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Does Balance Sheet Strength Drive the Investment Cycle?

Evidence from Pre- and Post-Crisis Cyprus[±]

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Abstract

Fixed investment has contributed significantly to the boom-bust cycle in Cyprus since it joined the European Union in 2004. Investment accelerated during a credit boom in mid-2000s, manifested by heavy corporate sector borrowing. Investment collapsed after 2008 when the credit boom ended. Investment and corporate balance sheets further deteriorated during the Cypriot banking crisis over 2012–14. Using firm-level data on investment and balance sheets, we find that corporate indebtedness is negatively associated with investment, although the effect is weaker after the start of the banking crisis, possibly due to the reduced role of credit in driving investment and growth. Our results suggest the need to repair corporate balance sheets to support sustainable investment.

Keywords: Cyprus, Corporate investment, Balance sheet, Leverage

1. Introduction

Cyprus has experienced a large boom-bust cycle and an unprecedented banking crisis since mid-2000s. The economy had expanded by 24 percent since Cyprus's accession to the European Union (EU) in 2004 before reaching 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.

Fixed capital investment contributed most to the upswing and later was hit the hardest. 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, after the GFC, the share dropped to 13 percent in 2015, with the level of fixed investment at half its 2008 peak. The contraction in fixed investment took

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away more than 15 percent of the aggregate output during this period. Even when the overall economy expanded in 2015, investment did not recover.[1]

The collapse in investment followed a period of credit boom 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 of 275 percent in 2012 and has remained elevated after the crisis.

A growing literature has emerged after the GFC to study the relationship between corporate debt and aggregate investment. However, to the best of our knowledge, no specific analysis beyond aggregate data has been conducted for Cyprus despite the magnitude of the boom-bust cycle and the 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 to the investment cycle in 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 affect investment. First, high *leverage*, an indicator of the tightness of a firm's financial constraint, prevents firms 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). Finally, *debt maturity* also matters because it affects a firm's tradeoff between investing and reducing indebtedness.

We identify the effect 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. We find 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 after 2012 when the Cypriot banking crisis started. One interpretation of this difference is that during the crisis and recovery period, 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 indicate 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. The mean total debt to assets ratio increased from 61 percent to 68 percent during the same period. Extrapolating from our firm-level results to the broad macroeconomy suggests that the increase in corporate leverage—measured by the total debt to assets ratio—can explain 1/6 to 1/3 of the decline in the

[1] We adjusted the data to exclude the impact from ship registration and deregistration. According to the European system of national and regional accounts (ESA2010), a registration (deregistration) of a ship corresponds to an increase (a decrease) in fixed investment. But this activity has no impact on GDP.

mean corporate investment rate in our sample. Moreover, we find that indebtedness has a much larger impact on the investment of young firms (i.e., those incorporated for 15 years or less). A one percentage point decrease (increase) in leverage is associated with an additional 3 to 5 percentage point increase (decrease) in the investment rate of young firms.

We also find that the effect of indebtedness on investment is asymmetric over the boom-bust cycle. The effect is negative overall and larger before the Cypriot banking crisis. One likely reason for this asymmetric effect is investment capacity. Before the crisis, credit boom fueled rapid investment growth. During the crisis and recovery period, the economy had spare capacity which could be utilized without much additional credit. In this case, a recovery without much credit (i.e. a creditless recovery) is possible.

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, Whited (1992) finds a key 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.

An emerging literature after the GFC suggests that corporate debt may 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 weak investment recovery in the euro area may be partly due to corporate debt burdens. However, none of these papers have studied Cypriot firms. Moreover, none of them have focused on the asymmetry of the leverage-investment linkage over the boom-bust cycle and its implications for a creditless recovery after a crisis.[2]

The remainder of the paper is structured as follows. Section 2 provides some stylized facts about investment and corporate balance sheet in Cyprus based on aggregate data. Section 3 uses firm-level data to estimate the effect of corporate balance sheet strength on investment. Section 4 concludes.

2. Stylized Facts about Investment and Corporate Balance Sheet in Cyprus

2.1 Fixed investment

At the aggregate level, fixed investment has contributed most to the boom and bust cycle in Cyprus since mid-2000s.[3] During the boom years over 2004–08 with growth averaging 4¼ percent per year, fixed investment contributed 2¼ percentage points on average per year despite its small share in GDP (one quarter on average). However, since the onset of the GFC, fixed investment

[2] Research on creditless recoveries after crises is scarce. One notable exception is Abiad et al. (2011).

[3] We measure aggregate fixed investment by fixed capital formation in the national accounts. The national accounts data has detailed breakdowns by categories, such as metal product and machinery equipment, transport equipment, and construction. The aggregate data also includes public fixed investment, which accounts for on average 20 percent of total fixed investment in Cyprus over our sample period.

experienced the steepest drop among all the 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 had taken away more than 15 percent of aggregate output by 2015.

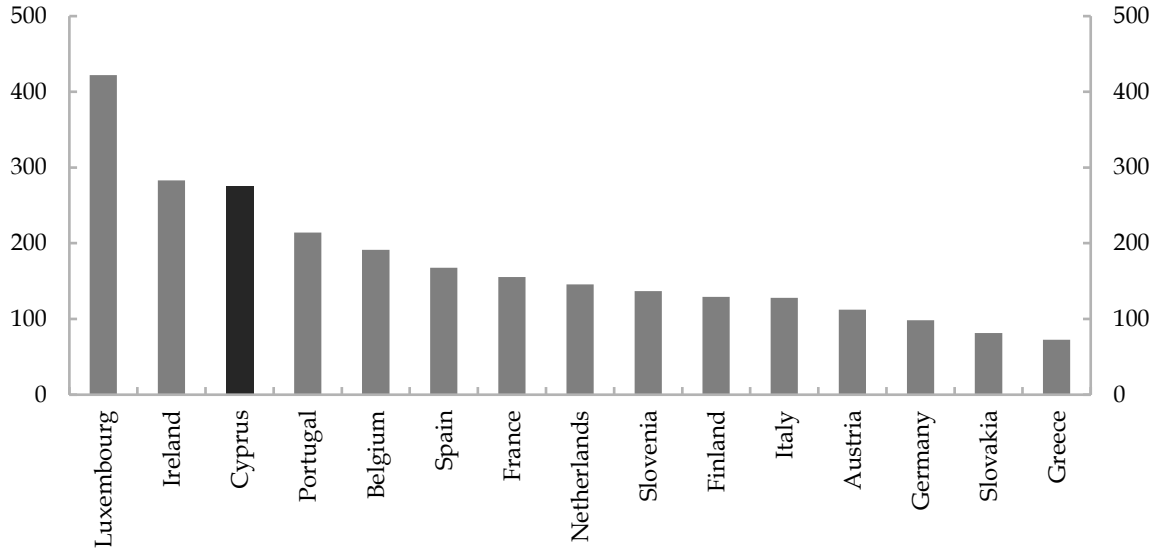
The behavior of fixed investment reflects primarily developments in housing construction, which has accounted for more than three-quarters of the decline in fixed investment since 2008. Between EU accession and the onset of the GFC, credit boom triggered by the capital inflow surge helped fuel a boom 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.

2.2 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 (Figure 1). The increase in debt was mainly driven by the expansion of domestic bank credit. Following EU accession, significant 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 (Figure 2). Corporate debt represented 57 percent of total corporate 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.

FIGURE 1

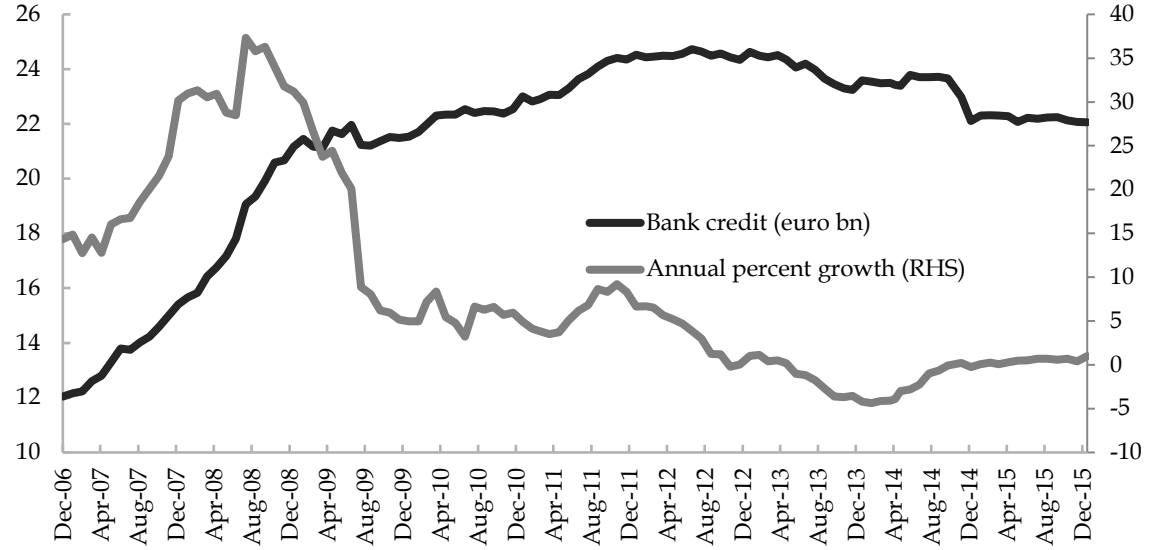
Corporate Financial Debt, end-2012
(percentage of GDP)



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

FIGURE 2

Cyprus: Bank Credit to NFC



Source: Central Bank of Cyprus.

With such a high debt level, despite sizable financial assets, Cypriot companies' net financial asset position was negative and large 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 share in total assets (18 percent), corporate net financial assets were -184 percent of GDP at end-2012, one of the most negative in the region (Figure 3).

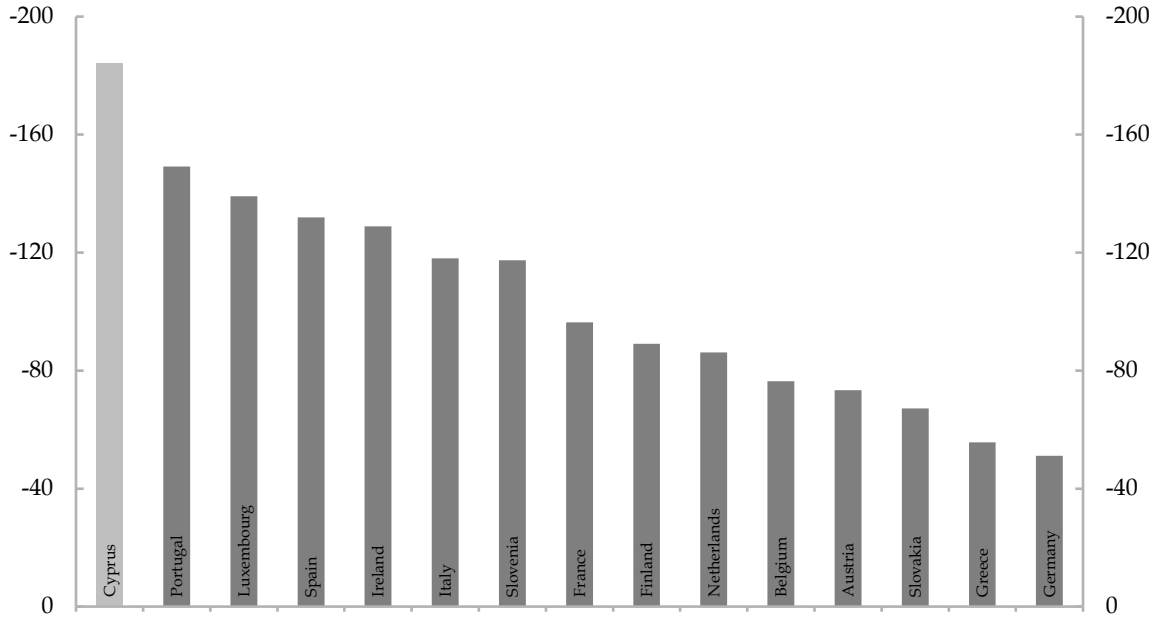
Credit started to contract from early 2013. However, despite a decline in the nominal level, the corporate debt to GDP ratio continued to increase, as price levels declined and the economy did not recover until 2015. This, together with the 9 percent drop in financial assets from December 2012 to December 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. 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.

FIGURE 3

Corporate Net Financial Assets, end-2012

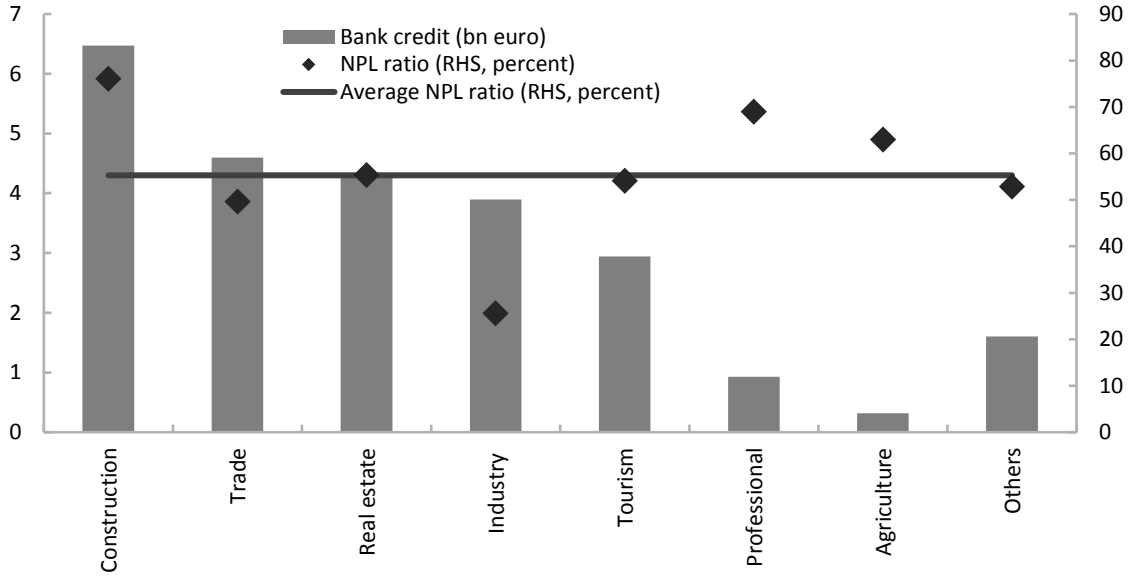


Sources: Central Bank of Cyprus; Haver; and IMF staff estimates.

Loans to the two housing-related sectors—construction and real estate services—accounted for 43 percent of total domestic bank credits at end-2015. Such a large sectoral 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 existing housing continued to rise. Consequently, three-quarters of bank credit to the construction sector and 55 percent of credit to the real estate services sector became impaired (Figure 4). These two sectors, in total, were responsible for 52 percent of total corporate NPLs at end-2015.

FIGURE 4

Cyprus: Banks' Sectoral Exposure (end-2015)



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

3. 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. 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 several advantages. It allows us to control for confounding factors and unobserved heterogeneity across firms. The data also allows us to examine the role of a variety of balance sheet indicators, such as leverage, cash holdings, earnings, and debt maturity. Finally, our data covers a broad sample of firms including small and medium size ones (SMEs), for which the role of balance sheet soundness likely differs from large firms.

Firm-level data also comes with caveats. Some 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 decisions on the same consolidated basis, consolidated data is unlikely to distort the relationship between investment and balance sheet soundness. 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.

3.1 Data and Measurement

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

Our sample period is from 2004 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 2004-2011 as the pre-crisis period hereafter.

Our data has detailed information on sector classification. We group firms by industries using the NACE 2-digit classification (see Appendix Table A3 for industry classification). The distribution of firms in the data covered by the Orbis database—2,000 firms with various period coverage—is in line with the structure of the Cypriot economy, which is highly concentrated in the 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 by a net or gross basis. Net investment measures the net increase in physical capital stock while gross investment also accounts for 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 remains 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 tangible assets.[4] This definition also helps to maximize the sample coverage because we can include companies that do not have information on investment expenditure or depreciation.

We consider four balance sheet indicators: 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 excludes 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 the risk of future cash shortfalls (Almeida and others, 2004). Thus, firms with more cash can 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

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

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.[5] The earnings to debt ratio captures the problem of debt overhang because indebtedness is related not only to the level of debt, but also to a firm's cash flow relative to the cost of debt (Myers, 1977). The firm 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 may depend on its characteristics such as size, age, and sector. However, large and sporadic time variation in leverage is not uncommon and usually reflects events such as equity issuance and the acquisition or sale of assets.

We measure debt *maturity* as the share of long-term debt in total debt. The maturity structure of debt is a key 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, debt overhang problem likely works through long-term debt (Myers, 1977). A firm with short debt maturity has less pressure in long-term debt payment and hence has higher investment.

3.2 Data summary

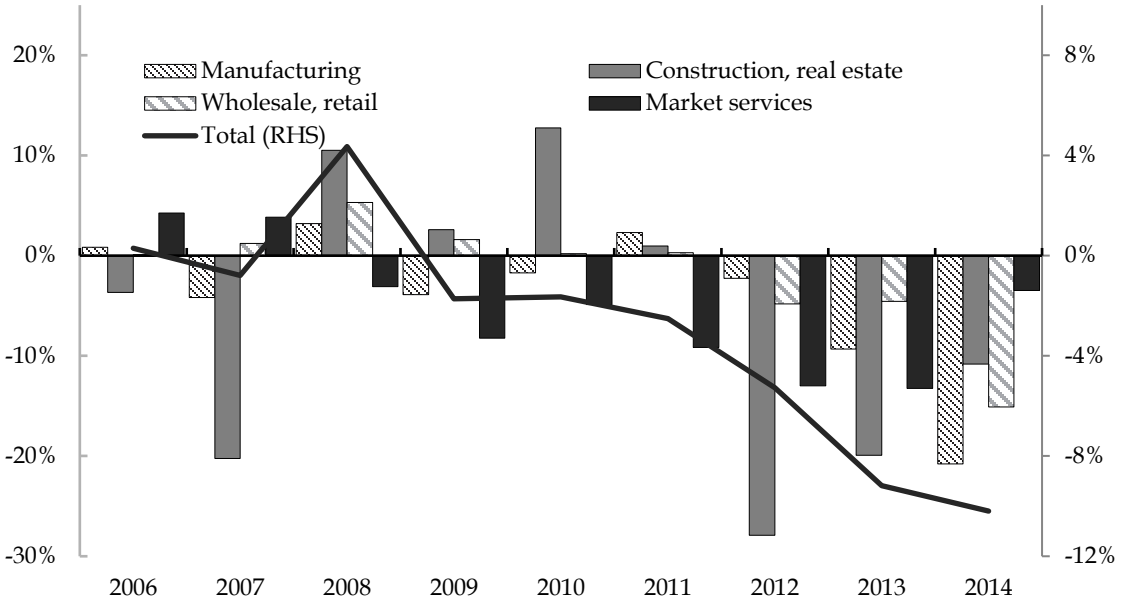
Our firm-level data shows an overall contraction in investment and deterioration in balance sheet strength in Cyprus after the GFC.[6] The average net investment rate declined from 4 percent in 2008 to -2 percent in 2009 and further down to -10 percent in 2014, which means that since 2009, investment has not been able to cover the depreciation of capital (Figure 5). 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 this period. Data also shows that companies with weak balance sheet invested less.

[5] 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.

[6] 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.

FIGURE 5

NFC Net Investment Rate

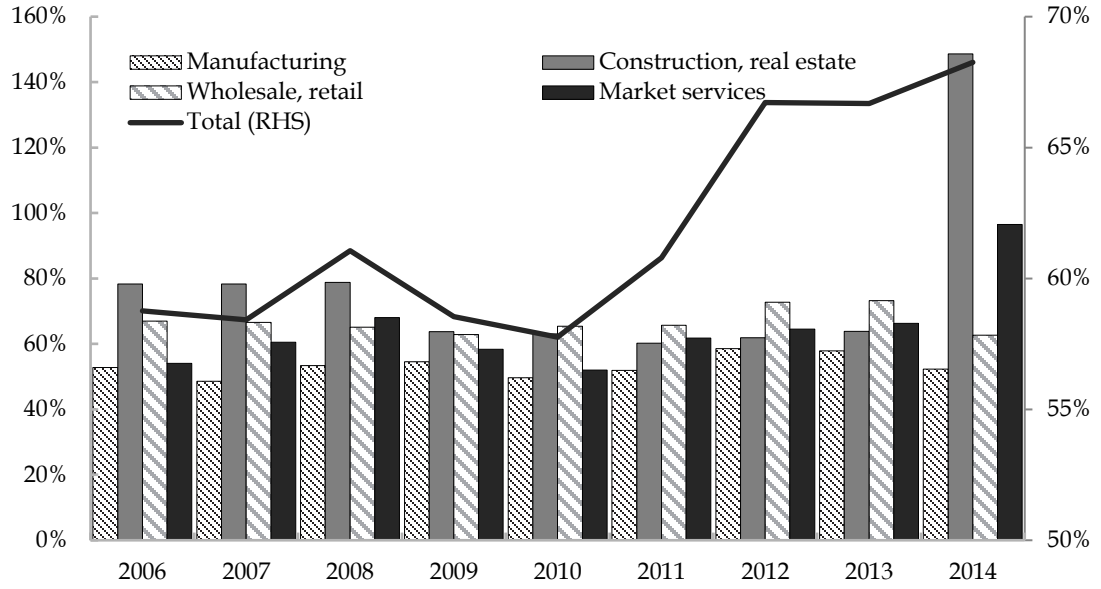


Sources: Orbis; and IMF staff estimates.

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 (Figure 6). 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 (Figure 7). 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 (Figure 8). The growth rate of corporate sales declined from 14 percent in 2008 to -4 percent in 2013 (Figure 9). The increase in sales in the wholesale and retail sector in 2014 explains the 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 (Figure 10). 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 (Figure 11).

FIGURE 6

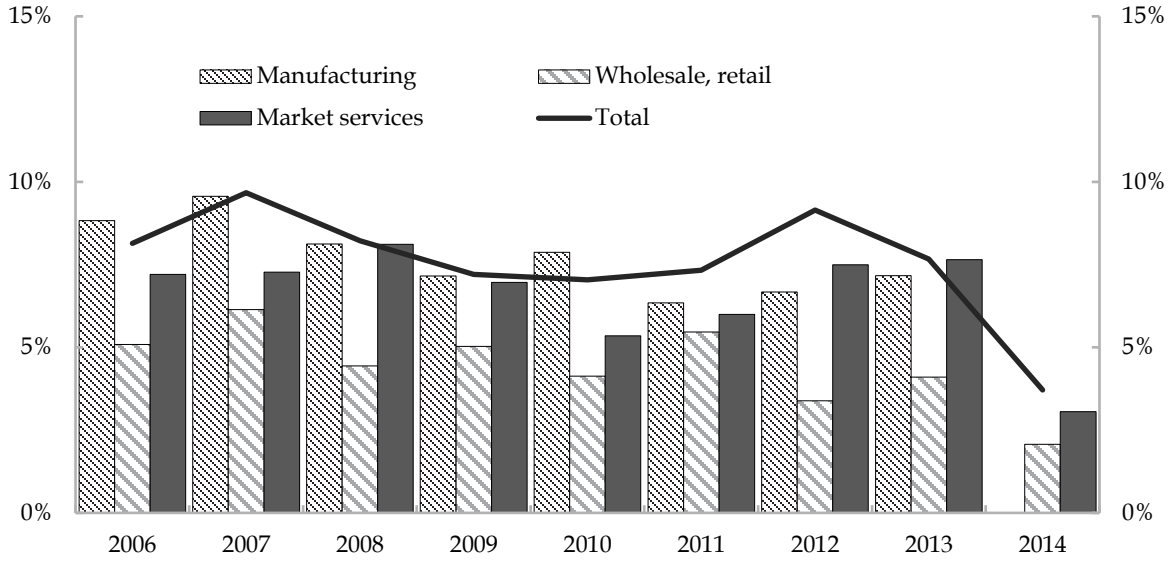
NFC Debt to Assets Ratio



Sources: Orbis; and IMF staff estimates.

FIGURE 7

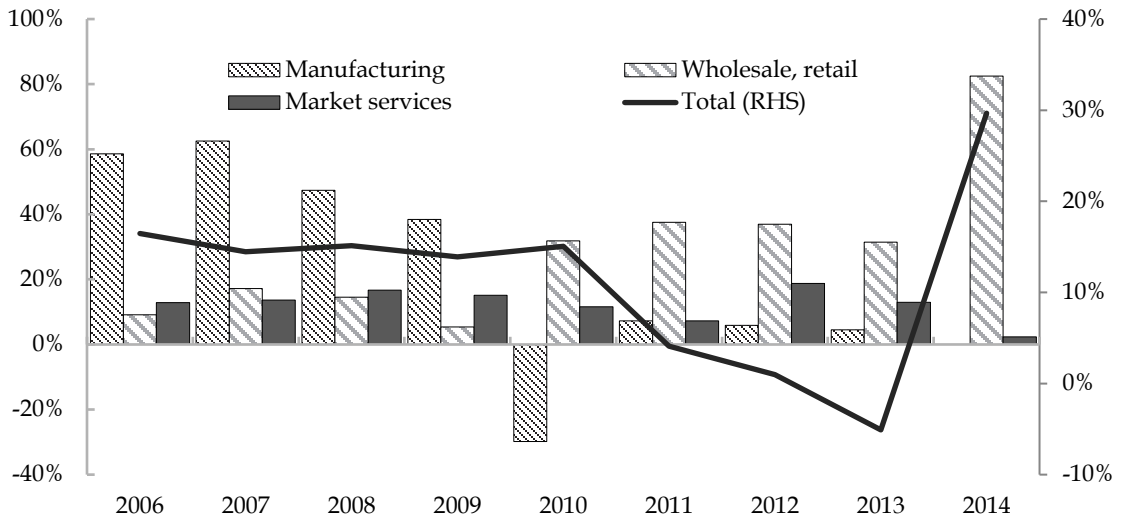
NFC Cash to Assets Ratio



Sources: Orbis; and IMF staff estimates

FIGURE 8

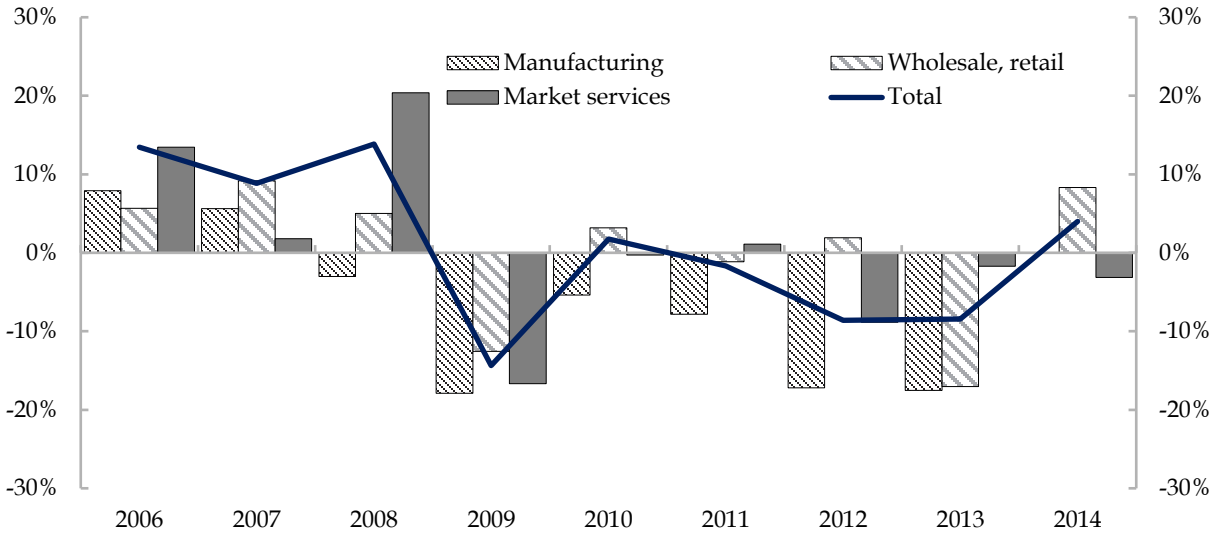
NFC Earnings to Debt Ratio



Sources: Orbis; and IMF staff estimates

FIGURE 9

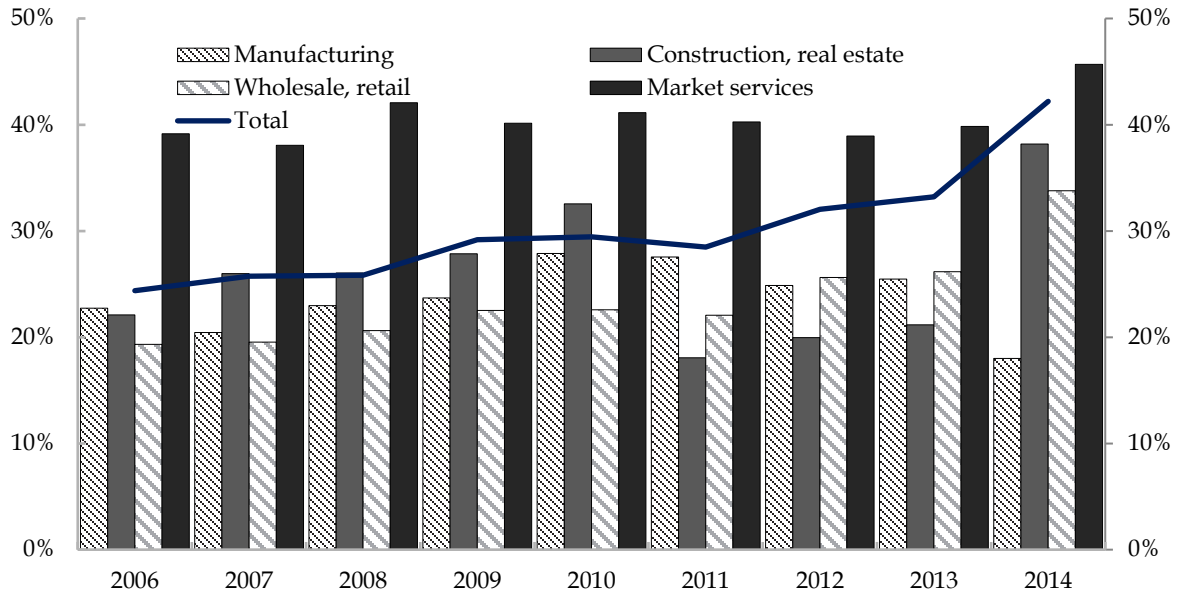
NFC Sales Growth



Sources: Orbis; and IMF staff estimates

FIGURE 10

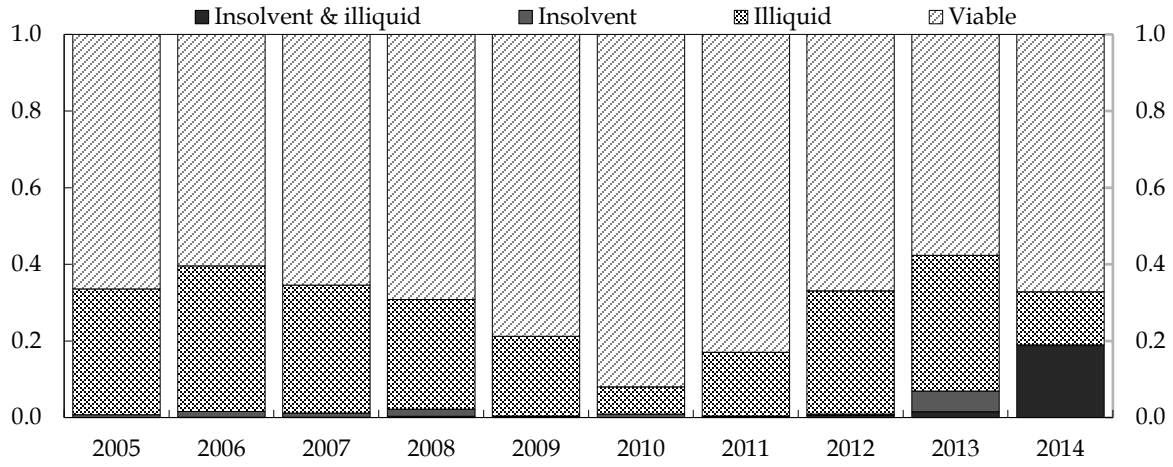
NFC Long-Term Debt to Debt Ratio



Sources: Orbis; and IMF staff estimates.

FIGURE 11

NFC Debt and Balance Sheet Health



Sources: Orbis; and IMF staff estimates.

From the full sample of Cypriot firms in Orbis, we exclude utilities firms, financial and insurance firms, and public-sector firms. We also exclude firms with missing data.[7] The remaining sample is 80 firms and about 300 observations. Our sample most captures large and publicly listed companies. About 85 percent of the observations are from active publicly listed companies. The mean and median asset size are 340 million and 159 million (real 2010) Euros respectively. Appendix Table A1 presents summary statistics of our regression sample.

3.3 Empirical Methodology

We estimate the following regression of investment:

$$\frac{I_{it}}{K_{it}} = \alpha \times Leverage_{it} + \beta \times Cash_{it} + \gamma \times Earnings_{it} + \delta \times Maturity_{it} + \eta \times \boldsymbol{X}_{it} + \varepsilon_i + \varepsilon_{it}, \qquad (1)$$

where i and t index firm and year. I/K is investment rate, *leverage, cash, earnings*, and *maturity* are defined in Section 3A.[8] $\boldsymbol{X}$ 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 cyclicality of leverage, total assets to control for firm size, and Tobin's q to control for growth opportunities (see Appendix Table A2 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 several 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}, fixed effects or generalized least squares models are inconsistent; while the 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: (i) the Arellano and Bond (1991) AR(1) statistic tests the first-order serial correlation of the error term; (ii) the Arellano and Bond (1991) AR(2) statistic tests the lack of second-order serial correlation in the first-difference of the error term; and (iii) The Hansen statistic tests overidentification or the join validity of the instruments (Hansen 1982).

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

[7] We only include firms with three or more years of observations due to the lag structure of our GMM estimator.
[8] To separate the effect of overall indebtedness and cash holdings, we only include cash in regression specifications where net debt is used.

dummies are included as exogenous variables.[9] 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.

3.4 Results

3.4.1 Does balance sheet strength matter and through which channels?

Table 1 presents our main results on the role of balance sheet soundness 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, 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.[10] 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 factor. Overall, we find that balance sheet strength is strongly associated with 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.

We should note that our diagnostic results are satisfactory. 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.[11] Nevertheless, due to the small sample size and the lack of strong exogenous instrument, we interpret our results as associations, and not as causal relations.

3.4.2 Effect of the Crisis

As discussed earlier, the Cypriot banking crisis had a significant impact on the economy. One question of interest is whether the crisis has affected the relationship between balance sheet soundness and investment. For the pre-crisis period, the coefficients on leverage remain negative and significant when Tobin's q is not included (Table 2). 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 (2008–11) (Table 3). Overall, our results suggest that before the banking crisis, a 10-percentage point decrease (increase) in leverage is associated with a 6 to 10 percentage point increase (decrease) in investment rate.

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[9] 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.

[10] 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 are omitted for space consideration.

[11] 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.

TABLE 1

Firm Balance Sheet and Investment: Main Results

	(1)	(2)	(3)	(4)
Net investment rate	All firms			
Total Debt / Assets	-0.552***	-0.286**		
	[0.131]	[0.140]		
Net debt / Assets			-0.381***	-0.284**
			[0.123]	[0.114]
Cash / Assets			-0.571*	-0.469*
			[0.310]	[0.267]
Earnings / Total Debt	-0.080	0.037		
	[0.060]	[0.059]		
Earnings / Net debt			0.003	0.011
			[0.017]	[0.021]
Long-term Debt / Total Debt	-0.018	-0.055		
	[0.118]	[0.101]		
Long-term Debt / Net debt			-0.027	-0.084
			[0.113]	[0.083]
Sales growth	0.338***	0.277***	0.325***	0.291***
	[0.083]	[0.079]	[0.084]	[0.080]
ln(Assets)	0.022	0.021	0.022	0.029
	[0.015]	[0.017]	[0.018]	[0.021]
Tobin's q		0.003		0.006
		[0.009]		[0.006]
Constant	0.040	-0.110	-0.051	-0.184
	[0.182]	[0.145]	[0.193]	[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

Source: Orbis and authors' calculations.

Note: This table shows results of a two-step system GMM estimation of the effect of corporate balance sheet strength on investment in Cyprus over 2005-2014. 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. 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 2

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***	-0.509		
	[0.261]	[0.368]		
Net debt / Assets			-0.592***	-0.317
			[0.205]	[0.194]
Cash / Assets			-0.700*	-0.512
			[0.400]	[0.434]
Earnings / Total debt	-0.114	0.020		
	[0.085]	[0.151]		
Earnings / Net debt			0.000	0.020
			[0.029]	[0.033]
Long-term Debt / Total debt	0.229	0.059		
	[0.182]	[0.175]		
Long-term Debt / Net debt			0.164	0.009
			[0.138]	[0.088]
Sales growth	0.303***	0.233**	0.309***	0.266***
	[0.089]	[0.100]	[0.107]	[0.099]
ln(Assets)	0.022	0.019	-0.003	0.009
	[0.035]	[0.036]	[0.028]	[0.027]
Tobin's q		0.004		0.002
		[0.008]		[0.010]
Constant	0.158	-0.001	0.294	0.069
	[0.329]	[0.285]	[0.333]	[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

Source: Orbis and authors' calculations.

Note: This table shows results of a two-step system GMM estimation of the effect of corporate balance sheet strength on investment in Cyprus over 2005-2014. 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. 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 3

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

	(1)	(2)	(3)	(4)
Net investment rate	Post-GFC, Pre-Cypriot Crisis (2008-2011)			
Total debt / Assets	-0.871***	-0.329		
	[0.241]	[0.354]		
Net debt / Assets			-0.534**	-0.302*
			[0.213]	[0.172]
Cash / Assets			-0.721*	-0.439
			[0.388]	[0.489]
Earnings / Debt	-0.092	0.053		
	[0.067]	[0.142]		
Earnings / Net debt			-0.019	-0.006
			[0.027]	[0.029]
Long-term Debt / Debt	0.256	0.032		
	[0.179]	[0.208]		
Long-term Debt / Net debt			0.117	-0.083
			[0.109]	[0.106]
Sales growth	0.319***	0.246**	0.377***	0.278***
	[0.093]	[0.114]	[0.100]	[0.101]
ln(Assets)	-0.004	0.002	-0.010	0.023
	[0.035]	[0.048]	[0.028]	[0.037]
Tobin's q		-0.004		0.008
		[0.009]		[0.006]
Constant	0.400	0.121	0.356	-0.088
	[0.336]	[0.422]	[0.313]	[0.371]
Observations	152	127	146	124
Number of firmid	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 of the effect of corporate balance sheet strength on investment in Cyprus over 2005-2014. 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.

To investigate whether the effects of balance sheet variables on investment are different before and after the start of the Cypriot banking crisis, we add interaction terms of the crisis dummy and balance sheet variables to the baseline model with the full sample. The crisis dummy takes a value of 1 for the years 2012-2014. The coefficients on the linear leverage term remain negative and significant in all specifications (Table 4). 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 at the Cypriot banking crisis and recovery period. Finally, none of the interaction terms with the crisis dummy is significant except earnings in one specification. Therefore, we conclude that balance sheet strength remains important for investment during the crisis and recovery period.

TABLE 4

Firm Balance Sheet and Investment: Effect of the Crisis

	(1)	(2)	(3)	(4)
Net investment rate	All firms			
Total debt / Assets	-0.769***	-0.484*		
	[0.201]	[0.276]		
Total debt / Assets x Crisis	0.436*	0.219		
	[0.237]	[0.259]		
Net Debt / Assets			-0.571***	-0.433**
			[0.218]	[0.196]
Net debt / Assets x Crisis			0.264	0.155
			[0.234]	[0.233]
Cash / Assets			-0.475	-0.775
			[0.479]	[0.532]
Cash / Assets x Crisis			-0.417	0.102
			[0.694]	[0.646]
Earnings / Debt	-0.109*	0.001		
	[0.057]	[0.113]		
Earnings / Debt x Crisis	0.086	0.015		
	[0.071]	[0.107]		
Earnings / Net debt			0.007	0.036
			[0.029]	[0.046]
Earnings / Net debt x Crisis			-0.021	-0.047

			[0.046]	[0.047]
Long-term debt / Debt	0.035	0.050		
	[0.152]	[0.139]		
Long-term debt / Debt x Crisis	-0.149	-0.170		
	[0.113]	[0.131]		
Long-term Debt / Net debt			0.017	-0.093
			[0.117]	[0.159]
Long-term Debt / Net debt x Crisis			-0.186	-0.082
			[0.167]	[0.166]
Crisis	-0.245**	-0.113	-0.060	-0.091
	[0.123]	[0.129]	[0.132]	[0.118]
Sales growth	0.334***	0.239**	0.314***	0.258***
	[0.077]	[0.096]	[0.075]	[0.083]
ln(Assets)	0.019	0.019	0.027	0.029
	[0.022]	[0.028]	[0.019]	[0.026]
Tobin's q		0.008		0.011
		[0.012]		[0.010]
Constant	0.189	-0.005	-0.038	-0.082
	[0.197]	[0.234]	[0.215]	[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

Source: Orbis and authors' calculations.

Note: This table shows results of a two-step system GMM estimation of the effect of corporate balance sheet strength on investment in Cyprus over 2005-2014. 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. 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.

Our result suggests that the effect of indebtedness on investment is larger before the crisis. One likely reason for this asymmetric effect is investment capacity. Before the crisis, credit boom fueled rapid investment growth. During the crisis and recovery period, the economy had spare capacity which could be utilized without much additional credit. In this case, a recovery without much credit (i.e. a creditless recovery) is possible.[12]

3.4.3 Heterogeneous firms

We assess whether the effect of balance sheet strength on investment is heterogeneous across firms. We start by examining the effect of firm age. If young firms are more financially constrained, then a weakening (strengthening) of their balance sheet strength should constrain their access to external financing more (less) and hence has a larger impact on their investment. Our data is well suited to study young firms. Half of the firms in our sample have been incorporated for 15 years or less and one quarters have been incorporated for 7 years or less. This coverage of young firms is in contrast with prior studies that mostly focus on mature and publicly listed firms.[13]

We define young firms as a dummy variable that takes a value of one for firms 15 years or younger. As shown in Table 5, the interaction term between young firms and both measures of leverage are negative and significant. This result suggests that indebtedness have a much larger effect on the investment of young firms. Compared to old firms, a one percentage point increase in leverage is associated with an additional 3 to 5 percentage point decrease in the investment rate of young firms.

It is natural to expect that similar differential effects hold for other proxies of financial friction, such as firm size. Unfortunately, the size distribution of our sample predominantly consists of small firms and thus does not allow us to distinguish the effect between smaller and large firms. For example, a quarter of our sample are firms with no more than 5 employees; half are firms with no more than 18 employees. Over 90 percent of our sample can be classified as SMEs by convention (i.e., no more than 250 employees). As such, our baseline can be interpreted as effects on SMEs.

3.4.3 Robustness

We carry out several robustness checks for our baseline results. We 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 sample to all solvent firms, defined as firms with total debt less than assets. About 5 percent of the firms in our sample period fall into this category and are excluded from this analysis. As shown in Table 6, 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

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[12] Cross-country experiences suggest that for a banking crisis preceded by 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).

[13] Due to data limitation, most existing papers also use listed age (i.e. the number of years since a firm's IPO) instead of natural age (i.e. the number of years since incorporation). Because many firms are not listed until many years after incorporation, using listed age in regression analysis will underestimate the effect of young age on the left-hand-side variables.

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.

TABLE 5

Firm Balance Sheet and Investment: Young vs. Old Firms

	(1)	(2)	(3)	(4)
Investment rate	All Firms			
Total debt / Assets	-0.538***	-0.280**		
	[0.120]	[0.140]		
Total debt / Assets x Young firms	-5.414***	-4.826***		
	[1.409]	[0.561]		
Net debt / Assets			-0.413***	-0.274**
			[0.113]	[0.130]
Net debt / Assets x Young firms			-3.749***	-2.891***
			[1.029]	[0.590]
Cash / Assets			-0.485	-0.416
			[0.455]	[0.467]
Young firms	4.369***	3.924***	2.710***	2.103***
	[1.084]	[0.440]	[0.671]	[0.385]
Earnings / Debt	-0.081	0.041	0.007	0.047
	[0.058]	[0.060]	[0.057]	[0.062]
Long-term Debt / Debt	-0.055	-0.041	-0.006	-0.059
	[0.110]	[0.097]	[0.123]	[0.101]
Sales growth	0.343***	0.282***	0.338***	0.287***
	[0.079]	[0.090]	[0.090]	[0.093]
ln(Assets)	0.028*	0.023	0.02	0.022
	[0.017]	[0.018]	[0.018]	[0.020]
Tobin's q		0.003		0.002
		[0.009]		[0.007]
Constant	-0.035	-0.143	-0.031	-0.115
	[0.176]	[0.166]	[0.177]	[0.171]
Observations	307	250	302	247
Number of firms	81	70	81	70
AR(1)	-1.859	-1.669	-1.864	-1.671
pval	0.063	0.095	0.062	0.0948
AR(2)	-0.212	-0.363	-0.202	-0.357
pval	0.832	0.716	0.84	0.721
Hansen J (overid)	64.49	58.44	67.45	59.39
pval	1	1	1	1

Source: 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.

[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).

TABLE 6

Firm Balance Sheet and Investment: Solvent Firms

	(1)	(2)	(3)	(4)
Net investment rate	Solvent firms			
Total Debt / Assets	-0.620***	-0.245		
	[0.164]	[0.176]		
Net debt / Assets			-0.359***	-0.208
			[0.137]	[0.129]
Cash / Assets			-0.590*	-0.486*
			[0.320]	[0.279]
Earnings / Total Debt	-0.098**	0.045		
	[0.039]	[0.065]		
Earnings / Net debt			0.009	0.015
			[0.021]	[0.021]
Long-term Debt / Total Debt	-0.001	-0.063		
	[0.108]	[0.102]		
Long-term Debt / Net debt			-0.052	-0.142*
			[0.105]	[0.080]
Sales growth	0.368***	0.267***	0.341***	0.299***
	[0.078]	[0.082]	[0.086]	[0.083]
ln(Assets)	0.028*	0.025	0.029	0.027
	[0.016]	[0.022]	[0.020]	[0.020]
Tobin's q		0.002		0.003
		[0.007]		[0.005]
Constant	-0.010	-0.173	-0.147	-0.157
	[0.175]	[0.175]	[0.210]	[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

Source: Orbis and authors' calculations.

Note: This table shows results of a two-step system GMM estimation of the effect of corporate balance sheet strength on investment in Cyprus over 2005-2014. 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. 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.

We also check if our results are robust to the firms' ownership and consolidation status. About 15 percent of our sample is foreign-owned (i.e. all shareholders are non-Cypriot enterprises). About 5 percent of the sample is jointly owned by domestic and foreign shareholders. We do not find evidence that our baseline results are driven by the ownership structure. Moreover, most of our sample are from consolidated accounts. Our results are still robust if observations with unconsolidated accounts are excluded.

4. 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. Moreover, indebtedness has a much larger impact on the investment of young firms. A one percentage point decrease (increase) in leverage is associated with an additional 3 to 5 percentage point increase (decrease) in the investment rate of young firms. These results are economically significant: extrapolating our estimates to the aggregate level suggests that the increase in corporate leverage may account for 1/6 to 1/3 of the decline in overall Cypriot corporate investment from its 2008 peak.

The negative effect of corporate indebtedness on investment highlights the need to repair corporate balance sheet. Despite a 2-percent output growth in 2015, output remained 9 percent below its 2008 peak. Cyprus has made substantial 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.

References

Abiad, A., Dell'Ariccia G., and Li B., (2011), 'Creditless recoveries', IMF Working Paper 11/58.

Almeida, H., Campello, M., and Weisbach M.S., (2004), 'The cash flow sensitivity of cash', *Journal of Finance,* 59: 1777–1804.

Arellano, M., and Bond, S., (1991), 'Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations', *The Review of Economic Studies,* 58 (2): 277–297.

Barkbu, B., Berkmen, S.P., Lukyantsau, P., Saksonovs, S., and Schoelermann, H., (2015), 'Investment in the Euro Area: Why has it been weak? ' IMF Working Paper 15/32.

Bernanke, B., and Gertler, M., (1989), 'Agency Costs, net worth, and business fluctuations', *American Economic Review,* 79(1): 14–31.

Blundell, R., and Bond, S.R., (2000), 'GMM estimation with persistent panel data: An Application to Production Functions', *Econometric Reviews,* 19(3): 321–40.

Dittmar, A., Mahrt-Smith, J., and Servaes, H., (2003), 'International corporate governance and corporate cash holdings', *Journal of Financial and Quantitative Analysis,* 38: 111–133.

Eckstein, Z., Setty, O., and Weiss, D., (2015), "Financial Risk and Unemployment," Center of Economic Policy Research, LSE, 2015.

Erickson, T., and Whited, T.M., (2000), 'Measurement error and the relationship between investment and q', *Journal of Political Economy*, 108(5): 1027-1057.

Hayashi, F., (1982), 'Tobin's marginal q and average q: A neoclassical Interpretation', *Econometrica,* 50(1): 213-224.

Hennessy, C.A., Levy, A., and Whited, T.M., (2007), 'Testing Q theory with financing frictions', *Journal of Financial Economics,* 83(3): 691–717.

IMF, (2016), 'Euro Area Policies—Selected Issues', IMF Country Report, No. 16/220.

Jensen, M., (1986), 'Agency costs of free cash flow, corporate finance and takeovers', *American Economic Review,* 76(2): 323–329.

Kalemli-Özcan, S., Laeven, L., and Moreno, D., (2015), 'Debt overhang in Europe: Evidences from firm-bank-sovereign linkages', mimeo.

Kalemli-Özcan, S., Sorensen, B., and Yesiltas, S., (2012), 'Leverage across firms, banks, and countries', *Journal of International Economics,* 88(2): 284-298.

Laeven, L., and Valencia, F., (2013), 'Systemic banking crises database', *IMF Economic Review,* 61: 225–270.

Lemmon, M.L., Roberts, M.R., and Zender, J.F., (2008), 'Back to the beginning: Persistence and the cross-section of corporate capital structure', *Journal of Finance,* 63(4): 1575-1608.

Myers, S.C., (1977), 'Determinants of corporate borrowing', *Journal of Financial Economics,* 5(2): 147–175.

Opler, T., Pinkowitz, L., Stulz, R., and Williamson, R., (1999), 'The determinants and implications of corporate cash holdings', *Journal of Financial Economics,* 52: 3–46.

Whited, T.M, (1992), 'Debt, liquidity constraints, and corporate investment: Evidence from panel data', *Journal of Finance,* 47(4): 1425–1460.

Windmeijer, F., (2005), 'A finite sample correction for the variance of linear efficient two-step GMM estimators', *Journal of Econometrics,* 126(1): 25–51.