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Entrepreneurial Finance and Performance: A Transaction Cost Economics Approach

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Abstract: The transaction cost economics project finance framework suggests equity is better suited to projects with high levels of asset specificity while debt is better suited to projects with low levels of asset specificity. We apply this framework to the entrepreneurial finance setting and generate a set of hypotheses. We test these hypotheses using data from the *Kauffman Firm Survey* to show that (1) firms align their debt ratio with their asset specificity and (2) firm performance is adversely affected when debt and equity are not properly aligned with asset specificity. Our findings highlight the importance of matching the *type of finance* used to the *characteristics of the project*.

Key Words: entrepreneurship, entrepreneurial finance, transaction cost economics, firm survival

JEL codes: D23, L25, L26

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1. Introduction

We build off of the transactions cost economics framework to argue that entrepreneurs should think hard about *what type* of financing best suits their needs. A firm's choice of financial structure is akin to a choice of governance structure, and it is important to have the financial structure aligned with the attributes of the assets. As argued in Williamson (1988), firms will be more likely to finance specific assets with equity rather than debt. The wrong type of financing may make it difficult to create and capture the value of the entrepreneur's idea. Hence, firms with highly specific assets and low amounts of equity relative to debt, or firms with non-specific assets and high amounts of equity, will suffer from poor performance.

We test these ideas using the *Kauffman Firm Survey*, a dataset of approximately 4,000 firms that began operations in 2004. We first show that *on average* firms with highly specific assets have financing structures with high proportions of equity to debt. We show this relationship using two measures of asset specificity: the ratio of intangible assets to total assets and an indicator for intellectual property ownership. We describe a departure from this prediction to be a misalignment between the asset specificity underlying the firm's project and the firm's financing mix. We then show that firms with high levels of misalignment are associated with higher probability of firm exit. For robustness, we also replicate the findings using the Federal Reserve Board's *Survey of Small Business Finance*, a cross-section of approximately 4000 new and established small businesses in 2003.

Our project builds on two streams of literature. One stream of literature focuses on the tradeoffs the entrepreneur faces when choosing between two different types of capital. This literature typically models the entrepreneur and one of the sources of capital, often venture capital, as strategic agents, and analyzes how characteristics of the entrepreneur or venture capitalist affect outcomes. For example, Ueda (2004) examines the entrepreneur's dilemma of choosing to receive finance from a bank, which will not try to expropriate the idea but requires collateral, or from a venture capitalist, which does not require collateral but will try to expropriate the idea. Other examples include de Bettignies and Brander (2007), Winton and Yerramilli (2008) and Subramanian (2010). Hsu (2004) studies how entrepreneurs choose between financing from different venture capital firms and shows that, even when focusing on a specific type of capital, the entrepreneur has to balance tradeoffs. In Hsu's setting, the entrepreneur is willing to accept worse financing terms from higher status venture capital firms. In this article, we focus more on the attributes of the project and less on attributes of the entrepreneur or financier. We instead analyze how the type of financing varies with characteristics of the project, specifically the asset specificity of the technology underlying the project.

Another stream of literature focuses on the relationship between entrepreneurship and theories of the firm. One criticism of theories of the firm, including transaction cost economics, property rights theory and agency theory, is the focus on firms in a static environment, whereas a dynamic context that accounts for the origin of the firm needs to be considered when studying entrepreneurial firms (Ghoshal and Moran, 1996, Foss and Klein, 2005). Klein (2008) and Stieglitz and Foss (2009), among others, have argued that there are nevertheless elements of theories of the firm which might usefully be applied to the entrepreneurial setting. As described in Foss (2003), two prominent concepts in transaction cost economics which seem to characterize elements of entrepreneurial decision-making are uncertainty and bounded rationality. The existence of uncertainty in entrepreneurial settings has been linked to the importance of judgment on the part of the entrepreneur (Knight, 1921), which in turn has been linked to the organization of assets and employees in a firm (Foss, Foss and Klein, 2007). One focus in this stream of research has been on using transaction cost economics (or other theories of the firm) to understand the discovery of entrepreneurial opportunities, and also on how organizations can be designed to incentivize employees to engage in discovery. In this article, we take the entrepreneurial discovery process as given, and instead focus on how an organization matches its financial structure to the technology underlying the discovery.

The article proceeds in Section 2 by describing how transaction cost economics applies to the project finance setting, while Section 3 develops the hypotheses to be tested. Section 4 describes the methods and data and Section 5 describes the results. Finally, Section 6 concludes.

2. Transaction Cost Economics and Project Financing

Transaction cost economics focuses on the governance of contractual relations and asks which transactions are better managed in the firm than in the market. For example, transaction cost economics seeks to understand and explain the conditions under which some interstate trucking firms rely on its own drivers for long hauls, whereas others instead rely on independent owner-operators (Nickerson and Silverman, 2003). Another example is Masten (1984) which uses transaction cost economics to explain the internal and external sourcing decisions of government contractors in the aerospace industry. According to transaction cost economics, market governance is lower cost for generic, non-specific transactions between trading partners. As the assets involved in the transaction become more specialized and less easily redeployed, the hazard of defection by a partner increases. Individuals who are party to a transaction may engage in opportunistic behavior when the stakes are high, thereby to take advantage of their trading partners and claim a more favorable distribution of the rents accruing from the transaction.[1] So as to mitigate against these hazards, supplier and buyer can be organized under unified ownership within the firm, where fiat and authority supplement renegotiation to resolve conflict. Moving the transaction from the market into the firm involves trading off the benefits of high powered incentives (found in markets) for the benefits of coordinated adaptation (found in firms). The basics of the theory have been laid out elsewhere by Williamson (1975, 1985). The central prediction is that as asset specificity of a given transaction increases, that transaction is more likely to be organized within the firm, *ceteris paribus*.

Transaction cost economics also has implications for firm performance. Other research has argued and shown that failure to correctly align governance structure with asset specificity has adverse consequences for the firm. Mayer and Nickerson (2005) study 190 IT projects and show that the firm is more likely to use in-house employees as asset specificity increases. They also show that failure to appropriately align contract governance with underlying asset specificity has a negative effect on profitability. Sampson (2004) studies R&D alliances in the telecommunications industry and shows that patent counts are lower when the alliance contract is misaligned with the underlying asset attributes of the project. Other examples include Masten, Meehan and Snyder (1991), Walker and Poppo (1991), Silverman, Nickerson and Freeman (1997) and Poppo and Zenger (2002). More generally, as reported by Macher and Richman (2008) the central prediction of transaction cost economics has been empirically documented in research across fields including industrial organization, marketing, finance, accounting, and law.

Using a transaction cost economics framework, Williamson (1988, 2002) argues that established firms with projects using highly specific assets will be more likely to use equity instead of debt financing. According to Williamson (1988, 2002), debt is a rules-based

[1] Note that this does not suggest that every agent is acting opportunistically. The risk of opportunism is present so long as some agents act opportunistically some of the time, and the identity of such agents is not known ex ante (Williamson, 1985: 64).

governance system suited to investments of a generic kind. If things go poorly, the lender can repossess the assets and redeploy them in alternative ways with little loss of productive value. In contrast, more specialized assets will be harder to redeploy, and so debt financing will be offered on less favorable terms. The firm may decide to sacrifice some of the specialized investment features in favor of greater redeployability, or may instead opt for a different governance structure more suited to specialized assets. Williamson argues that equity is such a governance structure because it provides many safeguards that debt does not. In particular, the residual claimant status to the firm, and the power to replace management through the shareholder elected board of directors, align management's incentives and allows for monitoring and oversight.

Insert Figure 1 about here

The relationship between debt, equity and asset specificity described by Williamson (1988) is summarized by the framework presented in Figure 1. In this framework, k is some measure of asset specificity. The cost to the firm of using debt to finance a project with asset specificity of a certain level k is designated as D(k); the corresponding cost of using equity is designated E(k). When there is no asset specificity, debt is cheaper than equity; that is $D(0) < E(0)$. This is because debt is a simple, cheap governance structure ideal for transactions which do not involve asset specificity. However, the cost of rules-based governance (debt) increases faster in relation to discretionary governance (equity). As asset specificity increases, because the restrictions imposed by debt become more onerous, debt becomes exceedingly expensive and it costs less to use equity to finance a project. As shown in Figure 1, $\bar{k}$ represents the point where the cost of debt equals the cost of equity. Those projects with asset specificity lower than $\bar{k}$ are more efficiently financed by debt, while projects with asset specificity higher than $\bar{k}$ are more efficiently financed by equity. The figure highlights the central prediction of Williamson (1988): the debt ratio decreases as the asset specificity of the technology underlying the project increases.

Several academic papers have subsequently tested and found support for the prediction that increased asset specificity leads to a lower debt ratio (debt divided by debt plus equity). Balakrishnan and Fox (1993) use R&D intensity (R&D spending to net sales) as a proxy for asset specificity and find that as R&D intensity increases, the firm's debt ratio decreases. Mocnik (2001) surveys Slovenian manufacturing firms and finds that as advertising and R&D intensity increases, the debt ratio decreases. Other examples include David, O'Brien and Yoshikawa (2008), Kochar (1996, 1997) and Tittman and Wessels (1988). The focus of Williamson (1988) and much of the existing empirical work is on the financing of projects by established companies.[2] The goal of this article is to understand the financing of projects undertaken by entrepreneurs in start-up companies.

3. Hypotheses

Asset specificity and project finance

Our first hypothesis extends the central prediction from Williamson (1988) to the new firm setting. As when existing firms engage in projects using assets that are non- specific, the entrepreneur engaging in a project using non-specific assets will primarily finance the project with debt. Regardless of how the entrepreneur intends to use the technology, the fact that it is non-specific means that a lender will be willing to lend funds to finance its purchase. Since the

[2] For example, Balakrishnan and Fox (1993) studies a sample of large mining and manufacturing firms that appear on COMPUSTAT; Mocnik (2001) studies a sample of Slovenian manufacturing firms with at least 50 employees.

technology is non-specific, it can be used as collateral and easily sold on a secondary market if the entrepreneur's project fails. As the technology becomes more specific, it will be harder to sell on a secondary market, all else equal. This increases the likelihood that the lender will not recoup its loan, and so the lender will require a higher interest rate, and will want to write more covenants into the loan contract. At some point, the cost of obtaining debt financing becomes too expensive for the entrepreneur relative to equity. The entrepreneur will instead use equity financing from an investor, who then takes partial ownership of the company so as to gain more information about and exercise more control over how the technology is being used. Hence, as the specificity of the technology increases, it is likely that the project is funded with a larger proportion of equity, leading to the following proposition.

> *Hypothesis 1: A start-up's debt ratio will be negatively correlated with the amount of asset specificity underlying its business.*

Performance consequences

Per Hypothesis 1, we expect that, *on average*, the new firm's debt ratio will decrease as the asset specificity underlying its business increases. However, we do not expect this relationship to necessarily hold for all firms. In the absence of frictions, debt and equity should be easily accessible for new firms. There are, however, many potential sources of frictions. For example, the costs of obtaining external debt may be higher for firms with lower credit scores, forcing them to instead rely on equity financing. As another example, a start up firm with a single owner-employee will need to cease production while the owner engages in fundraising. As a result, there may be large frictions associated with obtaining the right mix of financing for startups. As a result of these frictions, it may be too expensive initially for the new firm to obtain the mix of debt and equity financing that is best aligned with the asset specificity of the underlying project.

The resulting misalignment between governance structure and asset specificity can have negative performance consequences for a firm (Sampson, 2004, Mayer and Nickerson, 2005). A large amount of equity relative to debt when the project relies on generic technology is one example of misalignment between governance structure and asset specificity. Such a situation may arise if the entrepreneur has a poor credit score, forcing him to rely on equity instead of debt. The misalignment in this case may mean that the entrepreneur spends added time interacting with equity holders who want to monitor the new firm's progress and less time on the business itself. This extra burden may cause the entrepreneur to react slowly to changing market conditions and perform worse than peers without the extra burden. Another example of misalignment occurs when the new firm relies on highly specific technology but has a large amount of debt relative to equity. Such a situation may arise if the entrepreneur, owing to a psychological preference for sole-ownership, prefers onerous debt because he is reluctant to give up equity in his start-up. If the business suffers temporary setbacks due to idiosyncratic shocks debtholders may foreclose on the entrepreneur. In short, misalignment arises when highly specific assets are financed primarily with debt or when non-specific assets are financed primarily with equity. Since misalignment increases the costs to a new firm, we expect misalignment to result in negative performance consequences for the firm. We state this with two hypotheses:

Hypothesis 2a: Firms with high debt ratios will experience poor performance if their projects are characterized by high asset specificity.

Hypothesis 2b: Firms with high equity ratios will experience positive performance if their projects are characterized by high asset specificity.

4. Methods and Data

Methods

To assess Hypothesis 1 we run regressions of the following form:

(1) $\textit{debt ratio}_i = \beta_1 \textit{asset specificity measure}_i + \mathbf{X_{1}}_{\mathrm{i}} + \varepsilon_{\mathrm{i}}$

where $\textit{debt ratio}_i$ is the ratio of debt to debt + equity for firm *i*, where $\textit{asset specificity measure}_i$ will be one of two measures of asset specificity described below, and where $\mathbf{X_{1}}_{\mathrm{i}}$ is a vector of control variables described below. Hypothesis 1 predicts that $\beta_1 < 0$. That is, as asset specificity increases, the firm will be less likely to use debt and more likely to use equity.

To assess Hypothesis 2, we need to address potential endogeneity of the firms' financial structure. The ideal experiment would randomly assign different types of financing to firms using technologies with different levels of asset specificity and then observe performance outcomes. The firms in our sample, however, have already chosen their financial structure. From Hypothesis 1, we expect firms to match their financial structure to the asset specificity of the technology used. This self-selection will bias estimates of performance. One way to address the self-selection is with a switching regression model (Hamilton and Nickerson, 2003). We follow Mayer and Nickerson (2005) in adopting such an approach to account for self-selection of governance structure.

The model consists of two stages. In the first stage we predict the firm's financial structure using the following probit model:

(2) $\textit{high debt}_i = \beta_1 \textit{asset specificity measure}_i + \mathbf{X}_{\mathbf{1}\mathrm{i}} + \varepsilon_\mathrm{i}$

where high debt is an indicator variable which equals one if the firm's debt ratio is above a threshold, and where *asset specificity measure*$_i$ and $\mathbf{X}_{\mathbf{1}\mathrm{i}}$ are as in (1). As in (1) we expect that $\beta_1 < 0$, but the actual value of the coefficient will differ as the model has changed.

Using the coefficients from model (2) we construct inverse Mills ratios that are used in second stage regressions. Misalignment arises when highly specific assets are financed primarily with debt or when non-specific assets are financed primarily with equity. Accordingly, in the second stage we investigate effect of asset specificity on performance separately for firms with high debt and firms with high equity:

(3) $\textit{performance}_i | \textit{high debt} = \theta_1 \textit{asset specificity measure}_i + \mathbf{X}_{\mathbf{2}\mathrm{i}} + \eta_\mathrm{i}$

(4) $\textit{performance}_i | \textit{high equity} = \theta_2 \textit{asset specificity measure}_i + \mathbf{X}_{\mathbf{2}\mathrm{i}} + \eta_\mathrm{i}$

where *performance*$_i$ and *asset specificity measure*$_i$ are described below. $\mathbf{X}_{\mathbf{2}\mathrm{i}}$ is identical to $\mathbf{X}_{\mathbf{1}\mathrm{i}}$ except for the inclusion of an additional variable in $\mathbf{X}_{\mathbf{1}\mathrm{i}}$ which is used as an instrument to identify model (2). The non-linearity of the probit model is often sufficient to identify the model in the second stage, but it is generally preferred to include an instrument in the first stage which is excluded in the second stage (Mayer and Nickerson, 2005).

Hypothesis 2A predicts that $\theta_1 < 0$ when performance is a good outcome, and the reverse if looking at a bad performance outcome. That is, as asset specificity increases for a firm with high debt, the firm will be less likely to experience good performance. Hypothesis 2B predicts that $\theta_2 > 0$. That is, as asset specificity increases for a firm with high equity, the firm will be more likely to experience good performance.

Data

We test the hypotheses with data from *Kauffman Firm Survey* (*KFS*) microdata for the period 2004-08. The initial *KFS* survey collected information on 4,928 firms that began operations in 2004 and then re-surveyed them annually. These data contain detailed information on both the firm and their owners. *KFS* oversamples the high tech sector, a feature that we exploit in our analyses. For more information about the *KFS* survey design and methodology see Robb et al. (2009). We use a subset of the *KFS* dataset of less than 2500 firms due to missing values in some fields.

To assess the relationship between asset specificity and debt ratio, we focus on the initial conditions of the firm in 2004.[3] We follow Robb and Robinson (2010) to calculate the continuous variable *debt ratio* for each firm. Total financial capital can come from the owner, insiders (friends and family) and outsiders (banks, venture capitalists, etc.). Debt ratio is the ratio of outside (or formal) debt to total financial capital used. *Debt ratio* is the main dependent variable for measuring the extent to which the firm relies on a market governance structure (when debt is high) or a hierarchical governance structure (when equity is high). To assess the relationship between asset specificity, debt ratio and performance, we use a variable *exit* which equals one if the firm exits the sample during 2004 – 2008 and zero otherwise.

We construct two proxies for asset specificity. The first proxy focuses on physical asset specificity. Physical assets consisting of specialized machinery and equipment are not likely to be easily redeployable to other uses. We construct a ratio of other assets to total assets and call this variable *asset specificity - ASS*. We know from the data that "other assets" do not include

[3] The *KFS* data set is a panel, but there is little variation in debt ratio over time. See histogram of annual change in debt ratio (2004 – 2008) in appendix.

assets classified as land, buildings, or current assets and so we assume other assets include assets such as specialized machinery and equipment. Our measure is similar to one used by Pascali (2008).[4] The second proxy focuses on intangible assets. Using information from the *KFS* on firm intellectual property, we construct an indicator called *asset specificity - IP* that equals one if the firm has any intellectual property (patents, trademarks, and/or copyrights), or zero otherwise. The numbers of observations reported in regression results differ across the two measures due to data availability.

We include a number of control variables in the regressions. Two of the more important control variables are those indicating financial constraints faced by the firm. We include a measure *credit score* that transforms the firm's D&B rating to a 100 point scale. We include this variable to control for the idea that firms with lower credit scores will have a harder time accessing external debt. These firms instead rely on owner or family financing. We also include an indicator variable *employees>5* that equals one if there are more than five employees (in addition to owners) working at the firm, and zero otherwise. This variable controls for the idea that larger firms may be able to engage in fundraising without adversely affecting productivity in a significant way. In contrast, a firm with zero employees (i.e.: only an owner-employee) will need to cease production while the owner engages in fundraising.[5] Other control variables include indicators for *product* based firm, *home based* firm, *incorporation*, *multiple owners*, *high tech*, *black*, *Asian*, *Hispanic*, *female*, *college* or *graduate* degrees, and *same business* as prior job. Continuous variables include number of *hours worked* by owner in a week, *average age of owners* and its square, and *years of work experience*. We also include nine industry dummies (at

[4] Pascali (2008) uses the ratio of (total machinery and equipment)/ (total machinery and equipment + land + building) to measure physical asset specificity.
[5] As evident in a histogram presented in an appendix, firms with more than five employees are more likely to change their debt ratio than firms with five or fewer employees.

the 2-digit NAICS level) to control for systematic differences in the *debt ratio* used by firms across industry, and state dummies to control for differences in employment opportunities across states. Year dummies are also included in the hazard models. Summary statistics of the *KFS* variables are provided in Table 1.

Insert Table 1 about here

For robustness, we replicate the findings from the *KFS* on the Federal Reserve Board's *Survey of Small Business Finance* (*SSBF*) from 2003. Every five years the Federal Reserve Board surveys a nationally representative cross-section of firms with 500 or less employees. We use a subset of the 2003 *SSBF* dataset with approximately 4200 firms. We attempt to use similar control variables across the two datasets wherever possible. The variable *debt ratio* is debt divided by debt + equity. Unlike the *KFS* data, we do not have information about the type of equity and debt captured by these variables. As with the *KFS* data, we construct the variable *asset specificity - ASS* by taking the ratio of other assets to total assets. The *SSBF* does not include information on intellectual property so we cannot create an equivalent for *asset specificity – IP*. Also, the *SSBF* includes a mix of new and established firms (the average firm in the *SSBF* is 16.5 years old); we indicate *new* firms as firms which are five years or younger. Summary statistics of the *SSBF* variables are provided in an appendix.

We replicate the findings across datasets because the *KFS* contains only new firms and a large share do not report profits or revenues in their initial years. As described elsewhere, we examine performance by measuring exit from the dataset. It is possible that some of these firms had "successful exits" which would bias our results downward. The firms in the *SSBF* report revenue and profit. Accordingly, we use revenue and profit data from the *SSBF* to create the outcome variable *profit margin*. Evaluating performance outcomes across two populations of firms helps confirm the robustness of the hypothesized relationships.

5. Results

All of the results include owner characteristics, firm characteristics, industry dummies and geographic fixed effects, as indicated, but the output has been suppressed for space. We use two-tailed tests for all variables. Table 2 provides the results of our analysis using a measure of asset specificity that uses the ratio of other assets to total assets, *asset specificity – ASS*. Column (1) reports the results of OLS regressions of *debt ratio* on *asset specificity – ASS* and control variables. The coefficient on *asset specificity – ASS* is negative and significant at the 5% level, indicating that, on average, as a firm's asset specificity increases, the firm's debt ratio decreases. The result provides evidence in support of Hypothesis 1.

Insert Table 2 about here

Columns (2) – (4) present the results from a switching regression model. To do this, we transform the continuous variable *debt ratio* into a binary variable *high debt* indicating that the firm's debt ratio is greater than the mean debt ratio across all firms in the sample. We first predict whether the firm will be financed mostly with debt (*high debt* = 1). Column (2) reports the results of probit regressions of *high debt* on *asset specificity – ASS* and control variables. As in Column (1), the coefficient on *asset specificity – ASS* is negative and significant at the 5% level. Using the predictions from the model in Column (2), we then create separate Mills ratios for firms which have high debt (i.e.: *high debt* = 1) and those that have high equity (i.e.: *high debt* = 0). Column (3) restricts the sample to firms with high debt and reports the results of Cox hazard models of firm exit on *asset specificity – ASS*, control variables, and the Mills ratio for high debt. The Mills ratio is included to provide a correction for endogeneity of the capital structure decision. The coefficient on *asset specificity – ASS* is positive and significant at the 5% level. This result indicates that firms with a high debt ratio that have high asset specificity are more likely to exit than firms with high debt ratio and low asset specificity. The result provides evidence in support of Hypothesis 2A. The Mills ratio for high debt is negative but not significant. Column (4) restricts the sample to firms with high equity and reports the results of Cox hazard models of firm exit on *asset specificity – ASS*, control variables, and the Mills ratio for high equity. The coefficient on *asset specificity – ASS* is negative but not significant. The sign is in the hypothesized direction, however. The negative coefficient suggests that firms with a low debt ratio that have high asset specificity are less likely to exit than firms with low debt ratio and low asset specificity. The Mills ratio for high equity is positive but not significant.

Insert Table 3 about here

Table 3 provides the results of our analysis using a measure of asset specificity that indicates whether the firm owns any intellectual property, *asset specificity – IP*. Column (1) reports the results of OLS regressions of *debt ratio* on *asset specificity – IP* and control variables. The coefficient on *asset specificity – ASS* is negative and significant at the 1% level, indicating that, on average, as a firm's asset specificity increases, the firm's debt ratio decreases. The result provides evidence in support of Hypothesis 1. As in Table 2, Columns (2) – (4) of Table 3 present the results from a switching regression model. As presented in Column (2), the coefficient on *asset specificity – IP* in the first stage is negative and significant at the 5% level. Column (3) restricts the sample to firms with high debt and reports the results of Cox hazard models of firm exit on *asset specificity – IP*, control variables, and the Mills ratio for high debt. The coefficient on *asset specificity – IP* is positive, which is the correct direction, but not significant. Column (4) restricts the sample to firms with high equity and reports the results of Cox hazard models of firm exit on *asset specificity – IP*, control variables, and the Mills ratio for high equity. The coefficient on *asset specificity – IP* is negative and significant at the 1% level. The negative coefficient suggests that firms with a low debt ratio that have high asset specificity are less likely to exit than firms with low debt ratio and low asset specificity. The result provides evidence in support of Hypothesis 2B.

Insert Table 4 about here

Table 4 provides the results of our analyses on the effect of asset specificity on the firm's debt ratio using data from the *Survey of Small Business Finance (SSBF)*. Column (1) of Table 4 reports the results of OLS regressions of *debt ratio* on *asset specificity – ASS* and control variables. The goal in Column (1) is to replicate, to the best of our ability, the findings from the *Kauffman Firm Survey (KFS)* data. The coefficient on *asset specificity – ASS* in Column (1) is negative and significant at the 1% level which suggests that firms using highly specific assets are funded with less debt and more equity than firms with non-specific assets. The result provides support for Hypothesis 1. In Columns (2) and (3) we extend the analysis by including an indicator for new firms and an interaction between new firms and the asset specificity measure.

New is an important control given that the *SSBF* includes new and established firms. The coefficient on *asset specificity – ASS* remains negative and significant across the additional two columns suggesting both that the result is robust and that the relationship between asset specificity and debt ratio is not unique to nascent firms.

Columns (4) – (6) present the results from a switching regression model. To do this, we transform the continuous variable *debt ratio* into a binary variable *high debt* indicating that the firm's debt ratio is greater than the mean debt ratio across all firms in the sample. Column (4) reports the results of the first-stage probit regressions of *high debt* on *asset specificity – ASS* and control variables. As in Columns (1) – (3), the coefficient on *asset specificity – ASS* is negative and significant at the 1% level. Column (5) restricts the sample to firms with high debt and reports the results of OLS regressions of *profit margin* on *asset specificity – ASS*, control variables and the Mills ratio for high debt. The coefficient on *asset specificity – ASS* is negative and significant at the 10% level which provides support for the hypothesis that firms with a high debt ratio that have high asset specificity will have worse performance than firms with low debt ratio and low asset specificity. The result provides evidence in support of Hypothesis 2A. We also note that the Mills ratio for high debt is negative and significant at the 5% level. The negative coefficient on the Mills ratio in Column (5) suggests that if those firms which chose high equity instead of high debt had instead chosen high debt, they would have performed worse than the firms which initially chose high debt (see Hamilton and Nickerson 2003 for further discussion). Column (6) restricts the sample to firms with high equity and reports the results of OLS regressions of *profit margin* on *asset specificity – ASS,* control variables and the Mills ratio for high equity. The coefficient on *asset specificity – ASS* is positive but not significant. The coefficient is in the right direction, however, and suggests that firms with a low debt ratio that have high asset specificity will be more profitable than firms with low debt ratio and low asset specificity.

Taken as a whole, the results in Tables 2 – 4 provide evidence in support of the hypotheses. The results appear robust to various definitions of asset specificity and performance and are robust across two data sets. Moreover, the use of the two-stage switching regression model explicitly controls for potential endogeneity of the firm's capital structure.

6. Discussion and Conclusion

Using the logic of transaction cost economics, Williamson (1988) argues that firms engaged in projects requiring highly specific assets are more likely to be financed with equity. Williamson (1988) suggests that a firm's financial structure is akin to a governance structure and predicts that a firm's equity ratio will be positively correlated with asset specificity. We extend Williamson (1988) by focusing on the capital structure of start-up firms and furthermore link the capital structure to performance outcomes. We find that, on average, start-up firms with higher levels of asset specificity have lower debt ratios. We also find that, as the misalignment between a start-up firm's capital structure and its asset specificity increases, the firm is more likely to exit or to experience lower profitability.

The empirical results we report herein are just a first step in this line of research, and there are several limitations to our study. First, our methodology relies on proxies for asset specificity. Our findings, however, are consistent across two different measures of asset specificity and across two datasets. Second, a central precept of transaction cost economics is to focus on individual transactions, but we do not observe any transactions. However, in contrast to prior empirical work linking financial structure to asset specificity, we focus on very small firms, which are likely engaged in only a single project. Limitations notwithstanding, our results add to existing empirical work linking financial structure to asset specificity (e.g.: Balakrishnan and Fox, 1993; David, O'Brien and Yoshikawa, 2008; Tittman and Wessels, 1988) as well as empirical work linking misaligned governance structure to performance (Sampson, 2004; Mayer and Nickerson, 2005). In both cases, our unique contribution is to focus on these issues in an entrepreneurial setting.

More broadly, this paper highlights the important role played by the entrepreneur's project. Prior research on entrepreneurial finance has focused on characteristics of the entrepreneur or characteristics of the financier (see Shane (2008) for an excellent overview of these topics). Other literature on small business finance focuses on how structural factors such as tax laws and other regulations affect entrepreneurship. For example, Fan and White (2003) show that changes in bankruptcy law affect new firm formation. Much of the literature on venture capital firms takes the decision to seek venture financing as given and then attempts to ascertain how entrepreneurs choose venture capitalists and how venture capitalists structure contracts with entrepreneurs. While these studies have helped our understanding of entrepreneurs, we feel that such focus misses an important part of the story; namely the characteristics of the project should determine the type of financing used.

The results have significant implications for new firms. In order to better create and capture value, a new firm should arrange financing in alignment with its underlying assets. Our study shows that appropriate financial structure leads to new firm survival, thereby being better able to create and capture value. From a policy point of view, these results suggest that policymakers should work to ensure that many types of financing are available without hindrance to new firms. New firms that have ready access to debt and equity financing will be able to use the appropriate mix of financing required by their venture and in turn will have better performance prospects.

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Table 1:

Summary Statistics of and Correlations between Variables Used from KFS (2004)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1 Product	1.00																					
2 Home Based	-0.22	1.00																				
3 Incorporated	0.05	-0.14	1.00																			
4 Multiple Owners	0.08	-0.21	0.19	1.00																		
5 Credit Score	0.04	-0.08	0.10	0.08	1.00																	
6 High Tech Dummy	0.07	-0.03	0.08	0.04	0.03	1.00																
7 Black	-0.13	0.10	-0.04	-0.05	-0.14	-0.02	1.00															
8 Asian	0.03	-0.07	0.04	0.04	0.01	0.04	-0.06	1.00														
9 Other	0.02	-0.03	0.02	0.04	-0.01	-0.01	-0.04	-0.03	1.00													
10 Hispanic	0.00	-0.02	0.01	0.02	-0.03	-0.01	-0.06	-0.05	-0.03	1.00												
11 Female	-0.03	0.04	-0.01	0.02	-0.04	-0.07	0.10	0.03	0.03	0.00	1.00											
12 Hours Worked by Owner(s)	0.06	-0.25	0.11	0.04	0.03	0.01	0.05	0.03	0.00	0.01	-0.06	1.00										
13 Average Age of Owner(s)	0.02	-0.02	0.00	0.01	0.07	0.01	-0.10	-0.08	0.00	-0.04	-0.07	-0.08	1.00									
14 College Degree	0.01	-0.04	0.01	0.05	-0.02	-0.01	-0.04	0.07	-0.02	0.00	-0.02	-0.01	-0.03	1.00								
15 Graduate Degree	-0.06	-0.01	0.04	0.02	0.06	0.18	0.01	0.06	0.02	-0.05	-0.02	-0.04	0.14	-0.37	1.00							
16 Years of Work Experience	-0.06	-0.02	0.04	-0.02	0.06	0.10	-0.05	-0.05	-0.02	-0.04	-0.21	0.07	0.43	-0.05	0.07	1.00						
17 Same Business Dummy	0.05	-0.10	0.06	0.06	0.08	0.07	-0.03	0.00	0.01	0.00	-0.09	0.05	0.11	0.00	0.03	0.28	1.00					
18 Debt Ratio	0.09	-0.17	0.05	0.04	0.07	-0.05	-0.07	-0.02	0.01	-0.01	0.00	0.03	0.06	-0.05	-0.02	-0.02	0.00	1.00				
19 HHI	-0.08	0.02	0.04	-0.03	-0.04	0.03	0.02	-0.02	-0.08	-0.05	-0.08	-0.02	-0.03	-0.01	0.01	0.03	-0.06	-0.03	1.00			
20 Employees > 5	0.05	-0.27	0.18	0.22	-0.03	0.01	-0.01	0.04	0.00	-0.01	-0.01	0.10	0.06	0.06	0.03	0.06	0.11	0.15	-0.01	1.00		
21 Asset Specificity - ASS	0.05	-0.03	0.01	0.07	-0.01	0.06	-0.03	0.03	0.04	-0.03	-0.04	0.06	0.01	0.01	0.03	0.01	0.05	-0.02	0.02	0.06	1.00	
22 Asset Specificity - IP	0.17	-0.04	0.07	0.12	-0.04	0.15	0.03	0.03	0.04	0.01	-0.03	0.05	-0.02	0.03	0.10	-0.01	0.14	-0.04	-0.05	0.12	0.15	1.00
Mean	0.56	0.35	0.41	0.40	47.95	0.15	0.07	0.05	0.02	0.05	0.22	49.09	45.07	0.34	0.21	13.12	0.20	0.26	1441	0.19	0.01	0.22
Standard Deviation	0.50	0.48	0.49	0.49	27.09	0.35	0.26	0.21	0.14	0.21	0.41	21.90	10.86	0.47	0.41	10.96	0.40	0.33	732	0.39	0.07	0.41
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	0.00	0.00	0.00	0.00	0.00	478	0.00	0.00	0.00
Maximum	1.00	1.00	1.00	1.00	99.00	1.00	1.00	1.00	1.00	1.00	1.00	120.00	90.00	1.00	1.00	60.00	1.00	1.00	7001	1.00	1.00	1.00

Table 2:

KFS Results using Physical Assets Asset Specificity Measure

	(1)	(2)	(3)	(4)
Model:	OLS	Probit	Cox	Cox
Dependent Variable:	*Debt Ratio*	*High Debt*	*Exit| High Debt=1*	*Exit| High Equity=1*
Asset Specificity - ASS	-0.063**	-0.677**	1.019**	-0.011
	[0.027]	[0.314]	[0.400]	[0.826]
Mills Ratio - High Debt			-1.158	
			[0.992]	
Mills Ratio - High Equity				0.183
				[0.716]
Firm Characteristics	Y	Y	Y	Y
Industry Dummies	Y	Y	Y	Y
Organization Type	Y	Y	Y	Y
How Established	Y	Y	Y	Y
State Dummies	Y	Y	Y	Y
Observations	2,066	2,047	4,246	2,285
R-squared	0.153			
Pseudo R-squared				

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3:

KFS Results using Intellectual Property Asset Specificity Measure

	(1)	(2)	(3)	(4)
Model:	OLS	Probit	Cox	Cox
Dependent Variable:	*Debt Ratio*	*High Debt*	*Exit| High Debt=1*	*Exit| High Equity=1*
Asset Specificity - IP	-0.022***	-0.203**	1.414	-4.392***
	[0.006]	[0.092]	[1.096]	[0.898]
Mills Ratio - High Debt			-0.536	
			[0.968]	
Mills Ratio - High Equity				0.340
				[0.654]
Firm Characteristics	Y	Y	Y	Y
Industry Dummies	Y	Y	Y	Y
Organization Type	Y	Y	Y	Y
How Established	Y	Y	Y	Y
State Dummies	Y	Y	Y	Y
Observations	2,343	2,328	4,687	2,347
R-squared	0.157			
Pseudo R-squared				

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4:

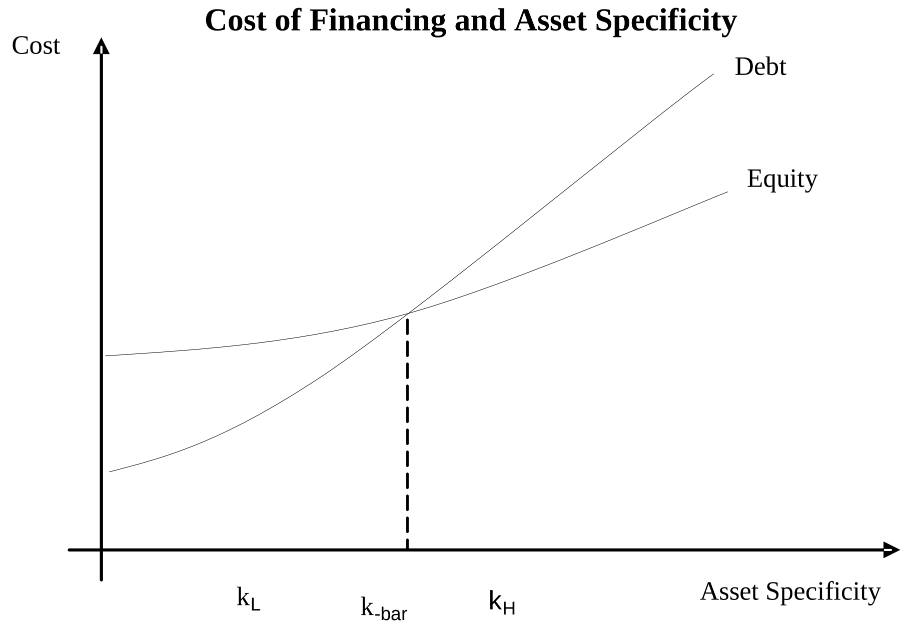
SSBF Results using Physical Assets Asset Specificity Measure

	(1)	(2)	(3)	(4)	(5)	(6)
Model:	OLS	OLS	OLS	Probit	OLS	OLS
Dependent Variable:	*Debt Ratio*	*Debt Ratio*	*Debt Ratio*	*High Debt*	*Profit Margin| High Debt=1*	*Profit Margin| High Equity=1*
Asset Specificity - ASS	-0.154***	-0.141***	-0.184***	-0.584***	-0.323**	0.159
	[0.023]	[0.025]	[0.047]	[0.204]	[0.121]	[0.139]
New (<5years)		0.074***	0.072***	0.264***	0.068	-0.122
		[0.014]	[0.016]	[0.047]	[0.040]	[0.087]
Asset Specificity - ASS*New			0.252	0.996	0.627	-0.888**
			[0.289]	[0.851]	[0.371]	[0.305]
Mills Ratio - High Debt					-1.649**	
					[0.695]	
Mills Ratio - High Equity						1.041
						[1.163]
Firm Characteristics	Y	Y	Y	Y	Y	Y
Industry Dummies	Y	Y	Y	Y	Y	Y
Organization Type	Y	Y	Y	Y	Y	Y
How Established	Y	Y	Y	Y	Y	Y
Region Dummies	Y	Y	Y	Y	Y	Y
Observations	4,051	4,051	4,051	4,050	1,730	2,218
R-squared	0.094	0.100	0.100		0.059	0.105
Pseudo R-squared				0.059		

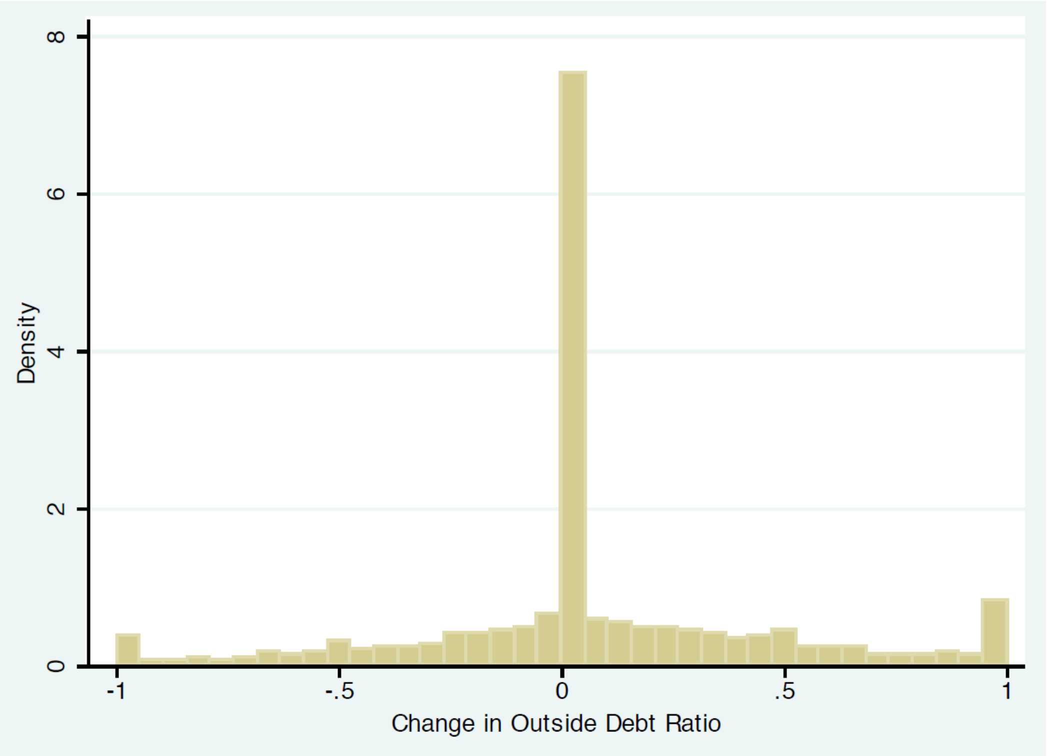
* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 1:

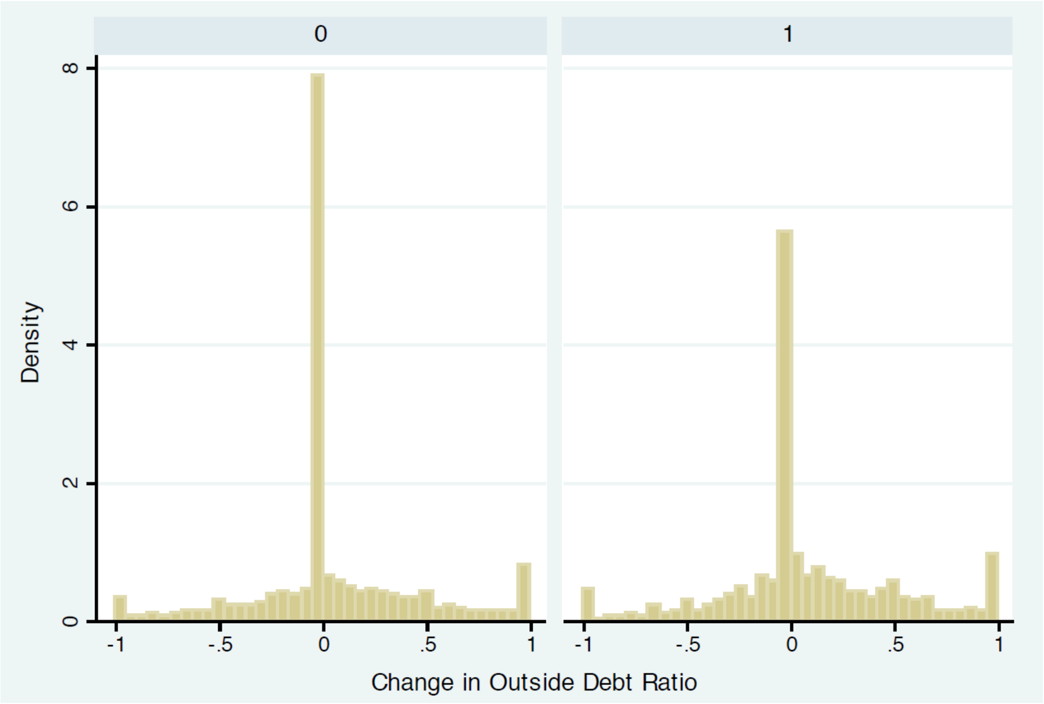
Transaction cost economics predicts that as asset specificity (k) increases, the cost of financing by debt will increase faster than the cost of financing by equity. Since debt is cheaper than equity at low values of asset specificity, at some point it will be cheaper to finance a project through equity than through debt. $\bar{k}$ is the point at which the cost of equity and the cost of debt are equal. Projects with low degrees of asset specificity (k_L) will be financed with more debt than equity whereas project with high degrees of asset specificity (k_H) will be financed with more equity than debt.



Appendix 1:
Histogram of Change in Debt Ratio



Appendix 2:
Histogram of Change in Debt Ratio, by *employees>5*



Appendix 3:
SSBF Summary Statistics

Summary Statistics of and Correlations between Variables Used from SSBF (2003)

	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Percent Debt	1.00															
2	Profit Margin	-0.22	1.00														
3	Asset Specificity - ASS	-0.01	-0.02	1.00													
4	New (<5years)	0.07	-0.03	-0.02	1.00												
5	Prior Bankruptcy	-0.04	0.03	0.00	0.03	1.00											
6	Female	-0.06	0.05	-0.01	0.05	0.01	1.00										
7	Black	-0.01	0.01	0.04	0.02	0.06	0.13	1.00									
8	Hispanic	0.01	0.00	-0.02	0.03	0.00	0.11	0.27	1.00								
9	Asian	0.01	0.01	0.00	0.02	-0.01	0.09	0.26	0.23	1.00							
10	Owners Working	0.16	-0.15	0.05	0.00	-0.01	0.10	0.03	0.05	0.06	1.00						
11	College Degree	0.02	-0.02	0.03	0.02	-0.02	-0.08	-0.01	-0.05	0.02	-0.03	1.00					
12	Graduate Degree	-0.01	0.04	0.03	-0.03	-0.02	-0.04	0.01	-0.02	0.09	-0.05	-0.32	1.00				
13	Larg Firm	0.24	-0.25	0.06	-0.13	-0.06	-0.11	0.01	0.03	0.06	0.36	0.06	-0.03	1.00			
14	Credit Score	-0.10	0.00	0.00	-0.17	-0.11	-0.03	-0.09	-0.02	0.00	0.07	0.00	0.03	0.09	1.00		
15	Inherited	0.01	-0.06	0.00	-0.07	-0.03	-0.06	-0.02	0.00	-0.02	0.08	0.04	-0.06	0.12	0.07	1.00	
16	High HHI	-0.02	-0.01	0.00	-0.02	0.04	0.04	-0.02	-0.03	-0.02	0.04	-0.05	-0.05	0.01	-0.01	0.02	1.00
	Mean	0.45	0.19	0.01	0.20	0.02	0.31	0.04	0.05	0.05	0.52	0.29	0.20	0.53	66.60	0.06	0.28
	Standard Deviation	0.38	0.29	0.06	0.40	0.15	0.46	0.20	0.23	0.23	0.50	0.45	0.40	0.50	28.02	0.24	0.45
	Minimum	0.00	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00
	Maximum	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	100.00	1.00	1.00