0.044)
			[0.000]	[0.000]
d_cash_ta			0.279***	0.304***
			(0.049)	(0.061)
			[0.000]	[0.000]
yoy_OUTPUTREAL				-0.061
				(0.070)
				[0.386]
yoy_OUTPUTDEFL				0.015
				(0.074)
				[0.843]
N	899	896	896	760
N_g	171	171	171	159
r2	0.029	0.096	0.504	0.486

of sentiment even further and pushes the p-value to 0.38. However, those two indicators of sectoral economic evolution are neither large nor statistically significant by themselves. As mentioned above, industry-level shocks have been found to be key determinants of firm expectations. Hence, it is of little surprise that the inclusion of sectoral output and price growth is driving down the coefficient and p-value of sentiment.

The main take-away from this firm-level regression is that business sentiment, by itself, has a large effect on firm debt growth. When additional control variables enter the

regression, though, the effect strength decreases drastically. This is not too surprising in lieu of both the theoretical foundations, which stipulate that the effect of sentiment on debt runs through fixed investment and inventories, and the empirical evidence uncovered by previous research that firms tend to have extrapolative expectation formation, i.e. their current business situation determines their sentiment about the future. Hence, business sentiment does not add too much to the information set once 'hard' business data are already available. However, as sentiment data are usually available much quicker than most other data, sentiment may serve as a powerful lead indicator for debt growth for policy makers. The next step is to test whether these firm-level results also hold for a larger sample of firms and at a more aggregate level.

5.2 Debt growth in the Bundesbank data

5.2.1 Panel regression results

Since the ifo data is rather limited in scope with less than 200 firms with sufficient balance sheet information available, I repeat my analysis using the firm dataset provided by the Bundesbank (JANIS) which contains more than 63,000 firms even after dropping implausible values and outliers. Unfortunately, data protection regulations prohibit linking the ifo survey data and the Bundesbank firm data at firm level. Hence, in the following regressions all the sentiment data are aggregates at NACE-two-digit level while the balance sheet data are at firm level. Another difference is that all the sentiment variables are dummy variables that are equal to 1 when the industry-level sentiment is positive and 0 otherwise. A specification with continuous variables will later be undertaken as a robustness check. As before, I start with a performance test of different sentiment indicators. Since the full aggregate data are not readily available for free, I focused on those indicators that are most potent at firm-level. The results are shown in table 7.

This time, the single most potent sentiment indicator in explaining firm debt growth, as measured by R^2, is production expectations (`PRODEXP`). This is not surprising: when firms expect to increase their production, they are going to purchase additional input goods and eventually additional investment goods when they need to expand their production capacity and will hence borrow to do so. Interestingly, unlike their firm-level counterparts, aggregate price expectations do not perform any worse than the other indicators. On the contrary, `PRICEEXP` shows the largest coefficient of all indicators. The reasons are difficult to assess. One explanation is that when many firms simultaneously raise their prices, this indicates either a general demand or a general supply shock both of which will cause firm debt to increase – either to expand production or to cope with increasing input costs which requires more pre-financing even against rising sales prices.

Generally, all these aggregate indicators are highly correlated anyway, probably due to aggregation effects. This is probably also the reason for why the composite indicator `COMPOSITE2`, which again is the mean between `ORDERS`, `PRODEXP`, and `EMPLEXP`, does not perform that much better than any of its individual components. Still, I will proceed using this indicator as sentiment measurement in all further regressions to maintain comparability with the regressions using firm-level sentiment.

Table 7: Impact of industry-level sentiment indicators on firm-level debt growth

Dependent variable:	d_total_debt_ta				
	(1)	(2)	(3)	(4)	(5)
	– not cleared for publication yet –				
N					
R^2					

Sources: ifo Business Surveys; Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, JANIS, 1999-2019; own calculations.

Table 8 shows the results of regression equation 2. The first two columns replicate the first two columns of table 6. The results are largely similar. Current sentiment alone is strongly associated with rising debt (column 1): when the balance of industry-level sentiment is positive, a firm's debt growth as a percentage of total assets increases by 1.9%. Adding profitability and lagged leverage as controls (column 2) reduces the effect to 1.3% of total assets. In column (3) I add the mediator variable (the sum of change in tangible assets, inventories, cash, and accounts receivable). The coefficient of the sentiment dummy now even turns negative, but is very small. The coefficient of the mediator is positive and large, as was to be expected: increasing growth of the mediator by 1 euro increases debt growth by 70 cents. In column (4), I add all the components of the mediator separately. Unsurprisingly, the results are grossly the same as in column (3). All regressors have a strong and statistically significant impact on debt growth.

What do the results shown in table 8 imply? As we have seen, sentiment alone is strongly positively correlated with debt growth when entering as the only regressor. Adding additional explanatory variables, though, not only causes the effect to vanish but even to turn negative. One interpretation could be that the strong effect observed in column (1) is mediated through the other regressors. However, it might as well be that it is simply a spurious correlation between those very regressors and sentiment which leads to those results. A proper mediation analysis will help us shed light on the issue.

Table 8: Results of regression equation 2

Dependent variable:	d_total_debt_ta			
	(1)	(2)	(3)	(4)
– not cleared for publication yet –				
N				
R^2				

Sources: ifo Business Surveys; Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, JANIS, 1999-2019; own calculations.

5.2.2 Mediation analysis

Table 9 shows the results of the mediation analysis as described by equations 3 and 4. In column (1), the outcome and mediator variables are as above. NIE, NDE, and TE are the natural indirect effect, natural direct effect, and the total effect, respectively. The bottom panel shows the coefficient β_1^M which shows us how the mediator variable changes when we change the treatment variable from 0 to 1. The NIE is $\beta_1^M * \beta_1^Y$. The NDE is β_2^Y. The TE is the sum of the two.

The NIE is the direct test of Minsky's hypothesis: how much does debt growth change due to a change in the sum of investment, inventories, cash, and accounts receivable induced by a change in sentiment? The NDE is the direct impact that sentiment has on debt growth. The five coefficients are very similar to those we observe for the sentiment indicator in columns (1) and (3) of table 8. This indicates that the specifications in table 8 do in fact hint at a causal effect and not just a correlation between the regressors.

What do these results mean in economic terms? The strong, positive, and statistically significant direct effect is a confirmation of the hypothesis tested: when firms are more optimistic about the future, they increase their tangible assets, inventories, cash, and accounts receivable and that, in turn causes their debt to grow faster. What is startling a little bit, though, is the negative direct effect: when firms are more optimistic, their debt grows more slowly, all else equal. This is counter-intuitive as we would expect the direct effect to be zero in a correctly specified model that fully captures all mediation effects. Now there is a good chance that my model does not cover all mediation effects as I have no information on the employment growth of firms or their R&D activities which, according to SAFE, are two more key reasons for firms to borrow (see figure 1). Still, though, the

NDE should be non-negative in this case. One possible explanation is that the negative NDE captures a denominator effect. Remember, the dependent variable is debt growth over lagged total assets. If sentiment is also determined by past firm performance and firm performance is reflected in strong total asset growth then the negative NDE reflects the fact that total assets in the previous year where growing particularly strongly which impacts the dependent variable negatively. As we will see in the robustness checks, the NDE is also positive when defining all variables in growth rates rather than normalizing them by lagged total assets.

In columns (2) to (5) of table 9 I run different mediation specifications, using each of the components of the composite mediator variable as mediator with the respective other three variables entering the outcome regression as controls. Interestingly, the indirect effect of investment (column 2) is rather small: when the treatment is 1 rather than 0, the associate increase in tangible asset growth increases debt growth by only 0.08% of total assets. For inventories and accounts receivable (columns 3 and 5), the effect is 0.9% and 0.8% of total assets, for cash (column 4) it is only 0.02%.

The meager mediation effect of investment we observe in column (2) is neither in line with the financial instability hypothesis of Minsky nor with the survey results of SAFE. There are multiple explanations. First, I measure the change in tangible assets, i.e. *net* investment. Gross investment might be the more appropriate variable as firms can be expected to undertake costly replacement investment when they are sufficiently confident about their future income. Unfortunately, gross investment is not available in this dataset. Second, closely related to the first point, the data does not contain any measure to control for capacity utilization. This is very important, though, when it comes to net investment: when the economy comes out of a recession and firms are starting to become more optimistic about the future again, but still produce well below their capacity, expanding their production will not require net investment. Third, investment could be subject to huge delays between decision and execution. Firms might decide to increase their tangible assets when their sentiment is up, but until those assets actually show up in their balance sheet, their mood might already have changed again. This might blur the observed relationship between the two variables. A hint into this direction could be that of all moderation equations (table 9, lower panel) the one for investment is the only one where lagged sentiment has a positive coefficient. This shows that the relationship between sentiment and investment is less straightforward than between sentiment and the other moderators.

On the other hand, the strong indirect effects we observe with inventories and accounts receivable (columns 3 and 5) are very much in line with both the FIH and the SAFE

results. Production expansion will always require additional input goods, irrespective of capacity utilization. At the same time, accounts receivable and its liability-side counterpart, liabilities arising from goods and services, will rise simultaneously.

Table 9: Results of mediation analysis, equations 3 and 4

Dependent variable:	d_total_debt_ta				
	(1)	(2)	(3)	(4)	(5)
– not cleared for publication yet –					
N					
R^2					

Sources: ifo Business Surveys; Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, JANIS, 1999-2019; own calculations.

6 Robustness Checks

6.1 Use continuous sentiment variable

In this section, I repeat all regressions from the main specification, but use the original continuous variables as sentiment indicators rather than dummy variables. The motivation is that by this I have a more precise measurement of sentiment than through a dummy. As mentioned in section 4, the mediation analysis requires a discrete treatment variable. Strictly speaking, this not true. To be precise, in mediation analysis we predict the mediator variable for different levels of the treatment variable. If the treatment variable is continuous, those levels need to be specified. Hence, for the purpose of the mediation analysis, I standardize the sentiment indicator so that it has a mean of 0 and a standard deviation of 1:

$$COMP_{std} = \frac{COMP - mean(COMP)}{sd(COMP)} \tag{5}$$

The results are shown in tables A1 through A3. They grossly confirm the results from the main specification. The coefficients in A3 show the change of the outcome variable if the treatment variable is one standard deviation below or above its mean.

6.2 Yoy growth rates

In this section, I repeat all regressions from the main specification specifying all variables in terms of percentage growth rates rather than the change over lagged total assets. As mentioned in section 3.2, the reason why I did not use this as the main specification is that balance sheet items may have very large growth rates even when they make up only a tiny fraction of total assets. The motivation to undertake this robustness check is to see whether the negative direct effect observed in the mediation analysis above still prevails. If this was indeed due to a denominator effect, then it should no longer show up in this robustness check.

To avoid absurdly large rates of change to bias my results, I compute normalized growth rates described by the following equation:

$$x_{i,t}^{yoy} = \frac{x_{i,t} - x_{i,t-1}}{(x_{i,t} + x_{i,t-1})/2} * 100 \tag{6}$$

This measure has two advantages. First, it is $\in [-200, 200]$. Second, it is also defined when a variable is zero in $t - 1$.

The result shown in table A4, A5, and A6. By and large, the patterns are the same as in the main specification. Most importantly, the direct effect of sentiment on debt growth in the mediation analysis is no longer negative. This shows that the negative effect we observe in the main specification was probably due to a denominator effect.

6.3 Impact on bank loans

In this section, I repeat all regressions from the main specification but use the change in bank loans as dependent variable, rather than the change in total debt. Bank loans are a narrower measure of external finance. Most importantly, they exclude trade credit, which might be an important driver of total debt but should hardly ever be used to finance fixed investment. Hence, one might argue that investment is a potent mediator between sentiment and bank debt. However, as the results depicted in tables A7 through A9 show, neither the panel regressions nor the mediation analysis show any stark differences compared to the main specification. The coefficients are generally smaller than in the main specification, but this is simply due to the fact that bank debt makes up a smaller share of total assets than total debt does.

7 Conclusion

In this paper, I investigated the relationship between business sentiment and firm debt growth. According to Minsky's financial instability hypothesis, there should be a strong effect of the former on the latter with the causality primarily running through investment: when firms become more optimistic about their future income, they will seek to increase their production and hence acquire additional capital assets which requires external finance. Results from the survey on the access to finance of enterprises (SAFE) confirm that financing fixed investment is the primary reason for firms to take in debt, as is financing inventories and working capital. My regressions confirm that business sentiment has a strong and statistically significant impact on debt growth. Mediation analyses confirm that this is indeed a causal effect. However, the primary driver here is not investment but inventories and accounts receivable.

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Appendix

This appendix contains all the regression tables from the robustness checks to maintain the readability of the main text.

Use continuous sentiment variable

Table A1: Impact of industry-level sentiment indicators on firm-level debt growth

Dependent variable:	d_total_debt_ta				
	(1)	(2)	(3)	(4)	(5)
– not cleared for publication yet –					
N					
R^2					

Sources: ifo Business Surveys; Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, JANIS, 1999-2019; own calculations.

Table A2: Results of regression equation 2

Dependent variable:	d_total_debt_ta			
	(1)	(2)	(3)	(4)
– not cleared for publication yet –				
N				
R^2				

Sources: ifo Business Surveys; Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, JANIS, 1999-2019; own calculations.

Table A3: Results of mediation analysis, equations 3 and 4

Dependent variable:	d_total_debt_ta				
	(1)	(2)	(3)	(4)	(5)
– not cleared for publication yet –					
N					
R^2					

Sources: ifo Business Surveys; Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, JANIS, 1999-2019; own calculations.

Yoy growth rates

Table A4: Impact of industry-level sentiment indicators on firm-level debt growth

Dependent variable:	d_total_debt_ta				
	(1)	(2)	(3)	(4)	(5)
– not cleared for publication yet –					
N					
R^2					

Sources: ifo Business Surveys; Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, JANIS, 1999-2019; own calculations.

Table A5: Results of regression equation 2

Dependent variable:	d_total_debt_ta			
	(1)	(2)	(3)	(4)
– not cleared for publication yet –				
N				
R^2				

Sources: ifo Business Surveys; Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, JANIS, 1999-2019; own calculations.

Table A6: Results of mediation analysis, equations 3 and 4

Dependent variable:	d_total_debt_ta				
	(1)	(2)	(3)	(4)	(5)
– not cleared for publication yet –					
N					
R^2					

Sources: ifo Business Surveys; Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, JANIS, 1999-2019; own calculations.

Impact on bank loans

Table A7: Impact of industry-level sentiment indicators on firm-level debt growth

Dependent variable:	d_bank_debt_ta				
	(1)	(2)	(3)	(4)	(5)
– not cleared for publication yet –					
N					
R^2					

Sources: ifo Business Surveys; Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, JANIS, 1999-2019; own calculations.

Table A8: Results of regression equation 2

Dependent variable:	d_bank_debt_ta			
	(1)	(2)	(3)	(4)
– not cleared for publication yet –				
N				
R^2				

Sources: ifo Business Surveys; Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, JANIS, 1999-2019; own calculations.

Table A9: Results of mediation analysis, equations 3 and 4

Dependent variable:	d_bank_debt_ta				
	(1)	(2)	(3)	(4)	(5)
– not cleared for publication yet –					
N					
R^2					

Sources: ifo Business Surveys; Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, JANIS, 1999-2019; own calculations.