Journal of Finance & Banking Studies 7(3), 2018: 01-19

IJFBS
Finance & Banking Studies

Finance & Banking Studies

IJFBS, VOL 7 NO 3 ISSN: 2147-4486
Contents available at *www.ssbfnet.com/ojs*

https://doi.org/10.20525/ijfbs.v7i3.114

Asymmetric Information in the Market for IPOs

Heather Rhodes

Corresponding Author: Department of Economics & Finance, University of North Alabama, Florence, AL, USA. (256) 765-4854

ORCID ID: https://orcid.org/0000-0002-8401-1991

Abstract

This study utilizes hand-collected ownership data to re-examine the signaling, agency and wealth effect theories in a matched-sample of initial public offerings (IPOs) issued in the U.S. prior to and following the passage of the Sarbanes-Oxley Act of 2002 (SOX). SOX provides some motivation for revisiting these topics because evidence exists that it may have affected the types of firms going public and ultimately the relatively importance of adverse selection and moral hazard, the asymmetric information problems with which these theories are concerned. Results on both the pre- and post-SOX samples are consistent with the signaling theory and evidence of a wealth effect exists in both eras. However, in contrast to results of studies conducted prior to SOX, both the pre- and post-SOX results give little credence to the agency theory, suggesting that SOX has not impacted investors' concerns regarding moral hazard. Rather, the difference between the pre-SOX results and the results of previous studies suggests that SOX appeared to reduce moral hazard concerns only through its effect on the self-selection of firms going public. That is, SOX appears to have affected the types of firms going public and prohibited firms with greater moral hazard problems from accessing public equity markets.

Keywords: *Initial Public Offerings, Asymmetric Information, Firm Valuation, Ownership Structure, Government Regulation*

JEL classification*: G32, G34, G38*

Introduction

Informational asymmetries in financial markets have been well-documented. Moral hazard and adverse selection, the problems generated by these asymmetries, are prevalent in the market for initial public offerings (IPOs). Informational asymmetries exist because owners of a firm have better information about the quality of projects, and therefore the profit potential, available to the firm than do outside investors. Additionally, a principal-agent problem exists because managers' interests are not necessarily aligned with those of shareholders. Thus, adverse selection is characterized by the inability of outside investors to distinguish between high-quality firms and low-quality firms (which have the financial incentives to represent themselves as high quality). Moral hazard persists because, when actions are unobservable, managers do not always choose the actions that maximize shareholder value. How do the agents in the market for IPOs

overcome these informational asymmetries so that the market can function as intended? They must be able to credibly convey and discover information.

Theory exists that suggests how the entrepreneurs of high-quality firms can credibly convey their value while preventing low quality firms from mimicking. Leland and Pyle (1977) developed a signaling model such that the greater the willingness of the entrepreneur to invest in his own project by holding a larger proportion of the firm and, therefore, under-diversifying his portfolio, the higher the expected value of the firm. Entrepreneurs of low-quality firms are deterred from mimicking because it is more costly for them to under-diversify than it is for entrepreneurs of high-quality firms. This is because under-diversification introduces additional risk and since the entrepreneur is also an investor, he is only willing to take on additional risk if there is a corresponding higher return. Consequently, equity retention is an increasing function of the entrepreneur's expectation of future returns. As a result, so long as it is more costly for the entrepreneur of the low-quality firm to mimic than it is to receive his fair price, signaling will be successful at creating a separating equilibrium where investors can infer intrinsic firm value and reward accordingly through market value. The signaling hypothesis predicts that equity retention and firm market value will be positively correlated.

Adverse selection is not the only problem with which investors of IPOs must be concerned. Under Jensen and Meckling's (1976) model of the agency relationship, when there is a separation of ownership and control, managers often have the incentive to take actions that are not in the best interest of shareholders. For example, because of asymmetric information, shareholders cannot directly observe the manager's effort level. They can only observe a random end-of-period cash flow that is a function of his effort. Because effort is costly to the manager, if there is no reward for effort, he will wish to put forth the minimum amount possible. However, because the firm's end-of-period cash flow is also a function of some random variation outside of the manager's control, he can simply blame a low draw on this variation. In order to combat this moral hazard problem, shareholders can devise compensation packages that more closely align manager and shareholder interests. Specifically, the greater the portion of the firm the manager owns, the more he benefits from his additional effort. Rational outside investors will recognize this and reward the firm with a higher market value. Therefore, the agency theory suggests that management ownership and firm market value will be positively related.

Simply analyzing the relationship between equity retention and market value to test the signaling hypothesis and the relationship between management ownership and market value to test the agency theory is problematic. Ritter (1984) notes that the greater the pre-IPO owners' equity retention, the greater management retention is likely to be since pre-offer owners often stay involved as managers after going public. Therefore, studies finding support for the signaling hypothesis may reflect an agency relationship instead. Alternatively, greater levels of management ownership may not only align manager and shareholder interests, but also convey a signal to investors about the quality of the firm. Rationally, investors may interpret management ownership as the best signal of firm quality since managers should know relatively more about the quality of investments available to the firm and their ability to manage those investments than other pre-offering shareholders. Hence, observing a positive relationship between management ownership and market value may indicate support for the signaling hypothesis rather than the agency theory.

Additionally, Ritter (1984) points out that a positive relationship between equity retention and market value can be an artifact of what he coins the wealth effect. The wealth effect refers to the fact that in order to raise a given amount of capital, the lower the market value of the firm, the larger the fraction of the post-offering value the offering must represent. Then if a wealth effect exists, along with the signaling hypothesis, it too will predict a positive relationship between ownership retention and firm value. Consequently, finding evidence to support the signaling theory may instead be evidence of a wealth effect.

The evolution of the literature in these areas coupled with increased data availability has made it easier to separately test each of these theories and, to my knowledge, no study has examined the signaling, agency and wealth hypotheses in the IPO context using data following the passage of the Sarbanes-Oxley Act of 2002. Morgenstern and Nealis (2004) point out that disclosure requirements resulting from SOX have significantly increased the costs of being a publicly listed company and disproportionately so for smaller firms

because compliance is largely the same for all firms, regardless of size, and involves significant fixed costs. Moreover, they note that since the passage of SOX, numerous acquired small- and mid-cap public firms have specified in their Merger Proxy statements that among the factors determining the ultimate sale of the company were increased disclosure and compliance costs. Block (2004) and Engel, Hayes, and Wang (2007) document that the higher costs imposed by SOX have led a number of small public firms to go private.[1] Rhodes and Ligon (2018) document that the number of yearly new issuances dropped off significantly following the burst of the dot-com bubble and that the yearly number of new issuances since 2001 has remained well below the pre-bubble period levels, suggesting that factors such as SOX are deterring new issuances, particularly among small issuers. Thus, it appears that SOX has a significant impact on small issuers, where asymmetric information problems tend to be more acute. As Morgenstern and Nealis (2004) suggest, since the implementation of SOX, firms must weigh the benefits of going public against the considerable operational and financial burdens imposed on public firms by the regulation. The implication is that SOX may have influences on the types of firms deciding to go public, which in turn, may influence the relative importance of the signaling, agency and wealth hypotheses. Rhodes and Ligon (2018) document significant differences in the characteristics of pre-SOX and post-SOX IPOs, where post-SOX issuers are significantly larger, older, more highly levered and raise more proceeds in the offering. Thus, it appears that SOX has, in fact, affected the types of firms choosing to go public.

Additionally, SOX spurred significant changes to the listing requirements of the NYSE, NASDAQ and Amex, which clearly affect firms looking to go public. Because SOX was passed in response to major management and accounting scandals, many of the reforms it imposed were aimed at improving corporate governance and transparency. Following SOX, the NYSE, NASDAQ and Amex required any firm listed on their exchange to have a board composed of a majority of independent directors. Numerous requirements to qualify as an independent director were outlined to ensure that independent boards were run by directors who had no conflicts of interest that might otherwise make them subject to and easily influenced by managers. In other words, establishing independent directors was important because they should be better suited for monitoring managerial actions that might not be in the best interest of shareholders. This clearly affects the moral hazard problem with which the agency theory is concerned. Establishing independent boards improves the probability that directors are properly serving their role as monitors of management on the behalf of shareholders. This is not to say that the moral hazard problem is eliminated, but post-SOX, managers should face more difficulty in successfully taking actions that benefit themselves at the expense of shareholders. Shareholders will likely recognize this and incorporate it into the importance they place on moral hazard concerns relative to adverse selection problems when valuing IPOs. Thus, SOX has provided some motivation for reexamining the signaling, agency, and wealth hypotheses in the context of IPOs.

The following section reviews the related literature, the third section presents the data and models, the fourth presents the empirical results and the last section concludes.

Literature Review

Downes and Heinkel (1982) were among the first to empirically test the Leland and Pyle (1977) signaling hypothesis. They utilize data on 297 initial public offerings in the U.S. between 1965 and 1969 to test whether firm value is positively correlated to ownership retention. They report strong support for the Leland and Pyle hypothesis as the price/earnings ratio is significantly and positively related to entrepreneurial ownership retention. However, Ritter (1984) points out that their results may have indicated support for either a wealth effect or an agency hypothesis.

Ritter advises that if a wealth effect is present, then an OLS regression of firm value on ownership retention will suffer from simultaneous equation bias because the independent variable, ownership retention, is affected by the dependent variable, firm value. Similarly, if an agency relationship exists, then any OLS

[1] In a related work, Bushee and Leuz (2005) examine a regulatory change mandating that firms traded on the OTC bulletin board comply with the reporting requirements under the 1934 Securities Exchange Act, which significantly increased required disclosures for firms not previously filing with the SEC. Similarly, they find that disclosure requirements resulted in significant costs for smaller firms, forcing three-quarters of affected firms off the OTCBB.

regression with ownership retention as the dependent variable and firm value as an independent variable will also suffer from simultaneous equation bias. This is because, in contrast to the signaling theory, where true firm value is exogenous, under the agency theory true firm value is a function of ownership retention; as managers retain less of the firm, they engage in more shirking which, in turn, lowers firm value. Additionally, in an OLS or WLS regression with market value as the dependent variable, the coefficient on ownership retention should be positive. Ritter uses a combination of OLS, WLS and 2SLS to test whether the positive relationship between firm value and ownership retention is caused by signaling, an agency relationship or a wealth effect. He finds support for the agency hypothesis but not for the wealth effect or signaling hypotheses. Krinsky and Rotenberg (1989) employ a Canadian dataset consisting of 115 IPOs from 1971 to 1983 to retest Ritter's hypotheses and find no statistical significance between entrepreneurial ownership retention and firm value under any of his proposed models. Firth (1992) also finds no relationship between firm value and ownership retention using New Zealand data.

Boehmer (1994) uses data on 1128 IPOs issued in the U.S. between 1980 and 1984 to test the signaling and wealth effect hypotheses. He finds a significant N-shaped relationship between firm value of equity and management ownership for the entire sample. A positive relationship exists for retention rates less than 33% and greater than 58% and a negative relationship exists for retention rates between 33% and 58%, consistent with the entrenchment effect hypothesis put forth by Morck, Shleifer and Vishny (1988) that supports the agency theory. (See the third and fourth sections for thorough discussion of Morck et al.'s (1988) entrenchment effect theory and the implications for moral hazard.) Next, Boehmer (1994) develops two tests of the Leland and Pyle hypothesis. First, he finds that the reward to signaling is a function of firm size where large firms receive a relatively greater increase in firm value than small firms for the same increase in retention. Second, he distinguishes between the impact of the wealth effect and the signaling hypothesis by taking a subsample where firm value and the amount of capital raised are almost proportional. According to Ritter's (1984) hypothesis, the wealth effect should dissipate if all firms raise proportional amounts of capital. Thus, by sampling firms in this manner, Boehmer reduces the potential impact of the wealth effect and can test for its presence. If significantly different results are obtained for the subsample and the original sample, then the wealth effect is instrumental in determining the relationship between firm value and ownership retention. He finds evidence that the wealth effect contributes at least 50% to 75% of the correlation between firm value and ownership retention in his large sample.

Keloharju and Kulp (1996) test these three hypotheses differently than their predecessors. (For the sake of saving space, I will abbreviate Keloharju and Kulp as KK from here on.) Rather than using the indirect simultaneous equation method employed by Ritter (1984), Krinsky and Rotenberg (1989) and Firth (1992), KK utilize Finnish IPOs to directly test the agency hypothesis by simply examining the relationship between market value and management ownership. They claim that they are better able to separate the agency hypothesis from the signaling and wealth effect hypotheses because they can observe equity retention and management ownership variables separately.

Just as KK (1996) observe the managerial ownership and equity retention variables separately, I hand-collect the ownership data used in this study from prospectuses available on the Security Exchange Commission's website so that managerial ownership can be separated from that of other pre-offer owners. The SEC requires that each issuer report the holdings of all blockholders (beneficial owners of at least 5% of the outstanding shares of common stock), each named executive officer, each director, and "all executive officers and directors as a group." Additionally, issuers must assign beneficial ownership to an individual when that individual has voting or investment power over the shares. In practice, this means that often the holdings of a venture capitalist firm are assigned to their representative who sits on the board and, hence, these holdings are reflected in the total for all executive officers and directors as a group. While Thomson Financial's SDC Platinum reports retention for all executive officers and directors as a group, it does not provide details on what portion of that percentage is held by managers and inside directors, venture capitalists who sit on the board, other institutions or corporations who hold a board seat, or outside (non-employee) directors.

Aggarwal, Bhagat, and Rangan (2009) also separate the ownership of managers from that of venture capitalists and other blockholders when examining the relationship between IPO valuation and ownership. The authors report a positive and significant relationship between IPO valuation and the holdings of each

group of owners they examine. However, Aggarwal et al.'s (2009) sample ends in 2001, just prior to the passage of SOX.

Research and Methodology

Data

The initial dataset consists of two samples of IPOs, one prior to and another following the passage of the Sarbanes Oxley Act of 2002 (SOX), identified using the Thomson Reuters' Securities Data Company database (SDC).[2] The pre-SOX sample is drawn from all issues between 1996 and 2001. I select 1996 as the lower bound on the pre-SOX date range because data necessary to this study must be collected from IPO prospectuses, which became available on the SEC's EDGAR online database beginning with IPOs issued in 1996.[3] The post-SOX sample covers all IPOs issued between 2005 and 2009. The post-SOX sample begins in 2005 because, though SOX was passed in 2002, most of the final compliance deadlines for the major regulations resulting from SOX were in October 2004. Only firm commitment offerings are included because the relative measure of value, the market-to-book ratio, requires the secondary market closing price for the first trading day. As is standard in the IPO literature, I exclude regulated utilities and financial firms (SIC codes 4900-4999 and 6000-6999), unit offerings, American Depository Receipts, limited partnerships, IPOs with offer prices less than $5, and best efforts offerings. Applying these filters yields a post-SOX sample of 380 IPOs and a pre-SOX sample of 1588 IPOs.

From SDC I also collect information on offering characteristics, including the offering date, offer price, number of primary, secondary and total shares offered, proceeds, listing exchange, and the identity of the lead underwriter.[4] I obtain the first closing market price, number of shares outstanding after the offering and market return data from the Center for Research in Security Prices (CRSP) database. Firm founding dates, used to compute firm ages, are obtained from Jay Ritter's website along with information on underwriter rankings.[5]

This study requires a significant amount of hand-collected information from prospectuses made available on the SEC's EDGAR online database. First, because shares outstanding prior to the offering are often incorrect in SDC, this data is hand-collected from each prospectus. I also collect information on pre-offering balance sheet and income statement data because it is either unavailable or unreliable in SDC. To this information I add detailed data on ownership structure immediately after the offering.

Rhodes and Ligon (2018) demonstrate that SOX has affected both the number of firms that go public (fewer firms do so today) and the type of firms that do (firms that go public today are larger, have larger offerings, are more levered, and are older). The markets in which firms go public have also changed with initial returns lower and market returns prior to offerings also lower. Thus, it will be necessary to control for these differences in order to accurately compare the results of pre- and post-SOX tests on the signaling and agency hypothesis in order to ascertain that any differences in results are not due to selection bias issues that likely arose post-SOX.

In order to accurately compare the pre- and post-SOX results requires identifying and examining a pre-SOX sample comparable to the post-SOX sample. As previously mentioned, some firms likely self-selected out of the public markets following the passage of SOX because the costs of going public outweighed the benefits. As a result, in order to properly compare pre- and post-SOX IPOs, it is important to control for selection bias.

The matched-sample of pre- and post-SOX IPOs used in this study is derived from the matched-sample created by Rhodes and Ligon (2018), who use a propensity score-matching method to create a pre-SOX sample comparable to the post-SOX sample.[6] The propensity score matching procedure begins with

[2] The initial dataset and sample selection method is the same as that utilized by Rhodes and Ligon (2018).

[3] (www.sec.gov/edgar)

[4] Given some of the accuracy issues of SDC data, particularly for earlier time periods, I cross-checked the variables obtained from SDC against prospectuses filed with the SEC available on the SEC's EDGAR website. Corrections were made where necessary.

[5] http://bear.warrington.ufl.edu/ritter/ipodata

[6] See Ligon and Rhodes (2018) for a more detailed discussion on the merits of using propensity score matching and its use in the corporate finance literature.

estimating the propensity score of each of the 380 post-SOX and 1588 pre-SOX issues from a logistic regression predicting the probability that the IPO would have been issued post-SOX. In this regression, the dependent variable equals one if the IPO was issued following the passage of SOX and zero if it was issued before SOX. Since Rhodes and Ligon find significant differences in the following variables pre- and post-SOX, they control for size, offering proceeds, leverage, age and market sentiment. The independent variables in the regression are then inflation-adjusted market capitalization at the time of the offering, inflation-adjusted proceeds, the debt-to-equity and debt-to-assets ratios at the first reporting date following the offering, firm age at the time of the offering, the issue's initial return and the cumulative value-weighted market return for the 30 trading days prior to the offering. Then, because they sample from the pre-SOX control sample without replacement and since the resulting sample could be sensitive to the order in which sampling is conducted, they randomize both the pre-SOX and post-SOX samples (as suggested by Dehejia and Wahba, 2002). Finally, using the propensity scores from the first step, they match each post-SOX IPO to its nearest neighbor from the pre-SOX sample. Their final sample is comprised of 380 post-SOX and 380 pre-SOX IPOs.[7]

As a final step, I drop each observation with a negative book value of equity following the offering, since a negative book value would result in an inaccurate market-to-book ratio. I also drop the firms matched to those firms with negative book values. My final sample is composed of 349 unique pre-SOX IPOs and 349 unique post-SOX IPOs.

Key Variables

RETEN: The equity retention signal is defined as the fraction of shares retained by all pre-offering owners following the IPO; that is, the overall level of retention includes the holdings of managers, venture capitalists, other institutional investors, blockholders and all other pre-offering owners. It is calculated by first dividing the total number of shares offered (both primary and secondary shares) by the total number of shares outstanding after the offering, which gives the fraction of shares offered, then subtracting that fraction from 1. As Ljungqvist and Wilhelm (2003) note, there are significant errors in the post-offering number of shares outstanding reported by SDC; so, this variable is hand-collected. To distinguish between evidence of the signaling and agency hypotheses, the overall level of retention (RETEN) is separated into managerial retention (MGTOWN), venture capitalist blockholdings (VCOWN), non-venture capitalist institutional/corporate blockholdings (INSTOWN), all other outside blockholdings (OTHERBLOCK), and all other non-manager non-blockholdings (OTHEROWN). One may then first regress the market-to-book ratio on the overall level of retention, and then replace RETEN with the individual components to determine how much of the relationship between equity retention and the market-to-book value is driven by managerial retention and the other components.

MGTOWN: The percentage of management ownership following the offering is collected from each issuer's prospectus to test the agency hypothesis. Management ownership is defined as the percentage of equity retained by executive officers and employee-directors as a group. Note that this number does not include holdings by outside directors (such as venture capitalists with board seats).

VCOWN: The percentage of total venture capitalist (VC) and private equity fund blockholdings following the offering are likewise collected from each issuer's prospectus (Ljungqvist and Wilhelm (2003) consider any issuer backed by either a VC or private equity firm to be VC-backed). Venture capitalists and private equity funds are identified by comparing the names of pre-IPO shareholders reported in the prospectus with the venture capitalists and private equity firms named in the annual volumes of Pratt's Guide to Private Equity & Venture Capital Sources.

INSTOWN: This variable reflects the total blockholdings of non-venture capitalist institutions and corporations. Though their presence is not as prevalent as that of venture capitalists, occasionally both private and publicly traded firms will be among the pre-offering owners of an issuer and their holdings are

[7] Ligon and Rhodes (2018) go on to show that the propensity matching score procedure yields pre- and post-SOX samples that are virtually identical in terms of size, leverage, age, proceeds and market sentiment. Thus, the analysis should be untainted by selection bias due to observable characteristics and problems introduced by differing market conditions.

included in this variable. This variable does not include holdings of firms owned solely by managers of the issuer. Notes to the ownership section of the prospectus indicate whether a blockholding entity is owned by a manager of the issuer and the holdings of firms owned by managers are included in the shares beneficially owned by that manager.

OTHERBLOCK: Individuals who are neither managers nor associated with a venture capitalist or any other institution are also occasionally among the pre-offering blockholders and their holdings are reflected in the OTHERBLOCK variable.

OTHEROWN: Finally, OTHEROWN reflects the retention of individuals and institutions that are not named in the prospectus (those who are neither managers nor blockholders). This variable is calculated by subtracting MGTOWN, VCOWN, INSTITOWN and OTHERBLOCK from the overall level of retention, RETEN. This variable likely reflects the holdings of a mixture of non-blockholders of each of the previous groups, but it is included so that when RETEN is replaced by each individual component in the regressions, the entire level of retention is reflected in the model.

BE_A: Book value of equity after the offering is calculated by adding the pre-offer book value to the primary offering proceeds. The pre-offer book value of equity is collected from the most recent pre-IPO financial statement available in the prospectus. Prospectuses are publicly available through the SEC's EDGAR online database (www.sec.gov/edgar).

ME: The market value of equity is calculated by multiplying the total number of shares outstanding after the offering by the first trading day's closing price. For robustness, it is also calculated using the offer price and closing prices up to six weeks out.

(ME/ BE_A): The market-to-book ratio is then simply the market value of equity divided by the post-IPO book value of equity.

Models

To test for the existence of the wealth effect, KK (1996) test whether the offering size is proportional to the pre-IPO book value of equity (BEB) using the following model:

$$OFFER_i = \alpha_0 + \alpha_1 BE_{B,i} + \alpha_2 BE_{B,i}^2 + \alpha_3 BE_{B,i}^3 + \epsilon_i \qquad (1)$$

where $OFFER_i$ is the total dollar amount of the offering size and $BE_{B,i}$ is the issuer's book value of equity prior to the offering. If a wealth effect is not present, then the coefficients on the squared and cubed terms as well as the intercept should be zero. While it would be more efficient to test the wealth effect directly based on its assumption that issuers with relatively lower market values generally must retain less equity, KK realize that testing whether offer size is proportional to market capitalization will not differentiate the wealth effect from the other hypotheses. This is because the signaling and agency hypotheses predict a negative relationship between offer size and market value. Thus, non-proportionality between offer size and market capitalization could result from any of the hypotheses. Instead of market capitalization they use pre-IPO book value of equity because it is not directly affected by equity retention and, as a result, should be a pure test of the wealth effect. I make use of their test of the wealth effect.

In addition to KK's test of the wealth effect, I also employ a method utilized by Boehmer (1994) whereby a subsample of firms where firm value and offer size are almost proportional is selected. The wealth effect only exists when firm value and capital requirements are non-proportional so that its influence should be greatly reduced in the subsample. Therefore, if the wealth effect is driving the relationship between equity retention and market value, the results for the original sample and subsample should be significantly different.

Tests of the signaling and agency hypotheses revolve around the relationship between the market-to-book ratio and equity retention and management ownership, respectively. Because other factors likely affect the market-to-book ratio, several control variables are included in the regression so that the initial model is:

$$(ME/BE_A)_i = b_0 + b_1 MGTOWN_i + b_2 RETEN_i + b_3 \ln(OFFER)_i + b_4 AGE_i + b_5 SECRATIO_i + b_6 NASDAQ_i + b_7 HIGHTECH_i + +b_8 HEALTH_i + b_9 CONSUMER_i + b_{10} MANUFACT_i + b_{11} VENTURE_i + b_{12} RANK_i + b_{13} R\&D_i + b_{14} ADV_i + \varepsilon_i \qquad (2)$$

where MGTOWN, RETEN and OFFER are as previously defined and the control variables are AGE (firm age), SECRATIO (the ratio of secondary offering proceeds to total IPO proceeds), NASDAQ (a dummy variable that equals one if the issuer is listed on the NASDAQ), VENTURE (a dummy variable equal to one if the offering is backed by a venture capitalist), RANK (underwriter ranking obtained from Jay Ritter's website), HIGHTECH, HEALTH, CONSUMER, MANUFACT (dummy variables based on the Fama French industry classification codes which were obtained from Kenneth French's website; OTHER is the omitted dummy), R&D (research and development costs in the year prior to the offering scaled by total assets prior to the offering) and ADV (advertising expenditures in the year prior to the offering scaled by total assets prior to the offering). The first three control variables are analogous to most of those used by KK and are incorporated because they have been found to affect firm values. The others are included because prior literature has indicated that it is necessary to control for industry effects that can affect the relationship between market value and ownership (Morck, Schleifer and Vishny, 1988) and venture capitalist backing (Barry, Muscarella, Peavy, and Vetsuypens, 1990; Megginson and Weiss, 1991; and Aggarwal et al. 2009) and underwriter ranking (Booth and Smith, 1986; Hughes, 1986; and Carter and Manaster, 1990; Ljungqvist and Wilhelm, 2003; Loughran and Ritter, 2004) can serve as signals of firm quality. It is also desirable to differentiate between firms listed on the NYSE and those on the NASDAQ. R&D is incorporated as a proxy for growth opportunities (Smith and Watts, 1992; Gaver and Gaver, 1993; Baber, Janakiraman and Kang, 1996) and because it is likewise a measure of intangible assets that affect relative market valuations (Morck, Shleifer and Vishny, 1988; Lang and Stulz, 1994). Morck, Shleifer and Vishny (1988) also incorporate advertising expenditures as an observable measure of intangible assets.

Obviously, the model in equation (2) will not differentiate between evidence of the signaling hypotheses and that of the agency hypothesis because the retention reflected in MGTOWN is also included in the overall level of retention, RETEN. This is the concern is established by KK (1996), but results from this model are reported to establish whether a positive relationship exists between the overall level of retention and market valuation; the relative effects of the individual components of RETEN are captured in the following model:

$$(ME/BE_A)_i = b_0 + b_1 MGTOWN_i + b_2 VCOWN_i + b_3 INSTOWN_i + b_4 OTHERBLOCK_i + b_5 OTHEROWN_i + b_6 \ln(OFFER)_i + b_7 AGE_i + b_8 SECRATIO_i + b_9 NASDAQ_i + b_{10} HIGHTECH_i + +b_{11} HEALTH_i + b_{12} CONSUMER_i + b_{13} MANUFACT_i + b_{14} RANK_i + b_{15} R\&D_i + b_{16} ADV_i + \varepsilon_i \quad (3)$$

In equation (3), RETEN is replaced with VCOWN, INSTOWN, OTHERBLOCK and OTHEROWN so that it is possible to observe the effect of retention of each group of owners separately. Additionally, the VENTURE dummy variable is dropped since the actual level of VC ownership is now incorporated. Note that a positive coefficient on management ownership may support either the agency or the signaling hypothesis, since management ownership not only aligns shareholder and manager interests but may also convey a signal to investors about firm quality. To differentiate between evidence of the signaling and agency hypotheses, management retention is squared and added to equation (3) to test for a non-monotonic (non-linear, concave) relationship between management ownership and market value.

If a strictly monotonic relationship between management ownership and market value exists, this will lend support to the signaling hypothesis; however, a non-monotonic relationship (where the relationship is positive over some range of management ownership but becomes negative over another range) will indicate that the market recognizes agency problems and passes these costs back to the firm in the form of lower market valuations. The intuition behind this interpretation is as follows. The agency theory predicts that increasing management ownership aligns manager interests with those of shareholders, and therefore, reduces moral hazard. However, as management ownership increases, an entrenchment effect arises because management voting power produces job security (Morck, Shleifer and Vishny, 1988), which, in turn, increases moral hazard, as it becomes more difficult to exert control over managers who still have incentive to take actions that benefit themselves at the expense of shareholders (because, although they too are shareholders, they don't bear all of the costs of their actions, but reap all the benefits). This implies that for management ownership levels just high enough to produce job security, the entrenchment effect may overpower the interest-aligning effects of increasing ownership and produce a negative relationship between market value

and management ownership, as the market passes these agency costs back to the firm. Once management ownership levels pass a point beyond which job security is unaffected by additional ownership, the interest-aligning effects of the agency theory once again dominate and the positive relationship between management ownership and firm value should resume. Thus, a non-monotonic relationship between market value and management retention may not support the agency theory in its purest form, but it does support the idea that investors recognize principal-agent problems and pass these costs back to the firm. Alternatively, a strictly positive (linear or non-linear, convex) relationship between management ownership and market value would indicate that investors fail to price changes in moral hazard (with which the agency theory is ultimately concerned), but rather focus on the adverse selection problem by granting higher valuations to firms which send signals (e.g. retention) that indicate that they are of higher quality.

Because all regressions are cross-sectional, I correct the standard errors for heteroskedasticity using White's (1980) heteroskedasticity-consistent covariance estimator. Also, all variables are winsorized at the 1st and 99th percentiles to reduce the effect of any outliers.

Empirical Analysis

Descriptive Statistics

Table 1 presents some descriptive statistics of the 349 pre-SOX and 349 post-SOX IPOs similar to those given by KK (1996). From the pre-SOX sample, 234 are primary offerings, 108 are mixtures of primary and secondary offerings, and 7 are secondary offerings only. Of the post-SOX offerings, 189 are pure primary offerings, 151 of are mixtures and 9 are secondary offerings.

Table 1: Descriptive Statistics[a]

A. Descriptive Statistics

Variable	Mean	Standard Dev	Skewness	Kurtosis	Minimum	Maximum
PRE-SOX						
RETEN	0.71	0.14	-1.72	5.54	0.00	0.94
MGTOWN	0.21	0.22	1.04	-0.03	0.00	0.86
VCOWN	0.17	0.21	0.96	-0.29	0.00	0.83
INSTOWN	0.16	0.25	1.72	1.80	0.00	0.92
OTHERBLOCK	0.06	0.12	2.90	10.16	0.00	0.82
OTHEROWN	0.12	0.13	1.60	3.44	0.00	0.73
ME	686.94	3,271.32	13.61	211.43	8.68	54,218.75
ME/BE	5.56	15.32	11.63	150.56	0.36	228.23
POST-SOX						
RETEN	0.70	0.12	-1.68	5.88	0.01	0.92
MGTOWN	0.10	0.14	2.29	5.38	0.00	0.73
VCOWN	0.33	0.24	-0.04	-1.28	0.00	0.81
INSTOWN	0.10	0.19	2.41	5.44	0.00	0.90
OTHERBLOCK	0.05	0.10	3.63	15.30	0.00	0.70
OTHEROWN	0.13	0.13	1.34	1.49	0.00	0.61
ME	750.16	1,330.11	8.52	106.50	31.05	19,131.12
ME/BE	4.41	4.80	7.00	77.28	0.29	65.52

B. Correlation Matrix
PRE-SOX

	RETEN	*MGTOWN*	*MGTOWNDUM*	*lnME*	*ln(ME/BE)*
RETEN	1.00				
MGTOWN	0.09	1.00			
MGTOWNDUM	0.05	0.59	1.00		
lnME	0.31	-0.21	-0.28	1.00	
ln(ME/BE)	0.47	0.15	0.17	0.26	1.00

POST-SOX

	RETEN	*MGTOWN*	*MGTOWNDUM*	*lnME*	*ln(ME/BE)*
RETEN	1.00				
MGTOWN	0.13	1.00			
MGTOWNDUM	0.13	0.57	1.00		
lnME	0.28	-0.01	-0.12	1.00	
ln(ME/BE)	0.44	0.17	0.20	0.26	1.00

[a] The sample consists of 349 pre-SOX and 349 post-SOX initial public offerings. *RETEN* is the fraction of equity retained by the initial owners; *MGTOWN* is the pre-IPO ownership fraction of managers and directors; *MGTOWNDUM* is a dummy variable that equals one if management ownership before the IPO is above 0.5% and zero otherwise; *ME* is the market value of equity after the IPO (in millions of dollars) calculated using the first trading day's closing price (results using closing prices for one to six weeks out produce almost identical results); and *BE* is the book value of equity after the IPO.

Referring to panel A, the average equity retention ratio is 71% pre-SOX and 70% post-SOX. Post-IPO management ownership is 21% on average pre-SOX with the minimum at 0% and the maximum at 86%. Post-SOX management ownership is significantly lower at only 10% on average. Average market value of equity is $686.94 ($750.16) million and ranges from $8.68 ($31.05) to $54,218.75 ($19,131.12) million pre-SOX (post-SOX). Finally, the market-to-book ratios range from below one to about 228.23 with an average of 5.56 pre-SOX and 4.41 post-SOX.

Panel B of Table 1 details correlations between key variables and is based upon computations using the first trading day's closing price. The correlation between the overall level of equity retention and post-offering managerial ownership in the post-SOX era (0.1, which is statistically significant with a p-value of 0.0138) indicates that including both RETEN and MGTOWN in the same regression will likely be problematic for making distinctions between support for the signaling and agency hypotheses, necessitating the separation of RETEN into its individual components, at least for the post-SOX analysis. Pre-SOX, the correlation between the two variables is not statistically significant.

Wealth Effect

Results from tests of the wealth effect based on equation (1) are reported in Table 2. Analogous to the results reported by KK, the first column includes all independent variables in model (1), the second column drops the cubed book value of equity term and the last column drops the squared and cubed book value terms. Again, if a wealth effect is not present, then the coefficients on the squared and cubed book values and the intercept should be equal to zero. Panel A reports the results based on the entire pre-SOX sample. The coefficients on the squared and cubed terms are never significant, although the intercept is. Panel C reports the results on the entire post-SOX sample. Here, it is more obvious that a wealth effect is present. The intercept is significant in all specifications and the squared and cubed terms are significant in the first model. Therefore, the test results based on the entire sample regarding the relationship between market-to-book value and retention measures should be interpreted with this in mind.

Since the wealth effect could manipulate the results of the signaling and agency hypotheses, it is desirable to identify a subset of data that exhibits reduced exposure to the wealth effect. In Table 2 Panels B and D, issuers are ranked based upon their pre-IPO book value of equity and then the top and bottom 10% are dropped from the sample. Boehmer (1994) uses this method to create a more homogenous sample of firms in hopes of reducing the non-proportionality of offer size to firm value. As shown in Panel B, excluding the top and bottom 10% of issuers is successful in reducing evidence of the wealth effect. Since only the coefficients on the intercept showed signs consistent with a wealth effect in the full sample pre-SOX, we are looking to reduce their significance in the subsample. The coefficients on the intercepts in Panel B are significantly smaller and less statistically significant than those in the full sample. The coefficients on the squared and cubed terms remain insignificant. In Panel D, the coefficients on the squared and cubed terms are no longer significant and, as in Panel B, the coefficients on the intercept are smaller and less significant. Consequently, these subsamples appear to be good candidates for controls with which to compare results of the entire samples.

Signaling Hypothesis

KK (1996) note that the relationship between equity retention and the market-to-book ratio is non-linear in their data and use a logarithmic transformation of the market-to-book ratio to make the relationship approximately linear. The same method is used for the current dataset because of a similar observation and to make comparisons expedient.

Table 2: Test for Presence of Wealth Effect

	Model 1	*Model 1 Excluding BEB^3*	*Model 1 Excluding BEB^2 & BEB^3*
	OFFER	*OFFER*	*OFFER*
A. Full Pre-SOX Sample			
Constant	62.62	62.22	59.49
	(7.27)***	(8.75)***	(10.12)***
BEB	0.06	0.09	0.20
	(0.20)	(0.62)	(2.96)**
BEB^2	$1.34x10^{-4}$	$5.67x10^{-5}$	
	(0.24)	(0.65)	
BEB^3	$-2.93x10^{-9}$		
	(-0.14)		
N	349	349	349
Adj R^2	0.22	0.22	0.21
B. Subsample of Pre-SOX Issuers: Excluding 10th and 90th Percentile Issuers[b]			
Constant	28.19	25.40	24.93
	(10.65)***	(8.52)***	(8.61)***
BEB	0.57	1.26	1.32
	(0.86)	(2.80)**	(5.88)***
BEB^2	0.02	$6.53x10^{-4}$	
	(0.89)	(0.11)	
BEB^3	$1.25x10^{-4}$		
	(-0.74)		
N	279	279	279
Adj R^2	0.42	0.41	0.42
C. Full Post-SOX Sample			
Constant	102.32	88.45	96.63
	(9.35)***	(8.76)***	(10.82)***
BEB	-0.07	0.45	0.26
	(-0.37)	(3.32)**	(3.80)***
BEB^2	$8.96x10^{-4}$	$-1.42x10^{-4}$	
	(2.82)**	(-1.25)	
BEB^3	$-4.26x10^{-7}$		
	(-3.77)***		
N	349	349	349
Adj R^2	0.26	0.20	0.18
D. Subsample of Post-SOX Issuers: Excluding 10th and 90th Percentile Issuers[b]			
Constant	66.98	57.93	62.39
	(4.63)***	(5.00)***	(7.83)***
BEB	0.15	0.91	0.68
	(0.21)	(2.28)*	(5.23)***
BEB^2	0.01	$-1.13x10^{-3}$	
	(1.11)	(-0.62)	
BEB^3	$-3.12x10^{-5}$		
	(-1.27)		
N	279	279	279
Adj R^2	0.12	0.12	0.12

* p<.05 ** p<.01 *** p<.001

[b]The exclusion is based on the pre-IPO book value of the issuer. Boehmer (1994) excludes the 25th and 75th percentile issuers to attempt to control for the wealth effect by producing a more homogenous group of issuers. If there is no wealth effect, then the coefficients on the squared and cubed terms and the intercept are zero.

Tables 3 and 4 display results of the regression of the market-to-book ratio on the dependent variables identified in equations (2) and (3). Table 3 reports the results of the full sample and Table 4 reports the results of the subsample identified using Panels B and D of Table 2 (excluding the top and bottom 10% of issuers). Model 2 of each table reports results based on equation (2), where the overall level of equity retention (RETEN) is included alongside post-offering management retention (MGTOWN). Model 3 drops RETEN and replaces it with each individual component of retention as specified in equation (3). All statistics reported in Tables 3 and 4 are based upon the ME/BE calculated using the first trading day's closing price. However, the statistics are almost identical to those obtained using the closing prices one to six weeks following the offer as well as those associated with the offer price.

The results reported in Table 3 are consistent with either the wealth effect or the signaling hypothesis or both. In Model 2, the coefficient on RETEN is positive and highly significant for both the pre- and post-SOX periods. For the pre-SOX period, where RETEN and MGTOWN are not significantly correlated, the coefficient on MGTOWN is positive and significant at the 1% level. The coefficient on this variable for the post-SOX period is only significant at the 5% level, suggesting that the positive correlation between MGTOWN and RETEN in the post-SOX period is affecting the results.

Table 3: Relationship between Market Value, Equity Retention and Management Ownership

Full Samples				
	Dependent Variable: ln(ME/BE$_A$)[c]			
	Model 2		Model 3	
	Pre-SOX	Post-SOX	Pre-SOX	Post-SOX
Constant	-1.01	-1.13	-1.00	-1.14
	(-5.32)***	(-3.96)***	(-5.23)***	(-3.79)***
MGTOWN	0.54	0.59	2.75	2.54
	(4.41)***	(2.37)*	(11.56)***	(7.28)***
RETEN	2.34	2.03		
	(9.29)***	(7.05)***		
VCOWN			2.62	2.14
			(9.28)***	(7.09)***
INSTOWN			2.05	1.76
			(8.57)***	(5.06)***
OTHERBLOCK			2.41	2.79
			(7.68)***	(6.52)***
OTHEROWN			2.27	2.07
			(7.58)***	(6.19)***
CONTROLS[d]	YES	YES	YES	YES
N	349	349	349	349
Adj R^2	0.41	0.31	0.41	0.31

* p<.05 ** p<.01 *** p<.001

[c]The statistics reported are based on the *ME/BE* calculated using the first trading day's closing price. However, the statistics are almost identical to those obtained using the closing prices one to six weeks following the offering as well as those associated with the offer price. (Tables 3, 4 and 5)

[d]Controls include *AGE*, *SECRATIO*, *NASDAQ*, *VENTURE*, *RANK*, *HIGHTECH, HEALTH, CONSUMER, MANUFACT*, *R&D* and *ADV* as discussed in the models section of the paper. They are not reported in the tables to conserve space. Full results are available upon request.

Comparing these results with those in Model 3, where RETEN is dropped and replaced with its individual components, one may observe that the coefficient on MGTOWN is positive, significantly larger and highly statistically significant. This indicates that, because RETEN and MGTOWN are positively correlated, simply observing the coefficient on RETEN is insufficient to establish support for the signaling hypothesis because this coefficient also appears to be capturing the effect of increasing managerial ownership on the market-to-book ratio. Turning to Model 3 of Table 3, we see that every component of the overall level of equity retention is positive and highly statistically significant for both the pre- and post-SOX eras. Thus, even after controlling for the effect of managerial ownership on the market-to-book ratio, the results indicate support for either the signaling or wealth effect hypothesis.

While it is possible that the positive relationship in Table 3 may be exaggerated by the presence of the wealth effect, evidence in Table 4, which is based on the sub-sample of issuers that face reduced exposure to the wealth effect, indicates an even stronger positive relationship between the equity retention of each group of pre-IPO owners and the relative market value. If the wealth effect were the main driver of the positive relationship, we would expect to obtain a weaker relationship (as Boehmer documents in his study) by eliminating those firms that face the most exposure to the wealth effect. Therefore, this study finds support for Leland and Pyle's (1977) signaling hypothesis.

Table 4: Relationship between Market Value, Equity Retention and Management Ownership

Subsample of Issuers Excluding 10th and 90th Percentile Issuers[d]				
Dependent Variable: ln(ME/BE$_A$)[c]				
	Model 2		Model 3	
	Pre-SOX	Post-SOX	Pre-SOX	Post-SOX
Constant	-1.32	-1.66	-1.30	-1.68
	(-8.60)***	(-6.52)***	(-7.44)***	(-6.53)***
MGTOWN	0.23	0.48	3.15	3.47
	(2.25)*	(3.34)***	(12.45)***	(12.92)***
RETEN	3.04	3.02		
	(13.11)***	(11.66)***		
VCOWN			2.94	3.02
			(11.15)***	(10.91)***
INSTOWN			2.79	3.04
			(10.55)***	(11.04)***
OTHERBLOCK			3.32	3.07
			(10.41)***	(9.78)***
OTHEROWN			2.85	3.04
			(10.06)***	(10.65)***
CONTROLS[d]	YES	YES	YES	YES
N	279	279	279	279
Adj R^2	0.62	0.61	0.59	0.60

* p<.05 ** p<.01 *** p<.001

[c]The statistics reported are based on the *ME/BE* calculated using the first trading day's closing price. However, the statistics are almost identical to those obtained using the closing prices one to six weeks following the offering as well as those associated with the offer price. (Tables 3, 4 and 5)

[d]Controls include *AGE*, *SECRATIO*, *NASDAQ*, *VENTURE*, *RANK*, *HIGHTECH, HEALTH, CONSUMER, MANUFACT*, *R&D* and *ADV* as discussed in the models section of the paper. They are not reported in the tables to conserve space. Full results are available upon request.

Agency Hypothesis

Recall that the agency hypothesis proposes that there is a positive relationship between management ownership and firm market value. Model 3 in Tables 3 and 4 shows that there is a positive and statistically significant relationship between IPO valuation and aggregate post-offering management ownership. However, this relationship may support either the agency or signaling hypothesis, since investors may interpret the level of managerial retention as a signal of firm quality. Thus, additional tests are necessary to infer whether these results support the agency or signaling theory.

As Morck, Shleifer and Vishny (1988), McConnell and Servaes (1990), Boehmer (1994) and Keasey and Short (1997) document, it is possible that the relationship between management ownership and market valuation is non-monotonic. That is, the relationship between firm value and management ownership may be positive over some ranges, but negative over others. This refers to the fact that increasing management ownership produces a convergence-of-interests effect, where managers have greater incentive to maximize shareholder wealth as their stake in the firm increases, which should in turn lead to a higher market value (i.e., this is the prediction of the agency theory). However, as Morck, Shleifer and Vishny (1988) point out, as management ownership increases, an entrenchment effect arises, increasing moral hazard and reducing market value as investors pass agency costs back to the firm; thus, if investors recognize and price moral hazard costs, then one would expect the relationship between firm value and management ownership to be negative over this range of management ownership. Once management ownership levels pass a point beyond which job security is unaffected by additional ownership, the interest aligning effects of the agency theory once again dominate and the positive relationship between management ownership and firm value should resume.

As a result, a strictly positive (linear or non-linear, convex) relationship between management ownership and firm value supports the signaling theory, but a non-monotonic (non-linear, concave) relationship would support only the agency theory. If firm value is positively related to management ownership initially, but negatively related to management ownership over a range where additional ownership entrenches managers, that suggests that investors recognize and price moral hazard problems (as suggested by Morck, Shleifer and Vishny (1988), who find evidence that firm value is positively related to ownership levels below 5%, negatively related over the 5% to 25% range and again positively related above 25%). However, this non-monotonic relationship would not support the signaling theory. No matter how high management ownership may be, the signaling theory would predict a strictly positive relationship between firm value and ownership levels, although it is possible that this relationship could become convex. This is true because as management ownership levels increase, the likelihood decreases that a low-quality firm is mimicking a high-quality firm as managers are investors who want to maximize returns on their own investments and retaining larger stakes in the low-quality firm is extremely costly for managers in terms of their expected returns. Finding a strictly positive relationship between firm value and management ownership lends support to the signaling theory because if investors recognize and price moral hazard problems, we would expect to see the non-monotonic relationship documented by Morck, Shleifer and Vishny (1988), McConnell and Servaes (1990), Boehmer (1994) and Keasey and Short (1997). Hence, testing for a non-monotonic relationship between management ownership and market value is likely the strongest test between the agency theory and the signaling theory.

KK (1996) perform an analysis like that performed by Morck, et al. (1988) but only look at management ownership levels above 30% because there are not enough observations in the other ranges from which to draw any meaningful results. For management levels above 30%, KK find that management ownership has no significant effect on firm value. In order to utilize more of their sample and to test the relationship between management ownership and firm value at lower ownership levels, KK define a management ownership dummy which is equal to one for management ownership greater than 0.5% and zero otherwise. With this definition, they find a positive and significant relationship between management ownership and market value. Using this result in combination with the insignificant relationship at ownership levels above 30%, they interpret their findings as being in line with those of Morck et al. (1988); increases in management ownership over very small levels significantly affect market values but increases over larger levels of ownership do not.

I test for a non-monotonic relationship between management ownership and IPO valuation by squaring and cubing the management retention variable and including these terms in the market-to-book regression. However, it is necessary to test this relationship prior to taking the natural log of the market-to-book ratio, because the natural log will transform a non-linear relationship into an approximately linear relationship. Thus, if the relationship is non-monotonic, testing it with the transformed market values will bias the results against finding a non-monotonicity.

Table 5: Test for Non-Monotonicity between Management Ownership and Market Value

	Dependent Variable: (ME/BE_A)[e]				
	Column 1	*Column 2*	*Column 3*	*Column 4*	*Column 5*
	Full Pre-SOX Sample	Pre-SOX Subsample 1 *(less exposure to wealth effect)*	Full Post-SOX Sample	Post-SOX Subsample 1 *(less exposure to wealth effect)*	Post-SOX Subsample 2 *(eliminating outliers from full sample)*
Constant	-5.93	-6.88	-7.93	-8.58	-7.96
	(-4.23)***	(-4.94)***	(-4.24)***	(-6.04)***	(-4.24)***
MGTOWN	13.04	14.43	18.67	18.97	17.42
	(3.60)***	(4.00)***	(5.49)***	(6.72)***	(5.14)***
$MGTOWN^2$	-0.31	-0.33	-13.35	-9.24	-9.62
	(-0.07)	(-0.11)	(-2.69)**	(-1.90)	(-1.68)
VCOWN	13.23	12.84	10.38	13.02	10.58
	(5.74)***	(5.82)***	(5.72)***	(7.83)***	(5.73)***
INSTOWN	8.74	12.14	9.28	12.85	9.43
	(5.61)***	(5.96)***	(4.32)***	(8.15)***	(4.34)***
OTHERBLOCK	9.88	14.14	13.33	11.39	13.47
	(4.97)***	(5.75)***	(4.19)***	(7.22)***	(4.23)***
OTHEROWN	11.20	13.14	8.40	12.39	8.71
	(4.92)***	(5.63)***	(4.86)***	(8.46)***	(4.89)***
CONTROLS [d]	YES	YES	YES	YES	YES
N	349	279	349	279	347
Adj R^2	0.23	0.38	0.20	0.51	0.21

* p<.05 ** p<.01 *** p<.001

The Pre-SOX Subsample 1 is the sample identified in Panel B of Table 2 with reduced exposure to the wealth effect.

The Post-SOX Subsample 1 is the sample identified in Panel D of Table 2 with reduced exposure to the wealth effect Post-SOX Subsample 2 eliminates two observations above the implied inflection point from the full sample.

[d]Controls include *AGE*, *SECRATIO*, *NASDAQ*, *VENTURE*, *RANK*, *HIGHTECH, HEALTH, CONSUMER, MANUFACT*, *R&D* and *ADV* as discussed in the models section of the paper. They are not reported in the tables to conserve space. Full results are available upon request.

[e]The statistics reported are based on the *ME/BE* calculated using the first trading day's closing price. However, the statistics are almost identical to those obtained using the closing prices one to six weeks following the offering as well as those associated with the offer price. (Tables 3, 4 and 5)

Column 1 of Table 5 shows the results of the entire pre-SOX sample and Column 2 reports the results on the subsample of pre-SOX issuers with less exposure to the wealth effect. The relationship between management ownership and market value is strictly monotonic in the full sample as well as the subsample, suggesting support for the signaling theory rather than the agency theory. This result is at odds with the results of earlier studies that found a non-monotonic relationship between firm value and management ownership.

Column 3 of Table 5 shows that the relationship between management ownership and firm value in the post-SOX era is non-monotonic in the full sample. (When the cubed term is included, it is not significant and causes the squared term to lose significance, so it is not reported in the results.) The reported coefficients imply that the relationship between these two variables will become negative for management ownership levels above 70%. Clearly, a negative relationship at ownership levels that high would not be caused by an entrenchment problem, since entrenchment would occur long before management ownership reached 70%. In the sample, only two observations have management ownership past this inflection point, so it is possible that outliers are driving the significance of the squared term. Dropping the two observations above the implied

inflection point results in a strictly monotonic relationship, as reported in Column 5 of Table 5. Column 4 of Table 5 replicates this analysis for the post-SOX subsample of firms with less exposure to the wealth effect. Again, we see that the relationship between management ownership and market value is strictly monotonic and the implied inflection point is above 100% ownership.

Since neither the squared nor cubed term is significant in the model after eliminating outliers in from the full post-SOX sample as shown in Column 5, this indicates that as a function of management ownership, the valuation function never changes direction; it is always increasing. The results based on the subsample of issuers with less exposure to the wealth effect suggest that the relationship would only change direction once management ownership exceeds 100%. The pre-SOX full sample and subsample results also indicate a strictly monotonic positive relationship. Hence, the results suggest that a non-monotonic relationship does not exist in the current dataset either pre- or post-SOX, indicating that the positive relationship between management ownership and market valuation is likely driven by signaling rather than the agency theory.

Why would this be true when there has been so much prior evidence of a non-monotonic relationship between these two variables and a plausible theoretical explanation for this observation? One explanation may lie in the relative time periods and samples under consideration. Each of the studies cited documenting a non-monotonic relationship between management ownership and IPO valuation were conducted between the late 1980s and late 1990s, prior to the passage of SOX. The pre-SOX matched sample used in this study is comparable to the post-SOX sample and so differences between the pre-SOX results presented here and the results of other studies conducted prior to the passage of SOX may have to do with inherent differences in the firms under consideration.

For a moment, disregard the pre-SOX analysis previously presented. If one were to simply compare the results of the post-SOX analysis with the results of previous studies, one might conclude that investors perceived that SOX reduced the moral hazard problem in the IPO market. Though previous studies present evidence that investors responded to moral hazard concerns in their valuation of IPOs prior to the passage of SOX, the post-SOX results presented here suggest that they are more concerned with adverse selection issues. Recall that the regulations imposed by SOX sought to improve corporate governance and transparency in the wake of major management and accounting scandals occurring in the early years of the 21st century. The establishment of independent boards and the institution of severe criminal penalties against CEOs and CFOs who falsely certify financial statements should affect the moral hazard problem inherent in any firm where there is a separation of ownership and control (a prime example of which being an IPO). This suggests that agency problems in IPO firms should have been reduced post-SOX.

However, compliance and disclosure requirements resulting from SOX have made it significantly more costly to become a publicly-traded firm, implying that SOX likely influenced the types of firms deciding to go public. It is reasonable to suggest that private firms in less compliance with SOX have greater potential for agency problems and incur relatively higher compliance costs (e.g. restructuring manager-dominated boards such that they meet the independence requirements). Hence, these firms likely opt out of public markets because the costs of going public outweigh the benefits.

Indeed, a number of studies provide evidence consistent with the argument that SOX has impacted both the number and the types of firms choosing to go public. From 1980 to 2000, the average yearly number of IPOs was approximately 310. From 2001 to 2013, that average dropped to about 99 and small issuers have been most significantly impacted (Gao, Ritter and Zhu, 2013). Rhodes and Ligon (2018) report that firms that went public post-SOX were significantly larger, older, more highly-levered and raised more money in the offering compared to pre-SOX firms. Wintoki (2007) provides evidence that SOX is more likely to push small, young, high-growth firms away from their optimal board structures than older, larger firms. Morgenstern and Nealis (2004) argue that small firms are most significantly impacted by the disclosure requirements that resulted from SOX because the costs are largely fixed, regardless of firm size. All of these results suggest that SOX has impacted the types of firms that go public, specifically preventing small, young firms from accessing public equity markets. These firms are those where we would expect asymmetric information problems like adverse selection and moral hazard to be more acute because, by their very nature, small, young firms are more opaque than larger, older firms that are more established. Clearly, young firms have limited track

records upon which to judge their financial strength and durability. In addition, small firms are more opaque than large firms because fewer institutions find it worthwhile to produce information on them, for example, in terms of analyst coverage.

Now consider the pre-SOX matched sample utilized in this study. It was chosen such that it was as comparable as possible to the post-SOX sample, the sample where firms likely self-selected out of the market. The fact that the results on the pre-SOX matched sample mimic those on the post-SOX sample, rather than the results of previous studies utilizing a broad sample of IPO firms that went public prior to the passage of SOX, suggests that the SOX "treatment" did not reduce the moral hazard problems of firms that go public, but rather, considering the studies by Wintoki (2007), Gao et al. (2013) and Rhodes and Ligon (2018), affected the types of firms going public and prohibited firms with greater moral hazard problems from accessing public equity markets.

Conclusion

This study re-examines the signaling, agency and wealth effect theories in a matched-sample of IPOs issued prior to and following the passage of the Sarbanes-Oxley Act of 2002. SOX provides some motivation for revisiting these theories. As Morgenstern and Nealis (2004) suggest, since the implementation of SOX, firms are forced to weigh the benefits of going public against the considerable costs imposed on public firms by the regulation. The implication is that SOX may have influences on the types of firms deciding to go public, which in turn, may influence the relative importance of adverse selection and moral hazard. Additionally, corporate governance reforms required by SOX have likely affected moral hazard issues in publicly-traded firms.

The results presented provide support for the signaling theory and suggest evidence of a wealth effect both pre- and post-SOX. On the other hand, there is no evidence supporting the agency theory either pre- or post-SOX. If one were simply to compare the post-SOX results to the results of previous studies conducted pre-SOX, which provided evidence supporting the agency theory, one might assume that SOX reduced moral hazard concerns. However, the results on the pre-SOX matched sample, which was chosen to be as comparable as possible to the post-SOX sample, do not mimic the results of previous pre-SOX studies, but mirror the results of the post-SOX matched sample, where firms likely self-selected out of the IPO market. If the pre-SOX results had provided the same results that other earlier studies had, then this would have suggested that SOX reduced moral hazard problems in the firms that choose to go public post-SOX, but since the pre-SOX results suggest no support for the agency theory, this implies that it is simply the sample of firms that go public post-SOX that affects investors' concerns with moral hazard problems. This is an important finding as it provides evidence that although SOX appears to have reduced moral hazard concerns, it does so only through its effect on the self-selection of firms going public; that is, the regulations resulting from SOX likely reduced the proportion of firms with greater agency problems in the population of firms that go public.

Considering the findings of this study in conjunction with those of Rhodes and Ligon (2018), the implication is that some provisions of the Sarbanes-Oxley Act should be modified or repealed, at least for small issuers. SOX was passed in response to major management and accounting scandals with the intent of reducing instances of lax and unethical behavior on the part of managers; in other words, it was passed in order to reduce moral hazard problems in publicly-traded firms. This study suggests that SOX does not reduce moral hazard in the firms that choose to go public, and as Rhodes and Ligon (2018) document, not only does it prohibit small firms from accessing public equity markets, it also imposes binding constraints on the board structures of issuers without a corresponding benefit in terms of firm valuation. Indeed, they provide evidence that there has been a negative impact on the valuations of firms whose boards were most significantly altered by SOX. Complying with SOX is expensive, especially for small firms because the costs of compliance are largely fixed, regardless of firm size. Given these findings, it makes sense to either exempt small-issuers, who appear to have been most significantly impacted, from the board-structure requirements and other

costlier provisions of the Act (e.g., Section 404, the most expensive aspect of SOX compliance)[8] or to repeal them altogether.

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[8] Section 404 requires the firm's management to assess and report on the effectiveness of the firm's internal controls for financial reporting, and an auditor attestation of management's assessment of internal controls.

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