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IMF Working Paper

Does Balance Sheet Strength Drive the Investment Cycle?
Evidence from Pre- and Post-Crisis Cyprus

by Sophia Chen and Yinqiu Lu

I N T E R N A T I O N A L M O N E T A R Y F U N D

IMF Working Paper

European Department

Does Balance Sheet Strength Drive the Investment Cycle?

Evidence from Pre- and Post-Crisis Cyprus

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Abstract

Fixed investment was the most important contributing factor to the boom-bust cycle in Cyprus over the last decade. Investment boomed during a credit boom in mid-2000s, during which the corporate sector borrowed heavily. Investment collapsed after 2008 when the credit boom ended. Investment and corporate balance sheets further deteriorated during the Cypriot banking crisis over 2012–2014. Using firm-level investment and balance sheet data, we find that corporate indebtedness is negatively associated with investment both before and after the banking crisis, although the effect is weaker after the Cypriot banking crisis, possibly due to the reduced role of credit in driving post-crisis investment and growth. Our results suggest the need to repair corporate balance sheets to support sustainable investment.

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I. INTRODUCTION

Over the last decade, Cyprus experienced a large boom-bust cycle and an unprecedented banking crisis. The economy expanded by 24 percent over the period between Cyprus's accession to the European Union (EU) in 2004 and its peak in 2008. It briefly contracted in the aftermath of the 2008 global financial crisis (GFC) and then collapsed during the Cypriot banking crisis over 2012–14, with output contracting by more than 10 percent over this three-year period. As a result, GDP in 2014 was 10 percent below its 2008 peak. The economy finally recovered with a 1.7 percent of growth in 2015. Robust tourism and professional services contributed the most to the recovery. Rising incomes encouraged households to spend, and the growth of private consumption accelerated.

Fixed capital investment contributed most to the upswing and was hit the hardest in the contraction. Fixed investment grew rapidly over the boom period, with its share in GDP increasing from 21 percent in 2004 to 27 percent in 2008. However, since the GFC, the share has dropped to 13 percent in 2015, with the level of fixed investment at half its 2008 peak. The contraction of fixed investment contributed more than 15 percentage points of GDP to the contraction during this period. Even when the overall economy expanded in 2015, investment did not recover.²

The collapse in investment followed a period of booming credit during which the Cypriot corporate sector borrowed heavily. Bank credit to non-financial corporations (NFCs) doubled over 2006–08. The total corporate debt to GDP ratio reached a peak in 2012 at 275 percent and has remained elevated until now.

Recent literature has suggested that corporate debt can explain weak investment after the recent European sovereign crisis. Kalemli-Özcan and others (2015) find a significant debt overhang effect on investment. Barkbu and others (2015) show that corporate leverage and financial constraints have weighed on investment across the euro area. IMF (2016) finds a negative relationship between a firm's leverage and investment ratio and suggests that the weak euro area investment recovery may be partly due to corporate debt burdens.³ However, to the best of our knowledge, no specific analysis for Cyprus has been conducted. This is unfortunate given the magnitude of the boom-bust cycle and crisis in Cyprus.

In this paper, we fill this gap and investigate whether corporate indebtedness, accompanied by overall balance sheet soundness, has been a contributing factor for the investment cycle in

² We adjusted the data to exclude the impact from ship registration and deregistration. According to the ESA2010, a registration (deregistration) of a ship corresponds to an increase (a decrease) in fixed investment. But this activity has no impact on GDP.

³ Recent studies find that leverage among non-financial firms is countercyclical or acyclical (Kalemli-Ozcan and others 2012, Lemmon and others 2008).

Cyprus. Our data set covers a broad set of balance sheet indicators including leverage, cash, earnings, and debt maturity, which allows us to investigate different channels through which corporate balance sheets affects investment. First, high *leverage*, an indicator of the tightness of a firm's financial constraint, prevents the firm from investing due to a lack of overall funds. Second, high *cash* holdings for precautionary purpose may offset the negative effect of high leverage. However, if high cash holdings are due to agency problems that lead firms to retain cash instead of paying dividends, it could indicate poor investment opportunities. Third, a firm with low *earnings* relative to its debt level likely indicates a debt overhang problem in which profitable investment is foregone because the marginal benefit of investment accrues largely to debt holders rather than shareholders (Myers 1977). Last but not least, *debt maturity* also matters because it affects a firm's tradeoff between investing and reducing indebtedness.

We identify the effects of balance sheet soundness on investment using a system general method of moments (GMM) model for a panel of Cypriot non-financial firms over the 2004–14 period. Our key finding is that overall corporate indebtedness, defined as the ratio of total debt to assets, or the ratio of net debt (i.e. total debt minus cash) to assets, is negatively associated with investment over the entire boom-bust cycle. The effect is weaker since the Cypriot banking crisis than before the crisis. One interpretation of this difference is that after the crisis, the economy has excess capacity to be utilized without additional credit. Corporate cash holdings are also negatively associated with investment. This result is consistent with the agency theory of cash holdings in which firms retain cash when they have poor investment opportunities.

Our results imply a very strong economic impact of corporate indebtedness on investment. All else equal, a 10 percentage point decrease (increase) in total debt to assets ratio is associated with a 3 to 6 percentage point increase (decrease) in investment rate. In our data, the mean investment rate decreased from a peak of 4 percent in 2008 to -10 percent in 2014. Mean the total debt to assets ratio increased from 61 percent to 68 percent during the same period. Extrapolating from our firm-level results to the macroeconomy more broadly suggests that the increase in corporate leverage—measured by the total debt to asset ratio—can explain 1/6 to 1/3 of the decline in mean corporate investment rate in our sample. Our results are consistent with recent evidence on the impact of financial distress on investment documented in other European countries. Nevertheless, alternative explanations are possible, particularly for the housing construction sector. For example, the collapse of the housing market after the crisis led to falling investment and rising debt as developers fully drew on previous-approved credit lines and were unable to service existing loans. Unfortunately, limited data in the housing construction sector prevents us from formally testing this channel.

Our paper is related to a large literature on financial frictions and investment, built upon the inapplicability of the Modigliani-Miller theorem. Bernanke and Gertler (1989) first model how the agency costs of borrowing affect output and investment at the macro level. At the firm level, White (1992) finds an important role of corporate debt on investment decision.

She shows that adding the effect of a debt constraint to a standard investment model improves the model fit. Hennessy (2004) and Hennessy and others (2007) find large debt overhang effects on investment in the United States. Kalemli-Özcan and others (2015) similarly identify debt overhang effects in Europe. They also find the effects to be stronger in Southern Europe where sovereign risks are higher.

The remainder of the paper is structured as follows. Section II provides some stylized facts about investment and corporate balance sheet in Cyprus based on aggregate data. Section III uses firm-level data to estimate the effect of corporate balance sheet strength on investment. Section IV concludes.

II. STYLIZED FACTS ABOUT INVESTMENT AND CORPORATE BALANCE SHEET IN CYPRUS

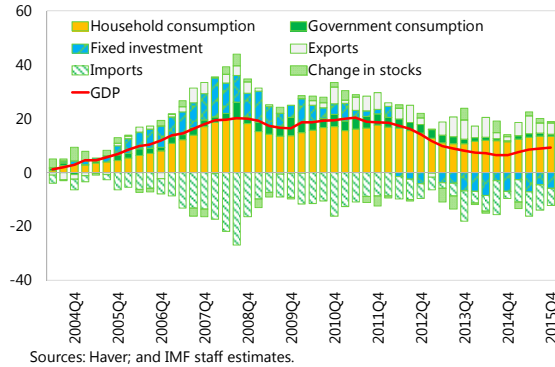
A. Fixed Investment

We use aggregate data of gross fixed capital formation in the national accounts data as a proxy for private fixed investment. The main reason to use this proxy is that the national accounts data have detailed breakdowns by categories, such as metal product and machinery equipment, transport equipment, and construction. Also, public fixed investment, which does not have detailed breakdowns, on average accounts for only 20 percent of total fixed investment in Cyprus. As a result, the latter is highly correlated with private fixed investment.

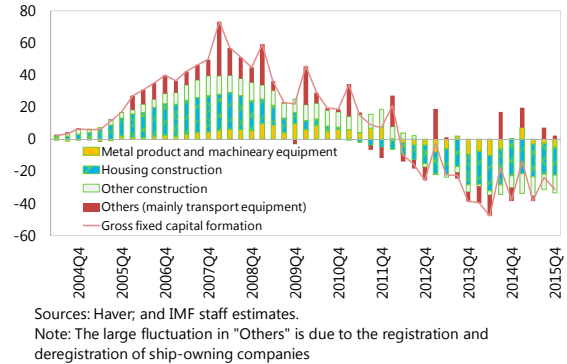
Fixed investment contributed most to the boom and bust cycle in Cyprus over the last decade. During the boom years over 2004–08 with growth averaging 4¼ percent per year, fixed investment contributed 2¼ percentage points per year despite its small share in GDP (one quarter on average). However, when the economy suffered recessions since the onset of the GFC, fixed investment experienced the steepest drop among all expenditure components. It fell by more than half relative to its 2008 level. As a result, the share of fixed investment in GDP fell from 27 percent in 2008 to 13 percent in 2015. Relative to 2008, the contraction in fixed investment has withdrawn more than 15 percentage points from GDP.

The behavior of fixed investment reflects primarily developments in housing construction, which has accounted for more than three-quarters of the decline since 2008. After EU accession and prior to the GFC, ample capital inflows and a credit boom fueled a boom in housing construction. When capital inflows began to reverse in 2009, credit dried up and housing construction fell precipitously. In contrast, investment in metal product and machinery equipment was much less affected.

Contributions to Real GDP Growth—Expenditure Side
(Cumulative from 2004:Q1)



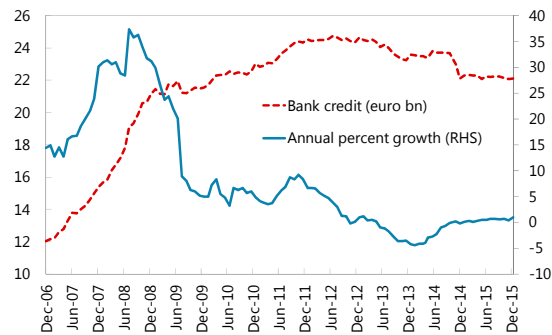
Contributions to Fixed Capital Formation
(Cumulative from 2004:Q1)



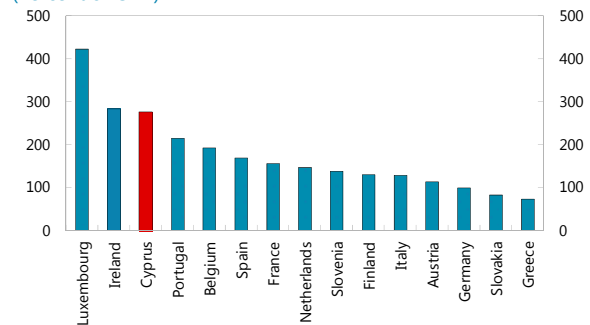
B. Corporate Balance Sheet

Cyprus's corporate debt grew rapidly over the last decade. At 275 percent of GDP, it was among the highest in the euro area in 2012. The large increase in debt was mainly driven by the expansion of domestic bank credit. Following EU accession, significant foreign capital inflows led to a rapid expansion of the Cypriot banking sector. Bank credit to the corporate sector doubled in three years prior to the GFC. Credit growth decelerated after the GFC though remained positive until early 2013. Corporate debt represented 57 percent of total liabilities, with the remainder largely comprised of unlisted equity (97 percent of total equity). The corporate leverage (debt-to-equity) ratio was 135 percent at end-2012, also one of the highest in the euro area.

Cyprus: Bank Credit to NFC



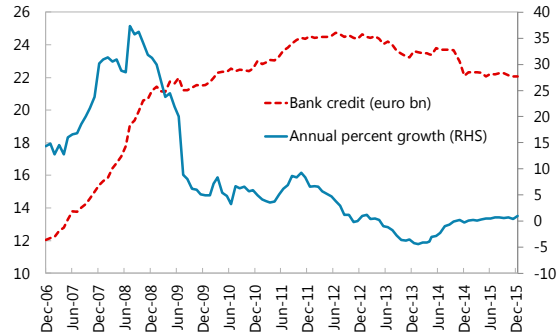
Corporate Financial Debt, 2012
(Percent of GDP)



With a high level of debt, despite a large size of financial assets, Cypriot companies' net financial asset position was large and negative at end-2012. Financial assets stood at 300 percent of GDP at end-2012. Equity shares constituted half of corporate financial assets, of which 97 percent were in the form of unlisted shares and other equity, whose valuation may be subject to some uncertainty. Despite a sharp increase in corporate deposits prior to

the GFC, given their low weight (18 percent of total assets), corporate net financial assets were -184 percent of GDP at end-2012, one of the most negative in the region.

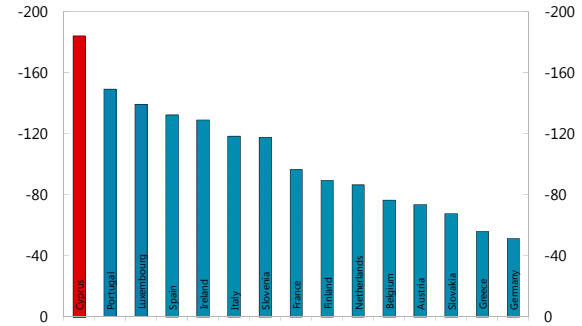
Cyprus: Bank Credit to NFC



Source: Central Bank of Cyprus.

Corporate Net Financial Assets, 2012

(Percent of GDP, reverse order)



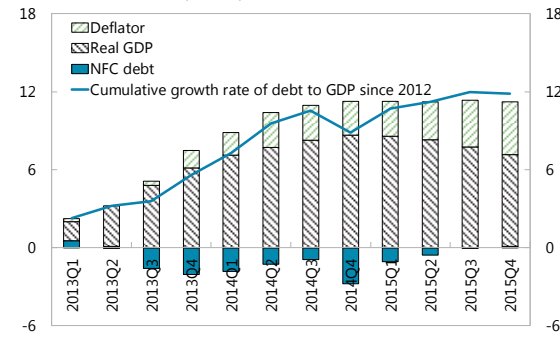
Sources: Central Bank of Cyprus; Haver; and IMF staff estimates.

Credit started to contract from early 2013. However, despite a decline in the nominal level, the corporate debt to GDP ratio continued to increase, as price levels declined during most of the post-crisis period and the economy did not recover until 2015. This, together with the 9 percent drop in financial assets from December 2012 to December 2015 (mainly due to the decline in bank deposits), resulted in a further widening of the already negative net financial asset position to 226 percent of GDP as of end-December 2015.

The poor quality of corporate balance sheet is reflected in a very high level of impaired loans. Before the Cypriot banking crises, flushed with easy money and accommodated by regulatory forbearance, banks relaxed lending conditions and overly relied on collaterals in lending. The rapid increase in corporate debt (and the associated interest payment, Eckstein and others, 2015) and a collapse of the economy led to the accelerated accumulation of non-performing loans (NPLs). The system-wide NPLs to total loans ratio jumped from 5 percent in early 2010 to 16 percent in the first quarter of 2013, and—partly due to a change in the NPL definition—from 30 percent in the second quarter of 2013 to 45 percent at end-2015.⁴ The NPL ratio was the highest in the euro area at the time and one of the highest among all banking crises. Corporate NPLs accounted for half of the system-wide NPLs, and the corporate NPL ratio reached 55 percent at end-2015.

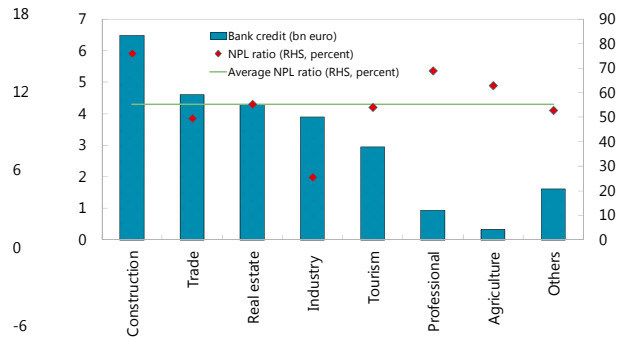
⁴ In the second quarter of 2013, the Central Bank of Cyprus (CBC) changed the scope of aggregation in system-wide NPLs. At end-2014, the CBC changed the NPL definition in accordance with EU regulations.

Contributions to the Cumulative Growth Rate of NFC Debt to GDP ratio (Percent)



Sources: Central Bank of Cyprus; Cystat; and IMF staff estimates.

Cyprus: Banks' Sectoral Exposure (Dec 2015)



Sources: Central Bank of Cyprus; and IMF staff estimates.

Loans to the two housing-related sectors—construction and real estate services—account for 43 percent of total domestic bank credits at end-2015. Such a large sector concentration of bank loans was related to the property boom in the run-up to the GFC. In the boom, housing prices jumped by 135 percent over 2003–08. Fueled by borrowed money, the number of newly completed dwellings more than doubled from 8,700 in 2003 to 18,200 in 2008. The boom eventually turned to bust as Cyprus was hit by the GFC and its own banking crisis. Housing prices plunged by 30 percent from their peak. The number of new dwellings shrank to one-quarter of its peak while the stock of housing continued to rise. As a result, three-quarters of bank credit to the construction sector and 55 percent of credit to the real estate services sector became impaired. These two sectors, in total, were responsible for 52 percent of total corporate NPLs at end-2015.

III. THE ROLE OF BALANCE SHEET STRENGTH ON INVESTMENT BOOM AND BUST

To provide additional insights beyond aggregate data, we turn to firm-level data to investigate the relationship between investment behavior and balance sheet soundness. In particular, we ask whether corporate indebtedness, accompanied by overall balance sheet soundness, has contributed to investment boom and bust, for which we have seen suggestive evidence from aggregate data.

Using firm-level data has a number of advantages. The large number of observations allows us to control for confounding factors with fixed effects. The data cover a broad sample of firms including small and medium size firms, for which the role of balance sheet likely differs from large firms. The data also allow us to examine the role of a variety of balance sheet indicators, such as leverage, cash holdings, earnings, and debt maturity.

Firm-level data also comes with several caveats. First, a large number of observations in our sample are based on consolidated accounts, which include assets and investment in the domestic economy and abroad. To the extent that firms make investment and balance sheet decisions on the same consolidated basis, consolidated data is unlikely to distort the relationship between investment and balance sheet strength. It is also reassuring that the sum

of investment by all firms in the firm-level data is highly correlated with investment in the national account. Second, we are not able to include all the firms in the regression analysis as because of missing data and the lagged structure of our estimation strategy.⁵ Also, some important financial indicators, such as interest coverage ratio, are not included in our regression analysis due to limited coverage. Third, our data and estimation methodology do not allow us to include new firms (less than 3 years old at the end of sample period, see Section III C for details). Thus our results are silent on the behavior of new firms.

A. Data and Measurement

Our firm-level data source is the Orbis database by Bureau van Dijk. Orbis is a commercial data set. It obtains information from national business registers and contains financial and ownership information on publicly listed and private companies worldwide including Cyprus.

Our sample period is from 2005 to 2014. This sample period expands several phases of the Cypriot economy: the post-EU membership expansion period (pre-2008), the GFC and great recession period (2008–11), and the Cypriot banking crisis and recovery period (2012–14). We define the year 2012 as the start of the Cypriot banking crisis instead of 2013 (when the crisis was in full-blown) based on the methodology of Laeven and Valencia (2013). We refer to the years prior to 2012 as the pre-crisis period and the years 2012 and onward as the post-crisis period. The data has detailed information on sector classification. We use the NACE 4-digit classification to group all firms into 19 industries (see Table 3 for industry classifications).

The distribution of firms in the data covered by Orbis database—2,000 firms with various period coverage—is in line with the structure of the Cypriot economy, which is highly concentrated in services sector. For example, close to half of the firms are in the wholesale and retail trade sector, and 15 percent of them are in the finance and insurance sector.

We use net investment rate to measure the level of investment. The level of investment can conventionally be measured on a net or gross basis. Net investment measures the net increase in physical capital stock while gross investment takes into account investment to compensate for the depreciation of capital. If a firm invests just enough to cover the depreciation of capital—for example, to maintain the machinery—gross investment rises but net investment is unchanged. For our purpose, net investment is more important because it directly relates to the capital capacity and future productivity of the firm. We therefore use net investment rate in our analysis, calculated as the annual change in fixed tangible assets divided by fixed

⁵ See Section III C for details.

tangible assets.⁶ This definition also helps to maximize sample coverage because we can include companies that do not have information on investment expenditure or depreciation.

We consider four balance sheet indicators as explanatory variables: leverage, cash, earnings, and debt maturity. We measure *leverage* as the ratio of debt to assets. Two alternative measures of debt are used: *total debt*—defined as the sum of long-term debt, loans, credit, and other current liabilities—and *net debt*—defined as total debt minus cash and cash equivalent. Total debt is a conventional measure for corporate indebtedness and overall financial constraint. Net debt complements the total debt measure, because it takes into account a firm’s cash holdings. A firm with higher cash holdings is more likely to be able to make debt payments.

We measure *cash* as the ratio of cash and cash equivalent to assets. Cash holdings have direct implications for investment. On the one hand, the theory of precautionary cash holdings suggests that firms hold cash to hedge for the risk of future cash shortfalls (Almeida and others, 2004). Thus, firms with more cash are able to invest more. On the other hand, the agency theory of cash holdings suggests that excess cash holding can be a result of poor corporate governance because managers build up cash to gain power instead of paying dividends or investing (Jensen, 1986). Existing empirical evidence is mixed. For example, Miccelson and Partch (2003) find that high cash holdings are associated with high investment and greater growth in assets. Dittmar and others (2003) find that excess cash holdings can be attributed to low corporate governance. Opler and others (1999) find little evidence that excess cash has an impact on investment.

We measure *earnings* as the ratio of EBITDA (earnings before interest, tax, depreciation and amortization) to debt.⁷ The earnings to debt ratio captures the problem of debt overhang because indebtedness is not only related the level of debt, but also related to a firm’s cash flow relative to the cost of debt (Myers, 1977). The firm’s needs sufficient cash flow to cover debt payments or its debt becomes impaired. Whereas different earnings likely reflect time-series variation in a firm’s cash flow, different leverage reflects cross-sectional variation in firms’ abilities to attract external financing. Compared to leverage, earnings to debt ratio is in general a more transitory indicator of a firm’s balance sheet strength, as earnings are more volatile than the stock of debt or assets. A firm’s leverage ratios may depend on its characteristics such as size, age, and sector. However, large and sporadic time variation in leverage is not uncommon and usually reflect events such as equity issuance and the acquisition or sale of assets.

⁶ We also calculate gross investment as net investment plus depreciation. Using this alternative definition does not change our main results.

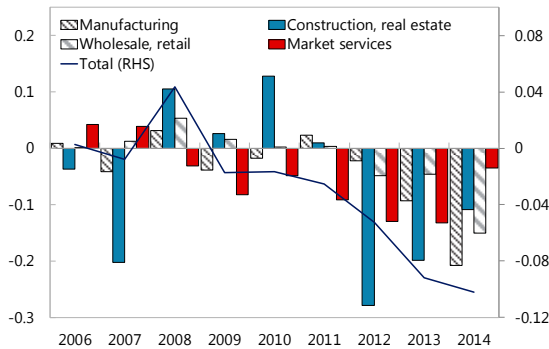
⁷ Alternatively, one can calculate total debt as the sum of current liabilities and loans, where current liabilities equal the sum of long-term debt, credit, and other current liability.

We measure debt *maturity* as the share of long-term debt in total debt. The maturity structure of debt is an important factor in a firm's investment decision. On the one hand, if a firm relies on short-term debt to finance investment, a higher long-term debt to total debt ratio is likely to be associated with lower investment. On the other hand, because debt overhang problem likely works through long-term debt according to Myers (1977), a firm with short debt maturity has less pressure in long-term debt payment and hence has higher investment.

B. Data Summary

Our firm-level data shows an overall contraction in investment and deterioration in balance sheet strength in Cyprus after the GFC.⁸ The average net investment rate declined from 4 percent in 2008 to -2 percent in 2009 and further down to -10 percent in 2014, which means that since 2009, investment has not been able to cover the depreciation of capital. The net investment rates were negative across the key sectors over 2012–14 with the most significant drop observed in the construction sector. This is consistent with the aggregate data, in which investment in the construction sector also collapsed during the same period. Data also shows that companies with weak balance sheet invested less.

NFC Net Investment Rate



Sources: Orbis; and IMF staff estimates.

Net Investment Rate Versus Leverage



Sources: Orbis; and IMF staff estimates.

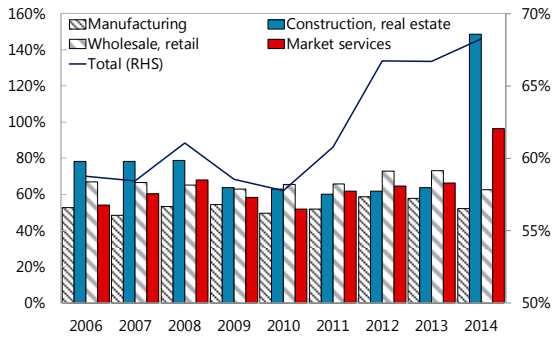
Note: Based on firms with at least three years of data.

The balance sheet of Cypriot firms weakened after the GFC. Overall debt burden at the firm level remained high with an average debt-to-assets ratio of 68 percent in 2014, a 10 percentage-point increase from the recent trough of 58 percent in 2010. The construction and real estate sector had the largest increase in debt-to-assets ratio. Cash position was weak with the average cash-to-assets ratio below 10 percent. The average earnings-to-debt ratio improved and turned to positive in 2014 from -5 percent in 2013, mainly due to the improvements in the wholesale and retail sector. The growth rate of corporate sales declined from 14 percent in 2008 to -4 percent in 2013. The increase in sales in wholesale and retail

⁸ The data summary covers a larger sample than that used in the estimation and therefore allows for an assessment of balance sheet strength by sector. We focus on sectors that most represent Cypriot economy, such as wholesale and retail trade, market services, manufacturing, and construction.

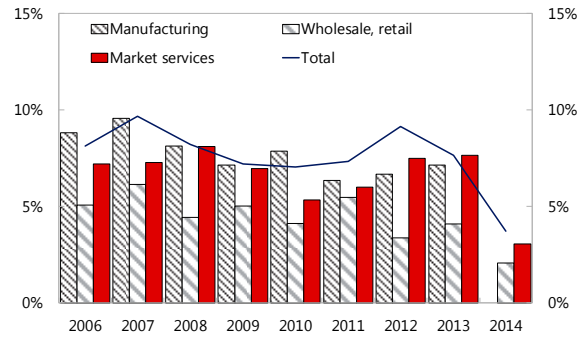
sectors in 2014 explains the large improvement in earnings in these sectors. The average debt maturity has risen since the GFC with long-term debt accounting for 42 percent of total debt in 2014, up from 24 percent in 2005. There was an increasing concentration of debt in firms with weak balance sheets. In 2014, about one-third of corporate debt was held by illiquid or insolvent firms, up from less than 8 percent in 2010.

NFC Debt to Assets Ratio



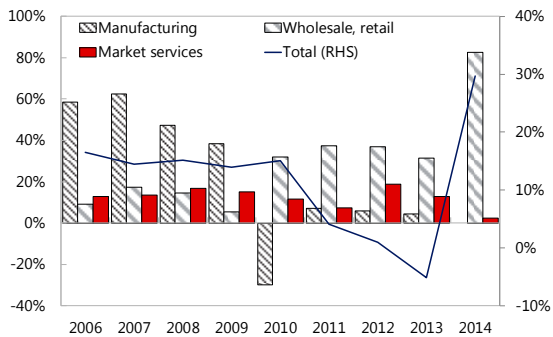
Sources: Orbis; and IMF staff estimates.

NFC Cash to Assets Ratio



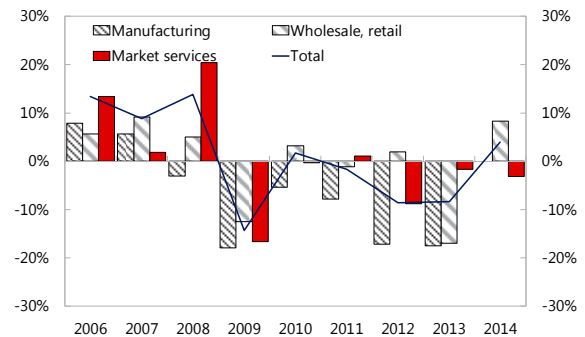
Sources: Orbis; and IMF staff estimates.

NFC Earnings to Debt Ratio



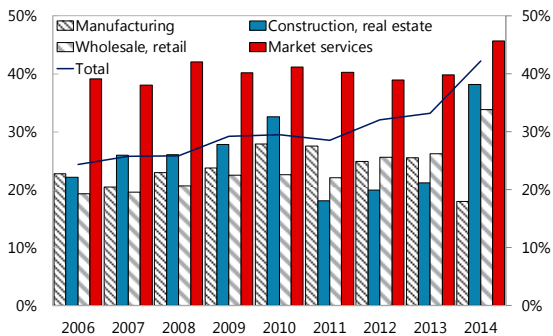
Sources: Orbis; and IMF staff estimates.

NFC Sales Growth



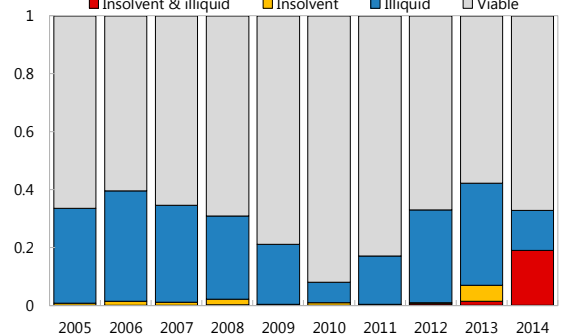
Sources: Orbis; and IMF staff estimates.

NFC Long-Term Debt to Debt Ratio



Sources: Orbis; and IMF staff estimates.

NFC Debt and Balance Sheet Health



The sample we use for regression is smaller than the full Cypriot firm sample in Orbis. We exclude financial and insurance firms, and public sector firms. We also exclude firms with

missing data.⁹ The remaining sample is 80 firms and about 300 observations. The majority of observations (85 percent) are publically listed companies. The average size of the observations is 350 million USD, and with a median of 180 million, the sample is highly skewed to small-sized observations. Table 1 presents summary statistics of our regression sample.

C. Empirical Methodology

We estimate the following regression of investment.

$$\frac{I_{it}}{K_{it}} = \alpha \times \text{Leverage}_{it} + \beta \times \text{Cash}_{it} + \gamma \times \text{Earnings}_{it} + \delta \times \text{Maturity}_{it} + \eta \times \mathbf{X}_{it} + \varepsilon_i + \varepsilon_{it}, \quad (1)$$

where i and t index firm and year. I/K is investment rate, *leverage*, *cash*, *earnings*, and *maturity* are defined in Section III A.¹⁰ \mathbf{X} is a vector of firm-level controls for other factors that affect firms' investment decisions suggested by the literature. We include sales growth to control for demand and the cyclical nature of leverage, total assets to control for firm size, and Tobin's q to control for growth opportunities (see Table 2 for variable definitions). We convert all nominal variables into Euros using year-end exchange rate and then into real variables using the GDP deflator of Cyprus (using 2010 as the base year).

Estimating a panel model such as (1) poses a number of econometric challenges. A central issue is the endogeneity of explanatory variables. The error term $\varepsilon_i + \varepsilon_{it}$ contains firm-specific effects ε_i and idiosyncratic shocks ε_{it} . The choice of estimation method depends on our assumption on the error term. For example, if leverage is not strictly exogenous to ε_{it} , then fixed effects or generalized least squares models are inconsistent. The generalized method of moments (GMM) estimator is consistent if a valid set of instruments is used (Arellano and Bond, 1991; and Blundell and Bond, 2000). For example, if ε_{it} is not serially correlated, properly lagged dependent variables can be used as instruments. GMM specification tests can verify the validity of instruments and assumption on errors. We report three diagnostic results. The Arellano and Bond (1991) AR(1) statistic tests the first-order serial correlation of the error term. The Arellano and Bond (1991) AR(2) statistic tests the lack of second-order serial correlation in the first-difference of the error term. The Hansen statistic tests overidentification or the joint validity of the instruments (Hansen 1982).

⁹ We only include firms with three or more years of observations due to the lag structure of our GMM estimator.

¹⁰ To separate the effect of overall indebtedness and cash holdings, we only include cash in regression specifications where net debt is used.

We estimate regression (1) using a two-step system GMM estimator (Blundell and Bond, 2000). Endogenous variables are contemporaneous values of firm-level financial variables, including *leverage*, *cash*, *earnings*, *maturity*, sales growth, assets size, and Tobin's *q*. Year and industry dummies are included as exogenous variables.¹¹ We use lagged values of endogenous variables as instruments for the first-difference equations and lagged values of the first differences of instrumented variables as instruments for the level equations. Based on the lagged structure of the GMM instruments, firms with observations less than three years are dropped.

D. Results

Main results: Does balance sheet strength matter and through what channel?

Table 4 presents our main results on the role of balance sheet strength on investment for all firms during the full sample period. The coefficients on both measures of leverage—total debt and net debt—are negative and significant at the 1 percent level in all specifications, consistent with the hypothesis that high corporate indebtedness discourages investment. Our estimates suggest that a 10 percentage point decrease (increase) in total debt to assets ratio is associated with a 3 to 6 percentage point increase (decrease) in investment rate.¹² Interestingly, the coefficients on cash holdings are negative and significant at 10 percent level, implying that firms with more cash do not invest more. This is consistent with the agency theory of cash holdings in which managers build up cash to gain power instead of investing. Our results also suggest that demand is an important driver for investment. Overall, we find that balance sheet strength drives investment and leverage is the dominant factor. After controlling for leverage, debt maturity or the ability of firms to pay debt by cash or earnings play a much smaller role. In all the specifications, the first order serial correlation is negative as expected. There is no evidence of second order serial correlation of residuals. The Hansen overidentification tests cannot reject the null hypothesis that our instruments are valid.¹³

We next investigate whether our results are driven by firms in financial distress because these firms are likely to have extremely weak balance sheet and weak investment. We restrict our

¹¹ Year dummy controls for aggregate shocks. Industry dummy controls for heterogeneity across industries, which is likely to be large as suggested by our aggregate data. Unfortunately, small sample size prevents us to perform regression analysis for individual industries.

¹² We find no evidence that the negative relationship between investment and leverage is driven by firms of very high leverage. We split the sample into high leverage and low leverage firms (by median) and re-estimate regression (1), the coefficients on leverage are very similar in the two samples. Result tables are omitted for space consideration.

¹³ The p value of the AR(1) test is significant at the 5 or 10 percent level in all results. The p values of the Hansen tests suggest that our instruments may be weak.

sample to all solvent firms, defined as firms with total debt less than assets. About 5 percent of the firms in our sample period are insolvent and excluded from the analysis. As shown in Table 5, the results are very similar to our baseline results when Tobin's q is not included in the set of control variables. When Tobin's q is included, the coefficients on leverage remain negative but are not statistically significant. This result likely reflects the negative correlation between leverage and Tobin's q .¹⁴ In contrast, the coefficients on cash remain negative and significant in all specifications.

Investment driver pre- and post-crisis

As discussed earlier, the Cypriot banking crisis had a large impact on the economy. One question of interest is whether the crisis has affected the relationship between balance sheet strength and investment. For the pre-crisis period, the coefficients on leverage remain negative and significant when Tobin's q is not included (Table 6). The coefficients on total debt and net debt are larger than those in the full sample. We obtain very similar results for the subsample after the GFC and before the Cypriot banking crisis (2008-2011) (Table 7). Overall, our results suggest that before the crisis, a 10 percentage point decrease (increase) in leverage is associated with a 6 to 10 percentage point increase (decrease) in investment rate.

The sub-sample with the post-crisis period is too short for a system GMM estimation. To investigate whether balance sheet variables have different effects on investment post crisis, we add interaction terms of the crisis dummy and balance sheet variables to the baseline model with the full sample. The coefficients on the linear leverage term remain negative and significant in all specifications (Table 8). Interestingly, the interaction term of the crisis dummy and leverage is positive and significant at the 10 percent level in one specification, while the overall effect of leverage remains negative post-crisis. Finally, none of the interaction terms with the crisis dummy is significant except earnings in one specification. Therefore, we conclude that the main balance sheet driver of investment remains unchanged after the crisis.

Our result suggests that the effect of indebtedness on investment is smaller after the crisis than before the crisis. One interpretation of this result is that after the crisis, an economy will have spare capacity which could be utilized without much additional credit. In this case, the leverage-investment linkage may weaken after the crisis and a creditless recovery is possible. Cross-country experiences suggest that after a banking crisis and a credit boom, the recovery would almost certainly be creditless (Abiad and others, 2011). However, credit-less recovery is not an optimal outcome, as on average output growth is a third lower than in recoveries with credit (Abiad and others, 2011).

¹⁴ In our data, Tobin's q is a weak predictor of investment in a model without financial variables (results not shown), likely due to measurement errors or omitted variables (Hayashi 1982; Erickson and Whited 2006).

IV. CONCLUSION

We find a strong and negative effect of corporate indebtedness on investment over the entire boom and bust cycle in Cyprus. Our estimates suggest that a 10 percentage point decrease (increase) in leverage—measured by total debt to assets ratio—is associated with a 3 to 6 percentage point increase (decrease) in investment rate over the last decade. Extrapolating these results to macroeconomic developments suggests that the increase in corporate leverage may account for 1/6 to 1/3 of the decline in corporate investment from its 2008 peak. Our results are consistent with recent evidence on the impact of financial distress on investment documented in other European countries.

The negative effect of corporate indebtedness on investment highlights the need to repair corporate balance sheet. Despite a 1.7 percent of output growth in 2015, output remained 9 percent below its 2008 peak. Cyprus has made good progress in setting up a legal framework to speed up an orderly corporate deleveraging. The new insolvency framework allows over-indebted borrowers to restructure their debt, providing viable companies an opportunity to repair their balance sheets. Banks have also put in place internal workout policies to facilitate debt restructuring. Overall, a comprehensive policy effort to reduce corporate debt and improve balance sheet strength would contribute to a faster recovery, a sustainable rise in investment, and macrofinancial stability.

Table 1. Summary Statistics of the Regression Sample

Variables	Mean	St. Dev.	Min	Median	Max	N
Net investment rate	0.012	0.312	-2.319	-0.018	0.969	307
Total debt / Assets	0.495	0.252	0.058	0.492	1.875	307
Net debt / Assets	0.427	0.281	-0.686	0.444	1.855	304
Cash / Assets	0.067	0.085	0.000	0.037	0.521	302
Earnings / Debt	0.228	0.451	-3.363	0.121	2.395	307
Earnings / Net debt	0.204	0.715	-3.478	0.124	6.918	301
Long-term debt / Debt	0.400	0.290	0.000	0.397	0.918	307
Long-term debt / Net debt	0.436	0.331	-0.367	0.438	1.672	299
Sales growth	0.028	0.347	-1.021	0.000	2.342	307
ln(Assets)	11.840	1.492	7.746	11.978	14.696	307
Tobin's q	2.212	3.603	-1.788	1.027	24.079	250

Sources: Orbis; and authors' calculations.

Table 2. Variable Definition

Variable	Description	Level	Source
Net investment rate	The annual change in tangible fixed assets divided by tangible fixed assets	Firm level	Orbis and authors' calculations
Total debt	The sum of long-term debt, credit, other current liabilities and loans	Firm level	Orbis and authors' calculations
Net debt	Total debt minus cash flow	Firm level	Orbis and authors' calculations
Cash	Cash and cash equivalent	Firm level	Orbis and authors' calculations
Earnings	EBITDA (earnings before interest, tax, depreciation and amortization)	Firm level	Orbis and authors' calculations
Long-term debt	Long term financial debts, including loans and credits to credit institutions and bonds	Firm level	Orbis and authors' calculations
Maturity	The ratio of long-term debt to total debt, or the ratio of long-term debt to net debt	Firm level	Orbis and authors' calculations
Sales growth	The annual growth of net sales (measured as logarithm difference)	Firm level	Orbis and authors' calculations
ln(Asset)	The logarithm of total assets	Firm level	Orbis and authors' calculations
Tobin's q	The ratio of enterprise value to total fixed assets, where enterprise value is defined as market capitalization divided by the sum of long-term debt, loans to financial institutions minus cash and cash equivalent	Firm level	Orbis and authors' calculations

Table 3. Industry Classification

Industry	NACE Rev. 2 Class	Description	No. of Cypriot firms in Orbis	No. of firms in regression
1	01-03	Agriculture, forestry and fishing	30	4
2	05-09	Mining and quarrying	18	7
3	10-33	Manufacturing	247	19
4	35	Electricity, gas, steam and air conditioning supply	3	0
5	36-39	Water supply	7	0
6	41-43	Construction	80	0
7	45-47	Wholesale and retail trade	901	21
8	49-53	Transport and storage	70	5
9	55-56	Accommodation and food service activities	47	3
10	58-63	Information and communication	36	4
11	68	Real estate activities	25	3
12	69-75	Professional, scientific and technical activities	74	3
13	77-82	Administrative and support service activities	51	9
14	84	Public administration and defense, compulsory social security	1	0
15	85	Education	5	0
16	86-88	Human health services and social work activities	10	2
17	90-93	Arts, entertainment and recreation	9	0
18	94-96	Other services	14	1
19	64-66	Financial and insurance activities	278	0

Table 4. Firm Balance Sheet and Investment: Main Results

	(1)	(2)	(3)	(4)
Net investment rate	All firms			
Total Debt / Assets	-0.552*** [0.131]	-0.286** [0.140]		
Net debt / Assets			-0.381*** [0.123]	-0.284** [0.114]
Cash / Assets			-0.571* [0.310]	-0.469* [0.267]
Earnings / Total Debt	-0.080 [0.060]	0.037 [0.059]		
Earnings / Net debt			0.003 [0.017]	0.011 [0.021]
Long-term Debt / Total Debt	-0.018 [0.118]	-0.055 [0.101]		
Long-term Debt / Net debt			-0.027 [0.113]	-0.084 [0.083]
Sales growth	0.338*** [0.083]	0.277*** [0.079]	0.325*** [0.084]	0.291*** [0.080]
ln(Assets)	0.022 [0.015]	0.021 [0.017]	0.022 [0.018]	0.029 [0.021]
Tobin's q		0.003 [0.009]		0.006 [0.006]
Constant	0.040 [0.182]	-0.110 [0.145]	-0.051 [0.193]	-0.184 [0.222]
Observations	307	250	294	243
Number of firms	81	70	78	69
AR(1)	-1.850	-1.662	-1.832	-1.656
pval	0.064	0.097	0.067	0.098
AR(2)	-0.220	-0.335	-0.216	-0.335
pval	0.826	0.737	0.829	0.737
Hansen J (overid)	67.92	58.58	67.81	62.47
pval	1.00	1.00	1.00	1.00

Sources: Orbis and authors' calculations.

Note: This table shows results of a two-step system GMM estimation. AR(1) and AR(2) are tests of first-order and second-order serial correlation of residuals. The Hansen statistic is a test of overidentification restrictions. Endogenous variables are contemporaneous values of right-hand-side variables. We use lagged values of endogenous variables as instruments for the first-difference equations and lagged values of the first differences of instrumented variables as instruments for the level equations (one lag is used). We use year and industry dummies as exogenous variables. Standard errors with finite-sample correction for the two-step GMM covariance matrix as developed by Windmeijer (2005) are reported in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively.

Table 5. Firm Balance Sheet and Investment: Solvent Firms

	(1)	(2)	(3)	(4)
Net investment rate		Solvent firms		
Total Debt / Assets	-0.620*** [0.164]	-0.245 [0.176]		
Net debt / Assets			-0.359*** [0.137]	-0.208 [0.129]
Cash / Assets			-0.590* [0.320]	-0.486* [0.279]
Earnings / Total Debt	-0.098** [0.039]	0.045 [0.065]		
Earnings / Net debt			0.009 [0.021]	0.015 [0.021]
Long-term Debt / Total Debt	-0.001 [0.108]	-0.063 [0.102]		
Long-term Debt / Net debt			-0.052 [0.105]	-0.142* [0.080]
Sales growth	0.368*** [0.078]	0.267*** [0.082]	0.341*** [0.086]	0.299*** [0.083]
ln(Assets)	0.028* [0.016]	0.025 [0.022]	0.029 [0.020]	0.027 [0.020]
Tobin's q		0.002 [0.007]		0.003 [0.005]
Constant	-0.010 [0.175]	-0.173 [0.175]	-0.147 [0.210]	-0.157 [0.206]
Observations	299	245	286	238
Number of firms	76	67	73	66
AR(1)	-1.865	-1.662	-1.843	-1.657
pval	0.062	0.097	0.065	0.098
AR(2)	-0.236	-0.320	-0.209	-0.316
pval	0.814	0.749	0.834	0.752
Hansen J (overid)	64.59	58.37	63.51	55.23
pval	1.00	1.00	1.00	1.00

Sources: Orbis and authors' calculations.

Note: This table shows results of a two-step system GMM estimation. AR(1) and AR(2) are tests of first-order and second-order serial correlation of residuals. The Hansen statistic is a test of overidentification restrictions. Endogenous variables are contemporaneous values of right-hand-side variables. We use lagged values of endogenous variables as instruments for the first-difference equations and lagged values of the first differences of instrumented variables as instruments for the level equations (one lag is used). We use year and industry dummies as exogenous variables. Standard errors with finite-sample correction for the two-step GMM covariance matrix as developed by Windmeijer (2005) are reported in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively.

Table 6. Firm Balance Sheet and Investment: Pre-Crisis (2004–11)

	(1)	(2)	(3)	(4)
Net investment rate		Pre-crisis (2004-2011)		
Total debt / Assets	-0.945*** [0.261]	-0.509 [0.368]		
Net debt / Assets			-0.592*** [0.205]	-0.317 [0.194]
Cash / Assets			-0.700* [0.400]	-0.512 [0.434]
Earnings / Total debt	-0.114 [0.085]	0.020 [0.151]		
Earnings / Net debt			0.000 [0.029]	0.020 [0.033]
Long-term Debt / Total debt	0.229 [0.182]	0.059 [0.175]		
Long-term Debt / Net debt			0.164 [0.138]	0.009 [0.088]
Sales growth	0.303*** [0.089]	0.233** [0.100]	0.309*** [0.107]	0.266*** [0.099]
ln(Assets)	0.022 [0.035]	0.019 [0.036]	-0.003 [0.028]	0.009 [0.027]
Tobin's q		0.004 [0.008]		0.002 [0.010]
Constant	0.158 [0.329]	-0.001 [0.285]	0.294 [0.333]	0.069 [0.289]
Observations	205	161	197	157
Number of firms	64	55	62	54
AR(1)	-2.657	-2.183	-2.545	-2.182
pval	0.008	0.029	0.011	0.029
AR(2)	-0.077	-0.144	-0.106	-0.121
pval	0.939	0.886	0.915	0.904
Hansen J (overid)	47.05	37.40	52.37	46.14
pval	1.00	1.00	1.00	1.00

Sources: Orbis and authors' calculations.

Note: This table shows results of a two-step system GMM. AR(1) and AR(2) are tests of first-order and second-order serial correlation of residuals. The Hansen statistic is a test of overidentification restrictions. Endogenous variables are contemporaneous values of right-hand-side variables. We use lagged values of endogenous variables as instruments for the first-difference equations and lagged values of the first differences of instrumented variables as instruments for the level equations (one lag is used). We use year and industry dummies as exogenous variables. Standard errors with finite-sample correction for the two-step GMM covariance matrix as developed by Windmeijer (2005) are reported in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively.

Table 7. Firm Balance Sheet and Investment: Post-GFC, Pre-Crisis (2008–11)

	(1)	(2)	(3)	(4)
Net investment rate	Post-GFC, Pre-Crisis (2008-2011)			
Total debt / Assets	-0.871*** [0.241]	-0.329 [0.354]		
Net debt / Assets			-0.534** [0.213]	-0.302* [0.172]
Cash / Assets			-0.721* [0.388]	-0.439 [0.489]
Earnings / Total debt	-0.092 [0.067]	0.053 [0.142]		
Earnings / Net debt			-0.019 [0.027]	-0.006 [0.029]
Long-term Debt / Total debt	0.256 [0.179]	0.032 [0.208]		
Long-term Debt / Net debt			0.117 [0.109]	-0.083 [0.106]
Sales growth	0.319*** [0.093]	0.246** [0.114]	0.377*** [0.100]	0.278*** [0.101]
ln(Assets)	-0.004 [0.035]	0.002 [0.048]	-0.010 [0.028]	0.023 [0.037]
Tobin's q		-0.004 [0.009]		0.008 [0.006]
Constant	0.400 [0.336]	0.121 [0.422]	0.356 [0.313]	-0.088 [0.371]
Observations	152	127	146	124
Number of firms	60	52	58	51
AR(1)	-2.252	-2.125	-2.287	-2.222
pval	0.024	0.034	0.022	0.026
AR(2)	0.153	0.357	0.301	0.457
pval	0.878	0.721	0.763	0.648
Hansen J (overid)	48.2	43.89	54.50	39.83
pval	1.00	1.00	1.00	1.00

Sources: Orbis and authors' calculations.

Note: This table shows results of a two-step system GMM estimation. AR(1) and AR(2) are tests of first-order and second-order serial correlation of residuals. The Hansen statistic is a test of overidentification restrictions. Endogenous variables are contemporaneous values of right-hand-side variables. We use lagged values of endogenous variables as instruments for the first-difference equations and lagged values of the first differences of instrumented variables as instruments for the level equations (one lag is used). We use year and industry dummies as exogenous variables. Standard errors with finite-sample correction for the two-step GMM covariance matrix as developed by Windmeijer (2005) are reported in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively.

Table 8. Firm Balance Sheet and Investment: Effect of Crisis

	(1)	(2)	(3)	(4)
Net investment rate			All firms	
Total debt / Assets	-0.769*** [0.201]	-0.484* [0.276]		
Total debt / Assets x Crisis	0.436* [0.237]	0.219 [0.259]		
Net Debt / Assets			-0.571*** [0.218]	-0.433** [0.196]
Net debt / Assets x Crisis			0.264 [0.234]	0.155 [0.233]
Cash / Assets			-0.475 [0.479]	-0.775 [0.532]
Cash / Assets x Crisis			-0.417 [0.694]	0.102 [0.646]
Earnings / Debt	-0.109* [0.057]	0.001 [0.113]		
Earnings / Debt x Crisis	0.086 [0.071]	0.015 [0.107]		
Earnings / Net debt			0.007 [0.029]	0.036 [0.046]
Earnings / Net debt x Crisis			-0.021 [0.046]	-0.047 [0.047]
Long-term debt / Debt	0.035 [0.152]	0.050 [0.139]		
Long-term debt / Debt x Crisis	-0.149 [0.113]	-0.170 [0.131]		
Long-term Debt / Net debt			0.017 [0.117]	-0.093 [0.159]
Long-term Debt / Net debt x Crisis			-0.186 [0.167]	-0.082 [0.166]
Crisis	-0.245** [0.123]	-0.113 [0.129]	-0.060 [0.132]	-0.091 [0.118]
Sales growth	0.334*** [0.077]	0.239** [0.096]	0.314*** [0.075]	0.258*** [0.083]
ln(Assets)	0.019 [0.022]	0.019 [0.028]	0.027 [0.019]	0.029 [0.026]
Tobin's q		0.008 [0.012]		0.011 [0.010]
Constant	0.189 [0.197]	-0.005 [0.234]	-0.038 [0.215]	-0.082 [0.287]
Observations	307	250	294	243
Number of firms	81	70	78	69
AR(1)	-1.901	-1.647	-1.872	-1.648
pval	0.057	0.100	0.061	0.099
AR(2)	-0.160	-0.185	-0.111	-0.345
pval	0.873	0.853	0.912	0.730
Hansen J (overid)	62.61	54.15	59.36	54.70
pval	1.00	1.00	1.00	1.00

Sources: Orbis and authors' calculations.

Note: This table shows results of a two-step system GMM estimation. AR(1) and AR(2) are tests of first-order and second-order serial correlation of residuals. The Hansen statistic is a test of overidentification restrictions. Endogenous variables are contemporaneous values of right-hand-side variables. We use lagged values of endogenous variables as instruments for the first-difference equations and lagged values of the first differences of instrumented variables as instruments for the level equations (one lag is used). We use year and industry dummies as exogenous variables. Standard errors with finite-sample correction for the two-step GMM covariance matrix as developed by Windmeijer (2005) are reported in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively. Crisis is a dummy variable that takes a value of 1 for the years 2012 onwards.

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