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Multi-stage investment, long-term asymmetric information and equity issues

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We analyze equity financing for a two-stage investment and consider different informational structures. When private information is short-term, equilibria are consistent with signalling theory and pecking-order theory. When private information is long-term, equilibria may exist where high quality firms issue equity. The model explains the link between debt-equity choice and subsequent performance after issue (short-term versus long-term). A set of new predictions is generated regarding the link between the extent of asymmetric information and equity issues, macroeconomic performance and equity issues and market timing.

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INTRODUCTION

The modern theory of capital structure began with the famous proposition of Modigliani and Miller (1958) that described the conditions of capital structure irrelevance. Since then, many economists have altered these conditions to explain the factors driving capital structure decisions. Harris and Raviv (1991) synthesize the major theoretical literature in the field and suggest promising avenues for future research. They argue that asymmetric information theories of capital structure are less promising than control-based or product-based theories.

The financial crisis of 2008-2009 forced financial economists to look critically at capital structure theory because the problems faced by many companies stemmed from their financing policies. Corporate managers appeared to lack an understanding of the role of asymmetric information. The market for mortgage-backed securities, which many believe was at the core of

financial crisis, involved asymmetric information between investors and issuers.

This paper builds on pecking order, signaling and market timing theories of capital structure. These theories directly relate to asymmetric information. The "Pecking-order theory" (POT) was put forth by Myers and Majluf (1984). According to this theory firms will use internal funds, if available, to finance profitable projects. In the case that internal funds are not available, they will issue debt. This creates the "pecking-order" where equity represents an inferior security. The evidence supports predictions of the pecking order theory such as the negative correlation between debt and profitability (Titman and Wessels, 1988; Rajan and Zingales, 1995; Fama and French, 2002; Frank and Goyal, 2007) and negative share price reaction on equity issue announcements (Masulis and Korwar, 1986; Antweiler and Frank, 2006). The evidence is mixed about whether firms always follow a pecking order hierarchy and whether the extent of asymmetric information reduces the incentive to issue equity (Shyam-Sunder and Myers (1999), Frank and Goyal (2003), Fama and French (2002), Lemmon and Zender (2008), Leary and Roberts (2010), Galpin (2004) and Chen and Zhao (2004)).

In the pecking order model, good quality firms have to use internal funds to avoid adverse selection problems and losing value. These firms cannot signal their quality by changing their capital structure. The signalling theory of capital structure offers models in which capital structure serves as a signal of private information (Ross, 1977; Leland and Pyle, 1978). Usually good quality firms increase leverage to signal quality. The empirical evidence supports such predictions of signaling theory as a negative market reaction on leverage-decreasing transactions and a positive reaction on leverage-increasing transactions excluding debt issues (Masulis, 1980; Antweiler and Frank, 2006; Baker, Powell, and Veit, 2003). Second, the evidence does not support a positive market reaction to debt issues (Eckbo, 1986; Antweiler and Frank, 2006). The

negative correlation between debt and profitability also contradicts signaling theory. Third, the evidence is mixed regarding the predictions of signaling theory about firms' operating performance after issuing equity. Long-term underperformance of firms issuing equity compared to non-issuing firms (Jain and Kini, 1994; Loughran and Ritter, 1997) seems to be consistent with the spirit of signalling theory while better operating performance of firms issuing equity shortly after the issue compared to non-issuing firms does not support the theory. According to Jain and Kini (1994, Figure 1) the operating return on assets is higher for IPO firms in the first years after the issue and the operating cash flow on assets is higher in year "0" (immediately after issue). In Loughran and Ritter (1997) profit margins are higher in years 0 and +1, although there is different evidence about operating returns. In Mikkelson, Partch and Shah (1997, Table 3) IPO firms have higher performance in year 0.

We analyze a model where managers representing initial shareholders raise capital for an investment project. When investment is one-staged or private information is short-term, there is a pooling equilibrium that is consistent with the pecking-order theory in which no firms issue equity. This equilibrium does not contradict the signaling theory because no firms use equity issues as a signal of quality. When the investment is two-staged and private information is long-term, one of two scenarios may arise. In one case, there is a pooling equilibrium that is consistent with pecking-order theory in which all types are financed by debt. In the second case, a separating equilibrium may exist where some firms (including highly-profitable firms) may issue equity. The following is an explanation of the main ideas behind the separating equilibrium.

First, it is well known that in a separating equilibrium, each financing strategy is chosen by the worst possible type of firm for that strategy (from the investor's viewpoint).¹ Otherwise, the firm will be mimicked by other firms which will benefit from the overvaluation of issued

¹ Brennan and Kraus (1987).

securities. We show that the value of shares depends on the firm's total value and not on the timing of earnings or on the rate of earnings growth. If a firm, with a higher overall value in comparison to other firms, has high short-term expected performance and low long-term expected performance, it can issue equity to signal its quality. Other firms may find it unattractive to mimic this strategy. The reason being is that when the extent of asymmetric information about firms' overall value is small enough, the value of equity issued by the high-value type is only marginally higher than the first-best value of this claim corresponding to other types. On the other hand, the expected value of claims issued by this firm for financing the second stage of investment is low (because of low expected performance in that period). Thus, other firms may find it unattractive to mimic high-value firms because of the expected loss in the second stage. This leads to the existence of a separating equilibrium in which a firm with high overall value issues equity.

The described above separating equilibrium implies that firms issuing equity have better operating performance at the moment of issue or soon after the issue. These firms also have lower operating performance in the long run. Leverage is negatively correlated with profitability because firms with higher profits in the first period issue equity in the first period. Firms with low rate of earnings growth issue equity and firms with high rate of earnings growth issue debt (Mohamed and Eldomiaty, 2008; and Chichti and Bougatef, 2010). The model also predicts that equity issues are more probable when the extent of asymmetric information about firms earnings profile over time is large while the extent of asymmetric information about firms overall values is small.

This paper shows that long-term asymmetric information can affect corporate capital structure. It contributes to POT literature by providing a model which explains the negative

correlation between debt and profitability and at the same time suggesting "new pecking order". In contrast to standard POT, firms can issue equity as a signal. This paper contributes to signalling theory by explaining why debt does not necessarily signal a firm quality. It also explains the link between debt-equity choice and subsequent performance after issue (short-term versus long-term). It contributes to the discussion about the link between the extent of asymmetric information and equity issues. The empirical evidence about this issue has been mixed from the point of view of either theory as was mentioned above.

The rest of this paper is organized as follows. Section 1 provides a review of pecking-order theory, signalling theory and market timing theory. The basic model, its predictions and their consistency with empirical evidence are presented in Section 2. Section 3 discusses the model's extensions and robustness. The conclusion is drawn in Section 4. Lengthy mathematical proofs are omitted for brevity. The proofs of some key results can be found in the Appendix. Others are available upon demand.

1. PECKING-ORDER THEORY, SIGNALLING AND MARKET TIMING

The key element of POT is asymmetric information between firm's insiders and outsiders. Information asymmetries exist in almost every facet of corporate finance and complicate managers' ability to maximize firm values. Managers of good quality firms face the challenge of directly convincing investors about the true quality of their firm especially if this concerns future performance. As a result, investors will try to incorporate indirect evidence in their valuation of firm performance, which is done through the analysis of information-revealing actions, including capital structure choice.

Equity is dominated by internal funds in POT. Low-quality firms will use equity as much as

internal funds but high-quality firms will prefer internal funds. If high quality firms issue equity it will be undervalued by investors because of lack of information. Similarly equity is dominated by debt. Suppose that the firm can finance the project with risk-free debt. Then high-quality firm can issue debt to avoid any mispricing. If debt issued by the firm is risky, the situation does not change appreciably. The same holds if the firm has available assets-in-place. Hence a "pecking-order" emerges: internal funds, debt, and equity (Myers and Majluf, 1984). Myers and Majluf (1984) show that this analysis basically holds in the case of continuum of types. The authors state (Myers and Majluf, 1984, p. 208): "In our model, the firm never issues equity. If it issues and invests it always issues debt."

The empirical evidence on whether firms follow the pecking order hierarchy is mixed. Shyam-Sunder and Myers (1999), Lemmon and Zender (2008), and a survey of NYSE firms by Kamath (1997) find support for pecking order while Chirinko and Singha (2000) and Leary and Roberts (2010) do not. Frank and Goyal (2003) show that the greatest support for pecking order occurs among large firms.

According to POT, the announcement of issuing stock drives down the stock price. Empirically, the announcements of equity issues result in significant negative stock price reactions (Masulis and Korwar, 1986; Antweiler and Frank, 2006). Also good-quality firms tend to use internal funds for financing as much as possible. Because low-quality firms do not have as much profits and retained earnings as high-quality firms, they use external sources, usually debt, more frequently. This helps to explain the puzzle about the negative correlation between debt and profitability.

Finally, POT predicts that a higher extent of asymmetric information reduces the incentive to issue equity. The evidence, however, is ambiguous. D'Mello and Ferris (2000) and Bharath,

Pasquariello, and Wu (2008) support the prediction that POT is more likely to hold when the extent of asymmetric information is large. Choe, Masulis, and Nanda (1993) find that equity issues are more frequent when the economy is doing well and information asymmetry is low. Yet, Frank and Goyal (2003) find the greatest support for pecking order among large firms that are expected to face the least severe adverse selection problem because they receive better coverage by equity analysts.

The following summarizes the above analysis. The evidence supports predictions of the pecking order theory such as the negative correlation between debt and profitability, negative share price reaction on equity issue announcements, and better share price reaction on debt issues than on equity issues. The evidence is mixed about whether firms follow a pecking order hierarchy and whether the extent of asymmetric information reduces the incentive to issue equity.

A rich set of new predictions can arise when analyzing an environment with staged investments. Halov (2006), for example, proposes a model that considers a firm without internal funds where the choice of security depends not only on the current adverse selection cost of security but also on the future information environment and future financing needs of the firm. Debt issues today make future security issues more sensitive to the degree of asymmetric information in the issuance period. Halov finds that future adverse selection costs negatively affect the debt component of new external financing and positively affect the cash reserves of the firm. He explains why companies may prefer equity to debt and provides an idea about why the incentive for issuing equity depends both on the extent of asymmetric information in the current period and in future periods. In contrast to Halov (2006), in the present paper asymmetric information does not concern the overall quality of the firm but its earnings profile over time.

In the pecking order model, good quality firms have to use internal funds to avoid adverse selection problems and losing value. These firms are unable to signal their quality by changing their capital structure. The signaling theory suggests models in which capital structure serves as a signal of private information (Ross, 1977; Leland and Pyle, 1977). Usually in these models the market reaction on debt issues (more generally, on leverage-increasing transactions, such as issuing convertible debt, repurchasing shares, and debt for equity swaps) is positive. Similarly, the market reaction on equity issues (or leverage-decreasing transactions) is negative.

A negative share price reaction on the announcement of equity issues is usually consistent with empirical evidence, as discussed in the previous section (similar for leverage-decreasing transactions). The evidence about the positive market reaction on leverage-increasing transactions (with the exception of debt issues) also supports signaling theory (Masulis, 1980; Antweiler and Frank, 2006; Baker et al., 2003). The evidence on the announcement of debt issues does not support signaling theories. Eckbo (1986) and Antweiler and Frank find insignificant changes in stock prices in response to straight corporate debt issues.

The other empirical prediction of signalling theory is that firm value (or profitability) and the debt-equity ratio is positively related. The evidence, however, is ambiguous. Most empirical studies report a negative relationship between leverage and profitability as discussed earlier. In a similar spirit, some studies document the superior absolute performance of equity-issuing firms before the issue and immediately after the issue (Jain and Kini, 1994; Loughran and Ritter, 1997). On the other hand, several studies examine long-term firm performance following capital structure changes. Shah (1994) reports that business risk falls after leverage-increasing exchange offers but rises after leverage-decreasing exchange offers. Jain and Kini (1994), Mikkelson, Partch, and Shah (1997), and Loughran and Ritter (1997) document the long-run operating

underperformance of equity issuing firms compared to non-issuing firms.

The above analysis leads to the following conclusions. The empirical evidence supports such predictions of signaling theory as a negative market reaction on leverage-decreasing transactions and a positive reaction on leverage-increasing transactions (excluding debt issues). The evidence does not support a positive market reaction to debt issues. The negative correlation between debt and profitability also contradicts the signaling theory. The evidence is mixed regarding the predictions of signaling theory about firms' operating performance after issuing equity. On one hand long-term underperformance of firms issuing equity compared to non-issuing firms supports the theory. On the other hand, better operating performance of firms issuing equity shortly after the issue compared to non-issuing firms does not support the theory.

Many explanations exist as to why managers of high-quality firms may use leverage-decreasing transactions as a signal. These include issuing equity to signal low variance of earnings (Brick, Frierman, and Kim, 1998), retiring existing debt to signal earnings quality (Brennan and Kraus, 1987), signaling in a model that combines asymmetric information with agency problems (Noe and Rebello, 1996).² A challenge for researchers today is to find a model that can explain several major empirical phenomena simultaneously. Two possible directions for research in signalling theory involve dynamic extensions of signaling models and security design models.

Hennessy, Livdan, and Miranda (2010) develop a dynamic model of the firm under repeated hidden information. In equilibrium, firms signal positive information by substituting debt for equity, which explains the inverse relationship between leverage and net worth. Firms with negative private information are unlevered, which is consistent with debt conservatism. In

²Also see Heinkel (1982), Daniel and Titman (1995), Dybvig and Zender (1991), Giammarino and Neave (1982) and Noe (1988).

contrast to Hennessy et al (2010) where insiders receive private information about firm's quality in the current period, in the present paper private information is about the timing of earnings (it affects the firm's quality in two consecutive periods).

Sometime investors such as banks may be able to obtain information on a firm's quality or to produce analytical information. Fulghieri and Larkin (2001) show that good firms want to partition their securities so that some of the claims are informationally sensitive. If the cost of becoming informed is low and the degree of asymmetric information is high, firms may prefer a higher information sensitive security to promote information production by "specialized" outside investors. This explains the negative correlation between debt and firm value because firms with low profitability do not need to issue equity, which is sensitive to a firm's value. Fulghieri and Larkin also predict that younger firms with good growth opportunities are more likely to be equity financed. These firms can be especially interested in information production by outside investors.

The decision to issue equity depends on stock market performance (Lucas and McDonald, 1990; Korajczyk, Lucas, and McDonald, 1992). It was not until Baker and Wurgler (2002), however, when this point had become one of the major capital structure theories also called "market timing" (MT). MT predicts that when the economy is bad, firms do not issue equity. When the economy has average performance, some firms will issue equity. When the economy is booming, equity issues are large. Empirical work by Choe et al. (1993), Bayless and Chaplinsky (1996), and Baker and Wurgler (2002) suggests a positive relationship between equity issues and the business cycle.

MT argues that firms issue equity when stock prices are relatively high. Empirical evidence supports the prediction that share price performance is important for equity issues decisions

(Rajan and Zingales, 1995; Kamath, 1997; Graham and Harvey, 2001; Baker and Wurgler, 2002). Mixed evidence exists about whether investors overpay for shares. Some researchers argue that investors tend to be overly optimistic during new issues, analyst forecasts are excessively high, and managers manipulate earnings prior to going public (Baker and Wurgler, 2002; Teoh, Welch, and Wong, 1998). Some research argues in favor of an efficient market version of the market timing argument (Hansen and Sarin, 1998; Knill and Lee, 2006). Other research suggests that market timing is not based on good market performance as compared to a firm's predicted performance. Instead, it is based on the market performance before the issue, called "pseudo-market timing" (Schultz, 2003; Butler, Grullon, and Weston, 2005).

It was found that stock return on stocks of companies issuing new shares underperform in the long run compared to that of non-issuing firms ("new issue puzzle", Ritter and Welch, 2002). This puzzle suggests that investors purchasing IPO or SEO shares are irrational because they have lower return compared to investments in shares of non-issuing firms. Eckbo, Masulis, and Norli (2007) and Carter, Dark and Sapp (2009) noticed, however, that one needs to estimate the risk of those firms to provide a correct interpretation of long-term underperformance of firms issuing stocks.

If the arrival of growth opportunities occurs independent of price history, then firms issuing equity will experience average performance before the issue. Firms with low share price will have above-average performance as they wait for the price to improve before they issue equity. Thus, on average, positive abnormal returns precede equity issues. The evidence confirms this prediction (Korajczyk, Lucas, and McDonald, 1990; Loughran and Ritter, 1995).

In summary, evidence generally supports the market timing theory. Evidence shows that managers wait before issuing equity until the stock market conditions get better. Also, stocks

tend to have high return before the issue of equity. Further, firms window-dress or improve their performance before issuing securities. Mixed evidence exists about whether investors overpay for shares. Also note that only few theoretical models exist on market timing. As a result, authors sometimes have different views about the interpretation of market timing. To be comparable with the trade-off theory or pecking-order theory, the market timing models should be able to explain a broader set of phenomena about capital structure.

2. THE BASIC MODEL, ITS IMPLICATIONS AND EMPIRICAL EVIDENCE

Recent literature has provided evidence that staged investment and staged financing are broad phenomena. First, IPOs (initial public offerings) are usually followed by subsequent public offering within 3 years after issue (Billett, Flannery and Garfienkel, 2007). Hence, one expects that corporations plan or should anticipate the second issue. Since the second issue can be a part of their normal long-term planning process (strategic planning or business planning) that usually covers a 5-10 years horizon.³

Second, a firm's IPO underwriter often serves as a banker for the firm in the period following an IPO (Chen, Chen and Ho, 2007). Again, this is a good indicator that links exist between subsequent major rounds of firm's financing. Theo, Welch and Wong (1998) found that 3/4 of IPO firms are actively involved in earnings management. They also argued that earnings management around IPO affects significantly the conditions for future rounds of financing. DuCharme, Malatesta and Sefcik (2004) report that average abnormal working capital accrual scaled by firm assets is 8.5% in the year of IPO. The authors argue that firms issuing equity are actively involved in earnings management. This fact as well their finding that shareholder lawsuits involving stock offers are positively related to abnormal accruals around the offer

³ See, for instance, David (2006).

suggests that insiders may have private information about firm's performance after issue.

We build a model with asymmetric information that allows for focusing on a firm's performance profile over time and its effect on capital structure. Consider a firm that consider equity financing for a two-period investment project with cost C_t in period t , $t = 1, 2$. In each period the project may be successful or unsuccessful. In the latter case the cash flow equals 1 and in the former case the cash flow equals 0. A firm's insiders have private information about the probability of success in each stage. The firms are of two types, type a and type b , with respective probabilities of success θ_{at} and θ_{bt} in stage t . The risk-free interest rate is zero. There exists universal risk-neutrality and perfect competition among investors, which implies zero market profit and risk-neutral valuation for any security issued. The net-present value of investment in stage t for type j is $\theta_{jt} - C_t$, $j = a, b$.

Suppose a issues equity for each stage of investments and distributes period 1 earnings as dividends. In stage 2, investors require a fraction of equity s_2 such that:

$$s_2\theta_{a2} = C_2 \quad (1)$$

In stage 1 investors require a fraction of equity s_1 such that:

$$s_1\theta_{a1} + s_1(1 - s_2)\theta_{a2} = C_1 \quad (2)$$

Now consider the payoff of shareholders of b in case b decides to mimic a . This equals $(1 - s_1)\theta_{b1} + (1 - s_1)(1 - s_2)\theta_{b2}$. If a signaling equilibrium exists, the shareholders' payoff for type b is $\theta_{b1} + \theta_{b2} - C_1 - C_2$ (the present value value of b). Thus, a separating equilibrium exists if $(1 - s_1)\theta_{b1} + (1 - s_1)(1 - s_2)\theta_{b2} < \theta_{b1} + \theta_{b2} - C_1 - C_2$. Using (1) and (2), this can be simplified to:

$$\frac{\theta_{a1} + \theta_{a2} - C_1 - C_2}{\theta_{b1} + \theta_{b2} - C_1 - C_2} < \frac{\theta_{a1} + \theta_{a2} - C_2}{\theta_{b1} + \theta_{b2} \left(1 - \frac{C_2}{\theta_{a2}}\right)} \quad (3)$$

Pecking order

Suppose $\theta_{a1} = \theta_{a2} = \theta_a$, $\theta_{b1} = \theta_{b2} = \theta_b$ and $\theta_a > \theta_b$. Then the Equation 3 becomes $(\theta_a - \theta_b)(2\theta_a - C_2) < 0$. Hence if projects have positive NPV (it implies $\theta_a > C_2$) a separating equilibrium does not exist.⁴ Investors will rationally realize that b has an incentive to mimic a and thus they will require higher fractions of equity than those offered by a . Alternative strategies for a do not lead to a separating equilibrium (for example, using internal funds for financing the second stage of investments). Therefore equilibrium is pooling where a is undervalued and b is overvalued. This confirms the pecking-order story. If internal funds would be available a would use them to avoid the mispricing. Equity is dominated by internal funds in this model. Low-quality firms will use equity as much as internal funds but high-quality firms will prefer internal funds. Similarly equity is dominated by debt. Suppose that the firm can finance the project with risk-free debt. Then a can issue debt to avoid any mispricing. If debt issued by the firm is risky, the situation does not change appreciably. One can show that debt suffers from misvaluation less than equity. The same holds if the firm has available assets-in-place. Hence a "pecking-order" emerges: internal funds, debt, and equity (Myers and Majluf, 1984).

More generally the separating equilibrium will never exist and POT holds if $\theta_{a1} > \theta_{b1}$ and $\theta_{a2} > \theta_{b2}$. Also POT holds if one considers one-stage investment with short-term (one stage) private information. This is the case with $\theta_{a2} = \theta_{b2} = C_2 = 0$.⁵

⁴ Cooney and Kalay (1993) demonstrate that POT can fail if projects have negative NPV.

⁵In Goswami, Noe and Rebbello (1995) a firm receives earnings for two periods and private information is long-term but investment is one-staged (it corresponds to the case $\theta_{a2}, \theta_{b2} > 0; C_2 = 0$ in our model). Equity is ruled out because it is dominated by long-term debt. Also one can consider the case where information about second-period performance is revealed to insiders at the beginning of the second period. In this case the value of any claim issued by the type with higher expected earnings in the first period is greater than the value of this claim issued by the type with lower expected earnings in the first period. There exists a pooling equilibrium and pooling with equity is usually not optimal because of large mispricing for high-quality firms. Given this insight, the existing literature analyzing dynamic models with asymmetric information where insiders have short-term (one period) private information usually focuses on the role of other mechanisms and market imperfections for capital structure. These are, for example, costly debt financing, opportunity of delaying investment decisions or the presence of financial

The Extent of Asymmetric Information and Capital Structure

If the extent of asymmetric information regarding firms' total values is sufficiently small and also if $\theta_{a1} > \theta_{b1}$ and $\theta_{a2} < \theta_{b2}$, then Equation 3 holds (see Appendix). In an extreme case, for example, when $\theta_{a1} + \theta_{a2} - C_1 - C_2 = \theta_{b1} + \theta_{b2} - C_1 - C_2$, Equation 3 becomes $\theta_{a2} < \theta_{b2}$. Intuitively, the value of shares in period 1 depends on the firm's total value and not on the firm's performance in a particular period, while the value of shares in period 2 depends on period 2's performance. The firm with low overall value can benefit from overvaluation in period 1 but can have a loss from period 2 undervaluation. When asymmetric information regarding a firm's overall value is relatively small and information regarding the timing of earnings is high, the latter effect can dominate. The separating equilibrium does not exist if the extent of asymmetric information regarding firms' total values is high or when it is small but in opposite to previous case $\theta_{a1} < \theta_{b1}$ and $\theta_{a2} > \theta_{b2}$. In that case the firm with low overall value will mimic the firm with high overall value because the latter has higher value of shares in both period 1 and 2.

Firm's performance after issue

A separating equilibrium where only high-value firms issue equity implies that firms issuing equity have better operating performance at the moment of issue or soon after the issue. These firms also have lower operating performance in the long run.

Existing literature suggests few explanations for the long-term underperformance of firms issuing equity. Among basic rational market intuitions, the following theories are notable. The theory of agency cost of equity (Jensen and Meckling, 1976) underlines the idea that equity issues decrease the manager's stake in the company and reduce the incentive to undertake value maximizing projects. This results in afterissuing underperformance of the firm, though the theory

intermediaries. Notable among the well-known contributions are Lucas and MacDonald (1990), Berkovitch and Narayanan's (1993), Viswanath (1993) and Hennessy et al (2010).

does not compare the performance in the short run with that in the long run after the issue. Also note that the link between afterissuing underperformance and a low managerial fraction of equity is empirically controversial. For instance, Pagano et al. (1995), Cai and Loughran (1998) and Mickelson et al. (1997) do not confirm the positive correlation between the fraction of insiders' equity and firm performance.

The trade-off theory in its standard form, proposing that firms equalize the marginal tax benefits associated with additional debt to the marginal cost of bankruptcy, suggests that more profitable firms should issue more debt. However, it will not predict the link between debt-equity choice and dynamic profile of performance after the issue (long-term performance versus short-term performance). For instance, it will predict that type (high expected performance in the first period) should issue more debt than in the first period in contrast to our results. According to the free cash flow theory (Jensen, 1986) debt is an instrument for solving the problem of a manager's entrenchment and thus more debt should lead to higher overall performance. However, this theory does not give an explanation for why firms should issue equity. This theory would also suggest that type (with high expected performance in the first period) should issue debt in order to prevent managers from overspending. Recently several dynamic versions of the trade-off model were developed which combine taxes, bankruptcy costs and different kinds of agency costs. Typically, these models lead to less extreme and more realistic predictions than the basic ideas do. However, we have not found a model which systematically analyzes the link between debt-equity choice and dynamic profile of operating performance after the issue. We will provide more discussion of dynamic trade-off models later when we discuss the correlation between debt and profitability.

To relate MT to the evidence about operating performances, one line of the literature focuses on non-rational aspects of investors' behavior. However, as was mentioned above, the evidence related to investors' irrationality is mixed. The literature based on rational investors is able to argue why firms may be interested in issuing equity in periods when market prices are high although it is not focused on explaining the link between debt-equity choice and changes in operating performance after issue (long-term versus short-term).

Market timing

Suppose that the probability of success in period 1 is $\theta_{j1} + m_1, j = a, b$. The publicly available parameter m_1 depends on the macroeconomic situation. Again consider a separating equilibrium where a issues equity. If b mimics a and issues equity its payoff is $(1 - s_1)(\theta_{b1} + m_1) + (1 - s_1)(1 - s_2)\theta_{b2}$, where s_1 and s_2 are determined by the following equations: $s_2\theta_{a2} = C_2$ and $s_1(\theta_{a1} + m_1) + s_1(1 - s_2)\theta_{a2} = C_1$. Let D_1 be the difference between the payoff of b from mimicking a and its first-best value: $(1 - s_1)(\theta_{b1} + m_1) + (1 - s_1)(1 - s_2)\theta_{b2} - (\theta_{b1} + m_1 + \theta_{b2} - C_1 - C_2)$. Then a separating equilibrium where a issues equity exists if D_1 is negative. As was mentioned above a necessary condition for separating equilibrium is $\theta_{a2} < \theta_{b2}$. The derivative of D_1 with respect to m_1 is $\frac{C_2(\theta_{a2} - \theta_{b2})}{\theta_{a2}} < 0$. Thus a separating equilibrium is more probable if m_1 is high.

The model predicts that when the economy is bad (m_1 is low), firms do not issue equity. When the economy is booming (m_1 is high), equity issues are large. Empirical work by Choe et al. (1993), Bayless and Chaplinsky (1996), and Baker and Wurgler (2002) suggests a positive relationship between equity issues and the business cycle.

Share Price and Equity Issue

Higher m_1 implies higher share price. Let n denote the initial number of shares outstanding and let Δn_t denote the number of shares issued by type a in period t in case a separating equilibrium exists. Let p be the share price in period 1. From (1) and (2) we have $s_1 = \frac{C_1}{\theta_{a1} + m_1 + \theta_{a2} - C_2}$. By definition it is also equal to $\frac{\Delta n_1}{n + \Delta n_1}$. Also $p\Delta n_1 = C_1$. Solving these equations we find

$$p = \frac{\theta_{a1} + m_1 + \theta_{a2} - C_1 - C_2}{n} \quad (4)$$

From previous section we know that issuing equity is more likely when m_1 is large. From (4) it follows that equity issues are more likely when the share price is high.

The other interpretation of this result regards stock returns before equity issue. If the arrival of growth opportunities is independent of price history, then firms issuing equity will have above-average performance as they wait for the price to improve before they issue equity. Thus, on average, positive abnormal returns precede equity issues.

Long-term macroeconomic performance and equity issues

Suppose that the probability of success in period 2 is $\theta_{j2} + m_2, j = a, b$. The publicly available parameter m_2 depends on the macroeconomic situation. Let D_2 be the difference between the payoff of b from mimicking a and its first-best value: $(1 - s_1)\theta_{b1} + (1 - s_1)(1 - s_2)(\theta_{b2} + m_2) - (\theta_{b1} + \theta_{b2} + m_2 - C_1 - C_2)$ where s_1 and s_2 are determined by the following equations: $s_2(\theta_{a2} + m_2) = C_2$ and $s_1\theta_{a1} + s_1(1 - s_2)(\theta_{a2} + m_2) = C_1$. A separating equilibrium where a issues equity exists if D_2 is negative. As was mentioned above a necessary condition for separating equilibrium is $\theta_{a1} + m_1 > \theta_{b1} + m_1$. The derivative of left side with respect to m_2 is $\frac{(\theta_{b2} - \theta_{a2})(\theta_{a2} - 2C_2)}{(\theta_{a2} + m_2)^2}$.

If a is doing very poorly in period 2 and $\theta_{a2} < 2C_2$ then this derivative is negative and a separating equilibrium is more probable if the economy is good in the long-term (high m_2). If $\theta_{a2} > 2C_2$ then the derivative is positive and thus equity issue is more probable if the economy is not expected to be good in period 2.

This analysis suggests that the decision to issue equity may not only be related to the current or short-term forecast of macroeconomic situation but also on its long-term forecast.

Let us now summarize the analysis in Section 2. The model provides some rationale for explaining the following facts:

(i) Firms issuing equity underperform in the long-run as compared to non-issuing firms (measured as a decline of profit, profit to assets ratio or profit per share). (ii) Equity issues are more likely when economic performance is good. Thus, equity issues are procyclical. (iii) Firms issues equity when share prices are high.

The second contribution is that it provides some new theoretical results that have hitherto not been tested.

(i) The model predicts that the performance of firms issuing equity exceeds the performance of the non-issuing firms at the time of issue (or in the near future after issue). The separating equilibrium where a issues equity is only possible when $\theta_{a1} > \theta_{b1}$. While this point was not the main focus of the empirical research cited above, some authors did stress the point that issuing firms outperform non-issuing firms just before issue, and others documented that issuing firms outperform non-issuing firms in the year of issue and in the first year after issue (Mikkelson, Partch and Shah (1997) and Jain and Kini (1994)).

(ii) This paper suggests a new motive for issuing equity that has not been explored in existing literature. When the firm knows that it will be high-profitable in the near future and low-

profitable in the long-term, the entrepreneur may want to issue equity. This paper shows that firms follow POT under asymmetric information only if the horizon of insiders private information is short-term or investment is one-stage. When investment is two-stage and information is long-term then two types of behavior may emerge, one consistent and one inconsistent with POT.

(iii) As was mentioned in Section 1, the issue of the link between the extent of asymmetric information and equity issues is controversial in existing literature. The model suggests that equity issues are more likely when the extent of asymmetric information regarding firms overall values is relatively small while that regarding earnings profile over time is large. Possible tests of this prediction will be based on identifying firms and industries with high degree of asymmetric information regarding the timing of earnings. One can use the spread in analysts' valuations of firms' shares as a proxy for the extent of asymmetric information regarding the firms' total values and the spread in the forecasts of future earnings (long-term spread versus short-term spread) as a proxy for asymmetric information about future rates of earnings growth. Also firms manipulating earnings prior to issue (as in Theo and all, 1998) can be seen as ones with high degree of asymmetric information about timing of earnings since earnings management can often be seen as a redistribution of earnings between periods rather than accounting fraud (Degeorge, Patel and Zeckhauser (1999), Miglo (2010)).

(iv) This paper suggests that the long-term post-issue underperformance for firms issuing equity, as well as negative correlation between debt and profitability (as we discussed below), should be more pronounced when the economy is growing.⁶

(v) Finally, the paper suggests that the decisions to issue equity depends not only on the

⁶The existing research about long-term afterissuing operating performance of firms issuing equity does not separately analyze different phases of business cycles.

current economic situation but also on the long-term economic forecast.

3. MODEL'S EXTENSIONS AND ROBUSTNESS

1. Debt issues. One can consider an extension where firms are allowed to issue debt. The main conclusions of basic model will not be affected. The same conditions will be required in order for a separating equilibrium to exist where a type with better short-term performance and respectively bad long-term performance issues equity. In this equilibrium the other type can issue short-term debt in the first period. Since it has worst performance in the first period, the interest rate on debt will be relatively high. The other type will not mimic this strategy.

Thus the model extension with debt predicts that leverage is negatively correlated with profitability. To see this let us look at the dynamics of capital structure (in market values) of both types of firms over two periods. Consider the basic model and a separating equilibria where b issues short-term debt and a issues equity. In period 1 (after the securities are issued until the earnings are received) the debt/equity ratio of type a is 0 and that of type b is $\frac{C_1}{\theta_{a1} + \theta_{a2} - C_1 - C_2}$ (the denominator shows the market value of firm's equity). It is clear that the debt/equity ratio of type b is higher than that of type a while the opposite is true for average earnings in the first period. This conclusion does not change if one measures debt/equity ratios at the end of first period (after the earnings are received but before second-period financing decision is made).

The trade-off theory in its standard form is inconsistent with the negative correlation between debt and profitability because highly-profitable firms should tend to finance with debt in order to reduce their taxes. Hennessy and Whited (2005) develop a dynamic trade-off theory with the idea that a profitable firm does not have to distribute its earnings immediately as the standard models assume. This may reduce the incentive to reduce taxes by issuing debt. The

financing decision depends on the next period financing margin or what the firm is going to do in the future: to issue more equity, to distribute more earnings or to remain neutral. While providing a valid intuition about why the static trade-off may not work, the authors do not obtain a theoretical proposition about the link between debt and profitability. However, they do show numerically that under some plausible values of parameters one can observe the negative correlation between debt and profitability in their model.

Zwiebel (1996) develops a dynamic model of capital structure based on the managers' entrenchment argument. The paper suggests that when a firm has more valuable investment opportunities the need to issue new debt as a disciplinary device decreases which leads to the situation where firms with lower debt are likely to be more profitable. While providing an idea about the negative correlation between debt and profitability the paper does not explain why firms issuing equity underperform in the long run. Also equity financing is not explicitly analyzed in the model.

2. *Mixed financing.* Allowing mixed financing provides little usefulness for the analysis of operating performance of firms issuing equity versus that of non-issuing firms. The reason is that most empirical literature on this topic does not differentiate issuers according to fractions of equity in capital structure. Even a marginally small issue of shares puts a firm into the category of issuing firms. Thus it will be hard to interpret the equilibrium in terms of existing empirical evidence. However, allowing for mixed financing is important with regard to the conclusions about the negative correlation between debt and profitability. With mixed financing, firms have a much greater degree of freedom than in the basic model and thus the set of possible equilibriums becomes much larger. More precisely each combination of initial parameters can support several separating equilibrium, in most cases a continuum of equilibria. One can show that in qualitative

aspects the results are very similar to those found in the basic model. First of all, the valuation of securities in this setting has a lot in common with pure financing scenarios. For instance, the share price depends only on the firm's total value and not on the rate of earnings growth. Secondly, we show that an increase of debt in the capital structure of firm type with greater rate of earnings growth reduces the potential earnings of the type with smaller rate of earnings growth if it mimics the former and conversely an increase of equity in the capital structure of the type with smaller rate of earnings growth reduces the potential payoff of the type with greater rate of earnings growth if it mimics the former. This in turn leads to the following result. For each set of exogenous parameters there exist two subsets of separating equilibria such that: 1) in any equilibrium in subset 1 the type with greater rate of earnings growth uses a higher fraction of debt financing than the type with smaller rate of earnings growth; 2) an equilibrium where the former type chooses strategy 1 and the latter chooses strategy 2 belongs to subset 2 if and only if a separating equilibrium where the type with greater rate of earnings growth chooses strategy 2 and the type with smaller rate of earnings growth chooses strategy 1 also belongs to subset 2.⁷

The subset 1 provides strong support for the results of the basic model about the negative correlation between debt and profitability. Firms issuing more equity have lower leverage during the first period and higher profitability in that period and vice versa in the second period. On the other hand, the subset 2 is irrelevant in predicting the link between debt and profitability since on average among all equilibriums in this set, type with greater rate of earnings growth has the same debt as type with smaller rate of earnings growth. Thus, it is similar to a pooling equilibrium situation which is not able to generate any predictions of this kind.

⁷ Similar approach was used in Goswami, Noe and Rebello (1995), proposition 3.

3. *Different profit distribution functions.* Now we briefly comment on the model's robustness with respect to possible generalizations of projects' profit distribution functions.⁸ For example, one can consider situation where different types' profits are ordered by first-order dominance. One can show that the basic results hold. The key here is that the share price of newly issued shares in period 1 depends on firm total values while the share price in period 2 relies mostly on the firm's performance in period 2. Thus firms with high second-period expected earnings will not issue equity because they will be mimicked by firms with low second-period earnings. However, the determination of exact conditions for the existence of different types of equilibrium, especially for the case of multiple type economy becomes very difficult technically. Nevertheless, numerical calculations for some classes of distribution functions confirm the results found in this paper.

4. SUMMARY AND CONCLUSIONS

This paper examines equity issues in a dynamic setting (two-stage investment process) under asymmetric information. The analysis is based on the idea that firms have private information about their profit profiles over time. When private information is short-term, equilibria is consistent with the pecking-order theory. Firms with high value never issue equity in equilibrium. When private information is long-term two cases may appear. When the extent of asymmetric information concerning the firms' overall values is high and that concerning the profit profiles over time is small, firms' behavior is consistent with POT. However, when the extent of asymmetric information concerning firms' total values is small enough and that concerning profit profiles over time is high enough, equilibria may exist where high-value type issues equity.

⁸ Recall that we use the Bernoulli function in the model.

This paper proposes new explanations for some important phenomena about capital structure such as long-term post-issue operating underperformance for firms issuing equity, positive correlation between business cycle and equity issues, and negative correlation between debt and profitability. To our knowledge, this is the first attempt to simultaneously explain all of these phenomena.

Also this paper provides some new theoretical results that have hitherto not been tested. This paper: suggests that firms issuing equity have superior performance at the time of issue; suggests new motivations for issuing debt and equity, that are based on private information about profit profile over time; argues that long-term post-issue underperformance for firms issuing equity, as well as negative correlation between debt and profitability, should be more pronounced when the economy is growing.

Appendix

Let v_j denote type j expected earnings over two periods ($v_j = \theta_{j1} + \theta_{j2}$); r_j denote the rate of earnings growth ($r_j = \theta_{j2}/\theta_{j1}$) and V denote the payoff of shareholders of type b in case b mimics a . The firm's performance can be described by a douplet (v_j, r_j) . The probabilities of success in each stage are then:

$$\theta_{j1} = \frac{v_j}{1+r_j} \text{ and } \theta_{j2} = \frac{v_j r_j}{1+r_j} \quad (5)$$

Lemma 1. $\partial V/\partial v_a > 0$ and $\partial V/\partial r_a > 0$.

Proof. Part 1. Using (1), (2), (5) and the following identity:

$$\frac{\partial V}{\partial v_a} = \frac{\partial V}{\partial s_1} \left(\frac{\partial s_1}{\partial \theta_{a1}} \frac{\partial \theta_{a1}}{\partial v_a} + \frac{\partial s_1}{\partial \theta_{a2}} \frac{\partial \theta_{a2}}{\partial v_a} \right) + \frac{\partial V}{\partial s_2} \frac{\partial s_2}{\partial \theta_{a2}} \frac{\partial \theta_{a2}}{\partial v_a}$$

we get: $\frac{\partial V}{\partial s_t} < 0, t = 1, 2$. $\frac{\partial s_1}{\partial \theta_{at}} < 0, t = 1, 2$. $\frac{\partial s_2}{\partial \theta_{a2}} < 0$. $\frac{\partial \theta_{at}}{\partial v_a} > 0, t = 1, 2$ and finally $\frac{\partial V}{\partial v_a} > 0$.

Part 2. Using (1), (2), (5) and the following identity:

$$\frac{\partial V}{\partial r_a} = \frac{\partial V}{\partial s_1} \left(\frac{\partial s_1}{\partial \theta_{a1}} \frac{\partial \theta_{a1}}{\partial r_a} + \frac{\partial s_1}{\partial \theta_{a2}} \frac{\partial \theta_{a2}}{\partial r_a} \right) + \frac{\partial V}{\partial s_2} \frac{\partial s_2}{\partial \theta_{a2}} \frac{\partial \theta_{a2}}{\partial r_a}$$

we get: $\frac{\partial V}{\partial r_a} = \frac{(1-s_1)\theta_{b2}C_2v_a}{(\theta_{a2})^2(1+r_a)^2} > 0$. End proof.

Lemma 2. 1) Either $V > \theta_{b1} + \theta_{b2} - C_1 - C_2$ for any r_a (other parameters being equal) or there exists r_a^* such that $V \leq \theta_{b1} + \theta_{b2} - C_1 - C_2$ if and only if $r_a \leq r_a^*$; 2) Other parameters being equal, there exists v_a^* such that $V \geq \theta_{b1} + \theta_{b2} - C_1 - C_2$ if and only if $v_a \geq v_a^*$.

Proof. From Lemma 1, $\partial V / \partial r_a > 0$. In extreme case when r_a is such that $\theta_{a2} = \theta_{b2}$, b mimics a . Thus either b mimics a for all values of r_a , or there exists r_a^* such that $V \leq \theta_{b1} + \theta_{b2} - C_1 - C_2$ if and only if $r_a \leq r_a^*$. Part 2. From Lemma 1, $\partial V / \partial v_a > 0$. In an extreme case, when $v_a = v_b$, b does not mimic a . On another extreme when $\theta_{a2} = \theta_{b2}$, b mimics a . Thus there exists v_a^* such that $V \geq \theta_{b1} + \theta_{b2} - C_1 - C_2$ if and only if $v_a \geq v_a^*$. End proof.

Lemmas 1 and 2 lead in turn to the following result.

Proposition 1. A separating equilibrium where a issues equity exists if and only if the difference between firms values are sufficiently small, and the difference between the rates of earnings growth is sufficiently high.

Proof. By Lemma 4, for given values of v_b and r_b , a separating equilibrium where a issues equity exists if and only if the following holds: 1) r_a^* exists (Lemma 2) and $r_a \leq r_a^*$; 2) v_a^* exists (Lemma 2) and $v_a < v_a^*$. Thus, for given values of v_b and r_b , a separating equilibrium where a issues equity exists if and only if v_a is sufficiently small and r_a is sufficiently small. End proof.

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