Organisation for Economic Co-operation and Development

ECO/WKP(2021)46

Unclassified

English - Or. English

13 December 2021

ECONOMICS DEPARTMENT

EXAMINING THE IMPACT OF DEBT ON INVESTMENT FOR AUSTRIAN NON-FINANCIAL SECTORS AND FIRMS

ECONOMICS DEPARTMENT WORKING PAPERS No. 1695

By Dennis Dlugosch and Selçuk Gul

All Economics Department Working Papers are available at www.oecd.org/eco/workingpapers.

JT03487353

Abstract/Résumé

Examining the impact of debt on investment for Austrian non-financial sectors and firms

Using a micro-level model of investment, this paper finds that firm-debt and investment are negatively associated across firms in Austrian manufacturing industries. The finding is robust to various changes to the model specification. Moreover, in an extension of the basic model, different components of debt are examined, pointing out that debt owed to banks and long-term debt have a stronger negative effect than other forms of debt. Comparisons with investment models estimated for other European countries suggest that the impact of debt on investment is more negative in Austria than elsewhere. Results from interaction models of debt owed to banks with an index of credit easing show that firms in industries which are more bank-dependent invest relatively more than firms in industries that are less bank-dependent after an easing of credit conditions.

This working paper relates to the 2019 OECD Economic Survey of Austria
https://www.oecd.org/economy/austria-economic-snapshot/

Keywords: Corporate investment, corporate debt, Austria

JEL Codes : E22, E44

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L'impact de l'endettement sur l'investissement des secteurs et des entreprises non-financiers en Autriche

En utilisant un modèle d'investissement au niveau micro, cet article trouve que l'endettement bancaire et l'investissement sont associés négativement dans les entreprises manufacturières autrichiennes. Le résultat est robuste à diverses modifications apportées à la spécification du modèle. De plus, dans une extension du modèle de base, différentes composantes de l'effet de levier sont examinées, soulignant que la dette bancaire et la dette à long terme ont un effet négatif plus fort que les autres formes de dette. Les comparaisons avec les modèles d'investissement estimés pour d'autres pays européens suggèrent que l'effet de levier sur l'investissement est plus négatif en Autriche qu'ailleurs. En outre, les résultats des modèles d'interaction de l'effet de levier bancaire avec un indice d'assouplissement du crédit montrent que les entreprises des secteurs plus dépendants des banques investissent plus que les entreprises des secteurs moins dépendants des banques après un assouplissement des conditions de crédit.

Ce document de travail est lié à l'Étude économique de l'OCDE de 2019 consacrée à l'Autriche
https://www.oecd.org/fr/economie/autriche-en-un-coup-d-oeil/

Mots-clés : Investissement, dette, Autriche
Code JEL : E22, E44

Table of contents

Tables

Figures

Examining the impact of debt on investment for Austrian non-financial sectors and firms

By Dennis Dlugosch and Selçuk Gul

1. Introduction

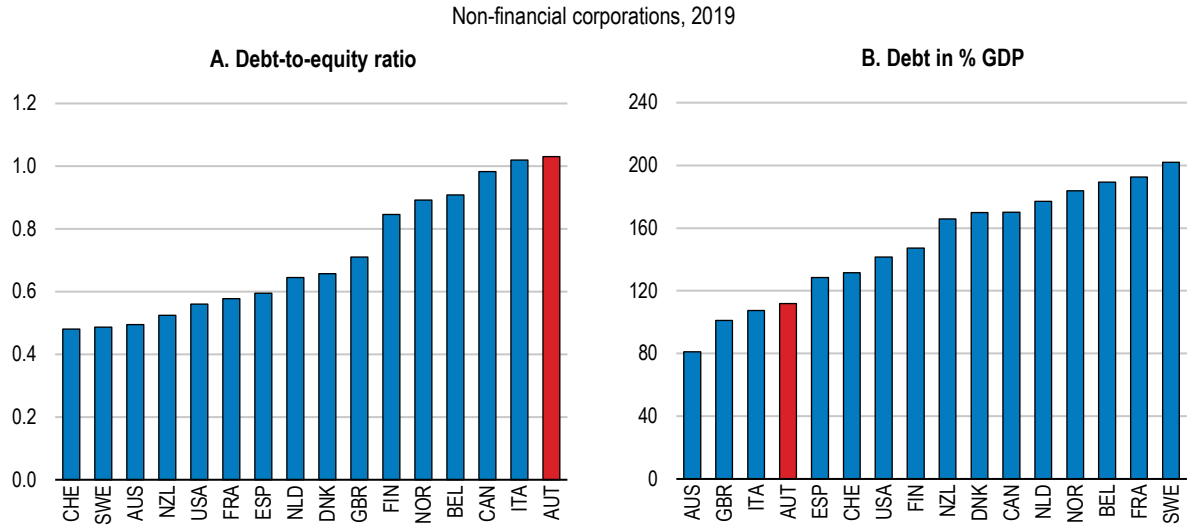
This paper analyses the relationship between leverage and investment across Austrian firms. Austria's financial system is a typical example of a traditional bank-based system and thus may serve as an interesting case study. The so-called Austrian *Hausbank* (home bank) system relies on the close relationship between bankers and business owners. This helps to mitigate conflicts arising from asymmetric information, since due to the close relations, bankers often have access to better information (Dirschmid and Waschiczek, 2005). The Austrian model benefits bank lending across all firm sizes, as spreads between borrowing rates for SMEs and large firms are among the lowest across OECD countries (Gassler, Pointner and Ritzberger-Grünwald, 2018).

Given the generally good access to bank financing for firms across all sizes and the less developed markets for risk capital (e.g. Dlugosch et al., 2020), it is not surprising that the capital structure of Austrian firms is biased towards debt-financing. Still, when compared to other OECD countries, in particular to other bank-based systems, Austria stands out as having high debt-to-equity ratios, combined with relatively moderate levels of debt in the aggregate (Figure 1) reflecting a comparatively low level of equity capital.

Against this background, this paper examines the relationship between debt and investment for Austrian non-financial sectors and firms. Using a reduced-form error-correction model of corporate investment, it finds that, higher debt is associated with lower levels of investment. A breakdown of debt into its different components reveals that the negative impact is highest for debt owed to banks and long-term debt. Results from extended models based on a broad sample of European countries suggest that the impact of deb is more negative in Austria than elsewhere. Further, interactions of the dependency on bank-based debt with an index reflecting the stance of credit conditions imply that firms in industries that use more debt owed to banks invest more when credit conditions are significantly eased. This finding may be interpreted as that investment of Austrian non-financial firms is strongly dependent on credit supply.[1]

[1] Dennis Dlugosch works as an Economist on the Austria/Turkey desk of the Economics Department of the OECD. Selçuk Gul is an Economist working for the Central Bank of the Republic of Turkey and co-authored this paper while being seconded to the Austria/Turkey desk of the Economics Department of the OECD. The authors would like to thank Rauf Gönenç, Volker Ziemann , Oliver Denk (all from ECO) and Sebastian Barnes (former ECO, now Banque de France) for very useful comments and suggestions. The paper has also benefitted from comments by Austrian officials and by members of the OECD Economic and Development Review Committee. Special thanks go to Eun Jung Kim for statistical assistance and to Heloise Wickramakaye for editorial assistance.

Figure 1. High debt-to-equity ratios but moderate total leverage point to lack of equity capital



Source: OECD (2020), OECD Financial Dashboard and BIS International Debt Securities Statistics.

While the provision of bank loans in Austria is highly developed and accessible by firms of all sizes at relatively narrow spreads, the empirical evidence in this paper may be interpreted such that Austrian firms would benefit from a more diversified capital structure.

The paper is structured as follows. Section 2 reviews the previous work on the relationship between leverage and investment at the micro-level. Section 3 explains in greater detail the approach taken in this paper to model investment. Section 4 introduces the data, while section 5 presents and discusses the results of the main empirical analysis and various extensions and robustness checks. Section 6 concludes and discusses some implications for policymakers.

2. Related literature

This study is related to the literature on the impact of external financing constraints and leverage on corporate investment. Several firm-level studies have provided evidence that high corporate debt, on average, leads to lower investment. Using a comprehensive firm data set from eight European countries, Kalemli-Özcan et al. (2019) investigate whether the financial conditions play a role in explaining weak investment expenditure in Europe after the Global Financial Crisis. Their findings suggest that investment of firms with higher debt level declines more after the crisis than the investment of firms with lower debt level.

Gebauer et al. (2018) use firm level data from five peripheral euro area countries. They estimate an investment model that includes both internal and external financing constraints based on a panel threshold approach. Their results point to a non-linear relationship; investment and leverage are associated positively up to a certain threshold, but significantly negative if leverage exceeds the threshold value.

Using BACH data, Buca and Vermeulen (2017) examine whether the relationship between investment and debt differs for bank dependent borrowers. Using data at the industry-size level for six euro area countries they provide empirical evidence that, following a common shock to bank lending, the negative impact of leverage on firms' investment is significantly stronger for bank-dependent borrowers. Since this finding

does not depend on the overall leverage position, it supports the view that different components of debt matter for the analysis of the relationship between debt and corporate investment.

Several other studies approach the phenomena from different perspectives such as the differential impact of debt with respect to tangibility of assets (see Sun et al., 2019 and Ferrando and Preuss, 2018), the role of bank leverage and trade credit in financing investment, in particular during times with tighter financial conditions, (see Carbo-Valverde et al., 2016; Casey and O'Toole, 2014, and Ferrando and Mulier, 2013), and the impact of debt maturity on the relationship between leverage and investment (see Fernandez, 2011 and Aivazian et al., 2005).

The growing importance of intangible investments suggests that a more diversified capital structure can lift investment and productivity. While financial development in general tends to benefit economic growth by reducing firms' costs of external capital (Rajan and Zingales, 1998), equity and credit markets tend to play different roles in fostering investment in intangibles. Intangibles investment are more difficult to value, because they tend to be partly embedded in human capital. Additionally, information on business success of new technologies without a track history is likely to be sparse. Therefore, intangible investments are more difficult to use as collateral (Hall and Lerner, 2010). Further, young firms in high-tech sectors, which are likely to experiment with these new technologies and foster their diffusion, have more uncertain and skewed returns (Brown,Fazzari, and Petersen, 2009), restricting the use of credit. By contrast, equity investors share the full upside returns and require no collateral requirements. Moreover, additional equity does not increase the probability of default (Hsu, Tian, and Xu, 2014). Empirical evidence underscores that external finance through equity benefits innovative activity, especially in high-tech sectors (Brown, Martinsson, and Petersen, 2012; Hsu, Tian, and Xu, 2014).

3. Modelling firm-level investment

This paper investigates the relationship between debt and investment using micro-level data for Austria. The empirical strategy builds on an error-correction framework, a widely used approach in the empirical literature on micro-level investment (e.g. Bond et al., 2003; Bloom, Bond and van Reenen, 2007; Mulier et al., 2016; Buca and Vermeulen, 2017). The model rests on a long-run specification for firms' demand for capital derived from the optimization problem of a profit maximising firm. It also allows for short-run deviations from this equilibrium. The error-correction model has the advantage over investment models based on the q-theory of investment that it does not require data on the market value of equity. Therefore it is ideal for analysing the investment decisions of a wide set of firms, including smaller firms like in this paper, where there is no price for equity capital, or only a very narrow and illiquid market for equity. With a constant returns to scale CES production function and under the assumption of no adjustment costs, the desired long-run level of capital is given by the profit maximising capital stock:

$$k_{it} = a_i + y_{it} - \sigma v_{it} \quad (1)$$

where k_{it} is the logarithm of the capital stock in firm or sector i at time t, y_{it} the logarithm of output, v_{it} the user cost of capital and σ the sensitivity of the capital stock with respect to the user cost of capital. The a_i captures firm-specific differences in their reaction to the user cost of capital (Cehtty, 2007) or firm-specific parameters of the underlying production function.

Due to adjustment costs, the actual level of the capital stock may deviate from its desired level in the short-run. The error-correction model incorporates these deviations by allowing for short-run fluctuations around the long-run equilibrium. Under the assumption that the user cost of capital can be controlled for by time-specific and firm-specific fixed effects (Bond et al., 2003; Buca and Vermeulen, 2017) and a lag structure which allows up to second-order dynamics, the capital stock can be described with the following equation:

$$k_{it} = \alpha_1 k_{it-1} + \alpha_2 k_{it-2} + \beta_0 y_{it} + \beta_1 y_{it-1} + \beta_2 y_{it-2} + d_t + \theta_i + \varepsilon_{it} \quad (2)$$

where d_t represents the year fixed effects, θ_i is an intercept and ε_{it} is an error term. The restriction $(\beta_0 + \beta_1 + \beta_2)/(1 - \alpha_1 - \alpha_2) = 1$ needs to hold such that equation (2) is consistent with equation (1). The equation (2) can then be rewritten as an error-correction model:

$$\Delta k_{it} = (\alpha_1 - 1)\Delta k_{it-1} + \beta_0 \Delta y_{it} + (\beta_0 + \beta_1)\Delta y_{it-1} - (1 - \alpha_1 - \alpha_2)(k_{it-2} - y_{it-2}) + d_t + \theta_i + \varepsilon_{it} \quad (3)$$

The coefficient on the long-run desired level of capital, $(k_{it-2} - y_{it-2})$, is expected to be negative. A negative coefficient implies that at levels of capital higher (lower) than desired level, the associated investment declines (rises) to bring the capital stock to its equilibrium value.

Measuring the growth rate of the capital stock, Δk_{it}, by net investment, I_{it}, and scaling with the level of the capital stock at the beginning of the period yields the final error-correction specification:

$$\frac{I_{it}}{K_{it-1}} = \gamma_0 \frac{I_{it-1}}{K_{it-2}} + \gamma_1 \Delta y_{it} + \gamma_2 \Delta y_{it-1} + \gamma_3 (k_{it-2} - y_{it-2}) + \gamma_4 \frac{Cashflow_{it-1}}{K_{it-2}} + \gamma_5 \frac{Total\ debt_{it-1}}{K_{it-2}} + d_t + \theta_i + \varepsilon_{it} \quad (3)$$

Besides real factors, financial conditions can impact investment spending. Shocks which reduce the amount of internal funds or increase the costs of external financing can hinder firms in reaching their target capital-output ratio (Bernanke et al., 1996). To control for the role of sources of internal and external financing, the specification incorporates a measure for cash-flow, $\frac{Cashflow_{it-1}}{K_{it-2}}$, and the stock of external debt, $\frac{Total\ debt_{it-1}}{K_{it-2}}$ (Aivazian et al, 2009; Buca and Vermeulen 2017). The cash-flow measure encompasses funds from equity financing, and thus also accounts for the strength of internal financing.

4. Data

The analysis uses industry-level data on Austrian industries from the BACH (Bank for the Accounts of Companies Harmonized) database, created by a sub-body of a group of European National Central Banks and maintained by the Banque de France. BACH provides annual balance-sheet data of European non-financial companies aggregated by industry (NACE Rev. 2) and by size (small, medium and large) categories. Thus for each year and for each NACE Rev. 2 industry cell, BACH provides aggregate statistics (weighted mean, 10% percentile etc.) based on firm-level data for small, medium and large corporates. The estimation sample in this analysis includes all non-financial Austrian industries (74 business sectors excluding utilities and real estate sectors) over the 2000-2016 period. The panel dimension of the study is given by the industry-size dimension of the data and is composed of 193 industry-size cross-sectional units. To avoid the impact of outliers on the estimation results, we winsorize all variables entering the regressions at the 1% percentile symmetrically (as for example Buca and Vermeulen, 2017).

Table 1 depicts summary statistics. Over the 2000-2016 period, average annual growth of total investment scaled by total assets is 16.6%. Total investment varies significantly through the period considered. The average bank debt-to-capital stock is 77% with a standard deviation of 59%. This variable only represents the amount of debt owed to credit institutions. A similar pattern is observed regarding debt with different maturities. Short-term debt is, on average, six times greater than the long-term average. These statistics based on industry-size level data for Austria are broadly comparable to statistics based on firm-level from Orbis for Austria, but also for other European countries (Mulier et al. 2016).

Table 1. Summary Statistics

Variable	Mean	Median	Std. Dev.
Investment (t) / Capital(t-1)	0.1660	0.0514	0.5260
Output growth (t)	0.0793	0.0593	0.2538
Ln(Capital(t-2)/Output(t-2))	-1.3956	-1.4145	0.8304
Cash flow(t-1)/K(t-2)	0.3454	0.2698	0.2938
Total debt (t-1)/Capital(t-2)	3.0528	2.2343	2.8651
Bank debt (t-1)/Capital(t-2)	0.7720	0.6728	0.5875
Non-Bank debt (t-1)/Capital(t-2)	2.2808	1.5048	2.5750
Long-term debt (t-1)/Capital(t-2)	0.3848	0.3217	0.4877
Short-term debt (t-1)/Capital(t-2)	2.6680	1.8656	2.6922

Note: This table shows sample means, medians and standard deviations of Austrian non-financial industries across different size categories for all variables entering the main regression specification. The period of analysis spans the years from 2000 to 2016. The mean for Investment (t) / Capital(t-1) thus denotes the average of the investment ratio across all non-financial industries, across all three size categories and for Austria in the 2000-2016 period. Capital refers to total assets, output to total sales.

5. Results

The estimation of the dynamic investment model follows the Arellano-Bover/Blundell-Bond system GMM approach (Arellano and Bover, 1995; Blundell and Bond, 1998). This estimator allows to address the endogeneity problem that arises from the correlation of the unobserved cross-sectional fixed effect and the lagged dependent variable. The selection of instruments follows Roodman (2009). Standard errors are clustered by industry and size

Table 2 reports the regression results of estimating equation (3). The regressions are well specified and pass the usual tests. The results of the *m2* specification test indicates that the hypothesis of second-order autocorrelation in the residuals can be rejected. The result of the Sargan-Hansen implies that the hypothesis, that the a priori restrictions on the coefficients are valid, cannot be rejected, suggesting that the set of instruments are valid. Coefficient estimates on the standard determinants of investment are in line with those generally found in the investment literature: the estimated coefficient on the capital-output ratio is negative and significant, suggesting that firms undertake corporate investment if the long-run value of the desired capital-output ratio differs from its actual value. The impact of cash-flow on investment is positive. The positive sign is interpreted as a sign of financial constraints, since cash-flow may help to pursue investment activity even if access to credit is impeded. Sales growth is positively associated with corporate investment.

The empirical results suggest that higher debt is associated with lower investment for Austrian non-financial industries. The result is consistent with economic explanations based on firms' perceived probability of default, since from a credit-supply perspective, the level of debt is an indicator of the firm's default probability. An increase in debt would thus decrease the firm's creditworthiness by increasing its default risk. The baseline model is also estimated using alternative leverage definitions such as bank and non-bank debt, and short and long term debt to investigate whether the results is robust to different types of debt[2].

Based on a comparison of the magnitude of coefficients, the point estimates imply that proportional changes to different forms of debt lead to different impacts on investment. In particular, the results indicate that bank debt is more negatively associated with investment than non-bank debt. This finding is in line with the empirical results of Buca and Vermeulen (2017), suggesting that bank-dependent borrowers invest

[2] Further, a non-linear relationship between leverage and investment is tested through the inclusion of a squared leverage term. Results on the squared term were, however, not statistically significant.

less if credit conditions are tight. Non-bank leverage is composed of three main elements: Debt owed to international investors following bond issuances, intra-group credits, and debt owed to other non-financial creditors, including trade credit but also pensions liabilities. These three debt types have distinct characteristics as compared to debt owed to banks. Firms issuing bonds are generally large and well-audited, while small and medium sized firms mostly lack access to corporate bond markets. Debt to other non-financial creditors includes tax and social security payables, dividends still to be paid, and trade credit. Trade credit may be easier to access for many firms, given that asymmetric information and subsequently borrowing costs are lower as compared to conventional bank loans. Finally, intra-group debt is plausibly less constraining to firms than external credits.

Regarding the maturity of corporate debt, the findings suggest a negative relationship between the duration of debt and investment intensity. These results are in line with previous findings in the literature and corroborate the under-investment hypothesis which postulates that owners withhold profitable investment financed by debt since part of the benefits would accrue to creditors (e.g. Aivazian et al., 2005; Fernandez, 2011).

The lagged investment to capital stock is negatively associated with the contemporaneous investment to capital stock. The empirical literature provides no clear guidance on whether the sign of the estimate for the lagged dependent variable should be positive or negative. Two recent studies using the same empirical approach as in this paper provide differently signed estimated coefficient of the lagged dependent variable: While Buca and Vermeulen (2017) estimate a positive lagged dependent variable, Mulier et al. (2016) report a negative coefficient estimate for the same variable. Our estimations are in line with the estimations of several recent studies such as Huang et al. (2019), Ek and Wu (2018), Kumar and Ranjani (2018), and Mulier et al. (2016).

The estimated coefficient of the lagged dependent variable by the GMM-system estimator lies in the boundaries spanned by the estimated coefficient using a pooled OLS and within estimator (cf. Roodman, 2009), implying –together with the specification tests on autocorrelation and the validity of the instrument set- that the model is well-specified. Table A1 in the Annex provides more details from regressions using pooled OLS, within, and GMM estimators.

Table A2 in the Annex summarizes the results from alternative models that include different combinations of fixed effects. The empirical results remain robust to these changes in specification. Among the alternative models, the model with industry and year fixed effects is chosen as the baseline given the results of the model specification tests. Furthermore, a test for joint significance suggests that the coefficients on the fixed effects of the model with industry and year fixed effects are jointly statistically significant.

To further investigate the impact of external financing constraints, especially the impact of bank debt the analysis follows two approaches.

First, the analysis includes a broader country sample by using all countries the BACH dataset provides. This allows to gauge whether the coefficient estimate of debt in Austria is different from other countries. The full country sample includes Austria, Belgium, Czech Republic, Germany, Denmark, Spain, France, Italy, Luxembourg, Poland, Portugal, and Slovakia. Table 3 presents the estimations of the individual models that use total debt, bank debt owed to banks, and non-bank debt as the indicators of external financing constraints for three samples: (i) Austria, (ii) all countries, (iii) and all countries excluding Austria. The results suggest that the coefficient estimate of total debt is larger for Austria than the corresponding coefficients for the broader country samples, though only weakly significant. While the coefficient estimate of the non-bank debt is still the largest for Austria, the estimates for the full sample and the sample excluding Austria do not differ substantially. In brief, the impact of debt owed to banks on investment is higher for Austria than the average impact of debt owed to banks on investment for the panel of European countries the BACH database provide.

Second, the analysis tests whether more bank-dependent firms increase their investment more in times of relatively easy credit conditions. This follows the approach of Buca and Vermeulen (2017). In particular, we interact an index of credit tightening with debt owed to banks. The index of credit tightening builds on information provided in the results of the ECB Bank Lending Survey. We construct the index based on the score of the answers to the first question of the survey: "*Over the past three months, how have your bank's credit standards as applied to the approval of loans or credit lines to enterprises changed? Please note that we are asking about the change in credit standards, rather than about their level*". The data is available quarterly and for different size classes. The scale of the response varies from 1 to 5 for which 1 represents "tightened considerably," and 5 stands for "eased considerably". Therefore, an increase in the easing variable implies an easing in bank credit standards.

Table 4 summarizes the estimation results based on the investment models that feature the interaction between credit easing and debt owed to banks. Consistent with prior expectations, the coefficient estimate of the interaction terms in models using total debt and debt owed to banks are positive. The finding may suggest that an easing in credit standards of Austrian banks benefits bank-dependent firms in industry-size cells more than less bank –dependent firms. This result suggests that firms in Austria are strongly dependent on credit supply. Further, it implies that shocks to credit supply would be less severe if firms in Austria would be less dependent on debt owed to banks. Regarding other types of debt, the estimate of the coefficient of the interaction term is positive, though not statistically significant.

Table 2. Main results based on industry-size-level BACH data

	(1)	(2)	(3)	(4)	(5)
Dependent variable: Investment (t) / Capital(t-1)	Total Leverage	Bank Leverage	Non-Bank Leverage	Long Term Leverage	Short Term Leverage
Investment (t-1) / Capital(t-2)	-0.3593***	-0.3633***	-0.3489***	-0.3184***	-0.3378***
	(0.0663)	(0.0849)	(0.0608)	(0.0568)	(0.0623)
Ln(Capital(t-2)/Output(t-2))	-0.3081***	-0.2604***	-0.2694***	-0.2548***	-0.2911***
	(0.0802)	(0.0806)	(0.0751)	(0.0935)	(0.0707)
Cash(t-1)/K(t-2)	1.0803***	1.1660**	0.8943**	0.6702*	0.9715***
	(0.3911)	(0.4889)	(0.3733)	(0.3951)	(0.3531)
Output growth (t)	1.2748***	1.2302***	1.2868***	1.2451***	1.2092***
	(0.0751)	(0.0866)	(0.0721)	(0.0790)	(0.0894)
Output growth (t-1)	0.3278***	0.2317	0.3262***	0.2391*	0.3224**
	(0.1246)	(0.1572)	(0.1152)	(0.1426)	(0.1275)
Total debt (t-1)/Capital(t-2)	-0.0682***				
	(0.0162)				
Bank debt (t-1)/Capital(t-2)		-0.3021***			
		(0.0815)			
Non-Bank debt (t-1)/Cap.(t-2)			-0.0637***		
			(0.0161)		
Longterm debt (t-1)/Cap.(t-2)				-0.2233***	
				(0.0526)	
Shortterm debt (t-1)/Cap.(t-2)					-0.0728***
					(0.0159)
Observations	2,554	2,554	2,554	2,554	2,554
Number of cross-sectional units	193	193	193	193	193
Year FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
# of instruments	100	100	100	99	100
AR(1)	0	0	0	0	0
AR(2)	0.585	0.836	0.459	0.135	0.280
Hansen p	0.736	0.538	0.753	0.258	0.451

Note: *** p<0.01, ** p<0.05, * p<0.10. Clustered standard errors are in parentheses.

Table 3. Results of the model including bank leverage using different samples

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent variable: Investment (t) / Capital(t-1)	Total Lev.-Austria	Total Lev.-All Sample	Total Lev.-All Sample Excluding Austria	Bank Lev.-Austria	Bank Lev.-All Sample	Bank Lev.-All Sample Excluding Austria	Non-Bank Lev.-Austria	Non-Bank Lev.-All Sample	Non-Bank Lev.-All Sample Excluding Austria
Investment (t-1) / Capital(t-2)	-0.3593***	-0.2673***	-0.2657***	-0.3633***	-0.3133***	-0.3073***	-0.3489***	-0.2657***	-0.2187***
	(0.0663)	(0.0330)	(0.0340)	(0.0849)	(0.0416)	(0.0428)	(0.0608)	(0.0302)	(0.0276)
Ln(Capital(t-2)/Output(t-2))	-0.3081***	-0.1714***	-0.2150***	-0.2604***	-0.1472**	-0.1337*	-0.2694***	-0.1449**	-0.1336**
	(0.0802)	(0.0690)	(0.0743)	(0.0806)	(0.0680)	(0.0788)	(0.0751)	(0.0647)	(0.0517)
Cash(t-1)/K(t-2)	1.0803***	0.9311***	0.7967***	1.1660**	1.2765***	1.2359***	0.8943**	0.7381***	0.6251***
	(0.3911)	(0.1969)	(0.1965)	(0.4889)	(0.2064)	(0.2204)	(0.3733)	(0.1891)	(0.1710)
Output growth (t)	1.2748***	1.0899***	1.0043***	1.2302***	1.1150***	1.0424***	1.2868***	1.0801***	1.0094***
	(0.0751)	(0.0416)	(0.0345)	(0.0866)	(0.0447)	(0.0473)	(0.0721)	(0.0395)	(0.0396)
Output growth (t-1)	0.3278***	0.2069***	0.1857**	0.2317	0.1849**	0.1462*	0.3262***	0.1991***	0.1507**
	(0.1246)	(0.0775)	(0.0738)	(0.1572)	(0.0833)	(0.0838)	(0.1152)	(0.0726)	(0.0603)
Total debt (t-1)/Capital(t-2)	-0.0682***	-0.0451***	-0.0386***						
	(0.0162)	(0.0064)	(0.0067)						
Bank debt (t-1)/Capital(t-2)				-0.3021***	-0.2353***	-0.1948***			
				(0.0815)	(0.0316)	(0.0325)			
Non-Bank debt (t-1)/Capital(t-2)							-0.0637***	-0.0393***	-0.0354***
							(0.0161)	(0.0063)	(0.0072)
Observations	2,554	16,516	13,962	2,554	16,516	13,962	2,554	16,516	13,962
Number of cross-sectional units	193	1,451	1,258	193	1,451	1,258	193	1,451	1,258
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# of instruments	100	102	103	100	105	105	100	101	102
AR(1)	0	0	0	0	0	0	0	0	0
AR(2)	0.585	0.348	0.374	0.836	0.179	0.178	0.459	0.136	0.212
Hansen p	0.736	0.143	0.149	0.538	0.115	0.187	0.753	0.148	0.303

Note: *** p<0.01, ** p<0.05, * p<0.10. Clustered standard errors are in parentheses.

Table 4. Results with Interaction Term Based on Banks' Credit Standards

	(1)	(2)	(3)
Dependent variable: Investment (t) / Capital(t-1)	Total Leverage	Bank Leverage	Non-Bank Leverage
Investment (t-1) / Capital(t-2)	-0.3224***	-0.3447***	-0.3845***
	(0.0855)	(0.0940)	(0.0705)
Ln(Capital(t-2)/Output(t-2))	-0.1942	-0.3358***	-0.6175***
	(0.1328)	(0.0760)	(0.1533)
Cash(t-1)/K(t-2)	0.6676*	0.0053	0.3892
	(0.3713)	(0.1095)	(0.4386)
Output growth (t)	1.4259***	1.2537***	1.2026***
	(0.1082)	(0.0727)	(0.0954)
Output growth (t-1)	0.3198*	0.4905***	0.5520***
	(0.1841)	(0.0881)	(0.1893)
Total debt (t-1)/Capital(t-2)	-0.8963***		
	(0.3395)		
Total debt (t-1)/Capital(t-2)*Easing(t-1)	0.3187**		
	(0.1251)		
Bank debt (t-1)/Capital(t-2)		-2.3860*	
		(1.2634)	
Bank debt (t-1)/Capital(t-2) *Easing(t-1)		0.8278*	
		(0.4527)	
Non-Bank debt (t-1)/Capital(t-2)			-0.6868*
			(0.4045)
Non-Bank debt (t-1)/Capital(t-2) *Easing(t-1)			0.2265
			(0.1515)
Easing(t-1)	2.9441	1.0412	3.2495**
	(1.8781)	(1.1714)	(1.5185)
Observations	2,417	2,417	2,417
Number of cross-sections	193	193	193
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
# of instruments	102	103	102
AR(1)	0	0	0
AR(2)	0.188	0.473	0.598
Hansen p	0.972	0.442	0.115

Note: *** p<0.01, ** p<0.05, * p<0.10. Clustered standard errors are in parentheses.

6. Conclusion

Using a micro-level model of investment, this paper finds that investment of firms and debtis negatively associated across firms in Austrian manufacturing industries. The finding is robust to various changes to the model specification. Moreover, in an extension of the basic model, different components of debt are examined, pointing out that bank-based debt and long-term debt have a stronger negative effect than other forms of debt. Comparisons with investment models estimated for other European countries suggest that the negative impact of debt on firm-level investment is more pronounced in Austria than elsewhere. Further, results from interaction models of debt owed to banks with an index of credit easing show that firms in industries which are more bank-dependent invest relatively more than firms in industries that are less bank-dependent after an easing of credit conditions. The divergent response of firms in more bank-dependent

and less-bank-dependent industries to the easing in credit conditions may suggest that high bank debt act as a financial constraint for Austrian non-financial firms.

Relatively high debt-to-equity ratios combined with this moderate level of debt suggests that the rather low provision of equity capital may constitute a binding factor to capacity-enhancing investment and productivity growth. Additionally, the rise of the knowledge-based economy, requires significant investments in intangible capital and experimentation with new technologies, business models and ideas. As intangible capital is more difficult to pledge as collateral and since most start-ups and young firms tend to have no history of stable cash-flows (e.g. Hsu et al., 2014), financing through bank loans appears more difficult and should be substituted with equity financing.

Thus, the relatively strong credit markets in Austria should be complemented with other forms of financing in order to enable Austrian firms to adopt and experiment with these new technologies. Austrian policies in this area have to comply with EU capital market rules and regulations, but there is room for various national initiatives to support the equity ecosystem, for example by upgrading financial literacy of investors and entrepreneurs, and by promoting corporate governance and reporting practices in order to improve disclosure of information and protection of minority investors (OECD, 2019).

Moreover, reforms of the corporate tax system can help to reduce the bias between debt and equity, thereby providing an incentive to use more equity capital. In many countries including Austria, the interest expenses on existing debt, can be deducted from pre-tax earnings, thereby lowering taxable income, leading to a lower tax liability. Usually, the returns on equity capital cannot be deducted. Thus from a tax point of view, the current corporate tax system incentivizes firms to use debt instead of equity. Experience from other OECD countries suggests that an allowance for corporate equity can stimulate the use of equity capital and lower leverage, if designed well (e.g. de Mooij and Devereux, 2009; Hebous and Ruf, 2017; Ozdamar, Tanyeri and Akdeniz, 2020).

Annex A.

Table A A.1. Coefficient Estimations of Lagged Dependent Variable Using Alternative Methods

	(1)	(2)	(3)	(4)	(5)
	Total Leverage	Bank Leverage	Non-Bank Leverage	Long Term Leverage	Short Term Leverage
Pooled OLS	-0.3363***	-0.3247***	-0.3281***	-0.3155***	-0.3300***
	(0.0348)	(0.0354)	(0.0337)	(0.0334)	(0.0340)
FE Estimator	-0.4512***	-0.4437***	-0.4458***	-0.4390***	-0.4460***
	(0.0366)	(0.0383)	(0.0355)	(0.0362)	(0.0356)
GMM	-0.3593***	-0.3633***	-0.3489***	-0.3184***	-0.3378***
	(0.0663)	(0.0849)	(0.0608)	(0.0568)	(0.0623)
Hansen p	0.736	0.538	0.753	0.258	0.451

Table A A.2. Robustness results with BACH industry-size level data

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Dependent variable: Investment (t) / Capital(t-1)											
Investment (t-1) / Capital(t-2)	-0.2799***	-0.2910***	-0.2782***	-0.3014***	-0.3593***	-0.2946***	-0.2864***	-0.3170***	-0.3023***	-0.3095***	-0.3650***
	(0.0688)	(0.0657)	(0.0687)	(0.0654)	(0.0663)	(0.0660)	(0.0663)	(0.0617)	(0.0686)	(0.0674)	(0.0705)
Ln(Capital(t-2)/Output(t-2))	-0.1186	-0.2732**	-0.1157	-0.2961***	-0.3081***	-0.2870***	-0.2646**	-0.3170***	-0.3194**	-0.3421***	-0.2774**
	(0.1330)	(0.1209)	(0.1344)	(0.1098)	(0.0802)	(0.1103)	(0.1232)	(0.1103)	(0.1254)	(0.1250)	(0.1267)
Cash(t-1)/K(t-2)	0.9603**	0.9177**	0.9618**	0.9876**	1.0803***	0.9454**	0.9193**	0.9167**	0.7520	0.7154	1.3448**
	(0.4318)	(0.4227)	(0.4330)	(0.4164)	(0.3911)	(0.4142)	(0.4250)	(0.4137)	(0.5063)	(0.5036)	(0.5210)
Output growth (t)	1.9165***	1.3092***	1.9158***	1.3003***	1.2748***	1.3132***	1.3106***	1.2933***	1.2714***	1.2755***	1.2631***
	(0.1664)	(0.0748)	(0.1666)	(0.0649)	(0.0751)	(0.0668)	(0.0742)	(0.0724)	(0.0784)	(0.0792)	(0.0822)
Output growth (t-1)	0.2738**	0.3329**	0.2719*	0.4111***	0.3278***	0.4287***	0.3299**	0.3533**	0.3902**	0.4071**	0.2569
	(0.1371)	(0.1450)	(0.1380)	(0.1396)	(0.1246)	(0.1399)	(0.1464)	(0.1370)	(0.1597)	(0.1586)	(0.1669)
Total debt (t-1)/Capital(t-2)	-0.0417*	-0.0713***	-0.0419*	-0.0743***	-0.0682***	-0.0741***	-0.0718***	-0.0713***	-0.0745***	-0.0729***	-0.0737***
	(0.0218)	(0.0171)	(0.0218)	(0.0161)	(0.0162)	(0.0159)	(0.0173)	(0.0158)	(0.0181)	(0.0177)	(0.0184)
Observations	2,554	2,554	2,554	2,554	2,554	2,554	2,554	2,554	2,554	2,554	2,554
Number of cross-sectional units	193	193	193	193	193	193	193	193	193	193	193
Year FE	No	Yes	No	No	Yes	No	Yes	Yes	No	No	Yes
Size FE	No	No	Yes	No	No	Yes	Yes	Yes	Yes	No	No
Industry FE	No	No	No	Yes	Yes	Yes	No	Yes	No	No	No
Industry*YearFE	No	No	No	No	No	No	No	No	Yes	Yes	No
Industry*SizeFE	No	No	No	No	No	No	No	No	No	No	Yes
# of instruments	16	29	18	86	100	87	31	102	1029	1027	221
AR(1)	0	0	0	0	0	0	0	0	0	0	1.83e-10
AR(2)	0.579	0.411	0.573	0.451	0.585	0.551	0.446	0.348	0.0315	0.0189	0.774
Hansen p	0.362	3.32e-06	0.134	0.193	0.736	0.389	4.98e-08	.	.	.	.

Note: *** p<0.01, ** p<0.05, * p<0.10. Robust standard errors are in parentheses.

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