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Corporate Debt Overhang in Croatia: Micro Assessment and Macro Implications

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CORPORATE DEBT OVERHANG IN CROATIA: MICRO ASSESSMENT AND MACRO IMPLICATIONS

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ABSTRACT

High corporate sector leverage is often been highlighted as one of the key impediments to economic recovery in Croatia. In order to quantify the size of this challenge, we conduct a debt sustainability analysis for Croatian corporates based on firm-level data. The analysis shows that almost a third of the corporate debt in Croatia is excessive, which points to sizeable deleveraging needs in the medium term. In the event of a decline in GDP and a rise in interest rates, almost half of the existing corporate debt might become unsustainable. By including the estimated firm-level debt overhang indicator in panel estimation of the investment equation, we find that over-indebted firms reduce their investment activity to a greater extent than those without debt overhang. This especially holds for exporters, private and domestically owned companies, what probably explains why they are less burdened by debt overhang compared to the rest of the corporate sector. Our paper contributes to the existing literature by showing that, in the case of Croatia, the firm-level debt sustainability thresholds based on firm performance, unlike the aggregate thresholds, capture the asymmetrically negative effect of excessive debt on investment. The adverse impact of the debt overhang on investment activity highlights the need to improve the institutional framework for corporate deleveraging in Croatia.

Keywords: corporate debt, investment, debt overhang, deleveraging, crisis, Croatia
JEL Classification: D22, E22, F34, G31

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CONTENTS

1. Introduction

The issue of (over)indebtedness has come into the focus of economic research during the recent global financial crisis. The need for deleveraging is frequently cited as the key limitation to a stronger economic recovery. In this respect Croatia is not very different from many other EU countries. In the period of economic expansion, which was characterised by low risk perception and abundant capital inflows, Croatian enterprises accumulated high debt from both domestic and foreign sources. As a result, non-consolidated debt of the corporate sector has increased to around 100% of GDP, thus putting the Croatian corporate sector among the most indebted in Central and Eastern Europe. However, corporate deleveraging since the beginning of the financial crisis has been very slow and uneven. This raises questions if and to what extent the existing corporate debt in Croatia is sustainable, how much deleveraging can be expected in the medium term, and what are the macroeconomic implications of debt overhang.

The high debt of non-financial corporations and the accompanying deleveraging needs may have various negative implications for economic activity. Excessive debt and deleveraging create pressures on firms' profitability and make the investment recovery more difficult because overleveraged enterprises have no financial space to engage in potentially good investment opportunities. Moreover, excessive corporate indebtedness hinders the reallocation of economic resources from firms with low productivity to more productive and promising firms. Finally, excessive debt poses risks for financial stability because it leads to deterioration in loan performance as well as to increased vulnerability of firms to interest rate shocks.

The aim of this paper is two-fold. First, we estimate the share of debt overhang in total debt of the corporate sector, thus quantifying the deleveraging needs. In addition, we perform a sensitivity analysis of the estimated debt overhang to selected economic shocks. Second, the paper aims to assess the impact of corporate (over)indebtedness on investment activity by estimating the dynamic panel data model of the investment equation that includes the previously estimated firm-level debt overhang indicator.

The paper is structured as follows. The introduction is followed by a literature review. The third section provides an estimation of the debt overhang for the corporate sector in Croatia and its subgroups defined by industry, size, ownership and export orientation. The fourth section

presents the econometric panel estimation of the investment equation with particular emphasis on asymmetric effects of over-indebtedness on investment activity, and accounting for firm-specific characteristics. The paper concludes with some policy implications.

2. The concept of corporate debt sustainability and literature review

Starting point in theory of corporate finance are Modigliani and Miller (1958) and their capital structure irrelevance proposition. They argue that the value of a firm and its investment decisions do not depend on indebtedness; i.e. it is irrelevant if the firm uses internal (capital and retained earnings) or external financing (loans and securities). However, subsequent theories have challenged the funding structure irrelevance theorem. This strand of literature emphasises that the selection of financing sources, their structure and price have an impact on corporate operations and investment due to the existence of market frictions. In particular, the trade-off and the pecking order theories of corporate leverage (Myers, 1984) suggest that firms decide on the structure of financing sources by comparing marginal benefits and costs of various financing sources. According to Myers, the trade-off theory argues that a firm sets a target debt to asset ratio, where the target level is determined by the tax benefits of debt on the one hand and potential bankruptcy costs on the other. The pecking order theory argues that a firm generally prefers internal to external financing, and debt to equity in case of external financing. Murray and Goyal (2005), in their overview of theoretical concepts of corporate debt, refer to numerous empirical studies that confirm the general hypotheses of these two theories. These concepts suggest, contrary to the Modigliani-Miller approach, that the quantity and price of corporate debt financed from different sources have significant implications on firm's operations. In the long run this influences investment decisions, which has far-reaching consequences for overall economic developments. The analysis of corporate debt in Croatia in this paper has been motivated by this theoretical background.

Following the trade-off and pecking order theories, the issue of debt sustainability (i.e. detection of debt overhang) has increasingly been in the focus of economic research. This issue becomes even more relevant in the aftermath of recessions when excessive debt and rollover risks can pose a great burden on economic recovery. Lo and Rogoff (2015) find a negative influence of debt overhang of all sectors (including the corporate) on recovery after the recent great financial

crisis. Likewise, in a comprehensive overview of the over-indebtedness issue, Buttiglione et al. (2014) point out that many countries are caught in a vicious circle between debt overhang and deleveraging. Debt overhang implies slower growth, which makes deleveraging more difficult, feeding back into continued slow growth. Another prominent paper is Eggertson and Krugman (2011), who theoretically formalise the fact that over-indebted economic agents must decrease their debt, which adversely affects aggregate demand.

As for empirical quantifications of the threshold value above which corporate debt becomes detrimental for the economy, literature is not so buoyant as in the case of public debt[1]. One paper that stands out is Cecchetti et al. (2011). Based on data for 18 OECD countries in the period from 1980 to 2010, they estimate that the threshold value above which the corporate debt becomes a burden to economic growth is 90% of GDP, as higher nominal debt in case of shocks increases volatility in the real sector and financial vulnerability, which together reduces growth. Furthermore, Cecchetti et al. (2011) point out that high private debt in combination with high public debt makes the economy even more vulnerable to shocks. Similarly, Arcand et al. (2012) estimate that financing starts having a negative effect on output growth when credit to the private sector reaches 100% of GDP. The fact that Croatian corporate (and private) debt already exceeds these thresholds warrants an in-depth assessment of the corporate indebtedness in Croatia. Hence, we build our assessment on these macro-level findings, but take a more disaggregated approach estimating corporate debt thresholds on firm level.

The issue of corporate (over)indebtedness is often incorporated in the studies analysing its implications on specific macroeconomic developments. Among recent papers, Goretti and Souto (2013) find a negative correlation between investment and debt burden on a sample of Euro area periphery countries in the period from 2000 to 2011. By using a narrative approach and observing deleveraging experiences in the post-crises periods, they stress the need for orderly deleveraging of the corporate sector, while at the same time pointing to the risks and macrofinancial costs of deleveraging. The impact of over-indebtedness on productivity growth in Central and Eastern Europe is assessed by Coricelli et al. (2010), who detect the threshold debt level at 40% of total equity above which additional borrowing leads to a decrease in productivity growth. Likewise, Kalemli-Ozcan et al. (2015) show that debt overhang and rollover risk have weakened the investment activity in Europe. Their results suggest that these

[1] Reinhart and Rogoff (2010) and Reinhart et al. (2012) show that public debt exceeding 90% of GDP lowers economic growth by approximately one percentage point.

two factors caused half of the drop in investment activity during the crisis. Moreover, they find that European firms with higher debt overhang invested less even before the crisis and that this negative correlation intensified during the crisis. This is especially valid for firms with higher share of short-term debt, which is usually associated with a higher rollover risk at times of financial market shocks.

Regarding the studies for specific countries, we can single out Lawless et al. (2014), who find the negative impact of debt overhang on SMEs' performance in Ireland, in particular on their investment, employment and financial stress indicators. Also, Damijan (2014) obtains similar findings for Slovenian enterprises: excessive leverage and lower debt service capacity hinder growth of corporate productivity, exports, employment and investment. In addition, he finds that the negative impact of over-indebtedness is greater for micro and small enterprises. Finally, Kuchler (2015) finds that high corporate leverage in Denmark contributed to the reduction in investment, in particular for small and medium-sized enterprises.

To sum up, the problem of over-indebtedness of corporate sector and its micro and macroeconomic implications is a wide and variously represented topic covered in numerous empirical and theoretical papers. They, together with the current developments in Croatia (high corporate debt), offer a good starting point and motivation for conducting the analysis of over-indebtedness of Croatian enterprises and of its impact on investment activity.

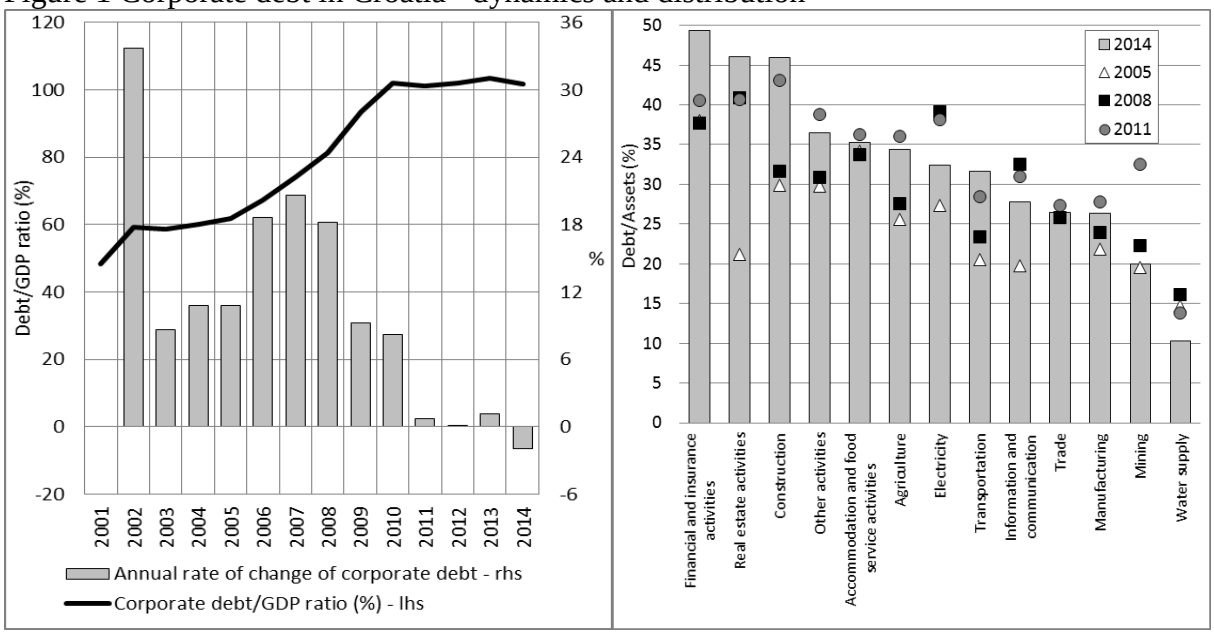
3. Corporate debt overhang in Croatia

3.1. Evolution of corporate debt in Croatia

Corporate sector debt in Croatia grew strongly in the years preceding the global financial crisis, supported by low risk perception, large capital inflows and the boom in the construction and real estate sector. In the period from 2001 to 2008, the total corporate sector debt increased threefold, growing by 17% annually (Figure 1, left panel). Although the central bank introduced measures that have successfully slowed down domestic credit activity, firms had turned to direct foreign borrowing, and total corporate debt continued to grow strongly until the beginning of crisis. After 2009, recession and higher risk aversion of both creditors and debtors led to a

marked slowdown of corporate borrowing. However, up to end-2014 there was still no evidence of significant deleveraging.

Figure 1 Corporate debt in Croatia - dynamics and distribution

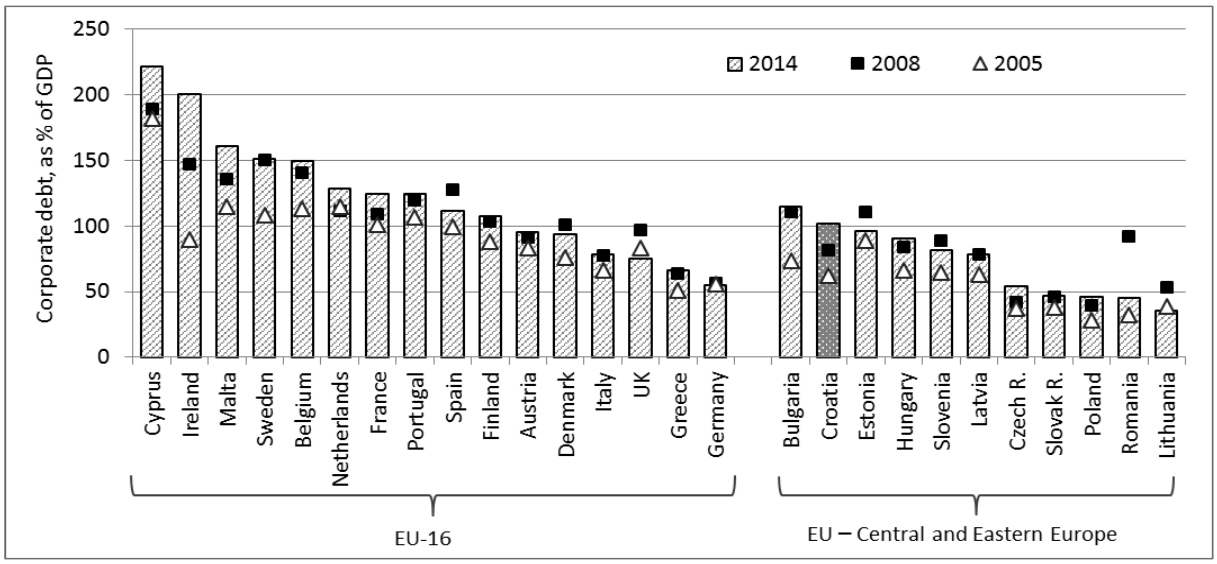


Note: Corporate debt on the left panel is the sum of loans and debt securities from non-consolidated financial accounts. Corporate debt on the right panel refers to a sample of firms used in debt sustainability assessment in Chapter 3.2).
Sources: CNB (left panel); Amadeus (right panel).

Accumulation and subsequent stabilisation of corporate debt occurred together with its reallocation within the sector. As a result, the distribution of debt across industries significantly differed in the adjustment phase compared to the expansionary phase before the crisis (Figure 1, right panel). Notably, debt growth in the period 2005- 2014 was the strongest in the real estate sector, construction, and transportation and storage activities, for which the debt-to-assets ratio increased by more than 50%. Conversely, since the beginning of the crisis indebtedness decreased in only four industries, primarily those where indebtedness was initially not very high (water supply, mining, ICT and electricity supply).

Unlike almost all Central and Eastern European countries, Croatian corporate sector has not deleveraged since the beginning of the crisis. In fact, the share of corporate debt in GDP until the end of 2014 even increased, and currently exceeds 100% of GDP, thus bringing the Croatian corporate sector among the most indebted in Central and Eastern Europe (Figure 2).

Figure 2 Debt of the non-financial corporations in EU countries



Note: Corporate debt is the sum of loans and debt securities from non-consolidated financial accounts. Luxembourg (in which corporate debt stood at 346% of GDP in 2014) is not shown in the chart.
Source: Eurostat

Nonetheless, the level of leverage itself does not necessarily imply that the corporate sector is over-indebted or unable to service its debt. In fact, majority of "old" EU members have been facing significantly higher corporate leverage levels for years. The firms' capacity to finance debt should therefore be assessed by taking into account their profitability and the cost of debt. Average profitability of Croatian enterprises, measured by the ratio of EBIT and total assets, recorded a strong decline after the beginning of the crisis, after which it remained at approximately 2% (Annex I, second table). This is almost one-third below the profitability levels recorded before the crisis. At the same time, a gradual decline in global and domestic interest rates resulted in a decrease of the interest payment burden. This has contributed to a gradual improvement of the interest coverage ratio, which, after a sharp decline in 2008-2010, gradually increased until the end of the observed period and, by 2014, slightly exceeded the pre-crisis level.

The described indicators suggest that high debt of Croatian enterprises has become a heavy burden on their performance. European Commission (EC, 2016) and International Monetary Fund (IMF, 2015) in their reports emphasise corporate indebtedness as one of the main impediments to the recovery of investment and thus of economic growth in Croatia. The following section therefore presents a quantitative assessment of corporate debt sustainability in Croatia.

3.2. Methodology of debt sustainability assessment and data description

There is no uniform approach to the assessment of corporate debt sustainability. The most frequent are comparative methods based on common indicators of indebtedness and debt-servicing burden with arbitrarily selected thresholds. The most common indebtedness indicators include the share of corporate debt in GDP, total assets or equity (an overview of the methods and indicators is shown in Bruggeman, 2013). However, these indicators point to the relative debt amount, but do not reveal whether firms can service their debt from regular operations.

More comprehensive methods that take into account the debt servicing capacity of firms include: (i) Stationarity Approach (Cuerpo et al., 2014), (ii) Contingent Claims Analysis method presented in Gapen et al. (2004) and (iii) the method based on the concept of net free cash flow (NFCF) (IMF, 2013). The first method (i) is based on the notion that a debt is sustainable if it moves in line with total discounted assets, which means that the "debt-to-discounted assets" ratio must be stationary. The advantage of the stationarity approach is that it does not require defining threshold values of debt. Its disadvantage is that the assessment of the imbalance between sustainable and actual debt levels depends on the selection of a reference year for sustainable debt, such selection being made arbitrarily. The second method (ii) is based on the assessment of corporate probability of default which uses data on market value of listed companies. Given a small number of listed companies in economies with less developed capital markets, such as Croatian, the scope for such research is limited.

The third method (iii) estimates what share of debt an enterprise will be able to finance from its current operations in the medium term. The method is based on the calculation of net free cash flow (NFCF) on firm-level data, which shows if a firm is able to finance liabilities to creditors and owners from current operations. A disaggregated approach allows taking into account the heterogeneity among firms and detection of the most vulnerable firms, which could not be possible from aggregate data. The advantage of this method is dynamic forward-looking perspective, as it allows for assessing debt sustainability over the medium term and its sensitivity to various macroeconomic scenarios (e.g. the interest rate shock and the economic downturn shock). This approach is used for the debt sustainability analysis of Croatian enterprises. Its detailed application follows below.

Net free cash flow is defined as operating cash flow (before interest expense) minus interest expense minus capital expenditures and minus dividends. It is calculated as follows:

$$NFCF = \frac{Net\ free\ cash\ flow}{Assets} = \frac{Operating\ cash\ flow\ before\ interest}{Assets} - \frac{Interest\ expense}{Debt} \times \frac{Debt}{Assets} - \frac{Capital\ expenditures}{Assets} - \frac{Dividends}{Assets} \quad (1)$$

A positive value of NFCF indicates that corporate debt is sustainable, i.e. that a firm can finance debt from its current operations. In contrast, if NFCF is negative, it means that the enterprise is unable to generate sufficient cash flow to finance the existing debt level (while retaining the existing level of capital investment and dividend payments) so the company is over-indebted.

Corporate debt sustainability is assessed based on the projection of NFCF in the medium term (up until 2017). For this purpose, operating cash flow before interest and interest expense are projected, while the other components of NFCF are kept unchanged at the last recorded levels (2014). Keeping the capital expenditures and dividends at the 2014 levels is justified because it can be assumed that firms have already reduced these expenditures during the recession and that they have no more room for further adjustment.

The projection of operating cash flow is based on the econometric estimation of the relation between operating cash flow and real GDP for the period from 2005 to 2014 (results of the firm-data panel model regression are given in Annex III)[2]. Using the estimated coefficients, the operating cash flow on firm level is projected up to 2017[3]. The projection of interest expenses is based on the assumption that both domestic and foreign interest rates will remain at current low levels until 2017 and on the assumption that the structure and maturity of the corporate remains unchanged[4, 5].

[2] Operating cash flow is the dependent variable, while explanatory variables include change in real GDP in years t and t-1, a constant and time fixed effects.

[3] For the projection of operating cash flow we use forecasted real GDP growth rates of 1.7% in 2015, 1.8% in 2016 and 2.0% in 2017, according to the CNB's December 2015 official projection.

[4] In line with expectations that CNB's and ESB's monetary policies will remain accomodative, it is assumed that interest rates will stay approximately at the level of the average of the first nine months of 2015.

[5] According to CNB's data for end-2015, enterprises have 41% of domestic debt (predominantly loans) and 59% of foreign debt (36% accounted for by loans of non-affiliated creditors, 18% by debt to affiliated companies and 5% are debt securities).

The corporate debt sustainability analysis focuses on those enterprises that have high debt, i.e. debt exceeding 30% of total assets (IMF, 2013)[6]. The rationale behind this assumption is that highly indebted firms are expected to be more exposed to the default risk. This threshold level can be considered suitable for Croatia, as the Croatian corporate debt-to-assets ratio of 30% corresponds to the corporate debt-to-GDP ratio of about 90%, which according to Cecchetti et al. (2011) is the threshold value of "excessive" aggregate corporate debt.

Enterprises with the debt-to-assets ratio above 30% and a negative projected value of net free cash flow ($NFCF_{2017} < 0$) are considered over-indebted. Next, for the over-indebted enterprises, the sustainable debt level is derived as the debt level at which $NFCF_{2017}$ equals zero (i.e. becomes non-negative). The difference between the existing debt level and the sustainable debt level of over-indebted enterprises is debt overhang and represents deleveraging needs in the medium term.

The analysis is based on annual data set obtained from the Amadeus database compiled by *Bureau van Dijk*. Data on interest expenses and exports are obtained from the annual databases of financial reports compiled by the Croatian Financial Agency (FINA). We excluded firms that, according to ESA 2010 classification, are part of the government sector. We also excluded *outliers* in line with Lopez-Garcia and di Mauro (2015). In particular, we excluded firms with variable values outside the range from the 2nd to 99th percentiles and outside the "median ± 10*interquartile range". In addition, we excluded enterprises with less than two employees and enterprises with negative assets or assets equalling zero. The resulting sample of firms comprises 31,656 enterprises, representing about 62% of total corporate sector assets and 59% of total corporate debt in 2014 (Annex I, first table). All variables used in the debt sustainability analysis are defined in Annex II.

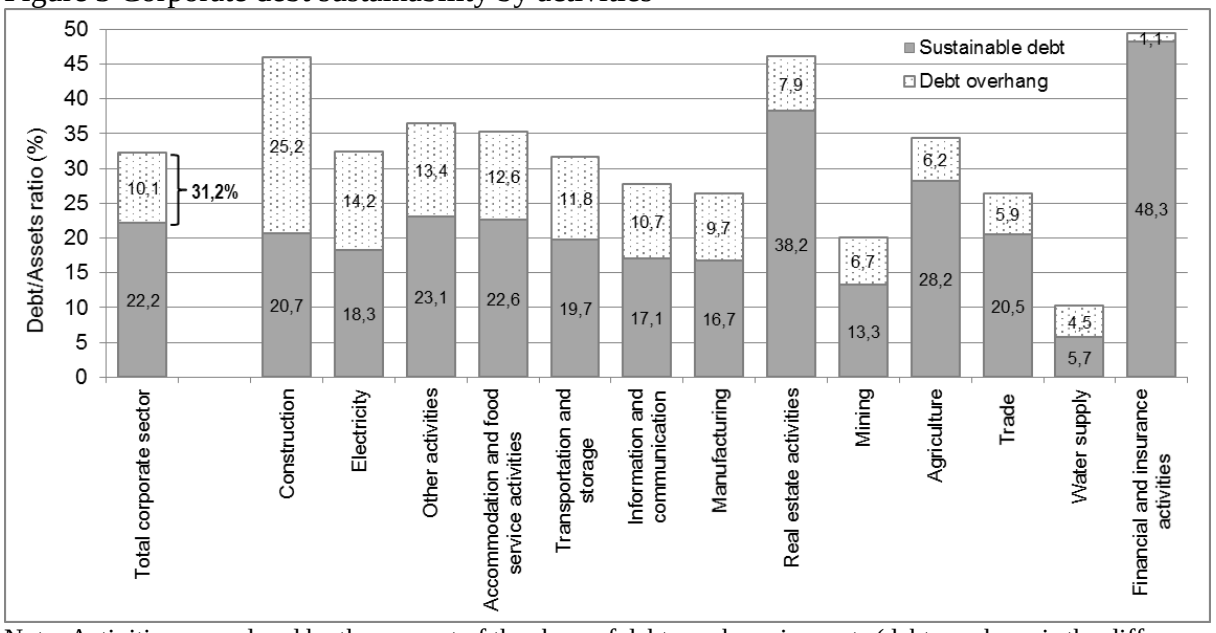
In the sample, 6,726 enterprises have high debt (debt-to-assets ratio above 30%), which is 21% of the total number of the enterprises in the sample, but they hold as much as 50% of total assets of the sample.

[6] Following IMF (2013), the corporate debt-to-assets threshold of 30% is chosen on the basis of the crisis debt levels in the core EU countries and the pre-crisis debt levels in EU peripheral countries.

3.3. Estimation of debt overhang and sensitivity analysis of deleveraging needs

The results of the debt sustainability analysis show that approximately one third (31.2%) of the corporate debt is excessive (Figure 3, first column)[7]. 2,097 enterprises have debt overhang (or negative projected $NFCF_{2017}$), accounting for 7% of the total number of enterprises in the sample (or 19% of the total assets of the sample). The analysis suggests that over the medium term corporate sector debt should decrease from 102% of GDP to about 70% of GDP in order to become sustainable (under the assumption that enterprises with debt overhang reduce their debt, and other enterprises do not increase their debt-to-assets ratio). Debt overhang is concentrated in a small number of enterprises: top 10 enterprises with the highest debt overhang (in absolute amounts) hold more than one third of total debt overhang, and top 100 enterprises with the highest debt overhang hold as much as three quarters of the entire debt overhang of the sample.

Figure 3 Corporate debt sustainability by activities



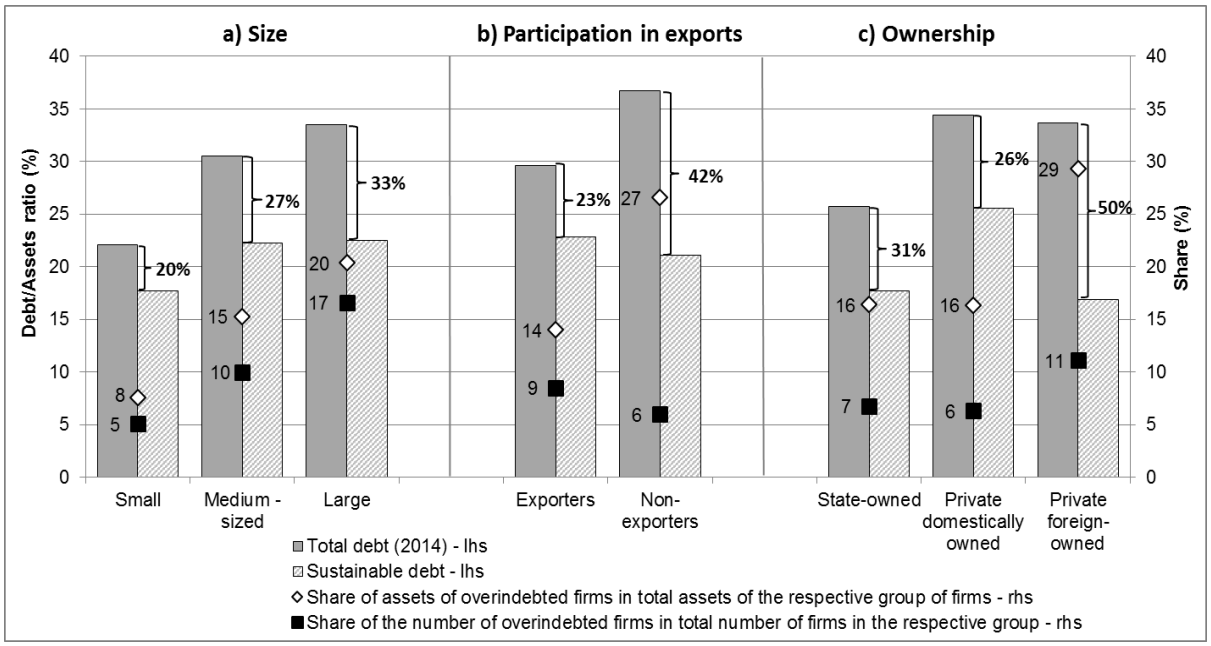
Note: Activities are ordered by the amount of the share of debt overhang in assets (debt overhang is the difference between the total debt and the sustainable debt).
Sources: Amadeus; FINA

The debt sustainability analysis by activities shows that the most severe deleveraging pressures are present in the construction sector (Figure 3). Notably, despite several years of deleveraging, this sector still has a very high debt level (over 45% of assets) and its profitability has been

[7] These results are in line with the assessment by the European Commission (EC, 2015) that found, on the basis of a comparison of firms by their debt-to-earnings and debt-to-capital ratios, that more than one third of the corporate debt may be considered at high risk of defaulting.

limited by continued decline in real estate prices, which is then reflected in the high share of non-performing loans in total loans of domestic banks (33% at end-2014)[8]. High deleveraging needs are also burdening electricity supply, accommodation and food services, and other activities (particularly those firms that provide services to the construction sector)[9]. On the other hand, the financial services sector is to the largest extent able to service high debt thanks to somewhat higher profitability[10]. In terms of absolute level of debt overhang, the highest debt overhang is found in manufacturing (as expected, as manufacturing has the highest share in total corporate assets), followed by electricity supply and construction.

Figure 4 Corporate debt sustainability by firm size, ownership and export participation



Notes: Classification by size was obtained from the Amadeus database. Large firms meet at least one of the following criteria: operating income ≥ EUR 10 mil, total assets ≥ EUR 20 mil, number of employees ≥ 150. Medium-sized firms meet at least one of the following criteria: operating income ≥ EUR 1 mil, total assets ≥ EUR 2 mil, number of employees ≥ 15, and are not classified as large. Classification by ownership was obtained from FINA database. Ownership with the share of government capital above 50% is classified as state ownership, and that with the share of government capital below 50% as private ownership. Private foreign-owned firms are those in which foreign private capital exceeds 50%. Data on exports have been obtained from FINA database.
Sources: Amadeus; FINA

As regards the firm size (Figure 4, panel a), small enterprises are considerably less indebted and have markedly lower deleveraging needs than the rest of the corporates. The weighted

[8] Loans of domestic banks to the construction sector declined in the period 2011-2014 by approximately 15%.

[9] Other activities, according to the NCA 2007 classification, include the following: professional, scientific and technical activities, administrative and auxiliary service activities, public administration, defence and compulsory social security, education, human health and social work activities, arts, entertainment and recreation and other service activities.

[10] It should be pointed out that financial services activity includes enterprises performing the activities of holding companies for affiliated non-financial corporations, i.e. having the role of their financial service provider.

average debt-to-assets ratio of small enterprises ranges around 22%, while in large enterprises' debt exceeds 33% of their assets. These results indicate that smaller enterprises, despite their growth potential and a rather low indebtedness, probably have limited access to finance, partly because a large part of creditors' lending potential is already allocated to large over-indebted firms, as well as due to lack of collateral[11].

Second, we find that exporters have a noticeably lower debt level than non-exporters and that they have significantly lower deleveraging needs (Figure 4, panel b). However, the non-exporters' large debt overhang is held by a small number of relatively larger firms. Better debt sustainability for exporters may be related to the fact that exporters are on average more profitable than non-exporters, so they can finance a higher debt level more easily.

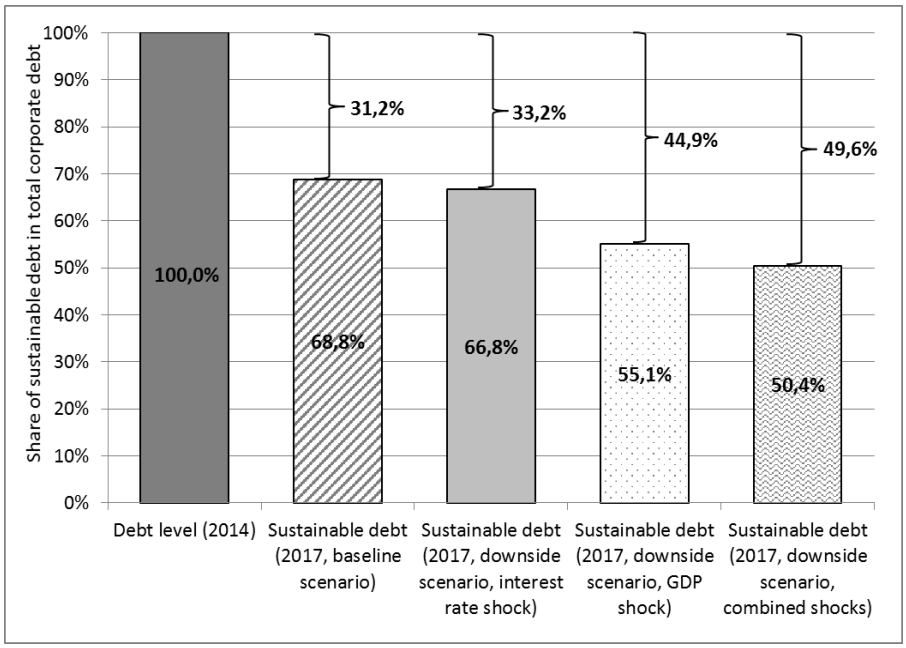
As regards the type of ownership (Figure 4, panel c), the debt sustainability analysis has shown that state-owned firms are less indebted that private ones. Foreign-owned private firms are significantly more burdened with debt overhang than domestic private firms, although their indebtedness level is very similar. Namely, as much as one half of debt of foreign-owned firms has been assessed as unsustainable, but the debt overhang is mostly concentrated in larger enterprises.

Finally, a sensitivity analysis of the debt overhang according is conducted, applying the downside scenarios that include interest rate and GDP shocks (Figure 5). More precisely, the following downside scenarios were analysed: (a) the shock of interest rate increase by one percentage point annually in 2016 and 2017, (b) the shock of decline in GDP by one standard deviation relative to the baseline scenario and (c) the combination of both shocks[12]. The sensitivity analysis shows that the interest rate shock would increase the share of debt overhang in total debt by 2 percentage points, i.e. from 31.2% to 33.2%. A relatively moderate effect on debt overhang partially reflects the fact that interest rates in 2015 dropped compared to 2014 (which is the reference year for this analysis), and this drop partially neutralises the effect of the expected rise in interest rates in the subsequent years (2016-2017). In addition, one should bear in mind that around 45% of foreign debt has a fixed interest rate and the interest rate shock does not affect this part of debt. On the other hand, the negative GDP shock would have a

[11] For more information on access to finance of SMEs in Croatia, see Box 6, CNB Bulletin No. 220.
[12] One standard deviation of the annual rate of change in real GDP in the period 2005-2014 equals 3.9 percentage points.

stronger effect on corporate debt sustainability. In the GDP downturn scenario 44.9% of total corporate debt would become excessive by 2017 (relative to 31.2% in the baseline). Finally, if both shocks materialised, almost a half (49.6%) of total corporate debt would become excessive, and the share of deleveraging needs in total corporate assets would increase from 10.2% to 16%.

Figure 5 Sensitivity analysis of the corporate sector debt sustainability



Note: The data next to the brackets show deleveraging needs expressed as % of total debt of sample enterprises.
Sources: Amadeus; FINA

4. Econometric assessment of the impact of corporate debt overhang on investment

In this chapter we test the impact of corporate indebtedness on firms' investment activity in the crisis period in Croatia. Particular attention is given to the asymmetry of this impact depending on whether a firm has excessive debt or not. For this purpose, we use firm-level data to estimate the basic investment equation, which includes common investment determinants such as sales growth and the company size, and we further extend it by including corporate indebtedness as the explanatory variable.

The baseline dynamic model of investment equation is:

$$INV_{i,t} = \alpha_i + \beta INV_{i,t-1} + \gamma \Delta S_{i,t-1} + \delta \log(A)_{i,t-1} + \sigma D_{i,t-1} + \varepsilon_{it} \quad (2)$$

where the dependent variable *INV* is the investment-to-capital stock ratio, ΔS is the change in the logarithm of the sales income and illustrates the firm's growth potential (Barbosa et al., 2007), *log(A)* is the value of firm's total assets and stands as a proxy for the firm's size (expressed in logarithms to reduce variations), and *D* is firm's debt-to-assets ratio[13]. Subscripts *i* and *t* refer to firm *i* and year *t*. The first lag of the dependent variable is included in the model to account for the autocorrelation in the investment activity, as well as to incorporate possible adjustment costs of the capital stock, as stated by Barbosa et al. (2007). All regressors are included with one lag (*t*-1) as they aim to represent the conditions prevailing at the beginning of investment period *t*. Descriptive stats of the variables are provided in Annex IV.

The data panel consists of annual data for 21,339 firms for the period from 2009 to 2014 (the time coverage of the sample is from 2007 to 2014, however, due to lagged variables two initial periods are lost). The panel is unbalanced as for some enterprises there are missing data in respective years. Nonetheless, the number of observations exceeds 95 thousand.

The dynamic model was estimated using the GMM method in line with Arellano and Bond (1991) in order to take account of the problem of endogeneity of the lagged dependent variable. The Arellano-Bond estimator is particularly suitable for the assessment of dynamic models with fixed effects where number of periods (*t*) is small, and number of units (*N*) is large. The instruments that replace the endogenous explanatory variable (INV_{t-1}) are the second and the third lags of the dependent variable (INV_{t-2} and INV_{t-3}). The instruments pass the Hansen test of over-identifying restrictions, thus confirming the validity of the instrument choice. In addition, we include year dummies to control for macroeconomic conditions common to all firms.

Estimation results of the equation (2) are presented in Table 1, column 1. All estimated coefficients (except the coefficient related to the lagged dependent variable) are significant and have economically justified signs. The estimated coefficient associated with sales growth is

[13] Investment in year *t* is calculated as the difference between the value of fixed tangible assets in year *t* and in year *t*-1 plus the amount of depreciation in year *t*.

significant and with a positive sign, supporting the assumption that the firm's investment decisions are positively affected by the demand for its products (Barbosa et al., 2007). By contrast, the firm's size displays a negative impact on investment, which supports the assumption that larger firms invest less because they overinvested in their growth cycle. In other words, investment weakens with the "maturity in the life cycle", while at the same time young propulsive firms must invest more in order to grow.

Table 1 Results of the baseline corporate investment model

Dependent variable: Investment/Capital ratio (INV)
Instruments: Lags 2 and 3 of the dependent variable
Period of estimation: 2009-2014

Explanatory variables	Interpretation of the interaction terms	Linear model	Model testing for asymmetric effects of debt
		1	2
INV_{t-1}		-0,001	-0,001
S_{t-1}		**0,177****	**0,170****
$log(A_{t-1})$		**-1,668*****	**-1,634*****
D_{t-1}		**-1,906*****	
$D_{i,t-1} * 1\{D_{i,t-1} > \tau_{i,t-1}\}$	Firms with debt overhang		**-2,369*****
$D_{i,t-1} * 1\{D_{i,t-1} \leq \tau_{i,t-1}\}$	Firms without debt overhang		**-1,077*****
J-statistics		16,016	17,091
Hansen test (p-value)		0,141	0,105
AR 1 (p-value)		0,074	0,075
AR 2 (p-value)		0,492	0,513
Number of firms		21.339	21.339
Number of observations		95.670	95.670

Notes: Variable $\tau_{i,t}$ denotes firm-specific and time-variant debt threshold above which debt is considered excessive. ***, **, * indicate significance at 1, 5, and 10 percent level. In both models there is no evidence of second-order autocorrelation in residuals (based on Arellano-Bond test). Instruments are second and third lag of the dependent variable. All regressions pass the Hansen test of overidentifying restrictions, indicating the validity of the instrument choice. The models include fixed effects for enterprises and dummy variables for time periods (coefficients for time dummies not presented).
Source: authors' calculation.

Finally, the results for the effect of indebtedness on investment show a statistically significant negative effect of firm's leverage on investment during the crisis. This finding supports the assumption that the corporate borrowing boom in Croatia prior to the crisis was indeed harmful for investment activity in the aftermath of the crisis. Furthermore, as the coefficient associated with indebtedness is significantly different from zero, we can reject the Modigliani-Miller hypothesis of the irrelevance of capital structure or corporate finance. Finally, the magnitude of the negative debt effect on investment is much larger than in the comparable study by

Rodriguez-Palenzuela et al. (2016), who estimated the effect of debt on investment at -0.49 for SMEs in selected Western European countries during the crisis.[14] This again implies that the corporate debt burden in Croatia has severe macroeconomic implications, even comparing with the Western European countries with higher debt levels.

We further extend the model in order to test the asymmetry in the impact of corporate indebtedness on investment activity. This approach is motivated by the assumption that over-indebted enterprises invest less than other enterprises, in line with the trade-off and pecking order theories of financing structure. For this purpose, we introduce two interaction terms that enable differentiating the debt effect on investment between over-indebted firms and firms with no excessive debt. A similar approach to assessing asymmetric effects of indebtedness on investment was used in a series of empirical studies (e.g. Rodriguez-Palenzuela et al., 2016, Goretti and Souto, 2013, and Jaeger, 2003).

The baseline investment equation is extended as follows:

$$INV_{i,t} = \alpha_i + \beta INV_{i,t-1} + \gamma \Delta S_{i,t-1} + \delta log(A)_{i,t-1} + \overline{\sigma} D_{i,t-1} \times 1\{D_{i,t-1} > \tau_{i,t-1}\} + \underline{\sigma} D_{i,t-1} \times 1\{D_{i,t-1} \leq \tau_{i,t-1}\} + \varepsilon_{it} \quad (3)$$

where the interaction term $1\{D_{it-1} > \tau_{it-1}\}$ represents the "debt-overhang indicator" and takes the value 1 if a firm is excessively indebted (e.g. if its leverage (D_{it}) exceeds the threshold value τ_{it}), and zero otherwise. By contrast, the second interaction term, the "no debt-overhang indicator" ($1\{D_{it-1} \leq \tau_{it-1}\}$), takes the value 1 when the firm is not excessively indebted and zero otherwise. By including the two offsetting interaction terms, we divide the sample to two subgroups in order to estimate whether the debt effect on investment significantly differs between over-indebted and not over-indebted firms. In other words, we test whether there is a statistically significant difference between the coefficients $\overline{\sigma}$ and $\underline{\sigma}$ and whether the latter is less negative than the former.

The key difference between our approach and the aforementioned papers is that the threshold value for identifying the overleveraged firms (τ_{it}) is computed individually for each firm and each year. Specifically, we compute the firm-specific time-variant threshold value of the debt-

[14] Other studies covering the same topic use different indebtedness indicators (i.e. debt-to-equity instead of debt-to-assets) so their estimated coefficients are not comparable.

to-assets ratio τ_{it} in line with the equation (1) and the methodology described in Chapter 3.2. Other studies use either aggregate or arbitrarily chosen thresholds that are equal for all firms and constant during the whole period under consideration (alternative thresholds are assessed in detail in section 4.2.).

The results of the panel estimation of the equation (3) are presented in Table 1, column 2. The estimated coefficients suggest that the corporate investment indeed reacts asymmetrically to indebtedness, i.e. investment activity contracts more strongly when a firm is over-leveraged. Specifically, the statistically significant negative coefficient associated with indebtedness is more than twice as high for over-indebted firms as for the others: the value of the coefficient related to debt of over-indebted firms is estimated to -2.37, compared to -1.08 for firms without debt overhang. In addition, the Wald test rejects the hypothesis that the two coefficients associated with the debt variable are statistically identical (results of the Wald test are shown in Annex V). The interpretation of these results is that for two firms with similar characteristics except for leverage, one having excessive debt and the other not, the expected adverse response of investment to a debt increase would be about two times stronger for the firm with excessive debt. In view of the high share of corporate debt overhang in Croatia (estimated to around 32%), this result implies that the deleveraging pressures have had a particularly strong adverse effect on investment activity in Croatia during the crisis.

Our findings of statistically significant asymmetric impact of debt on investment activity are in line with empirical findings for other countries. Jaeger (2003) has shown a significantly stronger negative effect of indebtedness on investment for the USA and Germany if indebtedness exceeds threshold values (the coefficients for the impact of debt on investment for the USA have been estimated at -1.9 for highly indebted firms vs. -0.5 for other firms and for Germany at -0.7 vs. -0.3). Rodriguez-Palenzuela et al. (2016) have also shown for the five largest Eurozone economies that the negative effect of debt on investment is greater if indebtedness exceeds the threshold value. In addition, a recent study of the Danish corporate sector done by Kuchler (2015) suggests that highly leveraged firms (i.e. those with leverage ratio above 80%) have reduced their investment rate by 3.9 percentage points more than the firms with low leverage. Finally, Goretti and Souto (2013) have even obtained different signs of the impact of debt on investment (e.g. positive sign for lower debt levels and negative for higher levels), thus also confirming the existence of asymmetry of the debt-to investment relation.

4.1. Breakdown by firm ownership and exports

To check whether the sensitivity of investment decisions to indebtedness depends on other firm-specific characteristics, we perform a set of robustness checks. In particular, we extend the model represented by equation (3) by including additional interaction terms with which we break down the sample to subgroups according to firms' participation in exports (e.g. exporters vs. non-exporters) and type of ownership (e.g. foreign vs. domestic ownership and private vs. public ownership). The extended investment models are specified as follows:

$$INV_{i,t} = \alpha_i + \beta INV_{i,t-1} + \gamma \Delta S_{i,t-1} + \delta \log(A)_{i,t-1} + \overline{\sigma_{\Psi}} D_{i,t-1} \times 1\{D_{i,t-1} > \tau_{i,t-1}\} \times \Psi_{i,t-1} + \\ + \overline{\sigma_{1-\Psi}} D_{i,t-1} \times 1\{D_{i,t-1} > \tau_{i,t-1}\} \times (1 - \Psi_{i,t-1}) + \underline{\sigma_{\Psi}} D_{i,t-1} \times 1\{D_{i,t-1} \leq \tau_{i,t-1}\} \times \Psi_{i,t-1} + \\ + \underline{\sigma_{1-\Psi}} D_{i,t-1} \times 1\{D_{i,t-1} \leq \tau_{i,t-1}\} \times (1 - \Psi_{i,t-1}) + \varepsilon_{it} \qquad (4)$$

where the term Ψ interacts with debt variable and takes the value 1 if a firm is exporter/foreign-owned/state-owned in the three extended models, respectively. Conversely, the interaction term (1-Ψ) takes the value 1 when a firm is non-exporter/domestically-owned/private-owned, respectively.

Overall, the main results from the baseline estimations robustly hold after accounting for selected firm characteristics (Table 2). The estimated values of the coefficients for sales income and firm size remain stable and statistically significant in all extended models. Moreover, the assumption of a stronger negative debt effect on investment (i.e. the asymmetry) is empirically found for five out of six subgroups of firms (except for foreign-owned firms).

Estimations of the extended models reveal additional interesting findings. First, the asymmetry in debt effect on investment particularly holds for exporters, domestically-owned firms and private-owned firms. Specifically, the overleveraged exporters seem to contract investment far more strongly following a debt increase than the exporters without debt overhang: the negative estimated coefficient for overleveraged exporters is more than two times larger than for other exporters (-2.4 compared to -1.0, as shown in Table 2, column 3). Conversely, for non-exporters excessive leverage does not seem to make a difference in their investment behaviour (e.g. the coefficients for overleveraged and non-overleveraged non-exporters are almost equal: -1.4 vs. -1.3). This finding is in line with the assumption that exporters are exposed to stronger competition than non-exporters, so in a situation of growing debt, exporters would not be in a

position to finance their rising debt obligations through price increases, but would be forced to cut investment. This is also in line with our finding that exporters are less burdened by debt and have lower deleveraging needs (Figure 4, panel b), as debt overhang is more likely to hurt their performance outlook than is the case for non-exporters.

Table 2 Results of the extended corporate investment models

Dependent variable: Investment/Capital ratio (INV)
Instruments: Lags 2 and 3 of the dependent variable
Period of estimation: 2009-2014

Explanatory variables	Interpretation of the interaction terms	Linear model	Model testing for asymmetric effects	Extended models accounting for firm-specific characteristics		
				Exporters vs. Non-exporteres	Foreign-owned vs. Domestically -owned firms	State-owned vs. Private-owned firms
		1	2	3	4	5
$INV_{i,t-1}$		-0,001	-0,001	-0,001	-0,001	-0,001
$S_{i,t-1}$		**0,177****	**0,170****	**0,170****	**0,169****	**0,170****
$log(A_{i,t-1})$		**-1,668*****	**-1,634*****	**-1,635*****	**-1,631*****	**-1,634*****
$D_{i,t-1}$		**-1,906*****				
$D_{i,t-1} * 1\{D_{i,t-1} > \tau_{i,t-1}\}$	Firms with debt overhang		**-2,369*****			
$D_{i,t-1} * 1\{D_{i,t-1} \leq \tau_{i,t-1}\}$	Firms without debt overhang		**-1,077*****			
$D_{i,t-1} * 1\{D_{i,t-1} > \tau_{i,t-1}\} * (1-\Psi_{i,t-1})$	Non-exporters with debt overhang			**-1,439*****		
$D_{i,t-1} * 1\{D_{i,t-1} > \tau_{i,t-1}\} * \Psi_{i,t-1}$	Exporters with debt overhang			**-2,423*****		
$D_{i,t-1} * 1\{D_{i,t-1} \leq \tau_{i,t-1}\} * (1-\Psi_{i,t-1})$	Non-exporters without debt overhang			**-1,293*****		
$D_{i,t-1} * 1\{D_{i,t-1} \leq \tau_{i,t-1}\} * \Psi_{i,t-1}$	Exporters without debt overhang			**-1,034*****		
$D_{i,t-1} * 1\{D_{i,t-1} > \tau_{i,t-1}\} * (1-\Psi_{i,t-1})$	Domestic firms with debt overhang				**-2,513*****	
$D_{i,t-1} * 1\{D_{i,t-1} > \tau_{i,t-1}\} * \Psi_{i,t-1}$	Foreign firms with debt overhang				0,321	
$D_{i,t-1} * 1\{D_{i,t-1} \leq \tau_{i,t-1}\} * (1-\Psi_{i,t-1})$	Domestic firms without debt overhang				**-1,181*****	
$D_{i,t-1} * 1\{D_{i,t-1} \leq \tau_{i,t-1}\} * \Psi_{i,t-1}$	Foreign firms without debt overhang				0,801	
$D_{i,t-1} * 1\{D_{i,t-1} > \tau_{i,t-1}\} * (1-\Psi_{i,t-1})$	Private firms with debt overhang					**-2,370*****
$D_{i,t-1} * 1\{D_{i,t-1} > \tau_{i,t-1}\} * \Psi_{i,t-1}$	Public firms with debt overhang					**-2,397***
$D_{i,t-1} * 1\{D_{i,t-1} \leq \tau_{i,t-1}\} * (1-\Psi_{i,t-1})$	Private firms without debt overhang					**-1,072*****
$D_{i,t-1} * 1\{D_{i,t-1} \leq \tau_{i,t-1}\} * \Psi_{i,t-1}$	Public firms without debt overhang					-1,535
J-statistics		16,016	17,091	17,131	17,086	17,080
Hansen test (p-value)		0,141	0,105	0,104	0,105	0,106
AR 1 (p-value)		0,074	0,075	0,075	0,075	0,075
AR 2 (p-value)		0,492	0,513	0,514	0,514	0,513
Number of firms		21.339	21.339	21.339	21.339	21.339
Number of observations		95.670	95.670	95.670	95.670	95.670

Notes: Variable $\tau_{i,t}$ denotes firm-specific and time-variant debt threshold above which debt is considered excessive. Variable $\Psi_{i,t}$ takes the value 1 when firm *i* in year *t* is exporter, foreign-owned and state-owned firm in the estimations presented in columns 3, 4, and 5, respectively. ***, **, * indicate significance at 1, 5, and 10 percent level. In all models there is no evidence of second-order autocorrelation in residuals (based on Arellano-Bond test). Instruments are second and third lag of the dependent variable. All regressions pass the Hansen test of overidentifying restrictions, indicating the validity of the instrument choice. The models include fixed effects for enterprises and dummy variables for time periods (coefficients for time dummies not presented).
Source: authors' calculation.

Turning to ownership, domestic firms' investment expectedly reacts negatively to a debt increase, and especially if they have excessive debt. Conversely, for foreign-owned firms we do not find a statistically significant effect of debt on investment, and this holds both for overleveraged firms and for firms without debt overhang (Table 2, column 4). This result probably reflects the fact that foreign-owned firms have access to direct financing from their parent company, and the intra-company financing does not primarily depend on the subsidiary's financial performance, but rather on general investment policies and business strategies determined by the owner. This also partly explains why foreign-owned firms accumulated larger debt overhangs compared to domestically-owned firms (Figure 4, panel c).

Finally, for private firms we obtain statistically significant negative impact of debt on investment, which is expectedly much stronger for overleveraged firms than for those without debt overhang (Table 2, column 5). However, interestingly, for public firms without debt overhang we do not find a statistically significant effect of debt on investment. This can be explained by the assumption that investment decisions in state-owned firms are not solely driven by economic criteria, but are often also subject to political objectives and cycles.

4.2. Alternative debt overhang thresholds

Finally, in order to test whether firm-specific debt threshold empirically outperforms aggregate thresholds in revealing the asymmetric impact of debt on investment, we re-assess the investment equation (3) by applying a set of alternative thresholds τ. Particularly, we re-estimate the equation (3) applying aggregate thresholds following Goretti and Suoto (2013), Jaeger (2003) and Rodriguez-Palenzuela et al. (2014). Aggregate debt thresholds are the 25th percentile, the median and the mean of the total distribution of debt-to-assets ratio of our sample in period 2009-2014 (standing at 9.2 percent, 23.0 percent and 32.9 percent, respectively). Finally, we also apply the firm-specific threshold defined as debt-to-EBITDA ratio equalling 4, following the approach by Damijan (2015). Results of the alternative estimations are presented in Table 3, columns 3 to 6, respectively.

Table 3 Alternative thresholds for excessive indebtedness

Dependent variable: Investment/Capital ratio (INV)
Instruments: Lags 2 and 3 of the dependent variable
Period of estimation: 2009-2014

Explanatory variables	Linear model	Models testing for asymmetric effects using various thresholds τ				
		$\tau_{i,t}$ = Debt overhang threshold based on NFCF for firm *i* in year *t*	Debt-to-assets ratio			$\tau_{i,t}$ = Debt-to-EBITDA > 4 for firm *i* in year *t*
			τ = 25th percentile	τ = Median	τ = Mean	
	1	2	3	4	5	6
$INV_{,it-1}$	-0,001	-0,001	-0,001	-0,001	-0,001	-0,001
$S_{i,t-1}$	**0,177****	**0,170****	**0,177****	**0,177****	**0,177****	**0,175****
$log(A_{i,t-1})$	**-1,668*****	**-1,634*****	**-1,673*****	**-1,669*****	**-1,671*****	**-1,661*****
$D_{i,t-1}$	**-1,906*****					
$D_{i,t-1} * 1\{D_{i,t-1} > \tau_{i,t-1}\}$		**-2,369*****	**-1,829*****	**-1,897*****	**-1,916*****	**-2,012*****
$D_{i,t-1} * 1\{D_{i,t-1} \leq \tau_{i,t-1}\}$		**-1,077*****	1,146	**-1,667*****	**-1,410*****	**-1,765*****
J-statistics	16,016	17,091	16,014	16,017	16,013	16,084
Hansen test (p-value)	0,141	0,105	0,141	0,141	0,141	0,138
AR 1 (p-value)	0,074	0,075	0,074	0,074	0,074	0,074
AR 2 (p-value)	0,492	0,513	0,491	0,492	0,492	0,492
Wald test C_5=C_6 (p-value)		**0,000**	**0,052**	**0,543**	**0,144**	**0,376**
Number of firms	21.339	21.339	21.339	21.339	21.339	21.339
Number of observations	95.670	95.670	95.670	95.670	95.670	95.670

Notes: Variable τ denotes debt threshold above which debt is considered excessive. Thresholds in the model in column 2 are estimated following the methodology described in Section 3.2. ***, **, * indicate significance at 1, 5, and 10 percent level. In all models there is no evidence of second-order autocorrelation in residuals (based on Arellano-Bond test). Instruments are second and third lag of the dependent variable. All regressions pass the Hansen test of overidentifying restrictions, indicating the validity of the instrument choice. The models include fixed effects for enterprises and dummy variables for time periods (coefficients for time dummies not presented). The null hypothesis of the Wald test is that the two coefficients representing the impact of debt on investment for firms with and without debt overhang are equal.
Source: authors' calculation.

Unlike the results based on our firm-specific thresholds (Table 3, column 2), the coefficients for the debt effect on investment in all four alternative estimations do not differ significantly between firms with debt overhang and firms without debt overhang. In all four alternative regressions, all but one coefficients related to the debt variable are statistically significant and expectedly negative. However, the pairs of coefficients with the debt variable for the firms with and without debt overhang do not significantly differ between themselves (as confirmed by the results of the Wald test). The largest difference occurs when the debt-to-assets threshold is the 25 percentile of the distribution (-1.8 vs. -1.1), but the latter coefficient is not statistically significant. Overall, the results based on alternative thresholds do not provide empirical evidence of the existence of asymmetric effects, thus supporting the appropriateness of the

choice of the firm-level debt overhang indicator as a threshold in capturing the adverse impact of debt overhang on investment activity.

To sum up, the results of the econometric model based on panel data confirmed that the issue of high indebtedness of non-financial corporations in Croatia hinders investment growth, with negative effect being stronger if over-indebtedness of enterprises is higher, i.e. if the corporate debt is less sustainable. Given the above described proportion of the over-indebtedness problem in Croatia and the insufficient speed of corporate deleveraging in the recent years, these results indicate that the over-indebtedness problem could have negative macroeconomic implications for the dynamics of recovery of the Croatian economy in the coming years.

5. Conclusion

The corporate sector debt in Croatia is high and approximately one third thereof has been detected as excessive. In the event of combined shocks of the GDP decline and interest rate hike, the deleveraging needs of the corporate sector would additionally increase to around 50% of the existing debt. Although the debt overhang is not evenly distributed across the corporate sector, but rather concentrated in large and non-exporting enterprises, the estimated extent of over-indebtedness undoubtedly has adverse impacts on macroeconomic developments. The results of the dynamic econometric model based on firm-level panel data have confirmed that the high indebtedness of non-financial corporations in Croatia hinders investment activity. Moreover, this negative effect is stronger if a firm is over-indebted, e.g. if it has debt overhang. A more detailed insight into subgroups of firms reveals that the investment activity of exporters and domestically-owned firms seems to be more sensitive to deleveraging pressures, what probably explains why they are less burdened by debt overhang.

These findings are consistent with the results from existing literature that addresses the issue of asymmetric impact of corporate debt. That said, the contribution of our approach is that the threshold values above which debt is considered unsustainable have not been arbitrarily selected and are not identical for all enterprises and all years, but are estimated individually for each firm taking into account its own debt servicing capacity and business performance.

Empirical estimations based on this debt overhang indicator support the assumption that excessive debt hurts investment more strongly than non-excessive debt.

Having in mind that in the crisis period in Croatia the corporate deleveraging process was weak and uneven, our findings indicate that the over-indebtedness problem could have negative macroeconomic implications on the recovery of the Croatian economy in the following years. This underscores the need for a proactive and coordinated implementation of economic policies in order to facilitate the deleveraging process. Accordingly, the desired amendments to the regulatory and institutional framework should go in two directions – on the one hand, to stimulate debt restructuring for firms with growth potential, and on the other hand, to simplify the liquidation process for those businesses that are unsustainable in the long run even with the debt restructuring. All this requires a balanced approach between the desire to achieve the greatest possible reduction in debt and the efforts for a fair liquidation process in which owners' rights are respected and fiscal costs and loss of value for creditors are minimized. All this demands an efficient institutional support – legislative and judicial – which is often cited as one of the impediments to doing business in Croatia. Given the fact that non-performing loans account for a great part of the total debt overhang, institutional efforts should also be oriented towards easing of the process of write-offs and sales of bad debts. This includes the problem of the banks' difficulties in collecting receivables by taking over and selling pledged collaterals. Finally, the problem of excessive debt additionally stresses the need for a better investment and business climate in Croatia in which enterprises could operate more easily, which might then facilitate the servicing of high and excessive debt.

ANNEX I Indicators of indebtedness and debt service capacity

Sample firms	2006	2007	2008	2009	2010	2011	2012	2013	2014
Assets (in HRK mn)	**405.220**	**467.707**	**525.775**	**545.795**	**555.784**	**587.174**	**602.832**	**619.436**	**649.047**
Share in total assets of the whole corporate sector (in %)	*49,5*	*50,5*	*53,1*	*52,0*	*53,4*	*56,0*	*58,5*	*59,8*	*62,3*
Debt (in HRK mn)	**106.164**	**129.192**	**154.328**	**164.814**	**175.806**	**191.755**	**193.763**	**199.719**	**209.335**
Share in total debt of the whole corporate sector (in %)	*41,8*	*41,8*	*51,5*	*49,4*	*51,0*	*53,9*	*55,3*	*56,3*	*59,0*
Indebtedness (Debt/Assets, in %)	**26,2**	**27,6**	**29,4**	**30,2**	**31,6**	**32,7**	**32,1**	**32,2**	**32,3**
Profitability (EBIT/Assets, in %)	**4,5**	**4,7**	**4,2**	**3,0**	**2,9**	**3,4**	**2,5**	**2,9**	**3,4**
Debt burden (Interest expenses/Debt, in %)	**4,4**	**4,8**	**5,0**	**4,8**	**4,8**	**4,8**	**5,3**	**5,0**	**4,7**

Source: Amadeus

Total corporate sector	2006	2007	2008	2009	2010	2011	2012	2013	2014
Indebtedness (Debt/Assets, in %)	**31,0**	**33,3**	**30,3**	**31,8**	**33,1**	**33,9**	**34,0**	**34,2**	**34,0**
Profitability (EBIT/Assets, in %)	**2,6**	**2,8**	**2,8**	**1,6**	**1,6**	**2,3**	**1,8**	**1,5**	**2,1**
Debt burden (Interest expense/Debt, in %)	**–**	**–**	**4,9**	**4,5**	**4,5**	**4,4**	**4,4**	**4,1**	**3,9**
Interest coverage ratio (EBITDA/Interest expenses)	**–**	**–**	**4,3**	**3,7**	**3,5**	**4,0**	**3,7**	**4,0**	**4,5**

Source: Fina

ANNEX II Data description

Variable:	Description:	Source:
Operating Cash Flow before Interest	EBIT – Taxation + (Depreciation & Amortization)	Authors' calculation based on Amadeus data
Assets	Total assets	Amadeus
Debt	Loans + Long term debt	Authors' calculation based on Amadeus data
Interest expense	Interest expense	FINA
Capital expenditures	Δ(Tangible fixed assets) + (Depreciation & Amortization)	Authors' calculation based on Amadeus data
Dividends	Δ(Retained earnings) + Current earnings – Δ(Income reserves) – Δ(Revaluation reserves)	Authors' calculation based on FINA data
GDP	Annual rate of change of real gross domestic product	Bureau of Statistics
Sales	Income from sales	Amadeus
Capital	Shareholders funds	Amadeus
Investment/Capital	Capital expenditures/Shareholders funds	Authors' calculation based on Amadeus data

ANNEX III Estimation results of the relation between GDP growth and firm profitability

Dependent Variable: OPERATING PROFITS BEFORE INTEREST/ASSETS

Method: Panel Least Squares

Sample (adjusted): 2006 2014

Cross-sections included: 31656

Total panel (unbalanced) observations: 210023

White diagonal standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10,067	0,222	45,317	0,000
GDP	0,126	0,036	3,460	0,001
GDP(-1)	0,526	0,051	10,218	0,000
Cross-section fixed (dummy variables)				
R-squared	0,172	Mean dependent var		10,028
Adjusted R-squared	0,025	S.D. dependent var		100,590
S.E. of regression	99,325	Akaike info criterion		12,173
Sum squared resid	1.76E+09	Schwarz criterion		13,719
Log likelihood	-1246621	Hannan-Quinn criter.		12,627
F-statistic	1,170	Durbin-Watson stat		2,487
Prob(F-statistic)	0,00			

ANNEX IV Summary statistics for the variables included in equations (3) and (4)

Year (*t*)	Number of firms (*i*)	Number od firms with debt overhang	Total assets (*A*)			Investment/Capital (*INV*)		Sales growth ($\Delta log(S)$)		Debt	Debt/Assets (*D*)	
			Sum	Mean	Median	Mean	Median	Mean	Median	Sum	Mean	Median
			in 000 HRK	in 000 HRK	in 000 HRK	%	%			in 000 HRK	%	%
2006	20.039	2.981	405.219.908	20.217	1.466	93,5	14,3	19,5	11,1	106.164.479	23,0	14,4
2007	20.996	3.328	467.706.978	22.268	1.570	97,9	13,7	18,3	10,4	129.191.973	23,5	15,2
2008	22.667	2.765	525.774.757	23.194	1.607	113,6	16,5	15,9	9,2	154.327.714	16,5	5,2
2009	24.936	2.150	545.794.510	21.885	1.493	63,5	6,5	-7,7	-10,9	164.813.611	15,5	3,3
2010	25.884	2.406	555.783.757	21.467	1.397	171,3	6,4	0,1	-4,7	175.806.239	18,1	2,8
2011	26.659	3.019	587.173.890	22.025	1.456	116,0	8,3	12,7	4,9	191.754.711	21,7	3,0
2012	29.697	3.095	602.831.921	20.295	1.314	96,0	6,6	3,5	-0,7	193.763.058	19,3	2,3
2013	31.654	2.976	619.436.323	19.568	1.291	73,6	6,3	11,8	4,3	199.718.955	16,6	1,5
2014	31.656	2.471	649.046.813	20.503	1.360	40,7	3,6	-2,0	0,4	209.334.942	16,4	1,7

ANNEX V Results of the Wald test for equality of coefficients in equation (3)

Equation (3): $INV_{it} = \alpha_i + \beta INV_{it-1} + \gamma \Delta S_{it-1} + \delta log(A)_{it-1} + \overline{\sigma} D_{it-1} \times 1\{D_{it-1} > \tau_{it-1}\} + \underline{\sigma} D_{it-1} \times 1\{D_{it-1} \leq \tau_{it-1}\} + \varepsilon_{it}$

Null Hypothesis: $\overline{\sigma}$=$\underline{\sigma}$

Test Statistic	Value	df	Probability
t-statistic	-5,109	95659	0,000
F-statistic	26,104	(1, 95659)	0,000
Chi-square	26,104	1	0,000

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