Domestic and Foreign Denominated Debt: Firm-level Evidence from South Korea

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Abstract: We explore the capital structure of South Korean firms during the period 2001-2016. A two-part fractional response model with fixed-effects is used here to empirically model a firm's binary choice to use debt, and among firms that use debt, their level of leverage. Our results indicate there is significant heterogeneity in the intensity of these firms' use of domestic versus foreign denominated debt. We also examine whether the intensity of debt use was impacted by a flight to quality by investors during the financial crisis (2007-2009). We find evidence supporting a flight to quality only among foreign investors in South Korea, as firms with lower pre-crisis quality were more constrained in their use of foreign denominated debt during the crisis.

Key words: Capital structure; financial leverage; foreign debt; financial crisis, South Korea.

JEL classification: G20, G30, G01

1. Introduction

Empirical studies (Rajan and Zingales 1995, Brav 2009, Ramalho and da Silva 2009, Rauh and Sufi 2010, Colla et al. 2013, Hanssens et al. 2016, Keefe and Yaghoubi 2016) of the capital structure of firms identify four key determinants of leverage – a firm's share of tangible assets, size, profitability, and growth opportunities. Rajan and Zingales (1995) find for a cross-section of US firms that asset tangibility and size are both positively related to leverage, while growth opportunities measured by the market to book ratio and firm profitability are negatively related – results that are consistent with typical findings in the literature. Rajan and Zingales (1995) also find these relations are generally consistent across samples of firms from other developed countries. More recent studies though have focused on examining the heterogeneous effects these determinants have on leverage in different contexts. Variation in the level of leverage is

found between privately held and public firms in the UK (Brav 2009), Belgium firms with differences in initial debt choices (Hanssens et al. 2016), and between firms across Central and Eastern Europe on the basis of differences in the strength of collateral (Hall 2012). Other studies (Allayannis et al. 2003, Rauh and Sufi 2010, Colla et al. 2013, Hanssens et al. 2016) have also shown these determinants affect the types of debt firms' use. We build on this literature by exploring the heterogeneity in firms' use of domestic and foreign denominated debt.

Our paper is similar in scope to Allayannis et al. (2003) in that we examine the domestic and foreign debt use of firms in South Korea. Allayannis et al. (2003) use a sample of approximately the forty largest exchange traded firms from each of eight East Asian countries, which includes South Korea. Using a cross-section of data from 1996, they estimate an OLS regression model to find the determinants of total debt and a Tobit regression model to find the determinants of foreign and domestic debt. Their results indicate significant heterogeneity in the use of foreign and domestic debt. The share of tangible assets, a measure of firms' collateral, they show increased (statistically significantly) leverage in foreign debt, yet had negative and statistically insignificant effects on domestic (local) currency and total debt. Profitability they find reduced domestic and total debt leverage, while having no effect on foreign debt. Firm size and the market to book ratio (growth opportunities) had similar effects across the three measures of leverage – with size increasing foreign, domestic, and total leverage ratios, and growth opportunities significantly decreasing each of the three ratios.

In our study, we take an empirical step forward by utilizing a two-part fractional fixed-effects model (Wooldridge 2010, Egger and Kesina 2014) to jointly estimate a firm's binary choice whether to finance with debt and the choice of leverage among firms using debt. This is particularly important in the study of foreign debt, as a large number of firms choose to forgo

foreign debt altogether, a choice we posit differs from the choice made by firms with leverage values near zero. Two-part models have been used previously (Cook et al. 2008, Ramalho and Da Silva 2009) to study total leverage. The benefit they offer over Tobit type models (Rajan and Zingales 1995, Allayannis et al. 2003), which assume zero values are due to censoring, is that we are able to determine how factors that affect the fixed cost associated with using debt differ from those that affect the variable costs, i.e. we are also able to model the heterogeneity in the use of debt. By adding a fractional response model (Papke and Wooldridge 1996), we are able to capture the non-linearity in the leverage ratio that is bounded from above by a value of one. This feature Keefe and Yaghoubi (2016) note is important to minimizing specification errors in their findings that cash flow volatility reduces the leverage of firms in the United States.

The two-part model of leverage used here is similar to Ramalho and Da Silva (2009), who examined the total leverage of Portuguese firms. We though extend the two-part model in an important way to control for firm-level fixed effects with unbalanced panel data (Wooldridge 2010). Inclusion of firm-level fixed effects allows us to reduce the potential for bias in our estimates from omitted variables that are invariant over the time period examined for a given firm and that influence the choice of debt – e.g., a firm's management risk aversion, lender relationships, and initial debt choices. Applying our econometric model to firm-level data from 1,445 South Korean firms for the years 2001-2016, we find additional evidence of heterogeneity in the use of domestic and foreign denominated debt. Our results show that firms with more collateral reduce foreign leverage and increase domestic leverage, which reflects substitution between the two types of debt and a preference for domestic debt. This result differs from Allayannis et al.'s (2003) findings from a cross-section of 315 East Asian firms and suggests

there is heterogeneity in the effects of the standard determinants across countries.[1] A similar pattern of substitution is also shown in regards to firm size, with larger firms increasing their domestic leverage and reducing foreign leverage. Cash flow volatility, which we add to the standard determinants as a measure of firm quality, exhibits a heterogeneous effect. Lower quality firms, with more volatile cash flows, are shown to have lower foreign leverage, yet no difference in domestic leverage. This finding we tie to lower quality firms having less access to foreign debt markets.

The other contribution of this paper is to further explore whether the adverse shock of the global financial crisis had a heterogeneous effect on firms' leverage. González (2015) finds firms that were less dependent on external finance i.e., had lower leverage prior to the crisis were less credit constrained during the crisis, which increased their leverage during the crisis relative to their constrained counterparts. Here we examine whether the shock to the supply of credit exhibited a flight to quality, whereby the increase in asymmetric information accompanying the crisis led investors to prefer higher quality firms. Our results show firms with higher quality pre-crisis had higher leverage during the crisis, when controlling for the change in quality. We interpret this result as providing evidence that foreign investors exhibited a flight to quality in South Korean firms. We do not find such an effect for domestic denominated debt.

The format of the paper is organized as follows. Section 2 reviews the literature on corporate debt and develops the hypotheses we test. In section 3, we describe the data set and section 4 describes the econometric specification of our two-part fixed effects model of firm leverage. Section 5 presents the empirical results and their discussion, with various robustness

[1] Allayannis et al. (2003) note in unreported results that when they included country specific dummies in their specification that South Korean firms used significantly more domestic debt than other countries. It is possible the effects of the other determinants may therefore vary by country, i.e. the intercept and slope vary by country.

checks. In section 6, we explore the role of credit supply shocks during the recent global financial crisis of 2007-09. The paper then concludes with section 7.

2. Literature and Hypothesis Tests

2.1. Theory of capital structure

Theory identifies that a firm's capital structure is influenced by the firm's desire to weigh the trade-offs between the tax benefits of using debt, relative to the costs from potential bankruptcy caused by servicing a higher debt. This trade-off theory suggests that as profitability rises, so do the tax benefits from using debt, thereby increasing firm leverage. Tangible assets, which serve as collateral, reduce the likelihood of default and allow firms to be more highly levered. Leverage also increases with firm size, as larger firms are better able to diversify and fail less often (Titman and Wessels 1988). Firms with strong growth opportunities face higher opportunity costs from default and therefore are less likely to be levered under the trade-off theory.

Complicating matters in the firm's calculus are the effects of agency costs influenced by the choice of capital structure and the presence of asymmetric information (for a review see Harris and Raviv 1991). Agency costs in corporate finance, reflect a principle-agent problem, where conflicts of interest arise between the firm's managers, shareholders, and debtholders (Jensen and Meckling 1976). The conflict between managers and shareholders is a result of managers being unable to fully capture the gain from their efforts, which causes them to shirk in terms of their effort and efficient resource use. A benefit of using additional debt financing, in place of equity, is that managers with a fixed equity claim face fewer incentives to shirk, while the firm's commitment of cash to debt repayment also reduces the availability of fungible cash

flows for managers to divert away from productive purposes (Jensen 1986). The use of debt though creates a conflict of interest between debtholders and shareholders. Debtholders, similar to managers, do not benefit fully from above normal returns, as their returns are fixed, yet they bear the full cost when below normal. Shareholders therefore face incentives to pursue more risky, suboptimal, investment projects to the detriment of debtholders. This behavior of asset substitution (Jensen and Meckling 1976) results in debtholders adding a premium to the cost of debt, which leads to underinvestment, i.e. a cost to using debt.

Theoretical models of agency costs draw similar predictions to trade-off theory with respect to the effects of the standard determinants on firm leverage. Harris and Raviv's (1990) model predicts that firms with more tangible assets, i.e. collateral, are likely to have more leverage. The basis for their model is that collateral increases the liquidation value of the firm, and given managers face incentives to avoid liquidation, even when optimal for owners and debtholders, a higher level of debt increases the ability of debtholders to force liquidation. Models by Jensen (1986) and Stulz (1990) predict that firms with high growth opportunities are less levered. Managers who are faced with profitable investment opportunities have fewer incentives to divert free cash flows and thus there is less benefit to shareholders from adding debt to reduce free cash. If higher profits result in increased cash flows, then these same models predict an increase in leverage constrains managers from using free cash flows towards their own ends.

The presence of asymmetric information between firm insiders (current shareholders and managers) and outsiders is theorized to influence the choice between using internal funds, debt, and equity. Firms are observed (Myers and Majluf 1984) to adopt a pecking order whereby they prefer the use of internal retained earnings to external sources of financing, and then prefer debt

to equity. In Myers and Majluf's (1984) model, managers have an incentive to issue debt when their inside information of the firm's future value indicates that share prices are undervalued, as debt is subject to fewer information costs than equity. Managers thereby only choose to issue equity when their inside information is unfavorable, and investors who know this only purchase equity when the firm is highly levered. If debt were risk free, the firm is indifferent between the use of debt and internal funds. The presence of tangible assets, which act as collateral, reduces the risk associated with debt and thereby increases leverage. The pecking order model implies the more free cash flows the firm is able to generate from internal profits the less there is a need for external sources of debt and the less levered the firm. Similar reasoning suggests the need for external financing rises with additional growth opportunities. These predictions of the effects of profitability and growth opportunities on leverage are opposite those posited by the trade-off and agency costs theories.

2.2. Empirical Evidence of Heterogeneous Effects

Empirical research has begun to examine whether the standard determinants of leverage have a heterogeneous effect in different contexts. Brav (2009), for example, looks at the sensitivity of public and private firms' leverage to changes in these measures in the United Kingdom. The notion is that private firms face higher costs to access external capital markets, which makes it more difficult to adjust their leverage. Private firms are therefore expected to respond more strongly to changes in internal cash flows from profits than public firms, yet respond less to changes in other measures (growth opportunities, size, and asset tangibility) that affect the trade-off between debt and equity. Estimates from Brav's (2009) fixed effects model show that private firms have a more negative (stronger) response to a change in profitability than their public counterparts and the difference is statistically significant. Statistically significant variation is

also found between the two types of firms with respect to the effects of growth opportunities. Brav (2009) finds that the growth opportunities of public firms has a negative effect on leverage, whereas the growth opportunities of private firms has a positive effect. That is to otherwise say that private firms have a less negative (weaker) effect than is typical.

Heterogeneity is also evident across different institutional environments. Hall (2012) theorizes the strength of collateral e.g., tangible assets, should vary across countries with ease in the transfer of assets, such as land. For a given value of fixed assets, one would expect firms operating in a country where transfer is unfettered to have more leverage than their counterparts in a country where transfer is limited. Hall (2012) finds this cross-country variation is evident for firms in Central and Eastern Europe, as asset tangibility has a larger effect on leverage for a sample of firms in countries where land is fully transferable. Differences in the initial conditions of firms, which proxy for firm-level heterogeneity are shown to influence leverage. Hanssens et al. (2016) find for a sample of Belgium firms that a firm's initial debt choice during their start-up influences subsequent leverage choices, independent of the contemporaneous and initial levels of standard determinants of leverage.

A number of studies (Allayannis et al. 2003, Rauh and Sufi 2010, Colla et al. 2013) have shown that the standard determinants have a heterogeneous effect on the types of debt firms use. Estimates from Rauh and Sufi's (2010) leverage regressions show the negative effect a firm's profitability has on total leverage is driven by decreases in their shares of private placement debt and convertible debt, rather than a change in the debt share of bonds or bank loans – a result they note is inconsistent with a pecking order, as firms in their data favor debt types that are more sensitive to information asymmetries, rather than less. Rauh and Sufi's estimates further indicate the direction of the effects on leverage may differ depending on the type of debt. Tangible assets

are shown to have a statistically significant effect on reducing leverage in convertible debt, while increasing leverage in program (e.g. commercial paper), bond, and private placement debt. The effect of firm size also varies in their estimates, with larger firms increasing their leverage in terms of program debt and reducing leverage in bank and private placement debt. Allayannis et al. (2003) find further evidence of heterogeneous effects in the use of foreign and domestic debt. They find firms with more tangible assets have a higher leverage in foreign denominated debt, whereas tangible assets have no effect on leverage in terms of either domestic or total debt. These characteristics though also influence the number of debt types that firms use. Colla et al. (2013) find that firms with higher expected bankruptcy costs (fewer tangible assets, more volatile cash flows) choose to specialize by using fewer types of debt in order to reduce the costs of renegotiation with multiple lenders.

2.3. Hypotheses

Our paper examines the choice of South Korean firms to use foreign and domestic debt. We assume that local investors are subject to less asymmetric information than foreign investors, such that South Korean firms prefer, *ceteris paribus*, to use domestic debt relative to foreign. Allayannis et al. (2003) find indirect evidence of this as they report South Korean firms use more domestic debt than their counterparts from seven other East Asian countries when controlling for differences in firm characteristics and yet use similar levels of foreign denominated debt. This implies South Korean firms have a stronger preference for using domestic debt relative to foreign debt than do their counterparts. We therefore posit that South Korean firms that are able to borrow more domestically will borrow less in foreign markets, i.e. they substitute between types of debt. Firms with more tangible assets, collateral, are able to borrow more and given firms preferences are expected to increase domestic leverage and decrease foreign leverage. We

expect to see a similar result with respect to firms' size, given larger firms are also less likely credit constrained.

Access to foreign debt markets is impacted by a firm's credit quality. Guedes and Opler (1996) show that low credit quality firms may be screened from long-term and foreign denominated debt based on their credit rating. Credit ratings are negatively related to firms' cash flow volatility (Minton and Schrand 1999). Lacking data on our firms' credit ratings, our proxy measure of credit quality is therefore a firm's cash flow volatility (Guedes and Opler 1996, Minton and Schrand 1999, Colla et al. 2013). Recent results from Keefe and Yaghoubi (2016) show that cash flow volatility, in general, has a negative effect on firm leverage. We therefore hypothesize that foreign denominated leverage is more sensitive to cash flow volatility, which implies a more negative effect on leverage given the inverse relationship between volatility and firm quality.

One of the reasons firms issue foreign denominated debt is to mitigate their exposure to foreign exchange risk associated with their share of foreign sales (Allayannis and Ofek 2001; Graham and Rogers 2002, Pramborg 2005). Heterogeneity is introduced here, in part, as the determinants of leverage influence the magnitude of foreign exchange exposure. Egger and Kesina (2014) show the share of foreign sales by Chinese firms is negatively related to firms' share of tangible assets and size.[2] We therefore hypothesize that leverage in terms of foreign currency denominated debt is less sensitive (increases less) than domestic leverage from either an increase in a firm's asset tangibility or size – effects that are similar to those we predict based on firms' preferences and their credit constraints.

[2] Capital intensity is measured by Egger and Kesina (2014) using the ratio of fixed capital, tangible assets of plant, property and equipment, to employment and size is measured using employment.

In our analysis, we explore the effects the global financial crisis (2008-2009) had on the supply and use of credit. Previous research (Duchin et al. 2010, Almeida et al. 2011, Vermoesen et al. 2013, Carvalho et al. 2015, González 2015) shows that the crisis had a heterogeneous effect on firms' access to credit due to differences in firms' financial constraints. Firms with greater exposure to long-term debt maturing at the onset of the crisis are observed (Almeida et al. 2011, Vermoesen et al. 2013) to make more cuts to investment than less constrained firms. Similarly, Duchin et al. (2010) observe that firms more dependent on external sources of finance prior to the crisis had the largest declines in corporate investment during the crisis. Firms' pre-crisis dependence on external finance also impacted their leverage during the crisis. González (2015) finds for a sample of firms from 39 countries that the global crisis, in general, led to increases in total, long-term, and short-term leverage, with smaller increases observed among firms more dependent on external finance prior to the crisis. This result strongly suggests the credit supply channel affects firm leverage.

Our analysis further explores this credit supply channel by considering whether the financial crisis led lenders in a flight to quality, whereby lenders shift more lending to borrowers of higher quality, increasing the financial constraints of lower quality firms. Lang and Nakamura (1995) show that following a tightening of monetary policy lenders increase the share of safer loans in their loan portfolio. In addition, tightening monetary policy results in fewer bank loans to small, presumably more risky, manufacturing firms relative to larger firms (Gertler and Gilchrist 1993). Higher quality firms though are also able to access a larger mix of credit sources. Quality firms are thus able to substitute between bank debt and commercial paper (Bernanke et al. 1996) and between bank debt and corporate bonds (Adrian et al. 2013, Becker and Ivashina 2014), which improves these firms' ability to access credit during adverse shocks.

We posit that given foreign debt is subject to greater agency costs (Allayannis et al. 2003), foreign denominated leverage likely exhibits a greater flight to quality.

3. Data Description

Our sample consists of firm-level data of 1,445 publicly listed companies on the Korea Stock Exchange. Similar to others (Brav 2009, Rauh and Sufi 2010, Hall 2012, Colla et al. 2013, González 2016, Keefe and Yaghoubi 2016), we exclude from the analysis firms that operate in the finance and insurance sector.[3] Firms' balance sheet and income statement data for the period 2001-2016 are drawn from Korea Investors Service (KIS) database. The balance sheet information includes a breakdown of firm debt into foreign and domestic denominations, which like the other financial data are all reported in terms of Korean Won.[4] Firms with negative shareholder (common) equity are also excluded. This unbalanced panel data consists of 13,515 firm-year observations.

The dependent variables used in our analysis are standard measures (e.g. Rauh and Sufi 2010) of firm leverage. Total leverage is equal to total debt divided by the sum of total debt and the book value of shareholder equity. Leverage denominated in domestic currency (Korean Won) is simply the value of domestic denominated debt divided by the sum of total debt and the book value of shareholder equity, with foreign leverage equal to the share of foreign denominated debt. Each of the dependent variables are scaled by the same denominator, thus total leverage is the sum of domestic denominated and foreign denominated leverage. Table 1 provides descriptive statistics of our firm-level data, where we also condition on whether a firm

[3] Sector information of firms is obtained from the Financial Supervisory Service of South Korea. There are 25 sectors in the sample, when finance and insurance is excluded.
[4] Our data does not include a breakdown of earnings (income statement) by currency denomination. Further we do not know which foreign currencies the debt is associated with.

uses a particular type of debt. The average firm's total leverage is 23%, which consists of 20% in domestic debt and 3% in foreign debt. Of the 13,515 firm-year observations in our dataset, 87% coincide with South Korean firms that use either foreign, domestic, or both types of debt. Domestic debt is used by 84% of firm-year observations, while foreign debt is used by 34%.[5] The fact that many firms choose not to use debt, and the majority do not use foreign debt is an important feature of our data we look to model empirically. Among firms that have foreign debt, their foreign leverage is 8%.

Explaining firm leverage in our model are the standard firm-level determinants, which include tangible assets, size, growth opportunities, and profitability. Tangible assets are measured as the share of total assets made up of tangible assets (e.g., land, building, machinery, furniture, tools, and vehicles). Size is measured here using the natural logarithm of total assets. Firms' growth opportunities are measured using their market-to-book ratio, and profitability is equal to the natural logarithm of their return on assets, i.e. the firms' net income divided by their total assets. We also add a measure of cash flow volatility to the standard determinants, which control for differences in firm quality. Recent evidence (Keefe and Yaghoubi 2016) indicates cash flow volatility reduces firm leverage – an effect we explore in greater detail with respect to the financial crisis. The measure of a firm's cash flow volatility in a given year is the standard deviation of their operating income calculated over the last 5 years scaled by their total assets. Keefe and Yaghoubi (2016) use the same measure of volatility in their models. To address possible outliers in our financial data we follow the literature (Kale and Shahrur 2007, Colla et al. 2013, Keefe and Yaghoubi 2016) and winsorize the variables size, market to book ratio, return on assets, and cash flow volatility at the 1% level in both tails of the annual distributions

[5] Allayannis et al. (2003) find for the cross-country sample of East Asia that on average 90% of the very large firms they examine use domestic debt and 66% use foreign debt.

of firm values.[6] The data shows firms with foreign debt have more collateral, less volatile cash flows, and larger size, while being less profitable and having fewer growth opportunities.

[Insert Table 1 about here]

4. The Empirical Model

The dependent variables in our empirical models are the ratios of total leverage, domestic currency denominated leverage, and foreign currency denominated leverage. Each measure is a proportion, bounded by the unit interval. In addition, we noted that each measure in our dataset has a significant number of firm-year observations that are equal to zero. A fractional response model (Papke and Wooldridge 1996) can be used to account for the fractional nature of the leverage ratio. Keefe and Yaghoubi (2016) use this econometric approach to estimate their model of leverage. The approach, while allowing the dependent variable to take values of zero and one, assumes that leverage ratios arbitrarily near zero are similarly explained as the large number observations we find equal to zero. That is to say a firm's decision whether to use debt is the same as how much debt to use, which ignores the fixed costs associated with borrowing. Fixed costs of public debt include legal, accounting, and registration fees that are independent of the amount borrowed (Altinkiliç and Hansen 2000, Esho et al. 2001). Altinkiliç and Hansen (2000) estimate that fixed costs are approximately 10% of the costs from seasoned equity and debt offerings. A Tobit model is an alternative approach used by Allayannis et al. (2003) and Rajan and Zingales (1995) to deal with the significant number of firms with zero values of leverage. This censored regression model though does not bound the leverage ratio to the unit interval and treats zero outcomes as due to censoring, rather than a choice made by firms.

[6] Our results are robust to using the data unadjusted. These estimates are available upon request.

A two-part model (Wooldridge 2002) is an econometric approach that allows us to control for both key features in our leverage ratios. The first part of the specification models a firm's decision to have debt, a binary outcome y*, where:

$$y^* = \begin{cases} 0 & \text{if } y = 0 \\ 1 & \text{if } 0 < y \leq 1 \end{cases} \tag{1}$$

We assume $P(y^* = 1 \mid x) = G(x\gamma + \mu_i)$ with G denoting the cumulative density function of the normal distribution, γ the coefficient estimates from the probit regression of firm debt use using the entire sample, x the covariates, and μ_i representing the firm level fixed effect. The second part of the specification uses the sample of non-zero leverage observations to estimate leverage with the fractional response model of Papke and Wooldridge (1996, 2008). Their Quasi Maximum Likelihood Estimator (QMLE) estimator is used to find $E(y \mid x, y^* = 1) = G(x\beta + \eta_i)$, where β represents the QMLE coefficient estimates, η_i is the firm level fixed effect, and G is again the normal cumulative density function.[7] One can then find the conditional expectation of a firm's leverage given the two sets of estimates and covariates.

$$\begin{aligned} E(y \mid x) &= P(y^* = 0 \mid x) \cdot (y \mid x, y^* = 0) + P(y^* = 1 \mid x) \cdot (y \mid x, y^* = 1) \\ &= G(x\gamma + \mu_i) \cdot G(x\beta + \eta_i) \end{aligned} \tag{2}$$

Ramalho and da Silva (2009) apply this type of econometric model to their study of the total leverage decisions of a cross-section of Portuguese firms in the year 1999. Their results indicate that there is heterogeneity as to the effects of the standard determinants on firms' use of debt and their leverage. They find the share of tangible assets increases the use of debt by small, medium, and large firms, while having no effect on the leverage of firms that used debt. The

[7] QMLE are found using Stata's GLM command with the probit link and binomial family specified, in addition to cluster robust standard errors.

direction of the effect is shown to vary between the two margins – firm size increases the likelihood debt is used, yet reduces firm leverage for samples of small and medium sized firms.

The model specification used here extends the two-part model by incorporating firm-level fixed-effects with unbalanced panel data. An advantage of using panel data with a firm-level fixed effect is that we are able to control for the effects of unmeasured, time invariant, firm-level factors correlated with our regressors, which would otherwise bias our estimates. These factors might include firm reputation (Harris and Raviv 1991), firm-bank relationships (Berger and Udell 1995), and initial debt choices (Hanssens et al. 2016, Lemmon et al. 2008), which have been shown in different contexts to matter to leverage. Lemmon et al. (2008) show that most of the variation between firms' leverage is in fact driven by differences in these fixed effects, and once controlled for the effects of the standard determinants decrease in magnitude by 86%. Controlling for firm fixed effects is therefore important when drawing inferences from leverage models. A number of leverage studies control for firm-level fixed effects (Lemmon et al. 2008, Brav 2009, Rauh and Sufi 2010, González 2015, Hanssens et al. 2016). The limitation of these studies is that they do not account for the fractional nature of the leverage ratio.

Incorporating fixed effects into the two-part fractional model is achieved by Wooldridge's (2010) adaptation of the Mundlak-Chamberlain approach, which models the firm-level fixed effects as a linear function of the firm-level means of the covariates. Egger and Kesina (2014) use the same framework to model Chinese firms' decisions to export and the shares of exports sales among firms that export. The method uses Mundlak's (1978) observation that in linear models the within (fixed effects) estimator is equivalent to a pooled OLS regression that adds to the specification the time averaged means of the covariates. Wooldridge (2010) shows the relation extends to unbalanced data by also adding to the specification each firm's

mean value of the time indicators, which vary by firm due to differences in the number of observations per firm. The fixed effects model is

$$y_{it} = \beta x_{it-1} + z_s + \delta_t + \theta_i + \varepsilon_{it}, \quad (3)$$

where x_{it-1} represents a matrix of lagged covariates that vary by firm i = 1:N and time t = 1:T, with industry sector z_s, time δ_t, and firm-level θ_i fixed effects. Equation 3 can be estimated via regression of y_{it} on a constant, x_{it-1}, $\overline{x}_{it-1}$, δ_t, $\overline{\delta}_{it}$, z_s and indicator variables for the number of years each firm is in the sample. This general approach can be extended to the types of non-linear specifications used in our two-part fractional model. The firm-level effect in each of our probit and GLM models is specified to be a linear function of the time averages, $\overline{x}_{it-1}$, with different intercepts for each number of periods. That is to say, we include in our non-linear specifications the original covariates, the time and industry fixed effects, the mean value of our covariates ($\overline{x}_{it-1}$) and time fixed-effects ($\overline{\delta}_{it}$), and add indicators for a firm's number of years in the sample. Controlling for the number of years in the sample allows the firm-level heterogeneity to depend on selection. Our specification lags each of the covariates by one year and includes robust standard errors clustered by firm.

5. Results and Discussion

5.1. Baseline Results

The estimates from our two-part model with fixed effects appear in Table 2. The marginal effects reported indicate the impact of a one-unit change in each measure, which we use along with standard deviations from panel a of Table 1 to discuss the quantitative effect on the probability a

firm uses debt and leverage. Our results provide strong evidence to support our hypotheses that Korean firms with greater collateral, i.e. less credit constrained, are more levered and rely more on domestic denominated debt. Increasing a firm's share of tangible assets by one standard deviation (0.18) increases the probability a firm uses domestic debt by 3.76 percentage points, and debt, in general, by 3.19 percentage points. Firms' use of foreign debt was not impacted by their collateral, i.e. the estimate was not statistically significant. We find even more of a heterogeneous effect of collateral on foreign and domestic denominated leverage. Increasing the share of collateral by one standard deviation among firms with domestic denominated debt increases domestic leverage by 1.73 percentage points, whereas among firms with foreign denominated debt it reduces leverage by 0.66 percentage points. This finding from a large sample of 1,445 South Korean firms differs from Allayannis et al.'s (2003) analysis of a sample of 315 firms from 8 East Asian countries that finds collateral increases foreign leverage, with negative but insignificant impacts on either domestic or total debt. This suggests the effects of the standard determinants of leverage are also heterogeneous across countries.

[Insert Table 2 about here]

Firm size, measured by total assets, is shown here to increase the use of foreign and domestic debt, with a slightly larger marginal effect for foreign debt. With respect to leverage, we find additional evidence of heterogeneity. Increasing firm size while increasing domestic denominated leverage is shown to reduce foreign leverage. This result, similar to our finding with collateral, suggests that as South Korean firms become less credit constrained they are more prone to increasing their leverage via domestic debt, relative to foreign denominated debt.

Recent work by Keefe and Yaghoubi (2016) suggests cash flow volatility has a negative impact on leverage of firms in the United States. We posited that cash flow volatility, a proxy

for firm quality, would have more impact on South Korean firms' use of foreign denominated debt. For South Korean firms, we find cash flow volatility does not impact their use of, or leverage in, domestic denominated debt and has no effect on total debt. We though do find that the use of foreign denominated debt is negatively affected at the 10% significance level – increasing the volatility of cash flows by one standard deviation reduces the probability a firm uses foreign debt by 1.22 percentage points. Firms with lower quality, i.e. more volatile cash flows, which use foreign debt are shown to have lower leverage – a result statistically significant at the 5% level – increasing the volatility of cash flows by one standard deviation among firms with foreign denominated debt reduces leverage by 0.49 percentage points. We though find no effect for either domestic denominated or total leverage ratios.

Controlling for firm level fixed effects is an important addition to the two-part model that minimizes the potential for our estimates to be biased. In Table 3 we report the estimates of the model without firm fixed effects. The biased estimates indicate that cash flow volatility has a positive effect on each of the three leverage ratios, which would seemingly suggest that lower quality firms are more highly levered – a result contrary to one's expectations. The estimates in Table 3 reflect the bias that is introduced by the omission of time-invariant firm-specific variables, which are correlated with the regressors. Lee et al. (2000), for example, find that Chaebols, typically family-owned large conglomerates in South Korea, had easier access to loans than non-Chaebol firms. Inclusion of these firm-level fixed effects is key here to understanding leverage as also highlighted by Lemmon et al. (2008).

[Insert Table 3 about here]

Returning to Table 2, the estimates of our other standard determinants, firm profitability and growth opportunities, show less heterogeneous effects. Firm profitability reduced the use of

debt (total, domestic, and foreign) and similarly had a negative effect on each of the three leverage ratios. Firms with higher growth opportunities, measured by a larger market to book ratio, were also less likely to use debt (total, domestic, and foreign) and had lower leverage ratios. The estimates were all statistically significant at the 5% level, other than the negative estimate of growth opportunities effect on foreign leverage, which was insignificant. Our finding that profitability and growth opportunities have a negative effect on foreign and domestic leverage is consistent with Allayannis et al.'s (2003) findings.

5.2. Robustness

The baseline specification reported in Table 2 includes the standard determinants of leverage. Egger and Kesina (2014) have recently shown some of these determinants influence a firm's share of foreign sales, which also influences their exposure to foreign risk and use of foreign debt (Allayannis and Ofek, 2001; Graham and Rogers, 2002, Pramborg, 2005). We therefore test whether the baseline results are sensitive to adding to the model the lagged ratio of firms' export sales to total sales. The estimates in Table 4 indicate the share of sales due to exports does not affect the decision of South Korean firms to use debt, whether domestic or foreign, and also has no effect on leverage. We find our estimates of the standard determinants are quantitatively and qualitatively similar to the baseline results – i.e. we find heterogeneity in the effects of tangible assets, size, and cash flow volatility on domestic and foreign denominated leverage.

[Insert Table 4 about here]

Finally, we experiment with the sample period examined. The baseline estimates in Table 2 use the period 2001-2016. We also consider whether our results are robust to the recent financial crisis. In panel a of Table 5, we re-estimate our models using only the pre-crisis years

of 2001-2006, while in panel b crisis/post crisis years of 2007-2016 are examined. The results in both panels do not qualitatively change compared to the baseline results. It should also be noted that we examined whether the estimates we report were sensitive to our winsorizing the data. Results without winsorizing the data, which are not reported and available upon request did not reveal any qualitative changes to our previous findings.

[Insert Table 5 about here]

6. Flight to Quality During The Financial Crisis

In this section, we explore whether credit supply shocks play an important role in firms' debt levels during the recent financial crisis. If supply shocks are important, then we might expect firms of different pre-crisis quality have different access to credit during the crisis. We posit that investors (lenders) during the crisis may have exhibited a flight to quality, where credit flows more readily to borrowers of previously high quality, relative to those of lower quality. Given foreign debt is subject to greater information asymmetries, we also posit that if supply shocks matter, then debt denominated in foreign currency is likely more sensitive to pre-crisis differences in firm quality.

A simple difference-in-difference estimator is used to compare firms' leverage between two periods, which reflect the years prior (2004-2006) and during (2007-2009) the global financial crisis. Kroszner et al. (2007) use a similar framework to evaluate the effects of cross-country banking crises and pre-crisis credit constraints on economic sectors' contributions to value added. The dependent variable used here is the difference in firm *i*'s leverage between the crisis and pre-crisis period, where similar to Kroszner et al. (2007) we use average values over the two periods. To test our hypothesis of a flight to quality, we include in the specification an

indicator of pre-crisis firm quality, which is interacted with the crisis period. The specification before and after first differencing is given below where *t* = pre-crisis and crisis averaged values.

$$\begin{aligned} y_{it} &= \beta x_{it} + z_s + \delta_{crisis} + pc\_q_i + \gamma\left(\delta_{crisis} \otimes pc\_q_i\right) + \theta_i + \varepsilon_{it}, \\ \Delta y_{it} &= \beta \Delta x_{it} + \gamma\left(\delta_{crisis} \otimes pc\_q_i\right) + \varepsilon_{it} \end{aligned} \tag{4}$$

The independent variables are the differences in our standard leverage determinants, δ_{crisis} is a dummy variable for the crisis-period, and pc_q_i represents our measure of pre-crisis firm quality. We examine two measures of firm quality, which capture the pre-crisis volatility of firms' cash flows and tangible assets. For the pre-crisis volatility we use the five-year standard deviation of the firms' operating cash flows for the period 2003-1999 scaled by total assets, and pre-crisis tangible assets is a firm averaged value over the same period. Each of these measures is also included in our covariates, therefore we also control for the change in quality during the crisis. If there is a flight to quality we would expect firms with higher pre-crisis cash flow volatility to have less leverage during the crisis ($\gamma<0$), i.e. are more constrained and firms with higher collateral to be less constrained ($\gamma>0$).

[Insert Table 6 about here]

The estimates of our model that use pre-crisis cash flow volatility to control for firm quality indicate that total, domestic, and foreign denominated leverage declined during the crisis among Korean firms with lower pre-crisis quality. The estimates though are only statistically significant for foreign debt (p-value 0.058). This provides evidence that foreign investors exhibited a flight to higher pre-crisis quality South Korean firms. A concern with difference-in-difference type estimates is whether the observed difference in firm behavior during the crisis simply was a reflection of previous trends. We test this assertion by creating a falsification test of the pre-crisis trends in leverage, where we compare leverage in the periods 2001-2003 and

2004-2006. The first difference specification in equation 4 is re-estimated by falsely treating the latter period as the crisis. Our estimates (Table 6, columns 4-6) of γ indicate there were no statistically significant differences in pre-crisis leverage trends based on the pre-crisis quality of firms.

For robustness, we also used firms' pre-crisis asset tangibility as a separate measure of quality. Estimates for this specification appear in panel b of Table 6. Similar to before, we find that South Korean firms' pre-crisis quality influenced their foreign leverage during the crisis. Higher pre-crisis quality firms, with more collateral, were more levered in their foreign debt during the crisis (p-value 0.070). The results of our falsification test indicated we rejected the null, i.e. we found no difference in pre-treatment trends. Panel c of Table 6 provides estimates when both pre-crisis quality measures are used. The conclusions are similar to the estimates from using the single measures – both measures indicate South Korean firms with higher pre-crisis quality were more levered in their foreign debt.

7. Conclusion

In this study, we investigate the capital structure of publicly listed firms in South Korea from 2001 to 2016. To empirically model the fact that many firms choose not to use debt and the majority do not use foreign debt, we use a two-part fractional response model with fixed effects. Unlike the previous studies of leverage that employ the two-part model, we extend the model by including firm-level fixed effects with unbalanced panel data. Inclusion of these fixed effects is important, as our estimates are otherwise biased – we show the direction of the effects of cash flow volatility on the three leverage ratios are positive and statistically significant without their inclusion.

The results indicate that there is significant heterogeneity in domestic and foreign denominated debt use, and intensity of use, among Korean firms. We find that collateral increases the probability to use domestic debt but does not affect use of foreign debt. Firms with more collateral are shown to have less foreign and more domestic leverage, which suggests that firms that are less credit constrained prefer domestic debt and partially substitute between the two. The substitution is partial in the sense that total debt leverage also increases with collateral. Firm size exhibits a similar pattern of substitution as larger firms are more likely to use debt and are shown to have greater domestic leverage and less foreign leverage. Firm quality also has a heterogeneous effect. Firms with more volatile cash flows are less likely to use foreign debt, which reflects less access by lower quality firms to foreign credit markets. Higher cash flow volatility also reduces foreign debt leverage, while having no effect on either domestic or total leverage.

We also contribute to the literature by providing evidence supporting a flight to quality by foreign lenders to South Korea during the recent global financial crisis period of 2007-2009. Our results show that firms with higher pre-crisis quality responded to the adverse credit supply shock caused by the crisis by increasing their leverage in foreign denominated debt, despite controlling for contemporaneous changes in firm quality due to the crisis. We interpret this result as providing evidence that foreign investors exhibited a flight to quality in their lending to South Korean firms – a pattern we did not find for domestic (Korean) debt.

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Table 1. Descriptive Statistics

	(1) N	(2) Mean	(3) Std. Dev.	(4) N	(5) Mean	(6) Std. Dev.
Panel a.	All firm-year observations					
Total Debt Ratio	13,515	0.233	0.201			
Domestic Debt Ratio	13,515	0.205	0.190			
Foreign Debt Ratio	13,515	0.029	0.067			
Tangible Assets	13,515	0.299	0.180			
Cash Flow Volatility	13,515	-3.597	0.788			
Size	13,515	18.758	1.407			
Profitability	13,515	-3.193	1.009			
Growth Opportunity	13,515	0.753	0.713			
Panel b. Total debt	0< Total Debt Ratio <1			Total Debt Ratio=0		
Total Debt Ratio	11,695	0.270	0.192	1,820	0.000	-
Tangible Assets	11,695	0.314	0.180	1,820	0.205	0.152
Cash Flow Volatility	11,695	-3.620	0.787	1,820	-3.446	0.778
Size	11,695	18.834	1.438	1,820	18.269	1.064
Profitability	11,695	-3.267	1.014	1,820	-2.721	0.837
Growth Opportunity	11,695	0.691	0.648	1,820	1.152	0.946
Panel c. Domestic debt	0< Domestic Debt Ratio <1			Domestic Debt Ratio =0		
Domestic Debt Ratio	11,345	0.244	0.183	2,170	0.000	-
Tangible Assets	11,345	0.316	0.180	2,170	0.211	0.153
Cash Flow Volatility	11,345	-3.625	0.788	2,170	-3.451	0.772
Size	11,345	18.851	1.446	2,170	18.272	1.052
Profitability	11,345	-3.280	1.015	2,170	-2.739	0.841
Growth Opportunity	11,345	0.689	0.650	2,170	1.089	0.910
Panel d. Foreign Debt	0<Foreign Debt Ratio<1			Foreign Debt Ratio=0		
Foreign Debt Ratio	4,577	0.084	0.093	8,938	0.000	-
Tangible Assets	4,577	0.334	0.174	8,938	0.281	0.181
Cash Flow Volatility	4,577	-3.677	0.755	8,938	-3.556	0.801
Size	4,577	19.078	1.531	8,938	18.595	1.309
Profitability	4,577	-3.351	1.026	8,938	-3.113	0.991
Growth Opportunity	4,577	0.571	0.540	8,938	0.846	0.771

Panel a reports the summary statistics (number of firm-year observations, mean, and standard deviation) of the three leverage ratios and our independent variables for all firm-year observations. Panel b (columns 1-3) reports these statistics for firm-year observations where total debt is non-zero and columns 4-6 report values where total debt is zero. Panel c reports these statistics for observations where domestic debt is non zero and separately where equal to zero, and panel d reports these values for the subset of firms with non-zero and zero foreign debt.

Table 2. Determinants of Firm Leverage – Baseline Results

	(1)	(2)	(3)	(4)	(5)	(6)
	Decision to Have Debt			**Intensity of Debt Use**		
	Total Debt	Domestic Debt	Foreign Debt	Total Debt	Domestic Debt	Foreign Debt
Parameter Estimates						
Tangible Assets	1.037***	1.068***	0.231	0.275***	0.318***	-0.245**
	(0.253)	(0.232)	(0.170)	(0.072)	(0.075)	(0.115)
Cash Flow Volatility	0.016	0.005	-0.045*	0.006	0.016	-0.041**
	(0.037)	(0.035)	(0.026)	(0.011)	(0.011)	(0.018)
Size	0.244***	0.209***	0.162***	0.141***	0.145***	-0.071*
	(0.066)	(0.063)	(0.057)	(0.024)	(0.026)	(0.037)
Profitability	-0.081***	-0.102***	-0.030**	-0.072***	-0.068***	-0.022**
	(0.023)	(0.022)	(0.014)	(0.005)	(0.006)	(0.009)
Growth Opportunity	-0.138***	-0.138***	-0.067**	-0.095***	-0.089***	-0.040
	(0.035)	(0.035)	(0.034)	(0.015)	(0.016)	(0.027)
Marginal Effect						
Tangible Assets	0.177***	0.209***	0.072	0.087***	0.096***	-0.037**
	(0.043)	(0.045)	(0.053)	(0.023)	(0.023)	(0.017)
Cash Flow Volatility	0.003	0.001	-0.016*	0.002	0.005	-0.006**
	(0.006)	(0.007)	(0.008)	(0.003)	(0.003)	(0.003)
Size	0.042***	0.041***	0.05***	0.045***	0.044***	-0.011*
	(0.011)	(0.012)	(0.018)	(0.008)	(0.008)	(0.006)
Profitability	-0.014***	-0.020***	-0.009**	-0.023***	-0.020***	-0.003**
	(0.004)	(0.004)	(0.004)	(0.002)	(0.002)	(0.001)
Growth Opportunity	-0.024***	-0.027***	-0.021**	-0.030***	-0.030***	-0.006
	(0.006)	(0.007)	(0.011)	(0.005)	(0.005)	(0.004)
Observations	13,417	13,414	13,436	11,576	11,215	4,441
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

The specifications in columns 1-3 estimate the binary decision to use (1) debt, (2) domestic debt, and (3) foreign debt. Estimates in column 1-3 use all firm-year observations where data is available. In columns 4-6 the dependent variables are each of the three leverage ratios for (4) total debt, (5), domestic debt, and (6) foreign debt. The samples used to estimate columns 4-6 are restricted to non-zero firm-year observations for each type of debt. Independent variables are all lagged by one period and the period examined is 2001-2016. Each specification includes a constant and firm, sector, and time fixed effects, which are not reported. Clustered robust standard errors appear in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 3. Determinants of Firm Leverage Without Firm Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)
	Decision to Have Debt			**Intensity of Debt Use**		
	Total Debt	Domestic Debt	Foreign Debt	Total Debt	Domestic Debt	Foreign Debt
Parameter Estimates						
Tangible Assets	1.505***	1.568***	0.0587	0.461***	0.500***	-0.158
	(0.222)	(0.204)	(0.160)	(0.071)	(0.070)	(0.107)
Cash Flow Volatility	0.009	0.007	-0.080***	0.024*	0.034***	0.045**
	(0.039)	(0.037)	(0.029)	(0.013)	(0.013)	(0.019)
Size	0.207***	0.216***	0.214***	0.048***	0.033***	-0.033**
	(0.031)	(0.029)	(0.022)	(0.010)	(0.010)	(0.014)
Profitability	-0.212***	-0.231***	-0.067***	-0.147***	-0.143***	-0.012
	(0.029)	(0.027)	(0.018)	(0.008)	(0.008)	(0.012)
Growth Opportunity	-0.208***	-0.174***	-0.199***	-0.139***	-0.120***	-0.094***
	(0.034)	(0.033)	(0.042)	(0.021)	(0.021)	(0.035)
Marginal Effect						
Tangible Assets	0.262***	0.312***	0.018	0.147***	0.152***	-0.024
	(0.038)	(0.040)	(0.050)	(0.022)	(0.021)	(0.016)
Cash Flow Volatility	0.002	0.001	-0.025***	0.008*	0.010***	0.007**
	(0.007)	(0.007)	(0.009)	(0.004)	(0.004)	(0.003)
Size	0.036***	0.043***	0.067***	0.015***	0.010***	-0.005**
	(0.005)	(0.006)	(0.007)	(0.003)	(0.003)	(0.002)
Profitability	-0.037***	-0.046***	-0.021***	-0.047***	-0.044***	-0.002
	(0.005)	(0.005)	(0.006)	(0.002)	(0.002)	(0.002)
Growth Opportunity	-0.036***	-0.035***	-0.062***	-0.044***	-0.036***	-0.014***
	(0.006)	(0.006)	(0.013)	(0.007)	(0.006)	(0.005)
Observations	13,417	13,414	13,436	11,576	11,215	4,441
Firm Fixed Effects	No	No	No	No	No	No
Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

The specifications in columns 1-6 do not include firm level fixed effects, which results in biased estimates. The specifications in columns 1-3 estimate the binary decision to use (1) debt, (2) domestic debt, and (3) foreign debt. Estimates in column 1-3 use all firm-year observations where data is available. In columns 4-6 the dependent variables are each of the three leverage ratios for (4) total debt, (5), domestic debt, and (6) foreign debt. The samples used to estimate columns 4-6 are restricted to non-zero firm-year observations for each type of debt. Independent variables are all lagged by one period and the period examined is 2001-2016. Each specification includes a constant and sector, and time fixed effects, which are not reported. Clustered robust standard errors appear in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 4. Robustness to Inclusion of the Share of Export Sales

	(1)	(2)	(3)	(4)	(5)	(6)
	Decision to Have Debt			**Intensity of Debt Use**		
	Total Debt	Domestic Debt	Foreign Debt	Total Debt	Domestic Debt	Foreign Debt
Parameter Estimates						
Tangible Assets	1.044***	1.070***	0.232	0.285***	0.329***	-0.244**
	(0.256)	(0.234)	(0.170)	(0.071)	(0.075)	(0.116)
Cash Flow Volatility	0.017	0.006	-0.050*	0.008	0.017	-0.042**
	(0.037)	(0.035)	(0.026)	(0.011)	(0.011)	(0.017)
Size	0.246***	0.209***	0.162***	0.143***	0.147***	-0.069*
	(0.066)	(0.063)	(0.057)	(0.025)	(0.026)	(0.037)
Profitability	-0.079***	-0.101***	-0.030**	-0.071***	-0.067***	-0.021**
	(0.023)	(0.022)	(0.014)	(0.005)	(0.006)	(0.009)
Growth Opportunity	-0.136***	-0.136***	-0.065*	-0.094***	-0.087***	-0.041
	(0.035)	(0.035)	(0.034)	(0.015)	(0.016)	(0.027)
Export Share	0.045	0.090	0.066	-0.015	-0.012	-0.021
	(0.113)	(0.112)	(0.085)	(0.031)	(0.033)	(0.050)
Marginal Effect						
Tangible Assets	0.179***	0.209***	0.0719	0.090***	0.099***	-0.037**
	(0.043)	(0.046)	(0.053)	(0.023)	(0.023)	(0.018)
Cash Flow Volatility	0.003	0.001	-0.015*	0.002	0.005	-0.006**
	(0.006)	(0.007)	(0.008)	(0.003)	(0.003)	(0.003)
Size	0.042***	0.041***	0.050***	0.045***	0.044***	-0.011*
	(0.011)	(0.012)	(0.018)	(0.008)	(0.008)	(0.006)
Profitability	-0.014***	-0.020***	-0.009**	-0.023***	-0.020***	-0.003**
	(0.004)	(0.004)	(0.004)	(0.002)	(0.002)	(0.001)
Growth Opportunity	-0.023***	-0.027***	-0.020*	-0.030***	-0.026***	-0.006
	(0.006)	(0.007)	(0.011)	(0.005)	(0.005)	(0.004)
Export Share	0.008	0.018	0.020	-0.005	-0.004	-0.003
	(0.019)	(0.022)	(0.026)	(0.010)	(0.010)	(0.007)
Observations	13,387	13,384	13,405	11,553	11,193	4,427

The specifications in columns 1-6 are similar to those of the baseline model (Table 2) with the addition of firms' shares of sales from exports. The specifications in columns 1-3 estimate the binary decision to use (1) debt, (2) domestic debt, and (3) foreign debt. Estimates in column 1-3 use all firm-year observations where data is available. In columns 4-6 the dependent variables are each of the three leverage ratios for (4) total debt, (5), domestic debt, and (6) foreign debt. The samples used to estimate columns 4-6 are restricted to non-zero firm-year observations for each type of debt. Independent variables are all lagged by one period and the period examined is 2001-2016. Each specification includes a constant and firm, sector, and time fixed effects, which are not reported. Clustered robust standard errors appear in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 5. Determinants of Firm Leverage During Pre-crisis vs. Post Crisis Periods

Panel a. Pre-crisis Periods (2001-2006)

	(1)	(2)	(3)	(4)	(5)	(6)
	Decision to Have Debt			**Intensity of Debt Use**		
	Total Debt	Domestic Debt	Foreign Debt	Total Debt	Domestic Debt	Foreign Debt
Tangible Assets	0.673	0.939**	0.374	0.321**	0.396***	-0.465**
	(0.428)	(0.420)	(0.387)	(0.141)	(0.152)	(0.208)
Cash Flow Volatility	-0.005	-0.007	-0.048	-0.008	-0.007	-0.017
	(0.058)	(0.056)	(0.049)	(0.019)	(0.021)	(0.025)
Size	0.483***	0.447***	0.157	0.277***	0.291***	-0.114*
	(0.145)	(0.143)	(0.128)	(0.051)	(0.054)	(0.060)
Profitability	-0.107**	-0.132***	-0.011	-0.052***	-0.044**	-0.028*
	(0.043)	(0.039)	(0.027)	(0.009)	(0.010)	(0.014)
Growth Opportunity	-0.048	-0.065	-0.274***	-0.083***	-0.077**	-0.022
	(0.058)	(0.058)	(0.076)	(0.032)	(0.036)	(0.054)
Observations	3,846	3,845	3,848	3,372	3,262	1,547
Panel b. Post-crisis Periods (2007-2016)						
Tangible Assets	0.691**	0.853***	-0.064	0.260***	0.283***	-0.216
	(0.303)	(0.282)	(0.187)	(0.075)	(0.080)	(0.144)
Cash Flow Volatility	-0.038	-0.038	-0.034	-0.016	-0.010	-0.047**
	(0.042)	(0.039)	(0.031)	(0.011)	(0.012)	(0.024)
Size	0.128	0.094	0.178**	0.093***	0.090***	-0.007
	(0.080)	(0.073)	(0.074)	(0.031)	(0.033)	(0.053)
Profitability	-0.054**	-0.069***	-0.021	-0.057***	-0.057***	-0.012
	(0.025)	(0.023)	(0.016)	(0.006)	(0.006)	(0.011)
Growth Opportunity	-0.098***	-0.093**	0.011	-0.066***	-0.062***	-0.022
	(0.038)	(0.039)	(0.036)	(0.016)	(0.017)	(0.026)
Observations	9,441	9,439	9,448	8,044	7,791	2,741

Panel a represents the baseline specification estimated for the pre-crisis period 2001-2006 and panel b reports the estimates for the period 2007-2016. The specifications in columns 1-6 are similar to those of the baseline model (Table 2) with the addition of firms' shares of sales from exports. The specifications in columns 1-3 estimate the binary decision to use (1) debt, (2) domestic debt, and (3) foreign debt. Estimates in column 1-3 use all firm-year observations where data is available. In columns 4-6 the dependent variables are each of the three leverage ratios for (4) total debt, (5), domestic debt, and (6) foreign debt. The samples used to estimate columns 4-6 are restricted to non-zero firm-year observations for each type of debt. Independent variables are all lagged by one period. Each specification includes a constant and firm, sector, and time fixed effects, which are not reported. Clustered robust standard errors appear in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 6. Flight to Quality: First Difference Estimation of Firm Leverage during the Crisis

Panel a. Pre-crisis cash flow volatility (CFV) as firm quality measure

	(1)	(2)	(3)	(4)	(5)	(6)
	Crisis vs pre-crisis			**Pre-crisis periods**		
	Total Debt	Domestic Debt	Foreign Debt	Total Debt	Domestic Debt	Foreign Debt
Tangible Assets	0.262***	0.251***	0.012	0.827	0.874	-0.047
	(0.093)	(0.089)	(0.023)	(0.716)	(0.715)	(0.049)
Cash Flow Volatility	-0.002	0.003	-0.005	0.135	0.135	0.000
	(0.010)	(0.010)	(0.004)	(0.122)	(0.122)	(0.005)
Size	0.084**	0.066**	0.019	-0.082	-0.089	0.007
	(0.037)	(0.033)	(0.016)	(0.235)	(0.235)	(0.008)
Profitability	-0.033***	-0.031***	-0.002	-0.235	-0.231	-0.004
	(0.007)	(0.006)	(0.004)	(0.206)	(0.206)	(0.008)
Growth Opportunity	-0.029*	-0.019	-0.011**	0.152	0.166	-0.014
	(0.017)	(0.016)	(0.005)	(0.171)	(0.171)	(0.009)
CFV(pre-crisis)	-0.010	-0.001	-0.008*	0.001	-0.007	0.009
	(0.011)	(0.011)	(0.004)	(0.025)	(0.024)	(0.005)
Constant	-0.044	-0.011	-0.033	0.049	0.022	0.027*
	(0.041)	(0.035)	(0.022)	(0.185)	(0.184)	(0.016)
Observations	782	782	782	782	782	782

Panel b. Pre-crisis asset tangibility as firm quality measure

	Crisis vs pre-crisis			**Pre-crisis periods**		
	Total Debt	Domestic Debt	Foreign Debt	Total Debt	Domestic Debt	Foreign Debt
Tangible Assets	0.287***	0.252***	0.035*	0.849	0.904	-0.055
	(0.093)	(0.089)	(0.020)	(0.803)	(0.803)	(0.053)
Cash Flow Volatility	0.002	0.004	-0.002	0.135	0.137	-0.002
	(0.009)	(0.008)	(0.003)	(0.122)	(0.122)	(0.005)
Size	0.087**	0.066**	0.021	-0.080	-0.086	0.007
	(0.038)	(0.033)	(0.016)	(0.230)	(0.23)	(0.007)
Profitability	-0.033***	-0.031***	-0.002	-0.235	-0.231	-0.004
	(0.007)	(0.006)	(0.005)	(0.207)	(0.207)	(0.007)
Growth Opportunity	-0.030*	-0.019	-0.012**	0.153	0.166	-0.013
	(0.017)	(0.016)	(0.005)	(0.175)	(0.175)	(0.008)
Tangibility (pre-crisis)	0.052	0.004	0.048*	0.025	0.047	-0.022
	(0.036)	(0.028)	(0.026)	(0.116)	(0.115)	(0.024)
Constant	-0.039*	-0.015	-0.024	0.043	0.037	0.006
	(0.022)	(0.015)	(0.017)	(0.084)	(0.084)	(0.011)
Observations	782	782	782	782	782	782

Table 6 (continued). First Difference Estimation of Firm Leverage

Panel c. Pre-crisis cash flow volatility (CFV) and asset tangibility as firm quality measures

	(1)	(2)	(3)	(4)	(5)	(6)
	Crisis vs pre-crisis			**Pre-crisis periods**		
	Total Debt	Domestic Debt	Foreign Debt	Total Debt	Domestic Debt	Foreign Debt
Tangible Assets	0.287***	0.252***	0.035*	0.003	-0.005	0.008
	(0.093)	(0.089)	(0.020)	(0.029)	(0.028)	(0.005)
Cash Flow Volatility	-0.001	0.003	-0.004	0.153	0.167	-0.014
	(0.010)	(0.010)	(0.004)	(0.173)	(0.173)	(0.009)
Size	0.087**	0.066**	0.021	0.848	0.906	-0.058
	(0.038)	(0.033)	(0.017)	(0.798)	(0.797)	(0.054)
Profitability	-0.032***	-0.031***	-0.002	-0.080	-0.087	0.007
	(0.007)	(0.006)	(0.004)	(0.230)	(0.230)	(0.008)
Growth Opportunity	-0.032*	-0.019	-0.013***	-0.235	-0.231	-0.004
	(0.017)	(0.016)	(0.005)	(0.207)	(0.207)	(0.007)
CFV (pre-crisis)	-0.007	-0.001	-0.006*	0.136	0.136	-0.000
	(0.011)	(0.011)	(0.004)	(0.125)	(0.125)	(0.005)
Tangible (pre-crisis)	0.046	0.003	0.042*	0.027	0.042	-0.014
	(0.036)	(0.030)	(0.025)	(0.132)	(0.131)	(0.025)
Constant	-0.063	-0.019	-0.044*	0.050	0.020	0.031*
	(0.044)	(0.036)	(0.026)	(0.157)	(0.155)	(0.019)
Observations	782	782	782	782	782	782

The dependent variable in each specification is the first difference of a particularly leverage ratio – total leverage (1,4), domestic leverage (2,5), and foreign leverage (3,6). The first three columns compare differences in the three leverage ratios between the crisis period (2007-2009) and pre-crisis period (2004-2006). The effect pre-crisis firm quality had on leverage during the crisis is given by the indicated (pre-crisis) measure. Panel a uses the pre-crisis measure of firm quality based on cash flow volatility, panel b uses the tangible assets measure, and panel c uses both measures. Columns 4-6 report the estimates of our falsification test, where we expect to find no difference in pre-crisis trends of our pre-crisis quality measures. Cluster robust standard errors in parentheses. *, **, *** Statistically different from 0 at the 10%, 5%, and 1% level of significance.