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Credit supply and corporate capital structure: Evidence from Japan☆

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ABSTRACT

In this paper we examine how financial constraints, especially fluctuations in the supply of credit, affect the capital structure of 1537 publicly listed Japanese firms from 1980 to 2007, in a data set with 33,000 observations. It is one of the first studies to do so and is inspired by the recent studies of Leary (2009) and Faulkender and Petersen (2006). Japan was selected due to the extreme credit supply fluctuations observed during the last 30 years. It thus offers an ideal natural experiment to test the impact of credit supply on corporate capital structure. In particular, in our panel data study we investigated the impact of the asset bubble in the 1980s and the credit crunch of the late 1990s on corporate capital structure decisions. The results of this paper show, among other findings, that financial policy decisions are indeed influenced by monetary conditions and the supply of credit. In particular, smaller sized firms face financial constraints, especially during economic downturns.

1. Introduction

Miller and Modigliani (1958) showed that in a world of perfect information and no transaction costs the "market value of any firm is independent of its capital structure and is given by capitalizing its expected return at the rate ρ appropriate to its risk class" (p. 268). Even though their paper is still regarded as the theoretical benchmark in the area of capital structure, subsequent studies have relaxed some of its restrictive assumptions, as suggested by Ho and Robinson (1994). This has led to the derivation of two main, competing theories that attempt to explain financial policy decisions of firms: the trade-off and the pecking order theories.

The trade-off theory stipulates that financial managers set target debt ratios by balancing out the benefits and costs of borrowing. Due to the existence of interest rate tax shields, financing with debt instead of equity increases a firm's market value (Miller, 1977; Miller & Modigliani, 1963; Myers, 2001). Nevertheless, an increase of the firm's debt levels increases financial distress costs (Bany-Ariffin et al., 2010; Miller & Modigliani, 1963; Philosophov & Philosophov, 1999, 2005; Titman, 1984) and agency conflicts between the firm's bondholders and stockholders (Jensen and Meckling, 1976; Frankfurter and Philippatos, 1992). DeAngelo and Masulis (1980) and Harris and Raviv (1991) conclude that firms with safe, tangible assets and large profits to shield should exhibit higher debt ratios than unprofitable companies with risky, intangible assets, high advertising expenditures and unique products that should rely mostly on equity finance.

The alternative theory is the informational asymmetry pecking order hypothesis proposed by Myers (1984) and Myers and Majluf (1984). The pecking order hypothesis assumes that financial managers have information that investors do not. Accordingly, firms will always prefer internal to external finance, since internal financing does not suffer from information asymmetries, and if external finance is required, the safest security will be issued first. According to the pecking order hypothesis, and contrary to the predictions of the trade-off theory, companies do not have a particular capital structure target.

The majority of the capital structure studies that have empirically investigated the validity of these two theories revolve around the examination of the determinants of leverage ratios (e.g. Bradley et al., 1984; Titman & Wessels, 1988) and the choice by firms of issuing debt versus equity (e.g. Hovakimian et al., 2004; Marsh, 1982). The results from both types of studies are mixed as far as the validity of either the trade-off or the pecking order theory is concerned.

Results from the US (Bradley et al., 1984; Hovakimian et al., 2001, 2004; Taub, 1975; Titman & Wessels, 1988) and international studies (Bhabra et al., 2008; Booth et al., 2001; Chen, 2004; Chen & Strange, 2005; Colombo, 2001; de Jong et al., 2008; Gaud et al., 2005; Hirota, 1999; Huang & Song, 2006; Kayo & Kimura, 2011; Rajan & Zingales, 1995) show that size and collateral factors have a positive relationship

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with leverage. This is in line with the trade-off theory. Studies on the financial distress costs also support the trade-off theory. Taub (1975), Titman and Wessels (1988), Colombo (2001), Hovakimian et al. (2001) and Nunes and Serrasqueiro (2007) report that the volatility of a company's earnings is inversely related to its level of debt. Nevertheless the evidence on profitability and tax shield factors — a cornerstone of the trade-off theory — is not supportive of its validity. The studies of Taub (1975), Bradley et al. (1984), Booth et al. (2001) report that non-debt tax shields are positively related with profitability. However, the studies of Allen and Mizuno (1989), Hirota (1999) and Huang and Song (2006) report the opposite. Thus the empirical findings on the role of tax shields in capital structure are inconclusive. More importantly, the profitability factor appears to have a negative association with corporate debt ratios in every single capital structure study.

The inverse relationship between profitability and leverage is the most important prediction of the pecking order hypothesis. Nevertheless several studies have presented findings that contradict the existence of a pecking order in capital structure. Minton and Wruck (2001) state that firms do not fully exhaust their internally generated cash before they tap the capital markets for credit. Lemmon and Zender (2001) report that companies have stable or rising cash balances two years before the issuance of securities. Helwege and Liang (1996) show that the internal cash deficit does not predict future financial policy decisions and even when firms obtain external finance they do not follow a pecking order. Finally, Frank and Goyal (2004) find that the deficit of internal funds is closely related with equity and not debt movements.

As the European study of Gaud et al. (2006) verifies, after 40 years of research in the area of capital structure a clear winner between the mutually competitive trade-off and pecking order theories has therefore not yet been found and a universal theory that sufficiently explains financial policy decisions has not been established. It is the writers' belief that this is due to the fact that previous capital structure studies have overlooked an important determinant of capital structure. It seems that researchers have been investigating the demand for credit so enthusiastically, that the question of how its supply affects firms' financial decisions got neglected. It is only natural that in a world of imperfect markets, information asymmetries and agency costs, the financial managers' wishes will not always become reality.

Consequently, a small but growing body of capital structure literature has recognized some form of financial friction. Fazzari et al. (1988), Ogawa and Suzuki (1999), Atanasova and Wilson (2004), D'Espallier et al., (2008) and Hovakimian (2009) have shown that companies do face financial constraints. Furthermore the recent capital structure studies of Bougheas et al. (2006), Faulkender and Petersen (2006), Kisgen (2006) and Leary (2009) have recognized the significance of financial constraints and incorporated the supply of credit in their research.

This paper is the first to take into consideration the findings of these aforementioned studies and test this hypothesis on the world's second largest capital market, namely that of Japan. Due to the extreme fluctuations in the supply of credit during the past 30 years, Japan is an attractive testing ground. This study uses a panel data set containing data for 1537 public firms from 1980 to 2007 and, similar to Leary (2009), focuses on two major economic events: the burst of the land value bubble in 1989, and the Japanese financial crisis in 1998. The empirical analysis employs fixed/random effect estimators.

This paper contributes to the literature in other ways. Kisgen (2006) and Faulkender and Petersen (2006) mainly investigated the effect of credit ratings on capital structure in the US while using a very limited number of capital structure determinants. Bougheas et al. (2006) examined the UK market, while not distinguishing between different groups of firms and not focusing on specific monetary shocks. Moreover all of these studies, contrary to this paper, did not make a distinction between private and public debt, and did not examine the role of trade credit.

As was stated earlier the only study of a similar methodology to the present one is the seminal paper of Leary (2009) examining the US market. Previous studies of capital structure in Japan (Allen & Mizuno 1989; Hirota 1999; Nishioka & Baba 2004) carried out only a demand-side investigation of corporate financial policy decisions. While Hosono (2003) has briefly touched on the matter of financial constraints, his study was based on the stagnant period of 1990–1996, thus excluding the two important monetary shocks that are likely to have affected the supply of credit.

The rest of the paper is organized as follows. The remainder of this section will provide an overview of the Japanese economy and the two economic events of interest. Section 2 will contain an overview of the determinants of capital structure used in this paper. The data set and methodology used will be depicted in Section 3. The results of this study will be discussed in Section 4 while Section 5 will conclude.

1.1. The Japanese case

During the late 1980s, Japan witnessed a major economic boom. Japanese asset prices rocketed, real GDP growth expanded at an average annual rate of 4.74%, while the Nikkei 225 equity index rose to a peak of ¥ 38,916 on 29 December 1989. Land prices also followed a similar trajectory; at the end of 1989, the land value of Japan was four times the land value of the U.S., despite Japan being a twenty-fifth or so in size. At the same time, Japanese capital outflows rose to unprecedented volumes. Several analysts were stating that in the late 80s Japanese money seemed to 'flood' the world. Well known examples include the purchase of the Rockefeller center and Columbia pictures by Japanese investors.[1] During the second half of the 1980s — the height of this boom — bank lending in Japan rose by 9% on average each year.

All this came to a halt when the asset 'bubble' burst. The Nikkei index, having peaked at the end of 1989, had plummeted to below ¥ 24,000 in 1991. A decade later, it reached ¥ 13,000 (June 2001). GDP growth during the 1990s averaged only 1.26%. Japanese capital exports also seemed to disappear. Within 3 years, bank lending growth had slowed to almost zero (Paker & Hodder, 2002; Werner, 1994, 2005, pp. 134–148). This expansion of economic activity, its sudden halt and its immediate transformation into a recession is one of the most dramatic economic events recorded in the post-WW2 era.

A similarly important economic event occurred in Japan during the late 1990s. The accumulated non-performing real estate loans and unsuitable monetary policies (Werner, 1997) led to a major Japanese banking crisis in 1998, triggered by the Lehman-style bankruptcy of a top-4 securities house in 1997 (Yamaichi Securities), and the external adverse effects of the Asian crisis and partial Russian sovereign default (1998) (Anderson & Campbell, 2000). While most of the top ten banks in the world were Japanese in 1989, by the end of the decade many had been overtaken by international competitors. Several Japanese banks, previously considered to be well-performing and secure, were forced to merge with other banks in order to survive bankruptcy. Bank restructuring after 1997 altered the banking scene for good. Naturally, the bank loan supply could not be unaffected by this crisis. Bank lending growth, already near zero in 1997, dropped into negative territory from the end of 1998, and recorded a record contraction in mid-2003. A significant recovery took place in the years 2006 and 2007, just before the US and European banking crisis worsened the international banking environment again.

[1] For a discussion of Japanese capital flows in the 1980s and early 1990s, as well as their determinants, please refer to Werner (1994).

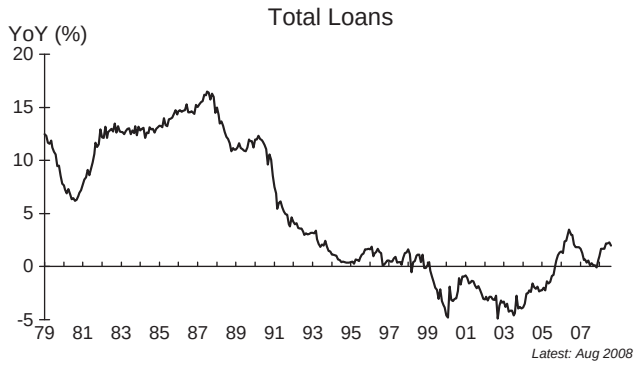

Fig. 1. Bank lending growth in Japan. Source: Compiled by Profit Research Center Ltd., Tokyo, from original Bank of Japan statistics (month-end bank loan balances outstanding, all banks).

2. The determinants of capital structure

In previous studies a variety of factors has been used to explain firms' financial policy decisions. In this empirical study, the most frequently used and theoretically appealing variables in capital structure were also deployed. These will be introduced below, alongside a summary of previous studies' relevant theoretical and empirical conclusions.

2.1. Credit supply fluctuations

As mentioned, this paper revolves around two major economic events: the burst of the asset bubble in 1989, and the Japanese banking crisis in 1998. As shown in Fig. 1, the supply of credit in Japan increased rapidly during 1980–1989, thus forming the land value bubble of the 1980s and triggering significant capital outflows (Werner, 1994, 1997). Then, bank lending growth decelerated sharply between 1989 and 1994, when it approached zero growth.[2] The next phase of deterioration started in 1998, when credit growth turned into credit contraction. This lasted until late 2005, but bank credit growth has remained weak ever since.

In order to examine how these changes in the supply of bank loans affected capital structure in Japan we will follow Leary (2009), who investigated the effects of two changes in bank funding constraints in the US: the 1961 emergence of the market for certificates of deposit and the 1966 credit crunch. Leary (2009) used a dummy variable to account for changes in the bank loan supply and this paper will do the same. We focus on the two instances of a change in the bank credit environment, by firstly comparing the 'easy credit' bubble period of the 1980s, which lasted until 1989, with the period of credit deceleration that followed (1990–1999). This constitutes data set 1, whereby the dummy variable will be equal to 1 during 1980–1989 and 0 during 1990–1999. The second data set compares the period of moderated credit growth with the period of a credit crunch, whereby the dummy takes a value of 0 during 1990–1999, and 1 during 2000–2007.

2.2. Bank dependency

Previous studies have shown that firms, especially smaller ones, frequently face financial constraints (e.g. Cantillo & Wright, 2000; Whited 1992). Following the studies of Leary (2009), Carpenter et al. (1994) and Gertler and Gilchrist (1993) this paper has used a dummy variable to classify firms according to the financial constraints they are expected to face. For every year of the sample, companies are ranked according to their total assets. The highest 30% is classified as bank independent and receives the value of 0 while the lowest 30% of firms is bank-dependent and receives the value of 1.

2.3. Size

Size is a factor that can be seen in almost every study investigating capital structure. Huang and Song (2006) support the idea that size can be used as a proxy for information asymmetries; the larger the firm, the more information is provided to outside investors. Alternatively, Rajan and Zingales (1995) state that size is likely to have an inverse relationship with the probability of default, thus enabling large firms to obtain larger amounts of leverage. Either way, a positive relationship between size and leverage is expected. Such a relationship is indeed reported by the majority of relevant papers (e.g. Booth et al., 2001; Guney et al., 2011; Hirota, 1999; Psillaki and Daskalakis, 2008). In this study the proxy chosen to measure size is the natural logarithm of sales and operating revenue.

2.4. Asset tangibility

Another commonly used variable in capital structure research is the asset tangibility and their collateral value. It can be hypothesized that firms with tangible assets will be subject to less information asymmetries, since they have a greater value than intangible assets in cases of bankruptcy, thereby reducing the agency costs of debt. A positive relationship between asset tangibility and leverage is thus expected, and has been reported by most studies (e.g. Titman and Wessels, 1988; Gaud et al., 2001). In this paper the ratio of total tangible fixed assets to total assets is used to account for the asset tangibility factor.

2.5. Profitability

One of the most controversial factors in capital structure is that of profitability. The trade-off theory states that profitable firms would have a greater amount of income to shield, thus they should use debt as a tax shield and therefore to have higher levels of leverage. On the other hand, the pecking order hypothesis states that financial managers will always prefer the use of internal to external finance, and thus more profitable firms should use their retained earnings to finance their projects. Almost all empirical studies have found a negative relationship between profitability and leverage (e.g. Aggarwal & Kyaw, 2010; Harrison et al., 2011; Margaritis & Psillaki, 2010). The most commonly used proxy for profitability is the earnings before interest and debt to total assets ratio; it is also used in this study. An alternative and more direct measure of the availability of internal finance and its use to finance investment opportunities is retained earnings. We have chosen to add the retained earning to total assets ratio as a robustness measure as well as a factor that will directly test for the validity of the pecking order hypothesis.

2.6. Non-debt tax shields

In accordance with the trade-off theory due to the existence of tax shields, companies with plenty of income to shield are expected to have high leverage ratios. This reasoning led many studies to use non-debt tax shields as a determinant of leverage. According to the trade-off theory they are expected to have a negative correlation with leverage ratios (e.g. Bradley et al. 1984; Lord & McIntyre, 2003; Taub 1975). Researchers have expressed tax shields in various ways; in this study we chose Hirota's (1999) definition for non-debt tax shields,

[2] On the question of why Japanese bank credit rose so rapidly during the 1980s and then collapsed sharply, see Werner (2002).

since he has carried out the most recent research in Japan: here non-debt tax shields are calculated as shown in (1).

$$NDTSE = PROFIT - \left(T \Big/ 0.5\right) \quad (1)$$

where *PROFIT* signifies net profits before tax, *T* is observed corporate tax payments and 0.5 is the assumed corporate tax rate. The assumption that the corporate tax rate was 50% was derived using reports from the Ministry of Finance Statistics Monthly of Japan. These reports stated that the tax rate for Japanese firms was on average 50% during 1970–1990.

2.7. Trade credit

Atanasova and Wilson (2004) and Steijvers (2004) have used trade credit in their investigation for the existence of financially constrained firms and it is the authors' belief that its inclusion in this study will help unearth potentially important relationships in the area of capital structure. According to Deloof and Jegers (1999), trade credit is an alternative form of finance to private or publicly-held debt. This was corroborated by Atanasova and Wilson (2004) and Steijvers (2004), who found trade credit to be inversely related with leverage. An alternative perspective is offered by Biais and Gollier (1997), in which the presence of trade credit signals the quality of the firm, thus reducing the adverse selection problem. The effects of trade credit are likely to be especially important in Japan, where strong intra-firm ties exist due to the higher cross-shareholding levels. In this paper we define trade credit as accounts payables, scaled by total assets.

3. Methodology and data set

The data set of this study was taken from the Nikkei Needs Financial Quest database and contained financial statement data for 1537 publicly listed Japanese firms (Table 1). Firms that were listed in any of the major stock market exchanges of the country (Tokyo, Osaka, Nagoya, Sapporo and Jasdaq) during the examined period have been included in our sample. As was stated earlier, the analysis has been split into two overlapping data sets; one covering the land value bubble (1980–1999) and the other investigating the credit crunch (1990–2007). As in most other capital structure studies (Bougheas et al. 2006; Faulkender & Petersen 2006; Gaud et al. 2005; Hosono 2003), non-manufacturing firms, such as banks, insurance, utility and railway companies were excluded from the sample. Furthermore only firms that submit their financial statements at the end of March were retained in the sample. This is the most frequent reporting year for firms in Japan, but other end-months exist, which may bias the results (especially when dummies are used). The sample includes de-listed

Table 1
Variables' definitions.

Variable	Variable definition
Leverage	(Commercial paper + short-term borrowings + short-term corporate bonds + long-term debt and maturities within 1 year + long-term debt + long-term corporate bonds)/total assets
Short-term leverage	(Commercial paper + short-term borrowings + short-term corporate bonds + long-term debt and maturities within 1 year)/total assets
Long-term leverage	(Long-term corporate bonds + long-term debt)/total assets
Private debt	(Short-term borrowings + long-term debt and maturities within 1 year + long-term debt)/total liabilities
Short-term private debt	(Short-term borrowings + long-term debt and maturities within 1 year)/total liabilities
Long-term private debt	(Long-term debt)/total liabilities
Public debt	(Long-term corporate bonds + short-term corporate bonds)/total liabilities
Short-term public debt	Short-term corporate bonds/total liabilities
Long-term public debt	Long-term corporate bonds/total liabilities
Equity issuance	Dummy variable. 1 if net increase of capital is in excess of that year's 1% book assets, 0 if otherwise
Debt issuance	Dummy variable. 1 if net increase of total debt is in excess of that year's 1% book assets, 0 if otherwise
Equity vs. Debt	Dummy variable. 1 if equity issuance = 1, 0 if debt issuance = 1; cases of dual equity and debt issuance are excluded.
Equity to total assets	Capital/total assets
Bankdep30	Dummy variable. 1 if firm belongs to that year's lowest 30% of total assets; 0 if firm belongs to that year's highest 30% of total assets
Bankdep20	Dummy variable. 1 if firm belongs to that year's lowest 20% of total assets; 0 if firm belongs to that year's highest 20% of total assets
BankdepSales30	Dummy variable. 1 if firm belongs to that year's lowest 30% of sales and operating revenue; 0 if firm belongs to that year's highest 30% of sales and operating revenue
BankdepSales20	Dummy variable. 1 if firm belongs to that year's lowest 20% of sales and operating revenue; 0 if firm belongs to that year's highest 30% of sales and operating revenue
Leveragelag	1st lag of leverage
Privdebtlag	1st lag of private debt
Publicdebtlag	1st lag of public debt
Bubble	Dummy variable. 1 if 1980–1989; 0 if 1990–1999
Crunch	Dummy variable. 0 if 1990–1999; 1 if 2000–2007
Bubble2	Dummy variable. 1 if 1980–1988; 0 if 1990–1998
Crunch2	Dummy variable. 0 if 1990–1998; 1 if 2000–2006
Listed	Dummy variable. 1 if firm is listed; 0 if firm is not-listed
Logsales	Natural logarithm of sales and operating revenue
Tangfassets	Total tangible fixed assets/total assets
EBIT	EBIT/total assets
Retearnings	(Profit reserves + various voluntary reserves + retained earnings carried forward)/total assets
NDTS	[Current income before taxes and other miscellaneous adjustments − (total corporation tax, inhabitance tax and enterprise tax)/0.5]/total assets
NDTS2	(Depreciation and amortisation expenses)/total assets
Accountspay	(Notes payable and accounts payable)/total assets

firms during the period of their listing, and thus a large element of potential survivorship bias, which plagues most relevant studies, does not arise here. The resulting data set consists of 32,947 firm year observations.

The sample described in the above paragraph enabled the use of panel data estimators for the empirical analysis section of this paper. The general regression model used is shown below:

$$y_{it} = az_i' + \beta x'_{it} + \varepsilon_{it} \quad (2)$$

where x_{it} is a 1 x K matrix of explanatory variables that does not include a constant term, β is the vector of the evaluated parameters and z_i is the individual effect or individual heterogeneity effect and contains a constant term and a set of individual or group specific characteristics, which may be observed or unobserved. It is this individual effect and its potential correlation with x_{it} that affects the selection of estimators.

In order to select between OLS, fixed and random effect estimators a series of post-estimation tests was used. Initially the Breusch and Pagan (1980) Lagrange multiplier test was conducted to detect the potential presence of an unobserved effect. If unobserved effects were present, then the use of OLS was deemed inappropriate and the Hausman (1978) test was run in order to select between the fixed and random effect estimators. As an additional post-estimation test the Wooldridge test was run to detect the presence of first order autocorrelation.

Since we are interested in various aspects of corporate capital structure, three different variables were examined: leverage, private debt and public debt. Leverage, as in most studies in the area of capital structure (e.g. Gaud et al., 2005; Rajan & Zingales, 1995) is defined as total debt scaled by total assets. Private debt is defined as the sum of short-term and long-term bank loans divided by total liabilities. Public debt is defined as the sum of long-term and short-term corporate bonds divided by total liabilities. All of the three aforementioned variables will be further divided into long-term and short-term categories for a more thorough investigation of financial policy decisions.

Furthermore, the probability of a firm issuing debt or equity was also investigated. Following Leary's (2009) approach, three panel data logit models were used to examine the choice between debt or equity. For the examination of the probability of a firm issuing debt, the dependent variable received the value of 1 if the net increase in total debt outstanding is greater than 1% of that year's book assets and 0 if it is not. An identical practise was followed for the examination of the probability of a firm issuing equity and for the probability of a firm choosing to issue debt vs. equity. It should be mentioned that firms that do not issue debt or equity were recorded as missing observations (as Leary, 2009).

The regression model used in this paper is mentioned below:

$$\begin{aligned} y_{it} = {} & a + a_1 Bankdep + a_2 MonetaryPolicy + \beta_1 Logsales_{it} \\ & + \beta_2 \frac{Tangassets_{it}}{Totalassets_{it}} + \beta_3 \frac{EBIT_{it}}{Totalassets_{it}} + \beta_4 \frac{Retearnings_{it}}{Totalassets_{it}} \\ & + \beta_5 \frac{NonDebtTaxShields_{it}}{Totalassets_{it}} + \beta_6 \frac{Accountspay_{it}}{Totalassets_{it}} + u_i + \varepsilon_{ut}. \end{aligned} \quad (3)$$

4. Results and discussion

Section 4.1 consists of an initial analysis derived from an examination of the descriptive statistics of this study's data set. In Sections 4.2–4.5 the findings of the main empirical analysis will be depicted and critically discussed.

4.1. Descriptive statistics

The discussion for this study's results begins with the descriptive statistics for our sample. Tables 2–3 contain the correlation matrices for both samples of this study; the correlation values are in low levels

Table 2
Correlation matrix, land value bubble period.

	Leverage	Private debt/ total liabilities	Public debt/ total liabilities	Natural log. of sales	Tangible assets/ total assets	EBIT/total assets	Retained earnings/ total assets	NDTS/total assets	Accounts payable/ total assets
Leverage	1.0000								
Private debt/total liabilities	0.8130***	1.0000							
Public debt/total liabilities	0.0742***	−0.3764***	1.0000						
Natural log. of sales	0.0312***	−0.1946***	0.2877***	1.0000					
Tangible assets/total assets	0.1808***	0.1752***	0.1921***	−0.0649***	1.0000				
EBIT/total assets	−0.2989***	−0.2339***	−0.0635***	−0.0047	−0.0982***	1.0000			
Ret. earnings/total assets	−0.6655***	−0.5013***	0.0860***	−0.0051	0.0603***	0.3825***	1.0000		
NDTS/total assets	0.1251***	0.1198***	0.0521**	0.0876***	0.0509***	−0.1865***	−0.0053	1.0000	
Accounts payable/total assets	−0.0916***	−0.0773***	−0.3610***	−0.0513***	−0.4176***	−0.0472***	−0.3516***	0.055***	1.0000

The above correlation matrix was generated through the use of the *pwcorr* STATA command. The *sig* option was used to show the significance level of each entry; **,*** denote significance at the 5% and 1% level respectively.

Table 3
Correlation matrix, credit crunch period.

	Leverage	Private debt/total liabilities	Public debt/total liabilities	Natural log. Of sales	Tangible assets/total assets	EBIT/total assets	Retained earnings/total assets	NDTS/total assets	Accounts payable/total assets
Leverage	1.0000								
Private debt/total liabilities	0.6508***	1.0000							
Public debt/total liabilities	0.1310***	−0.3031***	1.0000						
Natural log. of sales	0.0004	−0.2319***	0.3006***	1.0000					
Tangible assets/total assets	0.1198***	0.2075***	−0.0932***	−0.0083	1.0000				
EBIT/total assets	−0.4538***	−0.2168***	−0.0066	0.0859***	−0.0804***	1.0000			
Ret. earnings/total assets	−0.5025***	−0.2015***	0.0098	0.0714***	−0.0219***	−0.3776***	1.0000		
NDTS/total assets	−0.0751***	−0.0099***	−0.007	−0.0023	−0.0191***	0.1744***	−0.1878***	1.0000	
Accounts payable/total assets	0.1556***	−0.0796***	−0.2398***	0.0543***	−0.4541***	−0.1919***	−0.3193***	0.046***	1.0000

The above correlation matrix was generated through the use of the *pwcorr* STATA command. The *sig* option was used to show the significance level of each entry; *** denote significance at the 1% level.

Table 4
This table depicts the detailed descriptive statistics of the panel data sample of 1458 firms during the time period of 1980–1999. This is an unbalanced panel of data with a total number of 19,275 observations set. The values have been rounded up to the fourth decimal point.

	Mean	Median	Max	Min
Total debt to total assets	0.2700	0.2546	1.8767	0
Long-term debt to total assets	0.1188	0.0995	1.769	0
Short-term debt to total assets	0.1512	0.1296	1.7395	0
Private debt to total liabilities	0.2929	0.2819	0.9446	0
Long-term private debt to total liabilities	0.0929	0.0561	0.8896	0
Short-term private debt to total liabilities	0.2000	0.1826	0.9408	0
Public debt to total liabilities	0.1001	0.0064	0.8889	0
Long-term public debt to total liabilities	0.0882	0	0.8777	0
Short-term public debt to total liabilities	0.0119	0	0.8015	0
Natural logarithm of sales	10.67	10.535	16.0243	4.0775
Tangible assets to total assets	0.3563	0.3509	0.9112	0.0219
EBIT to total assets	0.0618	0.0574	0.8726	−1.7692
Non-debt tax shields to total assets	−0.0273	−0.0226	1.437	−1.788
Accounts payable to total assets	0.2171	0.2027	1.2068	0
Retained earnings to total assets	0.1756	0.1526	0.8773	−2.2678

and no perfect correlation is reported, thus multicollinearity is not likely to plague the regression results. Table 4 presents detailed descriptive statistics for the asset bubble data set, giving an overall view of the sample. Table 5 shows the significant differences between bank and non-bank-dependent firms. Table 6 shows the differences

Table 5
This table depicts the mean and median of the dependent and independent variables used in the empirical analysis. This is an unbalanced panel set of data for 1458 firms during the 1980–1999 period, with a total number of 19,275 observations. The values have been rounded up to the fourth decimal point. The *ttest* command was applied in order to test if the bank and non-bank-dependent means are equal,*** denote significance at the 1% level.

	Bank-dependent mean	Non-bank-dependent mean	Bank-dependent median	Non-bank-dependent median
Total debt to total assets	0.2615***	0.2957***	0.2470	0.2815
Long-term debt to total assets	0.0982***	0.1537***	0.0744	0.1415
Short-term debt to total assets	0.1633***	0.1420***	0.1409	0.1202
Private debt to total liabilities	0.3404***	0.2578***	0.3446	0.2249
Long-term private debt to total liabilities	0.1114***	0.0866***	0.0765	0.0511
Short-term private debt to total liabilities	0.2290***	0.1711***	0.2144	0.1501
Public debt to total liabilities	0.0370***	0.1678***	0	0.1186
Long-term public debt to total liabilities	0.0335***	0.1465***	0	0.1021
Short-term public debt to total liabilities	0.0036***	0.0213***	0	0
Natural logarithm of sales	9.3060***	12.2456***	9.3688	12.1132
Tangible assets to total assets	0.3500***	0.3731***	0.3445	0.3766
EBIT to total assets	0.0640***	0.0610***	0.0611	0.0544
Non-debt tax shields to total assets	−0.0313***	−0.0239***	−0.0266	−0.0189
Accounts payable to total assets	0.2394***	0.1841***	0.2254	0.1715
Retained earnings to total assets	0.1745***	0.1740***	0.1635	0.2254

Table 6
This table depicts the mean and median of the variables used in the empirical analysis taking into consideration the burst of the land value bubble. This is an unbalanced panel set of data for 1458 firms during the 1980–1999 period, with a total number of 19,275 observations. The values have been rounded up to the fourth decimal point. The *ttest* command was applied in order to test if the buring and post bubble means are equal, *** denote significance at the 1% level.

	During bubble mean	Post bubble mean	During bubble median	Post bubble median
Total debt to total assets	0.2780***	0.2637***	0.2642	0.2472
Long-term debt to total assets	0.1101***	0.1259***	0.0876	0.1095
Short-term debt to total assets	0.1679***	0.1379***	0.1522	0.1115
Private debt to total liabilities	0.3169***	0.2736***	0.3212	0.2455
Long-term private debt to total liabilities	0.0989***	0.0881***	0.0645	0.0491
Short-term private debt to total liabilities	0.2181***	0.1855***	0.2104	0.1584
Public debt to total liabilities	0.0555***	0.1357***	0	0.0535
Long-term public debt to total liabilities	0.0523***	0.1163***	0	0.0359
Short-term public debt to total liabilities	0.0025***	0.0194***	0	0
Natural logarithm of sales	10.556***	10.7654***	10.399	10.6357
Tangible assets to total assets	0.3234***	0.3826***	0.3138	0.3826
EBIT to total assets	0.0745***	0.0517***	0.0686	0.0485
Non-debt tax shields to total assets	−0.0317***	−0.0238***	−0.0273	−0.0198
Accounts payable to total assets	0.2456***	0.1942***	0.2338	0.1769
Retained earnings to total assets	0.1558***	0.1912***	0.1342	0.1708

between the mean and median of the variables used in the analysis, during and after the burst of the asset bubble. Tables 7 to 9 examine the corresponding relationships to Tables 4 to 6, for the credit crunch data set. Figs. 2–13 depict visually the numerical values of Tables 2–9.

The initial conclusions that can be drawn be simply examining the descriptive statistics of the aforementioned tables are:

1) Leverage levels drop significantly after the burst of the asset bubble and during the credit crunch after the Japanese banking crisis of 1998. This is a strong indicator that financial constraints affect the firms' capital structure.

Table 7
This table depicts the detailed descriptive statistics of the panel data sample of 1548 firms during the time period of 1990–2007. This is an unbalanced panel of data with a total number of 24,381 observations set. The values have been rounded up to the fourth decimal point.

	Mean	Median	Max	Min
Total debt to total assets	0.2448	0.2249	19.9698	0
Long-term debt to total assets	0.1091	0.0881	1.7691	0
Short-term debt to total assets	0.1357	0.1032	19.9698	0
Private debt to total liabilities	0.2820	0.2590	0.9981	0
Long-term private debt to total liabilities	0.0943	0.0547	0.8896	0
Short-term private debt to total liabilities	0.1878	0.1555	0.9981	0
Public debt to total liabilities	0.1038	0.0005	0.9979	0
Long-term public debt to total liabilities	0.0851	0	0.9979	0
Short-term public debt to total liabilities	0.0186	0	0.8015	0
Natural logarithm of sales	10.692	10.575	16.2640	0.6931
Tangible assets to total assets	0.4296	0.4289	0.9976	0
EBIT to total assets	0.0444	0.0412	0.9919	−3.7819
Non-debt tax shields to total assets	−0.0213	−0.0165	58.6194	−12.06
Accounts payable to total assets	0.1768	0.1601	5.8918	0
Retained earnings to total assets	0.1893	0.1798	0.9751	−39.1288

Table 8
This table depicts the mean and median of the dependent and independent variables used in the empirical analysis. This is an unbalanced panel set of data for 1548 firms during the 1990–2007 period, with a total number of 24381 observations. The values have been rounded up to the fourth decimal point. The *ttest* command was applied in order to test if the bank and non-bank-dependent means are equal, ** and *** denote significance at the 5% and 1% level respectively.

	Bank-dependent mean	Non-bank-dependent mean	Bank-dependent median	Non-bank-dependent median
Total debt to total assets	0.2511**	0.2603**	0.2286	0.2466
Long-term debt to total assets	0.0905***	0.1420***	0.0630	0.1318
Short-term debt to total assets	0.1606***	0.1183***	0.1292	0.0881
Private debt to total liabilities	0.3424***	0.2277***	0.3442	0.1859
Long-term private debt to total liabilities	0.1085***	0.0859***	0.0662	0.0481
Short-term private debt to total liabilities	0.2339***	0.1417***	0.2137	0.1034
Public debt to total liabilities	0.0424***	0.1841***	0	0.1562
Long-term public debt to total liabilities	0.0360***	0.1491***	0	0.1138
Short-term public debt to total liabilities	0.0064***	0.0349***	0	0
Natural logarithm of sales	9.297***	12.288***	9.4195	12.1532
Tangible assets to total assets	0.4134***	0.4516***	0.4083	0.4601
EBIT to total assets	0.0417***	0.0466***	0.0419	0.0407
Non-debt tax shields to total assets	−0.0248	−0.0174	−0.0204	−0.0126
Accounts payable to total assets	0.1930***	0.1571***	0.1769	0.1398
Retained earnings to total assets	0.1435***	0.2115***	0.1693	0.1816

2) Short-term debt radically decreased from 1990 onwards and is thus identified as the driving force behind the reduction of leverage.
3) Bank-dependent companies rely more on short-term debt while non-bank-dependent ones on long-term debt.
4) Private debt, especially short-term, is the main reason behind the reduction of debt to assets ratios during the bursting of the land bubble. It also played an important role in the more recent credit crunch.
5) Small bank-dependent firms rely heavily on bank loans, mainly short-term, probably due to informational asymmetries.
6) Japan is a bank-centred economy, as evidenced by the fact that private debt is approximately three times the size of public debt throughout the sample.
7) Despite this, public debt is an important factor on firms' leverage levels. Its steep reduction from 1998 onwards, followed by a smaller drop in private debt, drastically reduced companies' debt to assets ratios. The credit crunch led to a much larger reduction in leverage than the bursting of the asset bubble did.
8) Large non-bank-dependent companies were able to use public debt to at least partially mitigate the effect of the financial constraints introduced by the bursting of the asset bubble.

4.2. Leverage

Tables 10 and 11 show the results of the regression models examining the total, long-term and short-term aspects of leverage during the asset bubble period and the credit crunch period, respectively.

Table 9
This table depicts the mean and median of the variables used in the empirical analysis taking into consideration the credit crunch. This is an unbalanced panel set of data for 1548 firms during the 1990–2007 period, with a total number of 24,381 observations. The values have been rounded up to the fourth decimal point. The *ttest* command was applied in order to test if the pre Crunch and Crunch means are equal, *** denote significance at the 1% level respectively.

	Pre Crunch mean	Crunch mean	Pre Crunch median	Crunch median
Total debt to total assets	0.2645***	0.2201***	0.2475	0.1918
Long-term debt to total assets	0.1234***	0.0911***	0.1057	0.0658
Short-term debt to total assets	0.1411***	0.1289***	0.1132	0.0883
Private debt to total liabilities	0.2811	0.2832	0.2546	0.2625
Long-term private debt to total liabilities	0.0903***	0.0992***	0.0504	0.0606
Short-term private debt to total liabilities	0.1907***	0.1840***	0.1619	0.1454
Public debt to total liabilities	0.1304***	0.0704***	0.0439	0
Long-term public debt to total liabilities	0.1106***	0.0532***	0.0238	0
Short-term public debt to total liabilities	0.0198***	0.0171***	0	0
Natural logarithm of sales	10.7551***	10.614***	10.627	10.4912
Tangible assets to total assets	0.3907***	0.4783***	0.3906	0.4807
Ebit to total assets	0.0481***	0.0396***	0.0453	0.0353
Non-debt tax shields to total assets	−0.0238	−0.0181	−0.0190	−0.0128
Accounts payable to total assets	0.1893***	0.1612***	0.1724	0.1455
Retained earnings to total assets	0.1934	0.1842	0.1746	0.1901

One of the two most important contributions of this study is to show how small and large firms were affected during changes of monetary policy. The dummy variable accounting for this factor (*bankdep*) shows that during a monetary policy expansion, bank-dependent firms have higher levels of total and short-term leverage. More specifically, if a company is bank-dependent then, *ceteris paribus*, on average this leads to an increase of its total leverage levels by 0.0985 and its short-term leverage by 0.0735. As discussed in the descriptive statistics section, small bank-dependent firms have an easier than usual time in accessing credit during a period of economic expansion and therefore appear more levered than their larger counterparts. However, this phenomenon is reversed when it comes to long-term debt. This underlines the observation that the more desirable long-term debt is received mainly by the larger, safer firms, whereas small firms mostly rely on short-term debt. The relationship between bank dependency and leverage is reversed during the credit crunch of the late 1990s. Large firms have higher values of debt to assets ratios not only in total, but also in terms of long-term debt. The bank dependency coefficient for short-term leverage was however not statistically significant and thus no robust conclusions could be drawn on this point.

The second key implication of this study is that economic conditions affect the supply of credit and ultimately capital structure. Both the burst

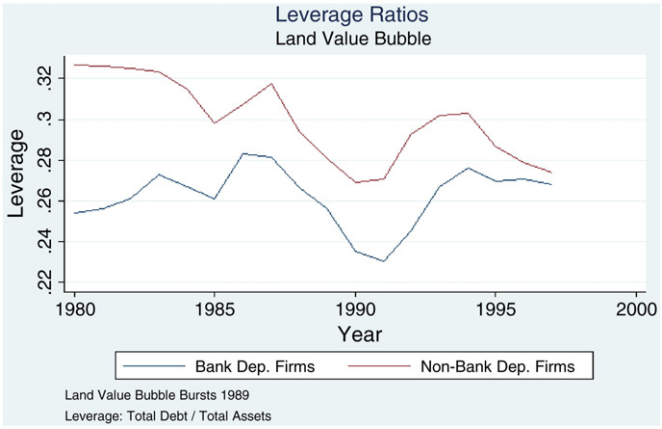

Fig. 3. Leverage ratios, by bank dependency, land value bubble period.

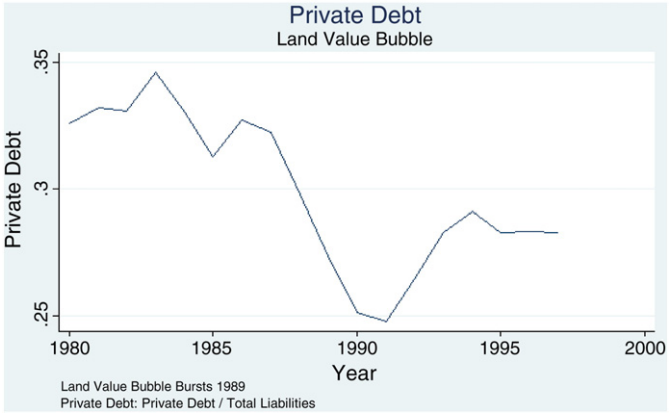

Fig. 4. Private debt ratios, all firms, land value bubble period.

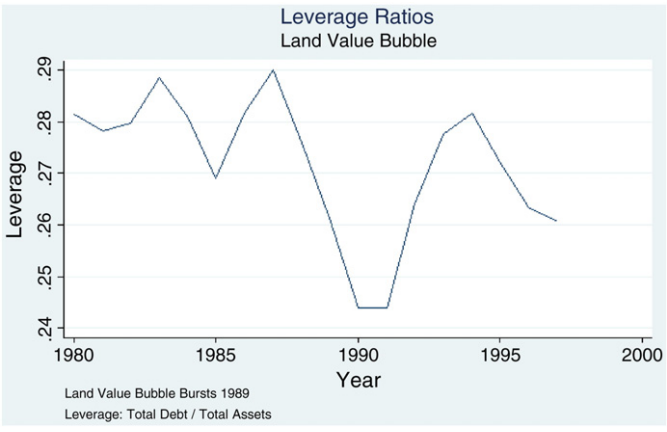

Fig. 2. Leverage ratios, all firms, land value bubble period.

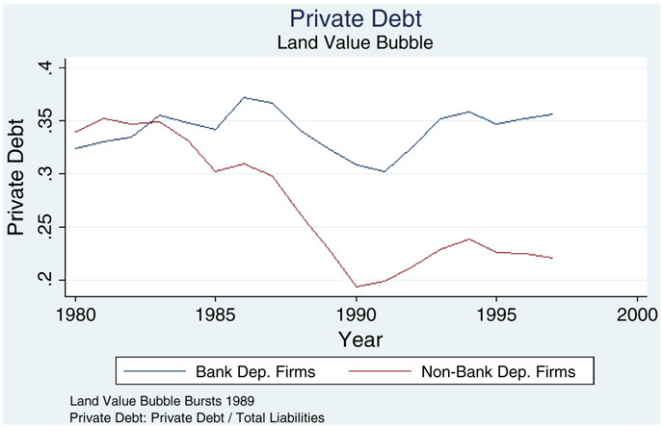

Fig. 5. Private debt ratios, by bank dependency, land value bubble period.

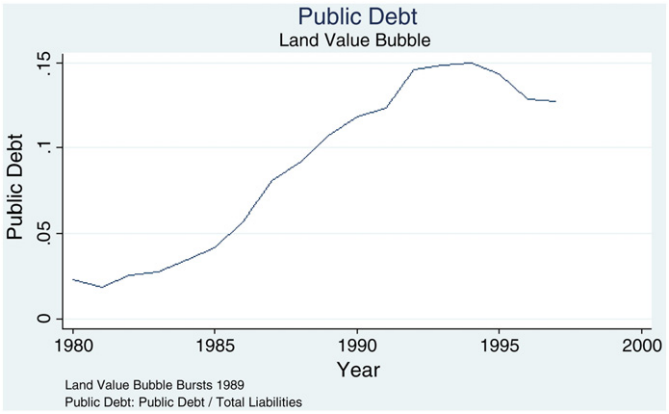

Fig. 6. Public debt ratios, all firms, land value bubble period.

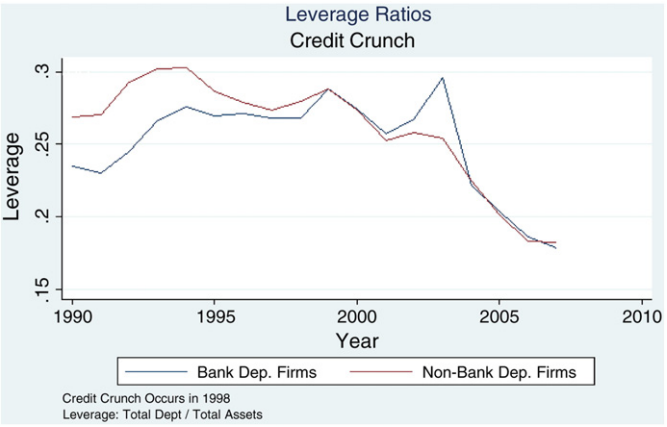

Fig. 9. Leverage ratios, by bank dependency, credit crunch period.

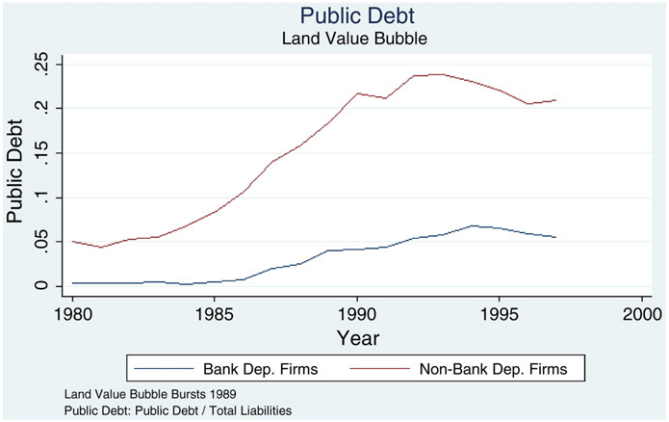

Fig. 7. Public debt ratios, by bank dependency, land value bubble period.

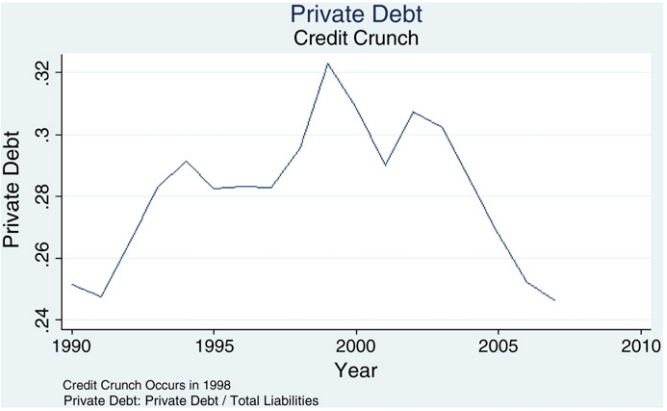

Fig. 10. Private debt ratios, all firms, credit crunch period.

of the asset bubble of the 1980s and the credit crunch taking place in the 1990s are followed by severe reductions in leverage (*bubble*). When the bubble bursts, total leverage is drastically reduced (a 0.0239 reduction occurs); this is underlined by a similar drop of short-term debt (a reduction of 0.0272 is observed). On the other hand, all forms of leverage experienced a steep decline during the credit crunch. This supports our hypothesis that a decrease in the supply of credit will have a similar impact on the firms' capital structures.

Concerning the dummy variables, in the majority of cases the bank dependency and monetary policy indicators are statistically significant, mostly at the 1% significance level.

Moving on to explanatory variables used more frequently in capital structure studies, the reader will find that results in general support the findings of previous published papers. The tangibility of assets factor is positively correlated with leverage, and is statistically significant (*tangfassets*). A one unit increase in the tangible fixed assets to total assets ratio leads to a 0.0445 increase of total leverage

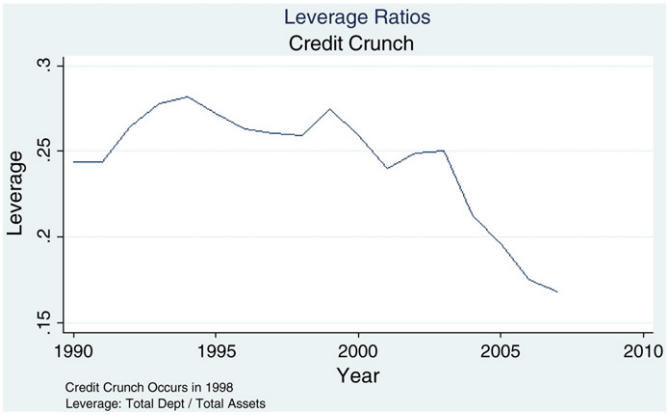

Fig. 8. Leverage ratios, all firms, credit crunch period.

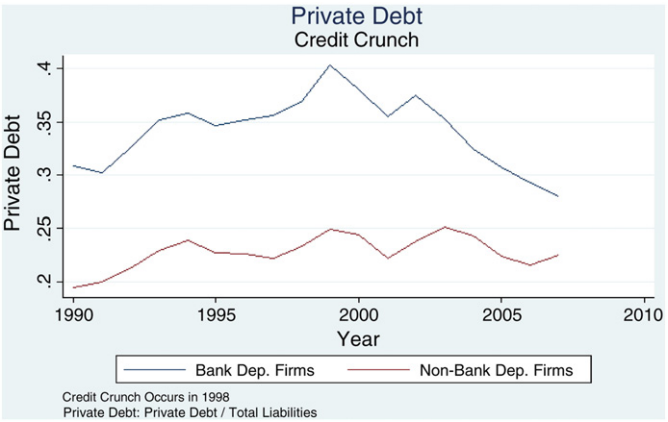

Fig. 11. Private debt ratios, by bank dependency, credit crunch period.

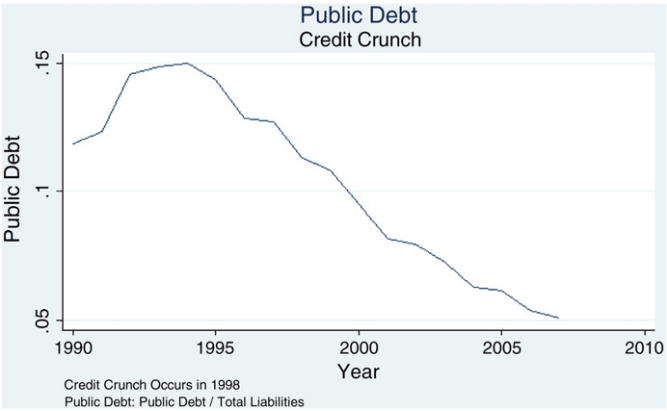

Fig. 12. Public debt ratios, all firms, credit crunch period.

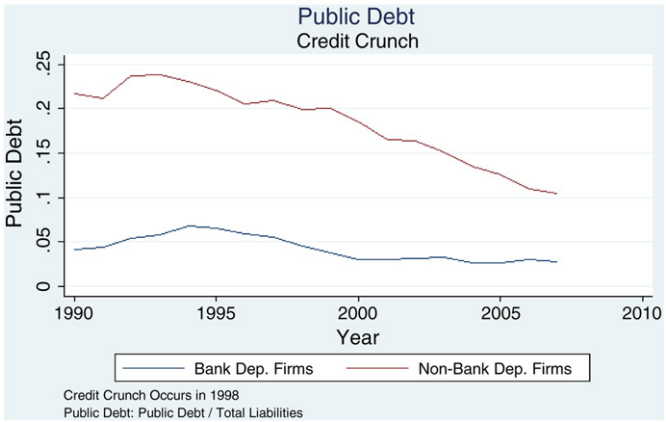

Fig. 13. Public debt ratios, by bank dependency, credit crunch period.

This is in accordance with previous studies, such as those of Booth et al. (2001) and Titman and Wessels (1988), stating that high collateral values are perceived by banks as a signal that the firm is less likely to default on its obligations. The only exception to this rule is the short-term leverage regression during the land value bubble. This could be explained nevertheless by the many small corporations that would normally be credit-rationed, but had access to short-term debt during economic expansion of the 1980s. This is in turn reflected in the asset tangibility variable.

The natural logarithm of sales factor (*logsales*) indicates that firms with higher financial activity are more levered. Nevertheless this variable in most cases remained statistically insignificant.

In accordance with the pecking order hypothesis, the terms depicting profitability and internal finance (*EBIT* and *Retearnings*) were negatively related to leverage. This relationship is significant and stable for both data sets. As this particular theory suggests, firms indeed seem to prefer internal to external finance. More specifically, in the asset bubble data set an increase of one unit in the *EBIT* variable leads to a decrease of 0.3247 in total leverage and an increase of one unit in the *Retearnings* variable results in a 0.6309 decrease of total leverage. These results confirm the majority of papers based either in Japan (Allen & Mizuno, 1989; Hirota, 1999) or worldwide (Rajan & Zingales, 1995).

Concerning the trade-off theory, non-debt tax shields (*NDTS*) should have a negative relationship with debt to assets ratios. The results, even if significant, were mixed on this count, with the specific variables having different signs in both data sets. This does not allow us to draw a conclusion on the validity of the trade-off theory, while it can be said that these specific findings are not particularly supportive.

Results reported for trade credit (*accountspay*) show that during the 1980s, when credit was still plenty, trade credit played the role of a debt substitute. More specifically, trade credit has a negative sign no matter which definition of leverage is examined. An example is that an increase of one unit in *accountspay* leads to a decrease of 0.6839 in total leverage. Similar results have been reported by Deloof and Jegers (1999). During the credit crunch regression analysis though, where it has already been shown that credit is likely to be rationed, trade credit has a different role. In this data set, with the exception of long-term leverage, trade credit seems to provide signals for the firms' quality levels, thereby reducing information asymmetry problems. This is more in line with Biais and Gollier's (1997) theory. This seems to be the explanation of why accounts payable are positively related with leverage in the credit crunch period.

A general comment on the regression results is that in every regression run, the Wooldridge test indicated the existence of first order autocorrelation. As expected, the BP test indicated towards the rejection of OLS. Furthermore, the Hausman test pointed towards the acceptance of fixed effect estimators. The R^2 results indicate a good fit for the model created, especially for the credit crunch data set, though the reader should keep in mind that regressions investigating capital structure and using panel data tend to report low R^2 values. Despite this, it appears that the regression examining long-term leverage has a particularly low R^2. This is a phenomenon observed not only in this regression, but also in all the subsequent regressions investigating long-term debt components. In our case, this result is likely influenced by the fact that approximately 18.5% of the total observations report long-term debt ratios of zero. Alternatively, it could be the case that there are one or more factors that affect long-term debt which are not included in this, and all the previous, analyses.

4.3. Private debt

The examination of private debt further enhanced our understanding of capital structure in Japan. As can be seen in Tables 12–13, the results show that fluctuations in the supply of credit indeed affect

Table 10
This is a panel data regression analysis based on data from the Land Bubble data set. *Bankdep* is a dummy variable that takes the value of 1 if the firm is classified as a bank-dependent firm and 0 if not. *Bubble* is also a dummy variable that takes the value of 1 if the year is 1980–89 and 0 if it is 1990–99. *Logsales* is the natural logarithm of sales, *Tangfassets* are tangible assets scaled by total assets, *EBIT* are EBIT to total assets, *Retearnings* are retained earnings divided by total assets, *NDTS* are non-debt tax shields scaled by total assets and *Accountspay* are accounts payable to total assets. If the Woolridge test has a value under 0.05 then first order autocorrelation is present and the Xtregar STATA command is utilized. If the BP test has a value of under 0.05 OLS are rejected. If OLS are rejected the Hausman test is run; if its value is under 0.05 then fixed effects estimators are used; if not, then random effects are selected. ** and *** denote significance at the 5% and 1% level respectively.

Variables	Leverage	Coefficient values	
		Short-term leverage	Long-term leverage
Bankdep	0.0985^{***}	0.0735^{***}	0.0393^{***}
Bubble	0.0239^{***}	0.0272^{***}	0.0005
Logsales	0.0298^{***}	0.0081^{***}	0.0215^{***}
Tangfassets	0.0445^{***}	0.0089	0.0367^{***}
EBIT	-0.3247^{***}	-0.1737^{**}	-0.1143^{***}
Retearnings	-0.6309^{***}	-0.3514^{***}	-0.3004^{***}
NDTS	0.0242^{***}	-0.0556^{**}	0.0915^{***}
Accountspay	-0.6839^{***}	-0.3449^{***}	-0.3198^{***}
Constant	0.1449^{***}	0.1581^{***}	-0.0161^{***}
R^2	0.42	0.18	0.13
Obs	10,466	10,466	10,466
BP	0.00	0.00	0.00
Wooldridge	0.00	0.00	0.00
Hausman	0.00	0.00	0.00

Table 11
This is a panel data regression analysis based on data from the Credit Crunch data set. *Bankdep* is a dummy variable that takes the value of 1 if the firm is classified as a bank dependent firm and 0 if not. *Crunch* is also a dummy variable that takes the value of 0 if the year is 1990–99 and 1 if it is 2000–07. *Logsales* is the natural logarithm of sales, *Tangfassets* are tangible assets scaled by total assets, *EBIT* are EBIT to total assets, *Retearnings* are retained earnings divided by total assets, *NDTS* are non-debt tax shields scaled by total assets and *Accountspay* are accounts payable to total assets. If the Woolridge test has a value under 0.05 then first order autocorrelation is present and the Xtregar STATA command is utilized. If the BP test has a value of under 0.05 OLS are rejected. If OLS are rejected the Hausman test is run; if its value is under 0.05 then fixed effects estimators are used; if not, then random effects are selected. * and *** denote significance at the 10% and 1% level respectively.

Variables	Leverage	Coefficient values	
		Short-term leverage	Long-term leverage
Bankdep	−0.1050***	−0.0989***	0.0258
Crunch	−0.0253***	−0.0022	−0.0218***
Logsales	0.0149***	0.0058*	0.0076***
Tangfassets	0.1366***	0.0841***	0.0449***
EBIT	−1.8548***	−1.6848***	−0.2018***
Retearnings	−0.0304***	−0.0282***	−0.0029***
NDTS	−0.1780***	−0.0232***	0.0044***
Accountspay	1.5098***	1.6066***	−0.1623***
Constant	−0.0799***	−0.1089***	0.0438***
R^2	0.76	0.74	0.05
Obs	13,459	13,459	13,459
BP	0.00	0.00	0.00
Wooldridge	0.00	0.00	0.00
Hausman	0.00	0.00	0.00

Table 13
This is a panel data regression analysis based on data from the Land Bubble data set. *Bankdep* is a dummy variable that takes the value of 1 if the firm is classified as a bank-dependent firm and 0 if not. *Bubble* is also a dummy variable that takes the value of 1 if the year is 1980–89 and 0 if it is 1990–97. *Logsales* is the natural logarithm of sales, *Tangfassets* are tangible assets scaled by total assets, *EBIT* are EBIT to total assets, *Retearnings* are retained earnings divided by total assets, *NDTS* are non-debt tax shields scaled by total assets and *Accountspay* are accounts payable to total assets. If the Wooldridge test has a value under 0.05 then first order autocorrelation is present and the Xtregar STATA command is utilized. If the BP test has a value of under 0.05 OLS are rejected. If OLS are rejected the Hausman test is run; if its value is under 0.05 then fixed effect estimators are used; if not, then random effects are selected. *, **, and *** denote significance at the 10%, 5% and 1% level respectively.

Variables	Private debt	Coefficient values	
		Short-term private debt	Long-term private debt
Bankdep	0.2877***	0.2262***	0.0438*
Crunch	−0.0155***	−0.0105***	−0.0074***
Logsales	0.0033	0.0050***	0.0013
Tangfassets	0.1588***	0.0309**	0.1463***
EBIT	−0.4429***	−0.2862***	−0.1581***
Retearnings	0.0013	0.0004	−0.0004
NDTS	0.0033***	−0.0002	0.0036***
Accountspay	−0.3228***	−0.2027***	−0.1222***
Constant	0.1123***	0.0590***	0.0276***
R^2	0.11	0.04	0.04
Obs	13,459	13,459	13,459
BP	0.00	0.00	0.00
Wooldridge	0.00	0.00	0.00
Hausman	HF	HF	0.00

financial policy decisions. As in Section 4.2, the bubble and crunch dummy variables again indicate that the two examined economic events severely affect the supply of credit. During the late 1980s we see private debt to total liabilities ratios, especially those of short-term debt, significantly higher before the recession of the 90s took place. Similarly, private debt levels drop significantly during the credit crunch (total private debt is decreased by 0.0155). It is clearly evident that when the banks decrease their loan supply, this is immediately shown in the firms' capital structure.

The dummy variable of bank dependency indicates that for small firms, bank loans occupy a larger portion of their total liabilities. It is likely that, due to information asymmetries, smaller companies have to rely almost exclusively on bank loans without having the option of issuing public debt or equity. Of particular interest is also the fact that for both data sets, when long-term private debt is examined, the size of the bank dependency coefficient is significantly lower. More specifically, a bank-dependent firm shows on average greater private debt ratios by 0.1487 and 0.2877, during the asset bubble and credit crunch data sets, respectively. These results are similar to those reported by Leary (2009). This could be due to smaller companies mainly relying on short-term bank loans that are granted more easily. On the other hand, due to informational asymmetries, long-term loans are much harder to be obtained by small firms, partly due to competition from their larger and more trustworthy counterparts.

Table 12
This is a panel data regression analysis based on data from the Land Bubble data set. *Bankdep* is a dummy variable that takes the value of 1 if the firm is classified as a bank dependent firm and 0 if not. *Bubble* is also a dummy variable that takes the value of 1 if the year is 1980–89 and 0 if it is 1990–97. *Logsales* is the natural logarithm of sales, *Tangfassets* are tangible assets scaled by total assets, *EBIT* are EBIT to total assets, *Retearnings* are retained earnings divided by total assets, *NDTS* are non-debt tax shields scaled by total assets and *Accountspay* are accounts payable to total assets. If the Wooldridge test has a value under 0.05 then first order autocorrelation is present and the Xtregar STATA command is utilized. If the BP test has a value of under 0.05 OLS are rejected. If OLS are rejected the Hausman test is run; if its value is under 0.05 then fixed effects estimators are used; if not, then random effects are selected. ** and *** denote significance at the 5% and 1% level respectively.

Variables	Private debt	Coefficient values	
		Short-term private debt	Long-term private debt
Bankdep	0.1487***	0.1231***	0.0508**
Bubble	0.0323***	0.0314***	0.0095***
Logsales	0.0094***	0.0083***	0.0009
Tangfassets	0.2643***	0.0808***	0.1737***
EBIT	−0.2932**	−0.1995***	−0.0636***
Retearnings	−0.2840***	−0.1778***	−0.1382***
NDTS	0.0788***	0.0310***	0.0594***
Accountspay	−0.6119***	−0.3968***	−0.1798***
Constant	0.1936***	0.1336***	0.0546***
R^2	0.20	0.10	0.06
Obs	10,466	10,466	10,466
BP	0.00	0.00	0.00
Wooldridge	0.00	0.00	0.00
Hausman	HF	0.00	0.00

The explanatory variables investigating profitability and internal finance have an inverse relationship with private debt for both periods, again indicating that internal finance is used as a substitute of bank credit. This in accordance with the pecking order theory, stating that firms will prefer internal to external finance. As an example, in the land value bubble data set an increase of one unit in the *EBIT* variable leads to a decrease of 0.2932 in total private debt and an increase of one unit in the *Retearnings* variable results in a 0.2840 decrease of total private debt. However, retained earnings are not statistically significant during the credit crunch.

Another substitute for bank credit can be found in accounts payable. Trade credit, this time consistently for both data sets, has a negative sign and is statistically significant. Trade credit and bank credit are thus to some extent substitutes for each other, which is to be expected. As an example, an increase of one unit in *accountspay* (trade credit) is associated with a 0.6119 unit fall in bank credit (total private debt) in the asset bubble data series. In the credit crunch data series, it is associated with a 0.3228 unit decrease of bank credit. Not surprisingly, the magnitude of the coefficient has halved from the late 1990s onwards, as the ability to supply trade credit has likely suffered, but it still remains quite large. Tangibility of assets in every regression run has again a positive relationship with debt, thereby verifying the common knowledge that banks regard firms' tangible assets as collateral, when issuing a loan. More specifically, in the land value bubble data set a one unit increase in the *tangfassets* variable leads to a 0.2643 increase of total private debt.

The natural logarithm of sales has a negative relationship with private debt, indicating that the smaller the size of the financial transactions of a firm, the higher its private debt to total liabilities ratio will be. For example, in the land value bubble data set a one unit increase in the *logsales* variable leads to a 0.0094 decrease of total private debt. This only confirms the conclusions drawn by the bank dependency and asset tangibility factors. Last but not least, non-debt tax shields disappoint yet again as they present a positive sign and are statistically significant, contrary to what the trade-off theory states (and in line with the literature).

4.4. Public debt

The analysis of the firms' public debt, in Tables 14–15, completes the picture drawn from Sections 4.1 and 4.2. The results from the monetary conditions dummy variables indicate that the issuance of public debt dramatically increases after 1990 as shown by a negative relationship between the *bubble* variable and public debt. The burst of the asset bubble leads to a 0.0179 decrease of total public debt. This means that indeed public debt is used by firms as a substitute for private debt. During the credit crunch the same does not happen. The coefficient of the *crunch* factor has a negative sign indicating that during the credit crunch public debt is reduced. Specifically, the credit crunch leads to a 0.0203 decrease of total public debt. It appears that when the banking sector faces severe problems, companies are neither able to utilize capital markets, nor obtain external finance through the issuance of corporate bonds or commercial paper. Nevertheless, the variables of bank dependency and size in most cases are not statistically significant and therefore safe conclusions cannot be drawn on this point.

As in the case of leverage and private debt regressions, EBIT has a negative and significant relationship with public debt issuance. In the asset bubble series, a one unit increase of the EBIT to total assets ratio results in a 0.2581 decrease of total public debt levels; similarly in the credit crunch data set a one unit increase of the *EBIT* factor leads to a 0.2051 decrease of total public debt. The same holds for retained earnings with the exception of some cases in the credit crunch data set for which the results for long-term public debt are not statistically significant. As an example, in the asset bubble data set an increase of one unit in the retained earnings variable leads to a decrease of 0.1557 in total public debt.

Summing up the results of the profitability and internal finance factors it seems that the main principle of the pecking order hypothesis can be safely accepted: firms prefer internal to external finance. The same statement cannot be made for the trade-off theory whose non-debt tax shields yet again fail to report the expected sign.

The results on the asset tangibility factor are rather intriguing. In every regression run, asset tangibility has an inverse relationship with public debt even though in some cases this is not statistically significant. In the asset bubble series, a one unit increase of the tangible assets ratio results in a 0.2091 decrease of total public debt levels. The exact opposite was expected due to the fact that the majority of corporate bond and commercial paper issuers are large trustworthy companies that are likely to have high collateral values. Apparently large, non-bank-dependent firms with many intangible assets and low profitability will prefer to issue public debt.

Table 14
This is a panel data regression analysis based on data from the Land Bubble data set. *Bankdep* is a dummy variable that takes the value of 1 if the firm is classified as a bank dependent firm and 0 if not. *Bubble* is also a dummy variable that takes the value of 1 if the year is 1980–89 and 0 if it is 1990–97. *Logsales* is the natural logarithm of sales, *Tangfassets* are tangible assets scaled by total assets, *EBIT* are EBIT to total assets, *Retearnings* are retained earnings divided by total assets, *NDTS* are non-debt tax shields scaled by total assets and *Accountspay* are accounts payable to total assets. If the Woolridge test has a value under 0.05 then first order autocorrelation is present and the Xtregar STATA command is utilized. If the BP test has a value of under 0.05 OLS are rejected. If OLS are rejected the Hausman test is run; if its value is under 0.05 then fixed effects estimators are used; if not, then random effects are selected. ** and *** denote significance at the 5% and 1% level respectively.

Variables	Public debt	Coefficient values	
		Short-term public debt	Long-term public debt
Bankdep	−0.0041	−0.0199	−0.0248
Bubble	−0.0179***	−0.0119***	−0.0180***
Logsales	0.0369***	0.0017***	0.0371***
Tangfassets	−0.2091***	0.0030	−0.1465***
EBIT	−0.2581***	−0.0545***	−0.2087***
Retearnings	−0.1557***	−0.0161**	−0.1166**
NDTS	0.1302***	0.0285***	0.1053***
Accountspay	−0.4337***	−0.0687***	−0.3669***
Constant	−0.0678***	0.0305	−0.1269***
R^2	0.09	0.04	0.07
Obs	10,466	10,466	10,466
BP	0.00	0.00	0.00
Wooldridge	0.00	0.00	0.00
Hausman	0.00	0.02	0.00

Table 15
This is a panel data regression analysis based on data from the Credit Crunch data set. *Bankdep* is a dummy variable that takes the value of 1 if the firm is classified as a bank-dependent firm and 0 if not. *Crunch* is also a dummy variable that takes the value of 0 if the year is 1990–99 and 1 if it is 2000–07. *Logsales* is the natural logarithm of sales, *Tangfassets* are tangible assets scaled by total assets, *EBIT* are EBIT to total assets, *Retearnings* are retained earnings divided by total assets, *NDTS* are non-debt tax shields scaled by total assets and *Accountspay* are accounts payable to total assets. If the Wooldridge test has a value under 0.05 then first order autocorrelation is present and the Xtregar STATA command is utilized. If the BP test has a value of under 0.05 OLS are rejected. If OLS are rejected the Hausman test is run; if its value is under 0.05 then fixed effect estimators are used; if not, then random effects are selected. *, **, and *** denote significance at the 10%,5% and 1% level respectively.

Variables	Public debt	Coefficient values	
		Short-term public debt	Long-term public debt
Bankdep	0.1070***	−0.0061	0.0555***
Crunch	−0.0203***	−0.0033***	−0.0254***
Logsales	0.0001	0.0006	0.0029
Tangfassets	−0.0940***	−0.0020	−0.0318***
EBIT	−0.2051***	−0.0616***	−0.1502***
Retearnings	−0.0022	−0.0025**	−0.0007
NDTS	0.0040***	0.0015***	0.0030***
Accountspay	−0.1831***	−0.0652***	−0.1284***
Constant	0.1442***	0.0342*	0.0807***
R^2	0.03	0.11	0.02
Obs	13,459	14,627	13,459
BP	0.00	0.00	0.00
Wooldridge	0.00	0.70	0.00
Hausman	0.00	0.00	0.00

4.5. Debt vs. equity

Concluding this paper's empirical analysis, the probability of a firm issuing debt or equity was investigated. As mentioned in Section 3, three separate regression models were run, their difference being changes in the dependent variable. In the first model, the dummy dependent variable takes the value of 1, if the firm issues equity and 0, if it does not. Likewise in the second model, the dependent variable depicts debt issuance, again taking the value of 1 if a company decides to issue debt and 0, if it does not. Finally, in the last regression the probability of a firm issuing equity or debt was examined. In this case the dependent variable takes the value of 1, if the firm chooses to issue equity and 0, if it decides to issue debt. Results are shown in Tables 16–17.

For the land bubble data set the results for the bank dependency variable were not statistically significant and thus robust conclusions could not be drawn. As far as the debt issuance is concerned, smaller

Table 16
This is a panel data regression analysis based on data from the Land Bubble data set. *Bankdep* is a dummy variable that takes the value of 1 if the firm is classified as a bank dependent firm and 0 if not. *Bubble* is also a dummy variable that takes the value of 1 if the year is 1980–89 and 0 if it is 1990–97. *Logsales* is the natural logarithm of sales, *Tangfassets* are tangible assets scaled by total assets, *EBIT* are EBIT to total assets, *Retearnings* are retained earnings divided by total assets, *NDTS* are non-debt tax shields scaled by total assets and *Accountspay* are accounts payable to total assets. The Xtlogit STATA command is utilized to run the regression. If the Hausman test is under 0.05 then fixed effects estimators are used; if not, then random effects are selected. *** denote significance at the 1% level.

Variables	Coefficient values		
	Equity issuance	Debt issuance	Equity vs. debt
Bankdep	0.2635	0.3666	1.4524
Bubble	0.4809***	0.3205***	0.4596***
Logsales	0.6441***	−0.4339***	1.0848***
Tangfassets	−7.0424***	−2.6581***	−5.7383***
EBIT	7.8397***	−5.1663***	8.5427***
Retearnings	−2.1066***	−2.3898***	−1.3643***
NDTS	0.7120	−1.5343***	0.339
Accountspay	−6.3781***	−3.3142***	−4.7926***
Hausman	0.00	0.00	0.01
Obs	8429	11,125	3632

companies are shown to be more likely to issue debt. A one unit decrease to *logsales* leads to an increase of 0.4339 in the probability of issuing debt. This means that smaller firms are more dependent on bank credit, and are thus likelier to seek a bank loan than larger companies that have other options available such as equity. Nevertheless, during the credit crunch it is clearly shown that non-bank-dependent firms are more likely to issue equity or debt than their bank-dependent counterparts. Bank dependency leads to a 4.3611 and 2.0461 decrease to the probability of the firm issuing equity or debt. These results are clearly influenced by the credit crunch. When a major economic contraction takes place then only the large, trustworthy companies are likely candidates for issuing either equity or debt.

The burst of the asset bubble leads to an increase in the probability of a company issuing equity, resulting in a 0.4809 increase in the probability of equity issuance. This is not surprising, given the fact that the severe reduction in the supply of bank credit forced firms to search for alternatives to credit. During the credit crunch it is shown that companies are less likely to issue equity or debt. The credit crunch results in a 0.2329 and 0.9091 decrease in the probability of a company issuing equity and debt, respectively. This was not surprising, because during a credit crunch fear is the major sentiment plaguing the financial markets. So companies are likely to face severe difficulties in obtaining any kind of external finance. Results from the examination of the probability of a firm issuing debt versus equity were however not statistically significant and therefore robust conclusions could not be drawn.

As far as the tangibility of assets variable is concerned the findings show that the higher the collateral value of a firm the less likely it is to proceed to an issuance of either debt or equity; even though the absolute value of the coefficient is much larger for the case of an increase in equity. It appears that companies with highly valued tangible assets do not rely on external finance.

Internal finance as depicted by retained earnings to assets, and in accordance to the existence of a pecking order, also has an inverse relationship with either a debt or an equity increase. This is also true for trade credit which again has the role of substitute for equity as well as debt. As an example, in the land value bubble data set, a one unit increase in *Retearnings* and *accountspay* leads to a 2.3898 and a 3.3142 decrease respectively to the probability of a company issuing debt. The EBIT variable tells a different story to the previous sections of the regression analysis. In this logit investigation EBIT retains their classic role as an indicator of internal finance and therefore as a substitute of debt. When it comes down to equity issuance though EBIT seems to lower information asymmetries and helps companies go through an equity issuance. It is only logical after all that profitable firms will appear attractive to potential investors. As an example in the asset bubble data set, a one unit increase in *EBIT* leads to a 7.8397 increase to the probability of a firm issuing equity and a 5.1663 decrease to the probability of a company issuing debt.

Non-debt tax shields present a negative signed coefficient when debt issuance is examined during the land value bubble. They also exhibit an inverse relationship with equity during the credit crunch. Nevertheless, the factor of non-debt tax shields produces statistically insignificant results for half the regressions.

Table 17
This is a panel data regression analysis based on data from the Credit Crunch data set. *Bankdep* is a dummy variable that takes the value of 1 if the firm is classified as a bank dependent firm and 0 if not. *Crunch* is also a dummy variable that takes the value of 0 if the year is 1990-99 and 1 if it is 2000–07. *Logsales* is the natural logarithm of sales, *Tangfassets* are tangible assets scaled by total assets, *EBIT* are EBIT to total assets, *Retearnings* are retained earnings divided by total assets, *NDTS* are non-debt tax shields scaled by total assets and *Accountspay* are accounts payable to total assets. The Xtlogit STATA command is utilized to run the regression. If the Hausman test is under 0.05 then fixed effects estimators are used; if not, then random effects are selected. *** denote significance at the 1% level.

Variables	Coefficient values		
	Equity issuance	Debt issuance	Equity vs. debt
Bankdep	−4.3611***	−2.0461***	−2.0718***
Crunch	0.2329***	0.9091***	−0.0626
Logsales	0.7074***	−0.2972***	−0.2111***
Tangfassets	−5.0002***	−2.2734***	−3.6839***
EBIT	8.5854***	−4.3937***	7.9998***
Retearnings	−0.0374	−0.4361	−0.2859
NDTS	−1.2287***	−0.1803	−1.0861***
Accountspay	−0.9199	−2.3886***	−1.5498***
Hausman	0.00	0.00	0.00
Obs	9882	13,672	8031

5. Conclusions

As discussed in the Introduction, the majority of previous studies on capital structure have taken into consideration only demand-side explanations. These previous papers have made the assumption that the financial manager's wishes are bound to become reality. The two main capital structure theories that have been derived by this school of thought were the trade-off theory, which is based on tax savings and agency costs, and the information asymmetries-based pecking order hypothesis.

The failure of these two competitive hypotheses to provide sufficient explanation of financial policy decisions has led to a new approach in examining capital structure. More specifically, recent papers, such as those of Faulkender and Petersen (2006), Kisgen (2006) and Bougheas et al. (2006), have taken into consideration that firms face financial constraints. These financial constraints exist either due to credit rationing or due to a bank lending/balance sheet channel. By incorporating the supply of credit in the investigation of capital structure, these studies have successfully enhanced our understanding of the area. This paper has followed in the footsteps of these studies while gathering evidence on Japan, the world's largest economy, where 'natural experiments' in the form of the extreme fluctuations of the supply of credit were utilized. To the authors' best knowledge this is the first study that incorporated financial constraints into a study of Japanese firms' financial policy decisions.

In this paper we show that both the burst of the land value bubble of the 1980s and the financial crisis of 1998 led to a severe reduction in the firms' leverage ratios and therefore provide corroboration of Leary's (2009) and Bougheas et al.'s (2006) findings in the Japanese

context. Public debt acts as a substitute of private debt during the burst of the bubble but not during the credit crunch. During the land bubble, small public firms are more levered than large ones; the opposite is true during the credit crunch. This provides further support to the belief that certain groups of firms face financial constraints (Atanasova & Wilson 2004; Ogawa & Suzuki 1999). In accordance with the majority of capital structure studies (Gaud et al. 2005; Rajan & Zingales 1995) the independent factors of profitability and retained earnings show an inverse relationship to external finance. Contrary to MacKie-Mason (1990), but in accordance with Minton and Wruck (2001), we find that non-debt tax shields produce mixed, inconclusive results. Moreover trade credit in most cases acts as a substitute to external finance. These results are indications in favour of the pecking order hypothesis and reject the trade-off theory.

Evaluating these results we conclude that fluctuations in the supply of credit and changes in monetary conditions have a serious impact on firms' capital structures. For example during the credit crunch firms, especially bank-dependent ones, experienced a severe reduction in their leverage levels. An implication for future research is that corporate capital structure studies should always account for credit supply factors.

Future studies in the area of capital structure should also consider that firms with different characteristics face different financial constraints, have access to different types of external finance and thus take different decisions regarding their capital structure. Financial policy decisions will therefore always depend on the characteristics of the firm itself. This conclusion further supports the view that capital structure studies should not only take into account supply-side explanations but also consider the effect that different characteristics have on the credit availability. For example smaller firms are likely to be more credit-rationed during a recession and should be encouraged to develop and exploit close business ties with their suppliers in order to use trade credit instead of bank credit. Together with the finding that small banks tend to lend more to small firms (Berger et al., 1998), another policy implication would be for banking competition regulators to respond by encouraging the creation and development of small and/or regional banks. Ironically, Japan has followed the opposite course since the 1980s by consolidating its banking sector and reducing the influence of smaller banks. Our findings throw new light on these developments and raise doubts about the recent tendency of banking systems to consolidate.

In summary, findings of this paper are: 1) Future capital structure studies should include both demand-side explanations and supply-side explanations. 2) When incorporating supply-side explanations, studies should consider the different financial constraints of different groups of firms. 3) Trade credit should be added as an external finance option. 4) The pecking order hypothesis appears to be better at explaining financial policy decisions than the trade-off theory. However, whichever theory is used researchers must not forget that this study shows that financial constraints clearly affect the performance of both theories.

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