How Does Underwriter Price Support Affect IPOs? Empirical Evidence*

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Abstract

While it is extensively documented that underwriters often "stabilize" or "support" initial public offerings (IPOs), less is known about how this practice impacts the IPO process. We argue that price support creates a short put position for underwriters, and thereby gives underwriters the incentive to reduce the *ex-ante* price risk of IPOs. We provide extensive empirical evidence that price support is related to IPO price risk, using several measures of support and risk. Rare data from SEC filings on price support, cross-sectional evidence from IPOs offered between 1985 and 1994, and data from two different price support regimes all indicate a negative relation between price support and the initial price risk of IPOs.

Initial public offerings (IPOs) have been extensively studied in the finance literature. Perhaps the best known fact about IPOs is that they tend to be "underpriced," i.e., IPOs tend to trade significantly above their offer price in the immediate after-market following the offer. The underpricing phenomenon has spawned an extensive body of theoretical and empirical work (see, e.g., Ibbotson and Ritter (1995) for a review). More recently, however, the IPO literature has documented another interesting, though less explored aspect of IPOs. Specifically, underwriters often "stabilize" or support IPOs in the after-market following a public offering (Hanley, Kumar and Seguin (1993), Ruud (1993), Schultz and Zaman (1994)).

As stabilization causes supported IPOs to trade above their free market prices, it appears to be a form of stock price manipulation. Indeed, the SEC itself has long recognized stabilization as a manipulative practice (see, e.g., SEC Release No. 2446). Nevertheless, stabilization is specifically exempt from anti-manipulative provisions of the 1934 Securities Act, provided it is carried out within certain parameters specified in the Act. For instance, stabilization can last only for a reasonable period of time, and issues cannot be stabilized above their offer prices. Additionally, the law requires underwriters to explicitly disclose the *possibility* of price support in the pre-IPO prospectus. Such disclosure typically forms part of the boilerplate clauses of an IPO, so that underwriters usually retain the right to stabilize IPOs, but are under no obligation to stabilize every IPO they bring to the market.

While the law permits price support, and much evidence suggests that underwriters do actually engage in price support, less is understood about the implications of price support for the going public process. Two questions arise in this context. First, stabilization is a costly activity and an entirely voluntary one for underwriters to engage in. Why would profit-maximizing underwriters voluntarily incur the costs of price support? A second and related issue is that underwriters do *not* stabilize all IPOs they bring to the market. For what types of issues are underwriters are willing to bear the costs of stabilization? What cross-sectional characteristics differentiate supported IPOs from other IPOs?

In this paper, we provide empirical evidence on the issues raised above. We argue that price support affects the going public process by altering the risk of IPOs brought to the market. The basic intuition is that underwriters supporting an IPO are effectively giving investors a put option in the issue. The stabilization put costs more when the IPO's value is highly uncertain; conversely, the put costs little when the IPO's value is known fairly precisely. Hence, underwriters stabilizing an IPO have the incentive to reduce the cost of the stabilization put by reducing the *ex-ante* price uncertainty of the IPO, through more intensive information production prior to the offering.

Reducing price uncertainty, in turn, has two benefits. First, the IPO literature extensively documents that less uncertainty mitigates information asymmetries between investors in the IPO *pre-market* (Beatty and Ritter (1986), Chowdhry and Nanda (1996), Benveniste, Busaba and Wilhelm (1996)). Additionally, we argue here that lesser uncertainty also alleviates *ex-post* information asymmetries in the IPO *after-market*, and thereby leads to better liquidity in the IPO after-market. We provide a theoretical model that generates these predictions. While the model is consistent with and formalizes the most frequently cited reason for allowing price support – better after-market liquidity – we emphasize that the intuition that underwriters support less risky issues is robust across several alternate explanations for price support.

We provide extensive empirical evidence on how price support affects IPOs. Our analysis proceeds along three lines. The first portion exploits a rare data set of SEC filings on price support. A major impediment in empirical work on price support has been the lack of transparency in this aspect of the IPO process, largely due to lack of disclosure requirements concerning price support. However, prior to the early eighties, underwriters engaging in stabilization were required to disclose such activities by filing form X-17A-1 with the SEC. The filing requirement has since been discontinued and all related records have been destroyed by the SEC. The only remnant of these filings is a set of forms X-17A-1 filed with SEC for IPOs offered between June 1981 and July 1982, which we have obtained. We analyze the return distributions and cross-sectional characteristics of the form X-17A-1 sample, to understand the nature of IPOs that were stabilized during the period.

Our second tests focus on IPOs brought to the market between 1985 and 1994, a large sample (2723 IPOs) that allows for potentially powerful tests. Here, our empirical approach is to identify IPOs in which underwriters plausibly intervened in the after-market to arrest potential price declines. We compare these issues with another set of IPOs whose prices were instead allowed to decline in the IPO after-market. Consistent with theory, we find that underwriters tend to support IPOs with low initial price risk. This relation is robust to the inclusion of controls and obtains across several proxies for support and risk.

In a third set of empirical tests, we take advantage of data from two different price stabilization regimes. In the current regime, underwriters stabilize IPOs for a few (typically 3-5) business days following an IPO. However, prior to passage of the 1934 Securities Act, there were no restrictions on price support, and during this period, underwriters engaged in price support for about six weeks (Lasdon and Steiner (1933)). Thus, the period before the 1934 Act provides one avenue for testing for the effect of stabilization on the risk and underpricing of IPOs brought to the market. Consistent with our hypothesis, we find that IPOs in the more intense stabilization regime prevalent prior to 1934 were less risky and experienced lesser underpricing.

The pre-1934 data are also interesting because they allow us to reexamine and reject the "legal" liability hypothesis for explaining why IPOs are underpriced. According to this theory (Tinic (1988)), pre-1934 IPOs were less underpriced because overpricing related lawsuits were less likely to be successful prior to passage of the 1933 Securities Act. However, if there were fewer lawsuit related concerns prior to 1934, pre-1934 IPOs should be *more* risky than IPOs in the current regime. We find exactly the opposite result: pre-1934 IPOs were less risky. Thus, the pre-1934 data provides little support for the contention that the 1933 Securities Act increased costs of going public by making overpricing-related litigation more likely.

The paper is organized as follows. Section I discusses regulations and market practices with respect to price stabilization and develops the hypotheses tested in the paper. Section II describes our data and sample selection. Section III presents the empirical results and Section IV concludes.

I. The Economic Effects of Price Stabilization

Section I begins by briefly describing the current law and market practice relating to price stabilization. We then discuss why, from an economic perspective, stabilization is a useful contracting device in IPOs. We argue that stabilization commits underwriters to produce more accurate information about the firms they take public. The implications of this analysis provide the basis for the empirical work that follows.

A. Regulations and Market Practice

Section 9 of the 1934 Securities Exchange Act prohibits manipulative conduct with respect to trading in listed securities. Section 9(a)-6 of the Act specifically prohibits any transaction that is entered into for the purpose of "pegging, fixing, or stabilizing" the price of securities unless such transactions are in accordance with procedures set out in applicable rules. Guidelines for such rules were set out first in a 1940 Securities Act release, in terms of which only detrimental stabilizing activities were prohibited (see, e.g., Hazen (1985)).[1]

[1] Manipulative practices other than those relating to trading of listed securities are covered by other parts of the 1934 Act. For instance, Section 15(c)-1 of the Act allows SEC to promulgate rules prohibiting manipulative, deceptive, or otherwise fraudulent devices and contrivances in relation to any purchase or sale of securities. These rules, however, are less relevant to the specific rules and exemptions governing price stabilization activities.

Specific exemption for price stabilizing activities from anti-manipulative provisions comes from Section 10(b)-6 of the 1934 Act.[2] This section prohibits the issuer, underwriters, prospective underwriters and all persons participating in the distribution of a security from bidding for or purchasing the security as well as any security in the same class, unless such purchases conform to Sections 10(b)-7 and 10(b)-8 of the Act. These sections clarify parameters within which stabilization activities must be conducted. For instance, they require that the possibility and existence of after-market support be disclosed to investors, which is done by inserting a boilerplate clause in the prospectus. The law also requires that stabilization only occur at or below IPO offer prices, the intent being that price support could be used to retard price declines, but not to create positive price run ups in the IPO after-market. Additionally, underwriters are allowed to stabilize prices only for a reasonable period of time, which market practitioners typically interpret to be a few days following an offering.

In light of the rules mentioned above, investors in an IPO are aware that IPOs may be supported in the after-market, and that such support will occur only at or below the offer price. In principle, underwriters could support IPOs either by entering a stabilizing bid or by directly purchasing shares through market orders. The current market practice, as documented in Aggarwal (1998) is that underwriters who intend to potentially stabilize an IPO begin by taking an *ex-ante* short position equal to the greenshoe amount (usually 10-15% of an issue) and an additional naked short position of about 10-15% of the issue, by overselling the IPO before trading in the IPO commences. If the IPO appreciates in the after-market, underwriters cover the short position at a loss. However, if there is selling pressure in the after-market, underwriters stabilizing the IPO step in and purchase shares to cover the short position, mostly at the IPO offer price, as documented, for instance in Hanley, Kumar and Seguin (1993) and Schultz and Zaman (1994)). Thus, stabilization effectively grants investors an option to *put* an IPO back to the underwriter at the offer price. Underwriters do *not*, however, support all IPOs at the offer, and even when they do, they support far less than 100% of the issue. Hence, investors in an IPO own much less than one put option for every share they buy in the IPO.

B. Stabilization and Risk Reduction in IPOs

While the law permits price support, and it is well-known that underwriters do engage in this practice, less is known about why they do so, and the consequences for the going public process.

[2]These provisions have been replaced by rules 100-105 of Regulation M effective February 3, 1997. While the new rules appear similar in spirit to the ones they replaced with respect to price support for IPOs, the IPOs analyzed in this paper were all governed by rule 10(b)-7 of the 1934 Act.

We suggest that underwriters will extend price support to less risky IPOs. We formalize a simple model that generates this implication and examine its consequences for the after-market liquidity and underpricing of IPOs. We also discuss how the intuition that less risky IPOs are supported is robust across other explanations for price support.

The main idea arises from the fact that underwriters engaging in price support are effectively giving investors a put option in the stock being supported. The stabilization put is more expensive to grant when volatility – in this context, the underwriter's uncertainty about the market price for the IPO – is high. Thus, underwriters engaging in stabilization have the incentive to reduce the initial price uncertainty of an IPO. Recognizing this relation, investors infer that if an IPO is supported, it has low risk; hence, price support acts as a mechanism by which an underwriter's assessment that an IPO's initial price risk is low, is communicated to investors. Lower risk, in turn, should translate into better offer prices, through two mechanisms that are not mutually exclusive. First, lower risk could mitigate *pre-offering* information asymmetries, i.e., those prevalent in the IPO pre-market prior to an offering (Beatty and Ritter (1986), Chowdhry and Nanda (1996), Benveniste, Busaba and Wilhelm (1996)). In addition, lower risk also alleviates *after-market* information asymmetries and thereby improves liquidity in the after-market following an offering, as emphasized here.[3] Indeed, practitioners, the SEC and recent empirical evidence in Aggarwal and Conroy (1998) suggest that this is a primary motive for price support.

The appendix presents a simple model that formalizes the above idea. Briefly, we consider two types of IPOs: a "low risk" IPO, for which the information gathering process is essentially complete, so its value is known fairly precisely and a "high risk" IPO for which the information gathering process is less complete, so that its value is subject to more uncertainty. We also suppose that underwriters of an IPO, but not the investors in the IPO know the IPO risk. We show that in such an environment, underwriters will stabilize low risk IPOs but not high risk IPOs, as long as the fraction of the IPO stabilized is sufficiently large. This condition makes sense: if the number of shares stabilized is zero, for instance, stabilization is costless and all IPOs will be supported. High risk IPOs are not stabilized, and such IPOs are allowed to fall in response to sell orders in the after-market. Recognizing that stabilized IPOs are less risky, investors are likely to engage in less *ex-post* information production for such IPOs, which alleviates *ex-post* information asymmetries and improves liquidity in the IPO after-market. Hence, we argue that underwriters

[3]Allowing underwriters to communicate risk (i.e., the precision of their information) has at least two other benefits: (i) it reduces the incentives of outside investors to engage in costly information gathering and to trade on this information (Diamond (1985)); (ii) it mitigates incentives to shirk of intermediaries (e.g., underwriters) who are delegated the task of producing information (see e.g., Diamond (1984), Puri (1998)).

will stabilize less risky IPOs, improve the after-market liquidity and get compensated in the form of better offer prices – equivalently, lesser underpricing – as a result. The appendix shows that this relation obtains regardless of the particular mechanism by which stabilization is implemented – through "pure" stabilization, i.e., purchases resulting in net long positions, or through cover of naked short positions established during IPO allocation. The result is also robust to consideration of overallotment "Green Shoe" options often included in the IPO.[4]

The intuition that less risky IPOs should be stabilized is also robust across many other explanations for price support. For example, a "reallocation" hypothesis would suggest that IPOs are stabilized in order to reallocate ownership of IPO shares from investors with allocations in excess of their desired holdings to other investors who receive insufficient allocation of IPOs in the pre-market at the IPO offer price. By stabilizing IPOs, underwriters can act as a buffer between these two groups of investors. Underwriters will do so provided they are fairly certain, based on the quality, size and distribution of the IPO "book," that such reallocation transfers mostly motivate after-market selling. Even if this is the motivation for price support, only less risky IPOs should be supported, because high risk IPOs, if supported, are more likely to end up as unsold and overvalued underwriter inventory, given the greater adverse selection problems for such IPOs. Another related explanation for price support is that underwriters are better able to extract information from after-market trading in an IPO. This happens because underwriters have private information on allocations, the size and quality of an IPO book through the bookbuilding and IPO allocation process. Thus, underwriters are better able to ascertain than an outside market-maker whether after-market selling is motivated by informed trading or uninformed trading unrelated to an IPO's pricing, and are better placed to support IPOs in the after-market. This explanation is also consistent with our main point, since it holds that underwriters support only IPOs in which they judge after-market selling to be driven by non-information related motives, i.e., low risk IPOs in which there is little information production. Thus, the essential idea that less risky IPOs are supported seems robust.

The notion that lower price risk in IPO markets might benefit issuers, underwriters and investors is not new (see, e.g., Beatty and Ritter (1986), Carter and Manaster (1988) and Rock (1986)). An unsettled issue, however, relates to what mechanism binds players in the IPO process to achieve lower risk. We suggest that stabilization could serve this purpose. In other theoretical

[4]Greenshoe options allow underwriters to sell extra shares, usually up to about 15% of the original issue size, at the offer price, if demand conditions so permit. Overallotment options of this nature are a relatively modern feature of IPO markets. In particular, they were not used in the 1920s (a period examined by one part of our study); the first known instance of their use was in the 1963 Green Shoe IPO (Ritter (1998)).

work, Benveniste, Busaba and Wilhelm (1996) and Chowdhry and Nanda (1996) suggest that price support is a contractual mechanism that helps mitigate information asymmetry problems between heterogeneously informed IPO investors prior to an offering in the IPO pre-market. We add to this literature along two dimensions. First, we provide some of the first empirical evidence on how price support impacts the going public process. Second, our model emphasizes that price support can mitigate not only information problems in the IPO pre-market, but also those in the IPO *after-market*, and thereby improve the liquidity of the IPO in the after-market. Indeed, both the SEC and practitioners cite better after-market liquidity as a primary reason for exempting price support from the anti-manipulation law (see also Amihud and Mendelson (1988)), though existing literature provides little formal guidance about the route by which this happens. Our paper provides this missing link. Finally, Smith (1986) suggests that stabilization bonds underwriters against bringing overpriced IPOs to the market. Our analysis also complements this explanation by emphasizing that price support guards not only against selling overpriced IPOs but also against the sales of speculative offerings whose price is highly uncertain. Whether stabilization achieves this purpose is the subject of our empirical investigation.

II. Data

In principle, we can test whether price support is negatively related to the initial price uncertainty of an IPO if data on price support activities of underwriters are available. However, this aspect of the IPO process is fairly opaque. Nothing in the IPO prospectus definitively identifies which IPOs will be stabilized. Furthermore, the SEC has stopped requiring underwriters to disclose price support data to regulators since 1982 and all records prior to the period have been destroyed by the SEC (Ruud (1993)). Hence, empirical research on price support has primarily relied on inferences based on after-market price and trading data rather than filings that identify supported issues.

We analyze price support in IPOs through three approaches. Our first approach exploits relatively rare data on stabilized IPOs from SEC filings on price support, a set of forms X-17A-1 filed between June 1981 and July 1982. Regulations during this period required underwriters engaging in stabilization to initially file form X-17A-1 no later than the third business day following the day on which the first stabilizing purchase was made. Subsequent reports were required to be filed on a daily basis until stabilization was completed and any related short positions were completely covered. A random set of X-17A-1 forms were copied from SEC records prior to their destruction and the data entered into a spreadsheet, which was supplied to us, with a sample of the form

X-17A-1.[5] We have 46 IPOs in this sample, with offer dates distributed between June 1981 and July 1982. These are the only known hard data on price support in the Rule 10(b)-7 period that we are aware of.

We analyze the cross-sectional characteristics and return distributions of the form X-17A-1 IPOs, and compare these to other IPOs brought to the market during the June 1981-July 1982 period. This comparison, however, does have a few limitations. First, the list of form X-17A-1 IPOs is not exhaustive. It is possible that some other IPOs sold in the same period were stabilized, but we do not have the form X-17A-1 for these IPOs. Hence, our sample is only a subsample of all stabilized IPOs. Nevertheless, it is a random subsample since the set of forms X-17A-1 extracted from SEC records was sampled completely randomly. Random sampling error of this nature will make our tests less powerful, and blur distinctions between stabilized and non-stabilized IPOs. To the extent we do find some differences, the results should be conservative. A second limitation of the data is that we do not have all the forms that were filed for a given IPO. Finally, the forms pertain to a relatively small window of thirteen months (June 1981 to July 1982), though this is similar to and a little longer than three-month windows employed in most other empirical work on price support.

In a second set of tests, we analyze a large sample of IPOs brought to the market over a longer period of time, between 1985 and 1994. Hard data on price support are not available for this period, since no filing requirements were mandated by SEC during this period. We have to rely on after-market returns of IPOs to identify issues that were *ex-post* supported through underwriter intervention in the after-market. Using several proxies for such support, we analyze the differences between supported issues and issues that underwriters did not support, primarily along the dimension of initial price risk of IPOs.

Our third approach exploits data from two different price stabilization regimes. Current practices are governed by the 1934 Securities Act, and under this regulatory regime, IPOs are stabilized for a few business days. However, prior to passage of the 1934 Act, underwriters did not face any restrictions on the extent of price stabilization. In the pre-1934 period, underwriters engaged in price support for about six weeks (Lasdon and Steiner (1933)). Thus, the pre-1934 period provides an interesting setting to assess the effect of price support on the IPO process. Accordingly, the third set of tests compare and contrast the riskiness of IPOs brought to the market prior to 1934 with a sample of IPOs drawn from the current regulatory regime. While other structural differ-

[5]We are grateful to Kathleen Hanley and Ivo Welch for kindly providing us these data.

ences between the two regimes could undoubtedly confound the comparison between pre-SEC and post-SEC IPOs, the test is nevertheless informative, for two reasons. First, the results should be conservative, since other confounding differences between the two regimes should make the test less powerful. Second, contrasting the risk of IPOs across the two regimes allows us to reexamine the only empirical evidence supporting the "legal liability" hypothesis of Tinic (1988) – the only other empirical work that we are aware of concerning underpricing differences between pre-SEC IPOs and IPOs in the current regime.

We draw three samples of IPOs to conduct the tests described above. Our first sample consists of IPOs for which forms X-17A-1 were known to be filed and a control sample of other IPOs brought to the market during the same period. We cross-verified the list of issues for which form X-17A-1 was filed with issue and offer date information with the New Issues database maintained by Securities Data Corporation (SDC). This yields a sample of 46 IPOs with offer dates distributed between June 1981 and July 1982. From the SDC databases, we also obtain a list of all other IPOs brought to the market in the June 1981-July 1982 period. After excluding spinoffs, IPOs by limited partnerships, unit offerings, non-original IPOs and IPOs of closed-end funds and real estate investment trusts, we are left with a sample of 208 IPOs including the form X-17A-1 sample. The SDC database compiles several characteristics of IPOs such as the offer price, issue size, the name of the managing underwriter(s), the gross spread charged for the IPO and so on. We obtain these and other cross-sectional characteristics of IPOs from the SDC database. For each IPO we also obtain after-market prices and trading volumes from the daily CRISP files, and where missing, from Standard and Poor daily price records.

Our second sample of IPOs consists of all firm commitment IPOs made between 1985 and 1994, excluding all spin-offs, IPOs by limited partnerships, unit offerings or non-original IPOs, and IPOs by closed-end funds and real estate investment trusts. We obtained issue data from the New Issues database of the Securities Data Corporation. We obtain price and trading volume data from CRISP tapes for this sample of 2723 IPOs for a period of thirty trading days following the offer date.

To construct the third sample of pre-1934 IPOs, we examined papers that studied equity issues in the pre-1934 period. Tinic (1988) studies IPOs from this period, while Simon (1989) studies IPOs and seasoned offerings offered in this period. We begin with the initial sample of 70 IPOs brought to the market between 1923 and 1930 used by Tinic. The sample information includes data on offering dates, offer prices, number of shares and the identity of the managing underwriter, all of which were gathered from the *Commercial and Financial Chronicle*. However, information in the *Chronicle* was not always complete. Hence we supplement these data with data from Moody's Manuals. We first verified that the issue was indeed an IPO by checking against the data in Moody's Manuals. We also cross-verified issue information in Moody's Manuals with that in the Chronicle. Moody's Manuals often has more detailed information on issues and sometimes categorically classified some of the issues as joint issues of equity and preferred stock sold at one price for the whole unit. Based on the information given in Moody's we excluded two joint issues from our sample.

We obtained weekly market prices for the pre-1934 IPOs for eight weeks following the offer date. The IPOs were listed on a number of exchanges: New York Stock Exchange, New York Curb, Chicago and Boston Stock Exchanges. We obtained price data by first searching through the weekly publications of the *Commercial and Financial Chronicle*, which was published on every Saturday. The *Chronicle* lists the last sale price of the week, which is typically associated with a transaction occurring on a Friday. If the closing price for a week was not available in the *Chronicle*, we examined *The Wall Street Journal* microfiche every day for that week. We treated the last traded price reported in the *Journal* as that week's closing price.

Table 1 presents some descriptive statistics for all three IPO samples. All three samples display significant underpricing. Most IPOs open above the offer and average initial returns range from 5.85% to 10.19%. Panels A, B and C of Table 2 report data on the distribution of buy-and-hold IPO returns for holding periods of up to six weeks following the IPO date. The mean return always exceeds the median return and the return distributions are positively skewed for all holding periods. Both facts are consistent with the existence of price stabilization. Price support tends to shift part of the left tail of the returns distribution towards the right. Such a shift will increase the mean but not the median of the returns distribution (if less than 50% of all IPOs are stabilized), and will also introduce positive skewness into the initial returns distribution. Both features are quite apparent in the distribution of initial IPO returns.

III. Empirical Analysis

A. Sample With Form X-17A-1 Data

We begin by examining the characteristics and return distributions of IPOs for which form X-17A-1 was filed. We distinguish these issues from other IPOs brought to the market in the June 1981-July 1982 period. The discussion in Section I.B suggests that underwriters are more likely to stabilize IPOs with less initial price risk – equivalently, supported IPOs are likely to be low risk

IPOs.[6] Accordingly, we mainly focus on distinguishing between stabilized and non-stabilized IPOs along the dimension of initial price risk. Empirically, this requires us to operationalize the definition of risk. The New Issues database maintained by SDC offers detailed cross-sectional information on IPOs brought to the market, and we use the database to construct the risk proxies.

A.1 Form X-17A-1 IPOs versus other IPOs

Our first proxy for risk, which is used widely in the IPO literature, is the size of an IPO. Size is regarded as being negatively related to the price risk of an IPO (see, e.g., Beatty and Ritter (1986)). A second proxy for risk is the *gross spread* of an IPO. The gross spread of an IPO denotes the difference between the price at which an underwriter buys an IPO and the price at which the IPO is sold to initial investors in the IPO. The spread is usually higher for IPOs that are harder to price (for a discussion, see, e.g., Bloch (1992)). The spread is a particularly interesting proxy for IPO risk because it is often finalized just before – sometimes minutes before – an IPO (see, e.g., a discussion of the Microsoft IPO in Uttal (1986)), and is therefore likely to be based on the underwriter's most current information set, similar to that used in making the stabilization decision. A third proxy for the risk of an IPO is the reputation of the book manager of an IPO. IPOs with more prestigious underwriters are likely to be less risky than IPOs underwritten by less reputed underwriters (Carter and Manaster (1990)). Operationally, we measure reputation as a dummy variable that takes the value zero or one depending on whether the underwriter is among the top ten ranked underwriters in the year. Finally, we consider the offer price of an IPO as a potential risk proxy. Though this variable should be irrelevant if splits and reverse splits are costless, stocks with low offer prices are regarded as being speculative and more difficult to price accurately. In the IPO context, Tinic (1988) uses offer price as a negative proxy for risk.

The literature on the "partial adjustment" phenomenon (see Hanley (1993), Ritter (1998)) suggests that the location of the final offer price relative to the initial filing range predicts initial returns. IPOs priced at the top of or above the filing range are likely to experience positive initial returns, and such IPOs are less likely to need stabilization. Thus, we also examine whether a partial-adjustment phenomenon related variable $PARTIAL$, the ratio of the final offer price to the mid-point of the preliminary filing range, distinguishes stabilized IPOs from non-stabilized IPOs.

[6] Section I suggests that if an IPO is of low risk, underwriters will stabilize it. Empirically, this implies that if $p_{low} = prob(stabilize \mid low\, risk)$ and $p_{high} = prob(stabilize \mid high\, risk)$, $p_{high} = p_{low} - \delta$ where $\delta > 0$. If this relation is true, it follows, using Bayes' rule, that $prob(low\, risk \mid stabilize) = \frac{p_{low}}{2\,p_{low} - \delta} > prob(low\, risk \mid don't\, stabilize) = \frac{1-p_{low}}{2-2\,p_{low}+\delta}$. This derivation suggests that if underwriters are more likely to stabilize low risk IPOs, then stabilized IPOs are also likely to be less risky than non-stabilized IPOs.

An alternative to $PARTIAL$ is a variable, $ADJUST$ based on the ratio of the offer price to the low end of the filing range. Similar results obtain under either specification.

Table 3 reports sample averages of selected characteristics of both stabilized IPOs – defined here as firms for which form X-17A-1 was filed – and other IPOs brought to the markets during the June 1981-July 1982 period. The first column reports sample averages for stabilized IPOs; column two reports sample averages for other IPOs, while the third column reports t-statistics for testing the significance of the difference in sample averages between stabilized and non-stabilized IPOs. Stabilized IPOs tend to be larger than non-stabilized IPOs. Additionally, stabilized IPOs tend to have lower gross spreads and higher offer prices than non-stabilized IPOs, and the difference in both characteristics is statistically significant. While stabilized IPOs appear to be underwritten by more prestigious underwriters, the reputation variable is not significantly different across the two samples. Collectively, the results provide some support for the notion that stabilized IPOs are less risky than non-stabilized IPOs, as the differences in risk proxies are always in the direction predicted by theory and mostly statistically significant. We also find, consistent with the partial adjustment literature, that stabilized IPOs are more likely to be priced below or at the lower end of their preliminary filing range. The variable $PARTIAL$ is 87.5% for stabilized IPOs versus 93.9% for non-stabilized IPOs.

Table 4 reports estimates of a probit specification in which the dependent variable is 1 or 0 depending on whether there was a form X-17A-1 filed for an IPO and the independent variable is one of the risk proxies discussed above. This analysis allows us to directly test whether conditional on an IPO's risk being low, it is more likely to be stabilized. In contrast, Table 3 examines the converse, i.e., whether, given that an IPO is stabilized, it is of low risk – exactly the opposite conditioning. We estimated the probit specification both with and without industry dummies based on the first digit of the four digit SIC code, so as to control for potential industry effects in price support. Both sets of estimates are similar and coefficients for industry dummy variables are not significant in any of the specifications. The probit results indicate that larger IPOs, IPOs with lower gross spreads and higher offer prices, and those priced at the lower end of their filing range are more likely to be stabilized.

Table 5 reports the correlation matrix of all the independent variables discussed above. Spread, log issue size and offer price are closely correlated with each other, with pairwise absolute correlations of about 0.7. Each of these variables is less correlated with underwriter reputation and the partial adjustment variable $PARTIAL$. Given that we have no particular prediction about which variable from these is a better predictor of risk than others, and the high correlation between the three variables leads to collinearity problems in the relatively small 1981-1982 sample, we do not estimate a full multivariate specification. It is, however, of some interest to assess whether the risk proxies are subsumed by the partial adjustment variable in the probit specification. The risk proxies do remain significant in multivariate specifications that also include $PARTIAL$ as an explanatory variable. For instance, in a specification that includes both log issue size and $PARTIAL$, log issue size has a coefficient of 0.33 with a t-statistic of 2.37 (versus a coefficient and t-statistic of 0.21 and 1.92, respectively, in the univariate probit – see row 1 of Table 4). Similar results obtain for gross spread and offer price as well. Thus, stabilized IPOs are less risky than non-stabilized IPOs, even after controlling for the fact that the former are more likely to be priced at the lower end of the filing range.

A.2 After-market Return Distributions

We also analyze the after-market return distributions of stabilized and non-stabilized IPOs. Table 6 reports the average return and cross-sectional standard deviation of returns for stabilized and non-stabilized IPOs for the first day, first week and the fourth week after the offer date. The average initial return of stabilized IPOs is small (0.2%) and is not significantly different from zero, whereas non-stabilized IPOs have statistically significant positive initial returns of 8.94%. We also computed the cross-sectional standard deviation of initial returns for both samples. The standard deviation is considerably *smaller* for stabilized IPOs (5.21%) compared to non-stabilized IPOs (18.02%). While these facts might certainly indicate that stabilized IPOs are less risky and less underpriced than non-stabilized IPOs, they also indicate that price support occurs primarily around the offer price of an IPO. In this regard, the form X-17A-1 data confirm the conclusions based on less direct data such as bid-ask spreads (Hanley, Kumar and Seguin (1993), microstructure data (Schultz and Zaman (1994)), and after-market return distributions (Asquith, Kieschnick and Jones (1998)).

More persuasive evidence on risk and underpricing of stabilized IPOs is provided by return distributions for holding periods longer than one day. The second and third rows of Table 6 show that stabilized IPOs have much smaller average returns and cross-sectional standard deviations than non-stabilized IPOs for one and four-week holding periods, when stabilization would have ceased. Similar results, not reported here, obtain for holding periods of five and six weeks as well. These data confirm that the lower initial return and variance of stabilized IPOs is at least partially because stabilized IPOs are less risky than non-stabilized IPOs.

A.3 Ruling Out Some Alternative Explanations For Price Support

The return distributions of stabilized and non-stabilized IPOs also allow us to examine two other explanations for the prevalence of price support, viz., a *favored customer* hypothesis and another *underwriter reimbursement* hypothesis. Under the favored customer hypothesis, which is discussed as a possible explanation for price support in Benveniste, Busaba and Wilhelm (1996), underwriters support IPOs simply to bail out their most favored customers out of losers, i.e., IPOs expected to sink substantially below offer in the IPO after-market. If this explanation for price support were correct, supported IPOs should, on average, drop significantly in value after stabilization is withdrawn, and more so than non-stabilized IPOs. To test this hypothesis, we estimate post-stabilization returns, which we define as buy-and-hold returns from days 5 through 20 (similar results obtain when the post-stabilization returns are computed as one-week and two-week buy-and-hold returns starting five days after the offer date). The results, reported in the last row of Table 6, show that stabilized IPOs did experience negative returns from days 5 through 20 following an IPO. However, the difference in post-stabilization returns between the two samples is not significant. In fact, stabilized IPOs appear to experience less short-run price adjustment in the post-stabilization period. There is little support for the favored customer hypothesis.

The underwriter reimbursement hypothesis suggests that stabilization is simply an extra cost of underwriting an IPO, which is recovered by underwriters through higher spreads. If this hypothesis is correct, gross spreads of stabilized IPOs should be *higher* than those of non-stabilized IPOs, whereas our stabilization risk-reduction hypothesis suggests that gross spreads of stabilized IPOs should be *lower*. The empirical evidence in Table 3 is inconsistent with the underwriter reimbursement hypothesis. There is no evidence that form X-17A-1 IPOs have larger spreads; in fact, these IPOs have smaller underwriting spreads.

B. Evidence from the 1985-1994 Period

This section examines a large sample of 2723 IPOs offered between 1985 and 1994. As there are no hard data on price support during this period, we follow previous literature in identifying IPOs that were *ex-post* supported from after-market return data. Specifically, we attempt to identify IPOs in which underwriters intervened in the after-market, and through active purchases, arrested (or at least impeded) potential declines in the price at which the IPO is traded.[7] We discuss several sets of IPOs in which this is likely to be the case.

B.1 Which IPOs Are Supported?

We begin by assuming that supported IPOs are issues with first-day returns of zero. This assumption has been made in previous work (e.g., Ruud (1993)) and appears reasonable not only because the offer price is a natural focal point for support, but also because it is a relatively consistent implication of much published empirical evidence in the literature. We discuss some of this evidence below.

Hanley, Kumar and Seguin (1993) argue that if underwriters support IPOs at the offer, bid-ask spreads of an IPO should narrow as the traded price of the IPO approaches the offer. Additionally, bid-ask spreads should *widen* across time for these IPOs as the floor provided by support at the offer is withdrawn. Hanley, Kumar and Seguin document empirical results consistent with both predictions. Schultz and Zaman (1994) analyze detailed microstructure data from the Bridge Quotation system that allows them to identify whether after-market trades and quotes involve an IPO underwriter. In their sample of 40 supported IPOs offered between March 1992 and June 1992 (32 of which had zero initial return), supported IPOs are characterized by a relative preponderance of sell orders, so that underwriters, who take the opposite side, are mostly buyers of supported IPOs. Additionally, underwriters spend more time (86.21%) at the inside bid than other dealers, but *less* time (4.42%) at the inside offer for supported IPOs. Thus, underwriters appear to be the most active buyers in the after-market for supported IPOs. More recently, Asquith, Jones and Kieschnick (1998) model early IPO returns as mixtures of two normal distributions. They report that one component of this mixture is centered at a zero initial return and has a small variance, which they interpret as evidence of underwriter price support at the offer.

Additional evidence on whether support appears to occur at the offer is provided by comparing the relative frequency of small negative price changes in the IPO sample and in random samples. If zero price change is a good proxy for support, we should see relatively few small negative price changes in the IPO sample compared to random non-IPO samples. Focusing on small price changes

[7]This exercise is different from analyzing the nature of IPOs in which underwriters take naked short positions, as in Aggarwal (1998). Naked short positions certainly give an underwriter the *option* to intervene or "support" an issue, but do not create the obligation to do so; underwriters can still elect not to intervene, and allow price declines in the face of after-market selling pressure (and make greater profits). On the other hand, we specifically focus on IPOs in which such intervention seems to occur and ones in which it does not. The two analyzes yield insights that are different and of independent interest in their own right.

should mitigate the effects of positive initial returns of IPOs relative to random samples, assuming underwriters have little incentive to underprice by small amounts such as an eighth or a quarter of a dollar. To implement the test discussed above, we pick a date at random and identify all stocks on the CRSP tapes, excluding closed-end funds and real estate investment trusts, that have valid price and volume data on this date. We compute the number of firms with small negative price changes of upto -\$ $\frac{1}{8}$, expressed as a fraction of the number of firms with a zero price change and the number with a positive price change of upto +\$ $\frac{1}{8}$. We compare these percentages to ones prevalent in the IPO sample.

The empirical results confirm that small negative price changes are indeed less frequent in IPOs. In our IPO sample, we have 84 firms with small negative price changes, 408 firms with a zero price change and 197 firms with small positive price changes. Thus, small negatives are only 17% of zeros and 32% of small positives. In contrast, for a typical date picked at random (e.g., November 29, 1993), firms with small negative price changes (696) are much more common – they form 36% of zeros and 59% of firms with small positive price changes. The difference between the number of small negatives in the IPO and random samples is significant. Qualitatively similar results obtain when price changes up to \$ $\frac{1}{4}$ rather than \$ $\frac{1}{8}$ are considered.

Based on the above discussion, it does seem reasonable to begin by defining issues that have a first day return of zero as ones experiencing underwriter support in the IPO after-market. However, as this definition is subject to error, we also consider somewhat tighter definitions of supported IPOs. As one alternative, we consider issues that close at zero return not only on the offer date but also on the next day and the next two days as well – the "two-day zero return" and "three-day zero return" samples, respectively. The idea here is that absent intervention by underwriters, actively traded issues such as IPOs are unlikely to have zero returns for two or three days in succession. Hence, the two-day zero return and three-day zero return samples are potentially more accurate indicators of supported IPOs. Similar results obtain for both samples, so we report estimates for the two-day zero return sample.

As another refinement, we also consider subsamples of the two-day zero return sample in which IPO turnover is at least 15%. The minimum turnover restriction serves two purposes. First, it provides us a subsample in which returns are zero despite significant trading volume. Second, it partially accounts for the existence of the overallotment option in IPOs, which usually amounts to about 15% of an IPO's size. As our minimum turnover cutoff of 15% is admittedly ad-hoc, and is based primarily on the size of the typical greenshoe option in IPOs, so it seems appropriate to consider other definitions as well. We considered two alternative restrictions, viz., that the minimum turnover in the IPO equal 30% of an IPO or 45% of an IPO, representing twice and thrice the greenshoe amount. The results are not sensitive to the particular cutoff we used and similar patters obtain under each of these assumptions.

B.2 Characteristics of Supported IPOs

Table 7 reports sample averages for several characteristics for the 1985-1994 IPO sample. The first three columns report data for supported IPOs, based on the various definitions discussed in the previous section. Column one reports averages for the 408 IPOs that had one-day returns of zero. The next two columns report data for the two-day zero return sample, with and without minimum turnover restrictions, respectively. This completes our sample of supported IPOs.

We compare the characteristics of supported IPOs to two other groups of IPOs. First, we compare supported IPOs to all other IPOs offered between 1985 and 1994, whose characteristics are reported in fourth column of Table 7. This comparison allows us to assess where supported IPOs stand relative to the remaining universe of IPOs. However, the latter group is heterogeneous, as it comprises both positive return IPOs, which trade at a premium to the offer, and negative return IPOs, which trade at a discount to the offer. Positive return IPOs are unlikely to have been supported. Such IPOs would qualify as supported IPOs, if there existed selling pressure at a point above the offer price, yet underwriters absorbed such selling pressure instead of allowing the issue to trade at a lower price. We consider this scenario unlikely because the law frowns upon such a practice and practitioners suggest it does not happen. Additionally, in such a scenario, it is rational and profitable for underwriters to allow the price to drop and then intervene, while still avoiding any reputational costs that seem to be associated with IPOs trading below the offer. Hence, positive return IPOs seem unlikely to have experienced intervention that can be characterized as price support.

On the other hand, negative return IPOs are potentially a fairly interesting comparison group. There are three ways of interpreting this group. First, it is possible that underwriters chose not to support these IPOs at all, so they trade at a discount in the after-market. Alternatively, it is possible that the underwriter extended weak price support, by intervening only after a preliminary price decline. Finally, it is possible that the underwriter gave up efforts to support negative return IPOs sooner, after a smaller turnover – since, e.g., total first-day turnover in negative return IPOs (28.3%)is indistinguishable from that in zero return IPOs (28.9%), support would have to be given up sooner, after lesser turnover for negative return IPOs. Whatever the interpretation, it seems reasonable to consider negative return IPOs as unsupported issues, in which underwriters had the opportunity to, but chose not to support (or more weakly supported) at the offer. Hence, in a second set of comparisons, we examine whether supported IPOs are less risky than negative return IPOs. The last column of Table 7 reports characteristics for negative return IPOs.

The data in Table 7 suggest that supported IPOs are less risky relative to both, all IPOs offered between 1985 and 1994 as well as the subsample of these IPOs that were not supported, and this pattern is invariant to the definition of supported IPOs. Supported IPOs tend to be larger, have smaller gross spreads and larger offer prices, and tend to be underwritten by more prestigious underwriters. Differences in all characteristics, except for offer prices, are significant at better than 1%. Additionally, stabilized IPOs are more likely to be priced at the lower end of the filing range, consistent with the partial adjustment phenomenon. Results for the two day zero return samples with and without turnover restrictions (the second and third columns) show similar – and even stronger – patterns in risk differences between supported and non-supported IPOs. Thus, the data in Table 7 are consistent with the negative relation between price support and the initial price risk of IPOs.

We also estimate probit specifications in which we model an underwriter's decision to support an IPO as a function of the various risk proxies discussed above. Here, we focus on comparing supported IPOs with IPOs that underwriters chose not to support, but similar results obtain if stabilized IPOs are compared to all other IPOs offered between 1985 and 1994. We include three controls in estimating the probit specification. The first control is an industry control, a dummy variable based on the first digit of the four-digit SIC code. In addition, because we do not have hard data on price support, we include two other controls in differentiating between supported and non-supported IPOs in this section. Specifically, we control for the turnover of an IPO and the *ex-post* volatility of the IPO. The turnover of an IPO is computed as the percentage of an IPO that trades in the after-market following an offering. The *ex-post* volatility of an IPO is computed as the standard deviation of daily returns from days 6 through 20 after the offer date. We control for turnover and volatility because stocks with greater *ex-post* volatility and higher turnover are less likely to remain at the offer price in the IPO after-market. Thus, both variables are included as controls in this section, where we differentiate between supported IPOs (defined here as IPOs that have a one-day return of zero) and unsupported IPOs.

Table 8 reports the probit estimates. In the univariate probit specification, coefficients for proxies of risk have the correct sign and most are significant at 5% or better. Thus, supported IPOs are less risky than unsupported IPOs and these results stand whether we include controls for industry, turnover and *ex-post* volatility or not. Neither the industry dummy coefficients nor the coefficients for both *ex-post* volatility and turnover turn out to be significant in differentiating between supported and unsupported IPOs. Further, the coefficients for the main risk proxies – issue size, gross spread, offer price and underwriter reputation – maintain their sign, magnitude and significance whether or not the additional controls are included. The probit coefficient for the partial adjustment variable ($PARTIAL$) is negative and significant, indicating that IPOs priced at the lower end of their filing range are more likely to be stabilized. As in Section III.A.1, we also verified that coefficients of the three highly cross-correlated risk proxies (log issue size, spread and offer), maintain their sign, magnitude and significance, even in multivariate specifications that also include the variable $PARTIAL$. There is no evidence that the risk proxies are subsumed by the partial adjustment variable.

The data are also not consistent with the underwriter reimbursement hypothesis. There is little evidence that spreads for supported issues are higher – in fact, the evidence suggests that spreads for supported IPOs seem to be lower. The favored customer hypothesis is rejected because the post-stabilization drift is not more negative. There is also little support for the favored customer hypothesis. The post-stabilization drift is negative (-0.38%, t-statistic -0.61) for supported IPOs, but there is no evidence that it is more negative for IPOs that were not supported (-3.32%, t-statistic =-5.28). It seems implausible that underwriters compensate customers for small losses of -0.38% in supported IPOs while not compensating them for larger losses of -3.32% in unsupported IPOs.[8]

As a check on the robustness of our results, we compare the cross-sectional patterns of risk in the IPO sample with similar patterns obtained for a random sample of non-issuers. The issue addressed here is that while we have found IPOs with a zero first day return are less risky than IPOs with non-zero returns, is this relation peculiar to IPOs? Alternatively, is the relation generic to any random sample of stocks – perhaps simply reflecting that stocks with zero return are less risky than those that experienced some price movement on the random date? To address this issue, we draw a date at random and from the universe of all stocks except real estate investment trusts and closed-end funds, we examine characteristics of stocks with zero return stocks relative to other stocks. Patterns in this random sample are exactly *opposite* to those in IPOs: zero return stocks are smaller and have lower prices compared to other firms. These results also obtain, and in fact, strengthen, when we look at stocks with zero returns on three days in succession rather than zero returns on one day. Based on this evidence, we conclude that cross-sectional patterns witnessed in

[8]The positive correlation between initial IPO returns and subsequent returns could also indicate a momentum effect in the IPO after-market (Krigman, Shaw and Womack (1997)).

the IPO sample are indeed peculiar to IPOs; they are *not* generic features of arbitrarily picked sets of stocks.

C. Comparing Pre-1934 IPOs With 1985-1994 IPOs

In this section, we compare pre-1934 IPOs with the large sample of IPOs brought to the market for a comparable length of time, between 1985 and 1994. The stabilization risk-reduction hypothesis suggests that the pre-1934 IPOs should be less risky than the 1985-1994 IPO sample, since the pre-1934 period was characterized by a more intensive price support regime. We test this implication and also examine it against some alternative explanations for differences between the pre-1934 and post-1934 initial IPO returns.

C.1 The Risk Of Pre-1934 and 1985-1994 IPOs

To begin, we compare the sample moments of the data across the two periods. The mean and median underpricing for the pre-1934 sample are lower than that for the 1985-1994 sample as a whole (see Panels B and C in Table 2). Data in Panel B and C of Table 2 also indicate that the pre-1934 sample had a lower cross-sectional variance than the 1985-1994 sample as a whole (and each sub-sample formed according to the year of the IPO as well, which results we do not report here to conserve space). Thus, it appears that the pre-1934 issues were less risky and experienced lower average underpricing. This finding is consistent with our principal proposition that a greater commitment to price stabilization leads to less risky IPOs being brought to the market at lower levels of underpricing.

A comparison of the raw variance estimates may be inappropriate due to the bias induced by price support. Specifically, price support left-censors the initial return distribution of IPOs, and this biases both the mean return (upward) and the variance of initial returns (downward). Hence, we attempt to correct for this bias, and then compare the resulting mean and variance estimates for the pre-1934 and the 1985-1994 periods. This requires us to specify a method for correcting for the bias induced by price support.

Assuming that negative IPO returns are never observed, Ruud (1993) uses the Tobit methodology to correct for the left-censoring of initial IPO returns. However, this analysis has two problems. First, Ruud uses logarithmic returns rather than buy-and-hold returns, which biases the mean downward in positively skewed samples such as initial IPO returns. Additionally, negative IPO returns *are* observed in practice. Thus, IPO return data do not fit the distributional assumptions of the Tobit model, so it is unclear what the Tobit estimates represent.

We propose a simple alternative to the Tobit model that is consistent with partial left-censoring of initial IPO returns. To begin, we assume (as in the Tobit model) that the true initial IPO return of IPO i, r_i^*, is normally distributed with mean μ and variance σ^2. If an IPO opens above the offer, we assume that it trades at its true market price. On the other hand, if an issue opens below the offer, underwriters are assumed to stabilize the issue at the offer with some probability p ϵ (0,1). This yields the following statistical specification:

$$r_i^* = \mu + \epsilon_i$$

$$r_i = r_i^*, \quad if \;\; r_i^* > 0$$

whereas if $r_i^* \leq 0$,

$$\begin{aligned} r_i = 0 \qquad & with \;\; probability \;\; p \\ r_i = r_i^* \quad & with \;\; probability \;\; (1 \Leftrightarrow p) \end{aligned} \tag{1}$$

where r_i^* is the true IPO return that would prevail absent price support, ϵ_i is normally distributed N $(0, \sigma^2)$, and r_i is the actual IPO return that is observed in the data.

The distinguishing characteristic of specification (1) is that it allows for partial and incomplete censoring of the left tail of the IPO returns distribution. Like the Tobit model, specification (1) allows for a non-trivial probability mass at zero, but unlike the Tobit model, it allows for and uses information on IPOs that open below zero. While the model specifies the probability of stabilization (p) and the expected return (μ) as scalar constants, p and μ can be modeled as cross-sectional functions of firm-specific variables as well. Finally, the model yields estimates that have a simple interpretation in terms of parameters of the IPO process – p is the probability that an IPO will be stabilized and μ and σ^2 are estimates of the mean and variance of underpricing adjusted for price support – relative to more ad-hoc mixtures of distribution methods recently used to model initial IPO returns (Hunt-McCool, Koh and Francis (1996), Asquith, Kieschnick and Jones (1998)). Specification (1) can be estimated by maximum likelihood (ML) in a fairly straightforward manner.

Table 9 reports ML estimates of specification (1) for both the pre-1934 and the 1985-1994 data. For the pre-1934 sample, p is estimated to be 0.77; thus, about three-quarters of all issues that would have opened below the offer are stabilized at the offer. The estimates of the price-support adjusted mean and standard deviation of initial IPO returns μ and σ are 4.3% and 11.02%, respectively, while the raw sample mean and standard deviation are 5.85% and 9.0% (Table 2, Panel C). Thus, price support appears to inflate initial underpricing by 1.55% and understates the initial return volatility by 2%. The stabilization-adjusted underpricing is 4.3% and remains statistically significant, indicating that the pre-1934 IPOs were significantly underpriced after correcting for the bias due to price support. Qualitatively similar conclusions obtain for the 1985-1994 period as well. For this period, the raw underpricing of IPOs is 10.19% (Table 2, Panel B), while the stabilization adjusted underpricing (parameter μ in Table 10) is 8.38%, about twice that in the pre-1934 period. The difference, about 1.8%, represents the amount of the raw underpricing attributable to price support. This estimate is probably an upper bound on the true bias due to price support, since specification (1) is estimated under the assumption that *all* IPOs that open at zero have been stabilized. Hence, the true effect of stabilization probably lies between zero and 1.8%. In any event, it is clear that price support does *not* seem to explain the entire underpricing phenomenon in either sample, as stabilization-adjusted underpricing is positive and significant in both samples. In fact, a simple calculation based on descriptive statistics for IPO returns shows that it is impossible for price support alone to explain IPO underpricing.[9]

Comparing estimates of specification (1) for the pre-1934 sample with those for the 1985-1994 IPO sample, we find a striking difference in the cross-sectional variance of initial returns across the two samples. The cross-sectional standard deviation of initial returns for the 1985-1994 sample as a whole, as well as that for individual five year subperiods, exceeds that of the pre-1934 sample by over 40%, and the difference is significant at 5%. Thus, even the price-support adjusted variance estimates tell the same story as the raw variance estimates: IPOs brought to the market in the pre-1934 period were less risky than the post-1934 IPOs.

Other *ex-ante* indicators of risk lead to similar conclusions. Table 1 indicates that the mean and median offer price for the pre-1934 issues (about \$ 33) are unusually large, well over twice those for the 1985-1994 sample. From Table 1, it appears that the median issue size for the pre-1934 sample (\$ 4.2 mm) is lower than that for the 1985-1994 sample (\$ 18 mm). However, this comparison of nominal sizes ignores the market-wide changes in company size in the six decades that separate the pre-1934 period from the 1985-1994 period. Adjusting for the capital gains component of the market return for the six decade period (5.6%), the median pre-1934 issue size is \$ 87 mm, which

[9] Given specification (1), we can analytically derive the probability limit of the difference between the sample average underpricing $\overline{r}$ and the true expected underpricing μ. Specifically, $plim\ \overline{r} - \mu = \sigma\, p\, n\,(\frac{\mu}{\sigma}) - p\,\mu\, N\,(\frac{\mu}{\sigma})$, where $N\,(.)$ and $n\,(.)$ represent the standard normal distribution and density functions, respectively. This difference is positive since if z is standard normal, $E\ (z \mid z > \frac{\mu}{\sigma}) = \frac{n\,(\mu/\sigma)}{N\,(\mu/\sigma)} > \frac{\mu}{\sigma} \Rightarrow \sigma\, n\,(\mu/\sigma) - \mu\, N\,(\mu/\sigma) > 0$. Further, given $\overline{r} = 10.19\%$ (Table 1) and $\sigma \approx 18\%$ (Table 10), we can solve the expression for the bias for the value of p such that the true expected underpricing μ is zero. Doing so gives $p \approx 1.42$, which is clearly impossible, as p must satisfy $0 \leq p \leq 1$.

is about five times that for the 1985-1994 IPOs. Thus, even when one considers issue size as a proxy for risk, there is little evidence that the pre-1934 issues were more risky than their 1985-1994 counterparts; on the contrary, the pre-1934 IPOs appear to be less risky ones.

A possible explanation for the difference in the variances between the pre-1934 and the 1985-94 period is that stocks were less volatile in the pre-1934 period. The average annualized volatility of returns of the Dow Jones Index during 1923-1928 period is 12.7% (this is the average of annualized standard deviation of returns computed for each month during the subperiod), while the average for the 1985-94 period was 11.7%. Thus, on a market-wide basis, there is no evidence that stocks were less volatile in the pre-1934 period. One possibility is that while the market-wide volatility is not different across the two periods, idiosyncratic risk was less in the pre-1934 period. But even here, a 15% p.a. difference in idiosyncratic volatilities across the two periods gives less than $\frac{15}{\sqrt{260}} = 0.93\%$ difference between pre and post-1934 for one-day returns and a 2.08% difference for weekly returns. By contrast, the actual difference between the *one-day* cross-sectional standard deviation of IPO returns in the current period and a *one week* standard deviation of IPO returns IPOs in the pre-1934 period is about 7%. Hence, period-specific differences in stock-return variances do not seem to be responsible for the differences in IPO risk across the two periods.

C.2 The Legal Liability Hypothesis

Examining the risk associated with IPOs also helps distinguish between our hypotheses and the alternate "legal liability" hypothesis proposed by Tinic (1988). Tinic argues that underwriters were less concerned about investor initiated lawsuits about overpriced IPOs in the pre-1934 period, as due diligence rules for underwriters were laid out only with the passage of the 1933 Securities Act. Thus, Tinic suggests that IPOs are underpriced more in the current regime, in response to the greater threat of litigation brought upon by the 1933 Act. Tinic's finding is thus widely seen as evidence that the 1933 Act imposes real costs on the going public process.

One can discriminate between the legal liability insurance hypothesis and the stabilization risk-reduction hypothesis by examining the risk associated with IPOs across the pre-1934 and the 1985-1994 period. The insurance hypothesis suggests that underwriters were less concerned about the possibility of lawsuits arising out of mispriced issues in the pre-1934 period, and hence ought to engage in less intense pre-market information production in that period. Therefore, the insurance hypothesis suggests that the pre-1934 IPOs should be *more* risky than the 1985-1994 IPOs. However, we find exactly the opposite effect in the data – pre-1934 IPOs are *less* risky than the 1985-1994 IPOs. This finding is *not* consistent with the legal liability hypothesis, and calls into question whether that the 1933 Act really adds to the cost of going public by imposing significant litigation costs on IPO underwriters in the US market.[10]

IV. Conclusions

Received evidence suggests that underwriters support prices in the after-market following an IPO. The economic consequences of such price support are, however, less understood. Our work provides this missing link. We provide extensive evidence that price support influences both the *ex-ante* risk of IPOs brought to the market and the level of underpricing at which the issues are sold.

Our results suggest that the conventional SEC perspective of stabilization as a form of price manipulation, and the view that stabilization simply imposes additional costs on underwriters –and, ultimately, IPO issuers – are both somewhat narrow. Rather, our results provide support for the more broad view that price support alleviates informational problems between issuers, underwriters and investors in IPO markets, a view also suggested in recent theoretical literature in this area. We add to this body of work by providing some of the first empirical evidence on the positive contracting role of price support in the IPO process.

Our work also makes a methodological contribution to the IPO underpricing literature. The methodology introduced here quantifies the bias introduced by price support on the mean and variance of initial IPO returns. It provides parameter estimates that have simple and direct structural interpretations in terms of the IPO process. These estimates indicate that price support does not alone explain the underpricing phenomenon. IPOs do remain significantly underpriced, even after accounting for price support.

[10] Other papers have also argued against the validity of the legal liability theory on theoretical grounds and based on anecdotal evidence. Hughes and Thakor (1992) argue that simply the existence of litigation risk alone is not sufficient to cause IPOs to be underpriced. Alexander (1993) argues that the offer price is irrelevant to the probability of initiating a lawsuit or the dollar amount at which such a suit is settled (see also Drake and Vetsuypens (1992) in this context). Keloharju (1993) presents evidence from the Finnish IPO market that underpricing is unlikely to be due to legal liability considerations. None of the papers reconcile Tinic's evidence concerning pre-1934 and post-1934 IPO underpricing.

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Appendix

A Model Of Price Support

1. Information Structure

We begin at the stage when the underwriter has investigated the company being underwritten and has gathered information about the firm's value $\tilde{V}$. The information gathering process may be complete, in which case we assume that $\tilde{V} = \overline{v}$. On the other hand, there may exist residual information about the IPO that is not known to the underwriter. If such residual information exists, it could be either "good" or "bad" with equal probability. In the good state, the IPO's value is $\overline{v} + s$, whereas in the bad state, the IPO's value is $\overline{v} \Leftrightarrow s$. Thus, the IPO's expected value is $\overline{v}$, while s, the "volatility" measures the effect of any potential undiscovered information on the IPO's value.

Let θ denote the probability that the information gathering process is complete. The parameter θ may be interpreted as the quality of the underwriter's information collection efforts, since a large value of θ indicates that $\tilde{V} = \overline{v}$ almost surely, i.e., there is little likelihood that any additional information about $\tilde{V}$ exists, beyond that already gathered by the underwriter. Conversely, a small θ implies that extra information about the $\tilde{V}$, beyond that collected by the underwriter is likely to arrive in the IPO after-market. This structure implies that $prob\ (\tilde{V} = \overline{v}) = \theta$, while $prob\ (\tilde{V} = \overline{v} + s)$ $= prob\ (\tilde{V} = \overline{v} \Leftrightarrow s) = \frac{1}{2}(1 \Leftrightarrow \theta)$. We assume that underwriters, but not investors in the IPO, know the value of θ.

2. The Profits From Price Support

To begin, assume that the offer price (OP) is exogenously specified and that $\overline{v} \Leftrightarrow s < OP < \overline{v}$. The first inequality says that the offer price is greater than the lowest possible value of the IPO, and the second one is equivalent to assuming that IPOs are underpriced on average. We derive an expression for underwriter profits from supporting an IPO, given that a sell order arrives in the after-market following the commencement of trading in the IPO.

An underwriter's profit from supporting the IPO depends on what information is contained in a sell order. If the sell order is a random trade initiated for reasons unrelated to the IPO's value, there is no new information in the trade. On the other hand, if a sell order is prompted by adverse information about the IPO's value $\tilde{V}$, the sell order could cause a downward revision in the expectations of the IPO's value. The profit from price support is the difference between the revised expectation of $\tilde{V}$ and the offer price for the IPO.

To model the information contained in a sell order, suppose that q denotes the probability that an investor in the IPO is informed. An informed investor knows whether $\tilde{V}$ is $\overline{v}$, $\overline{v}+s$ or $\overline{v}-s$, and would sell the IPO at the stabilizing bid in the state in which $\tilde{V}=\overline{v}-s$. In this state, selling now yields a price OP while waiting will yield a price $\overline{v}-s<OP$. In all other states, waiting is better than immediately selling since in these states $OP<\tilde{V}$. Since the probability that $\tilde{V}=\overline{v}-s$ is $\frac{1}{2}(1-\theta)$, the probability of a trader initiating a sell order, given that the trader is informed, is

$$prob\,(t=sell \mid I=i)=\frac{1}{2}\,(1-\theta) \qquad (2)$$

where $t=sell$ denotes that the trade (t) is a sell order and $I \in \{i,\,u\}$ denotes whether the investor is informed (i) or uninformed (u). This completes the specification of informed investors.

To model the trading pattern of uninformed investors, let p be the probability that an uninformed investor sells in the IPO after-market, for random ("liquidity") reasons unrelated to the IPO's value. Thus, the probability of a trader initiating a sell order, given that the trader is uninformed, is

$$prob\,(t=sell \mid I=u)=p \qquad (3)$$

Equations (2) and (3) give the probabilities of selling by each type of investor. However, from an underwriter's perspective, what matters is the identity of the selling investor, conditional on receiving a sell order. Using Bayes' rule, equations (2) and (3), and the fact that $prob\;(I=i)=q$, the relevant conditional probabilities are:

$$prob\,(I=i \mid t=sell) \;=\; \frac{q\,(1-\theta)}{q\,(1-\theta)+2p\,(1-q)} \qquad (4)$$

$$prob\,(I=u \mid t=sell) \;=\; \frac{2p\,(1-q)}{q\,(1-\theta)+2p\,(1-q)} \qquad (5)$$

and the revised expectation of the IPO's value, conditional on receiving a sell order in the after-market, is

$$E\,(\tilde{V} \mid t=sell)=\Sigma_{I=i,\,u}\,E\,(\tilde{V} \mid t=sell,\,I)\,*\,prob\,(I)=\overline{v}-\frac{s\,q\,(1-\theta)}{q\,(1-\theta)+2p\,(1-q)} \qquad (6)$$

Using equation (6), the expected per share profit from price support is given by the expression

$$E\,(\pi\,(su,\,\theta))\;=\overline{v}-\frac{s\,q\,(1-\theta)}{q\,(1-\theta)+2p\,(1-q)}-OP \qquad (7)$$

where variable su denotes the strategy of supporting an IPO. With this expression in hand, we consider what types of IPOs will be stabilized, and the implications of allowing price support for the equilibrium information production and underpricing in IPOs.

3. What Types Of IPOs Will Be Supported?

Consider two types of IPOs: a low risk IPO of type G ("good"), which has a high value of θ, say θ_G, and a high risk IPO of type B ("bad") with $\theta = \theta_B < \theta_G$. Underwriters but not investors know the IPO type.

For expositional ease, we assume that $\theta_G = 1$ and $\theta_B = 0$ (though this assumption is easily relaxed for a weaker assumption that the difference $\theta_G \Leftrightarrow \theta_B$ is sufficiently large). Hence, if an IPO is known to be of type G, its value $\tilde{V}_G$ – hence its offer price OP_G – is $\overline{v}$. On the other hand, the type B IPO is risky, and has an uncertain value $\tilde{V}_B$, which is either $\overline{v} + s$ or $\overline{v} \Leftrightarrow s$ with probability $\frac{1}{2}$. The offer price of such an IPO OP_B will be less than $\overline{v}$. Suppose that $OP_B = \overline{v} \Leftrightarrow \delta$, where $\delta > 0$ denotes the underpricing required for the risky issue.

Let k be the commission earned by underwriters of an IPO, so that underwriters earn either $k\ OP_G$ (for a type G IPO) or $k\ OP_B$ (for a type B IPO). Since $OP_G > OP_B$, underwriters have an incentive to misrepresent type B IPOs as type G IPOs. This creates a familiar lemons problem in the IPO market since investors cannot distinguish between less risky and more risky IPOs. The lemons problem adversely affects both the prices at which IPOs can be sold as well as the incentives of underwriters to expend resources in producing information. However, both problems are mitigated if underwriters are allowed to engage in price support, as shown below. Proposition 1 provides the first set of results.

Proposition 1 *Suppose that underwriters are allowed, at their discretion, to support a fraction x of the shares they underwrite. Then, there exists an equilibrium in which underwriters of less risky IPOs will support the issues they underwrite, while more risky IPOs are not supported.*

Proof

Consider a hypothetical equilibrium in which the underwriter supports a type G IPO but not a type B IPO. If k denotes the spread (percentage commission) from underwriting an IPO, the revenue from the equilibrium strategy of underwriting and supporting a G type IPO, $R_G(su)$, is $k\,OP(G) \Leftrightarrow x\,E(\pi(su, 1))$, where x denotes the fraction of an IPO that is supported in the after-market, su denotes the strategy of supporting an IPO and $E(\pi(su, 1))$, is given by equation (7).

Using equation (7) to substitute out $E(\pi(.))$ and the fact that $OP\ (G) = \overline{v}$, we get

$$R_G(su) = k\,\overline{v} \tag{8}$$

Similarly, the revenue from the equilibrium strategy of underwriting and *not* supporting a type B issue is

$$R_B(ns) = k(\overline{v} \Leftrightarrow \delta) \tag{9}$$

where ns denotes the strategy of not supporting an IPO.

For the equilibrium in Proposition 1 to be sustainable, underwriters of neither type of IPO should find it profitable to mimic the other. From equations (8) and (9), the type G IPO's underwriter clearly has no incentive to mimic the type B IPO's underwriter. On the other hand, the type B IPO underwriter may find it profitable to mimic the type G IPO underwriter, and support a type B IPO, in order to get the higher offer price $\overline{v}$ rather than the discounted price $\overline{v} \Leftrightarrow \delta$ associated with type B IPOs. However, supporting this type of IPO is costly. Specifically, type B IPOs could have a value of $\overline{v} + s$ or $\overline{v} \Leftrightarrow s$. Selling and supporting such IPOs at a price $OP_G = \overline{v}$ implies that underwriters may be repurchasing shares worth $\overline{v} \Leftrightarrow s$ or $\overline{v} + s$ at a price of $\overline{v}$. This is costly if there are informed investors in the market, since sell orders are then more likely to originate from investors who know that the IPO's value is $\overline{v} \Leftrightarrow s$. If these adverse selection costs exceed the benefit from representing the B IPO as a type G IPO, the equilibrium in Proposition 1 will be sustained. It is straightforward to derive the conditions under which this will happen.

The incremental commission from representing a type B IPO as a type G IPO is $k\,\overline{v} \Leftrightarrow k(\overline{v} \Leftrightarrow \delta)$, while the costs of supporting the type B IPO is $x\,E\,\pi(su, 0)\,prob(t = sell)$. Using equations (7), (9) and the fact that $prob(t = sell) = \frac{q}{2} + p(1 \Leftrightarrow q)$, we have the following expression for the revenue from representing the B IPO as a G IPO:

$$R_B(su) \Leftrightarrow R_B(ns) = k\,\delta \Leftrightarrow x\,s\,\frac{q}{2} \tag{10}$$

The expression in Eq.. (10) must be negative in order that the equilibrium in Proposition 1 is sustainable, which essentially says that the amount supported x must be large enough relative to the spread k, for the equilibrium to be sustainable.This makes sense: if, for instance, the amount supported is *zero*, price support is (trivially) costless and all IPOs will be supported.

4. Naked Short Positions and Overallotment Options

The previous analysis assumes that an underwriter starts out with no position in the underlying stock, and supports the IPO by repurchasing shares at the offer, should selling pressure arise in the

IPO after-market. However, even when support is effected by establishing a naked short position at the time of the allocation and then covering it in the IPO after-market, it is straightforward to show that less risky IPOs will be supported. The intuition is simple: when support is done by covering naked short positions, high risk IPOs expose underwriters to large losses in IPOs whose prices rise in the after-market. Such losses are clearly low when the IPO risk is low, so only less risky IPOs are supported. This is similar to our result when there is stabilization with no initial short position though the intuition is a bit different.

The analytics in this case proceed more or less as above, so we provide only a brief outline. Consider, as before, the profits when the underwriter of a high risk IPO of type B goes short x shares at the issue offer price OP. If there is selling in the after-market, the underwriter covers at the offer price OP and there is zero profit from the short position. Alternatively, there may be no after-market selling pressure, either because investors are informed and learn that the IPO's true value is $\overline{v}+s$ or because investors are uninformed but have no liquidity reasons to sell. Substituting in $\theta = 0$ into Eqs. (3) and (4) and using $prob\ (I = i) = q$ and $prob\ (I = u) = 1 \Leftrightarrow q$, the probability of reaching this node and the IPO's expected value conditional upon reaching it may be computed as

$$prob(stab\ not\ hit) = \frac{q}{2} + (1 \Leftrightarrow p)(1 \Leftrightarrow q) \quad (11)$$

$$E\ (\tilde{V} \mid stab\ not\ hit) = (\frac{q}{2}(\overline{v}+s) + (1 \Leftrightarrow p)(1 \Leftrightarrow q) * \overline{v})/(\frac{q}{2} + (1 \Leftrightarrow p)(1 \Leftrightarrow q)) \quad (12)$$

The product of the expressions in Eqs. (11) and (12) give the value of the IPO at this node, and when the product is subtracted from the offer price ($\overline{v}$), we obtain the expected loss from the naked short position, given that a type B IPO is stabilized. For type B IPOs to be not stabilized, the expected loss should exceed the benefit from price support, viz., the extra income $k\,\delta$ from obtaining a higher offer price (as before). Functionally, this condition is identical to Eq. (10).

An additional question concerns the effect of a "Green Shoe" overallotment option on the above analysis. The greenshoe option allows underwriters to sell extra shares, usually amounting to $g = 15\%$ of the shares issued at the IPO, at the offer price. Thus, the greenshoe will be exercised if the IPO appreciates *above* the offer price in the after-market, in which case the underwriter can sell extra shares *at* the offer and earn extra commission on the g extra shares thus sold to the public. The existence of a greenshoe option changes little in our analysis, except that the number of shares stabilized, i.e., x, must now be interpreted as the quantity in *excess* of the greenshoe option. It is easy to see why this happens. The greenshoe option certainly changes the *level* of an underwriter's revenue in IPOs. It provides a hedge against losses in naked short positions – if IPOs rise in the after-market, the short position loses money, but, on the other hand, the greenshoe is now exercised and the extra commission therefrom accrues to the underwriter. Thus, the revenue level is altered by the existence of a greenshoe, but it does not alter the *differential incentives* to support less risky rather than more risky IPOs. The risk of holding shares that are overpriced (in "pure" stabilization) or the risk of selling shares that rise in value (in the case of naked short positions) still exists for the extra shares purchased above the greenshoe amount. In fact, to the extent stabilized IPOs have higher offer prices, and therefore are less likely to have positive initial returns, the existence of the greenshoe option is likely to further shift incentives towards stabilizing IPOs of lower risk.

5. Information Production and Underpricing If Price Support Is Not Allowed

The previous analysis assumed that the equilibrium level of underpricing δ and the number of informed investors q were exogenous. In this section, we endogenize these variables. We first consider a regime with no price support, so that all IPOs brought to the market in this environment are of type B. We then consider a regime where price support is allowed. In this regime, underwriters potentially have incentives to engage in information production and bring firms of type G to the IPO market. We focus on the instance of "pure" stabilization, though similar results also obtain when considering stabilization via naked short positions.

Accordingly, begin with a regime with no price support, so underwriters bring type B IPOs to the market in this regime. The equilibrium number of investors who choose to engage in *ex-post* information production, viz., q, may be derived by considering the marginal investor's decision to invest in information production, given that IPOs are of type B. The q'th investor in the IPO will become informed if the cost of becoming informed, say $c\,(q)$, is less than the benefit from becoming informed. The benefit from investing in information production is that in the state where $\tilde{v} = \overline{v} \Leftrightarrow s$, this allows the investor to sell early at a price exceeding $\overline{v} \Leftrightarrow s$ rather than to wait and sell at the IPO's true value $\overline{v} \Leftrightarrow s$. If such an investor sells early to a risk-neutral competitive market maker, the interim price at which the IPO will be sold is the expected value of the IPO conditional on a sell order, i.e., $E(\tilde{V} \mid t = sell)$, an expression for which is given by equation (6). The expected profit from such an early sale is $\frac{1}{2}\, E(\tilde{V} \mid t = sell) \Leftrightarrow (\overline{v} \Leftrightarrow s)$. Thus, the equilibrium level of informed investors solves

$$\frac{1}{2}\left(E\left(\tilde{V} \mid t = sell\right) \Leftrightarrow (\overline{v} \Leftrightarrow s)\right) \quad = \quad c\,(q)$$

$$\Leftrightarrow \frac{p(1 \Leftrightarrow q)\,s}{q + 2p(1 \Leftrightarrow q)} \quad = \quad c(q) \tag{13}$$

A solution to equation (13) exists if $c(q)$, the cost of investing in information production, is increasing in q, since the left-hand side of equation (13), the benefit from investing in information production, is decreasing in q.

Given q, the equilibrium underpricing may be derived easily by requiring that uninformed investors in the IPO make non-negative profits. An uninformed investor may be an early seller with probability p, in which case such an investor sells the IPO at the market price $E(\tilde{V} \mid t = sell)$, as given by equation (6). On the other hand, the uninformed investor may not be an early seller, in which case the sale price is $\overline{v}$, the expected value of the IPO. Thus, for the uninformed investor to break even, we need that

$$\begin{aligned} pE(\tilde{V} \mid t = sell) + (1 \Leftrightarrow p)\overline{v} \quad &\geq \quad \overline{v} \Leftrightarrow \delta \\ \Leftrightarrow \delta \geq \frac{pqs}{q + 2p(1 \Leftrightarrow q)} & \end{aligned} \tag{14}$$

Equations (13) and (14) give the equilibrium level of *ex-post* information production and underpricing in an environment with no stabilization.

6. The Effect Of Allowing Price Support

Allowing price support effectively allows underwriters to commit to reduce the risk of some of the IPOs they take public. Suppose that a fraction f of the IPOs to the market are low risk IPOs of type G so that a fraction $1 \Leftrightarrow f$ are of type B. Let underwriters' costs of information production be $c_u(f)$, where $c'_u(.)$ and $c''_u(.)$ are both positive. At the margin, an underwriter will increase the fraction f if the incremental revenue from bringing a better quality IPO, viz., the better offer price for this IPO exceeds the marginal cost of increasing f. Thus, underwriters will choose f to solve $c'_u(f) = k\,\delta$

Thus, with price support permitted, a fraction f of all IPOs will be stabilized and have low risk. Such IPOs will be sold at a higher offer price OP_G. The remaining fraction $1 \Leftrightarrow f$ of the IPOs will not be stabilized and be sold at the lower offer price OP_B, and the analysis of the previous section applies. Thus, on average, stabilization reduces both the risk and underpricing of IPOs.

7. Analysis If Offer Prices Cannot Be Contingent On The Stabilization Decision

The previous results are based on an assumption that individual offer prices for each IPO can be adjusted depending on whether an underwriter supports the IPO. This is a standard assumption in the existing theories of price support. However, even if offer prices cannot be adjusted on an IPO-to-IPO basis depending on the promise of price support, the underpricing results go through. We discuss two scenarios in which this occurs. First, suppose that underwriters can just commit to stabilize some fraction f of all IPOs, the low risk IPOs based on Section 3 above . For these IPOs, *ex-post* information production is inhibited, and these IPOs will have better after-market liquidity. However, the resultant benefits are now spread across the universe of IPOs rather than being confined to the specific set of IPOs that are supported. Thus, offer prices of *all* IPOs, on average, will be greater when stabilization is permitted. The analytics for this case are straightforward. Following the derivation of equation (14), the equilibrium level of underpricing will solve

$$\begin{aligned} p(1 \Leftrightarrow f)E(\tilde{v} \mid t = sell) + p\,f\,\overline{v} + (1 \Leftrightarrow p)\overline{v} \quad &\geq \quad v \Leftrightarrow \delta \\ \Leftrightarrow \delta &\geq \frac{p\,q\,s(1 \Leftrightarrow f)}{(q + 2\,p(1 \Leftrightarrow q))(1 \Leftrightarrow p\,f)} \end{aligned} \tag{15}$$

Note that the underpricing in equation (15) is less than that obtained in equation (14) (which was derived assuming no IPOs are supported) by the factor $\frac{1-f}{1-pf}$, since the benefit of price support is now available to a fraction f of IPOs brought to the market.

An alternative approach is to consider a model of price support in which underwriters cannot commit *ex-ante* but have the option to support *ex-post*. If they do not support an IPO, there is some depreciation in reputation capital, for instance due to a decline in market perception of their ability to accurately price IPOs. In such a scenario, underwriters will support IPOs if the expected losses from doing so are smaller than the reputational capital lost from not supporting. It is quite evident that this condition is less likely to be satisfied for high risk IPOs, since the revenue from price support (Eq. (7)) is decreasing in risk (θ).

Table 1

Descriptive Statistics†

Variable	1981-1982 Sample	1985-1994 Sample	Pre-1934 Sample
Number of IPOs	208	2723	67
Offer Price	8.75 (8.73)	10.80 (10)	34 (34.32)
Issue Size ($ mm)	9.24 (5.5)	33.32 (18)	6.7 (4.2)
Initial Return	6.91 (0.54)	10.19 (4.41)	5.85 (1.56)

† Table 1 presents the mean and median (the number in parentheses) of various characteristics of three samples of initial public offerings. The first (second) is a sample of all firm commitment IPOs made between June 1981 and July 1982 (1985 and 1994) excluding unit IPOs, spinoffs and IPOs made by limited partnerships, closed-end funds and real estate investment trusts. The third sample consists of 67 initial public offerings of common stocks made between 1923 and 1930 (the *pre-1934* sample). Data for the pre-1934 IPO sample were obtained from the *Commercial and Financial Chronicle*, *Moody's Industrial Manuals*, and *The Wall Street Journal*, while data for the post-1934 IPO sample were obtained from the New Issues database of Securities Data Corporation and from CRSP tapes. The first row in Table 1 gives the number of IPOs, while the second through fourth rows give the number of IPOs that had first-day returns that were positive, zero, and negative, respectively. The last three rows report averages of the offer price, the issue size (i.e., the number of shares offered times the offer price), and the first-day return of the IPOs.

Table 2

Distributional Characteristics of Returns of IPO Samples†

Panel A: 1981-1982 Sample

Week	Mean	Median	Standard Deviation	Skewness
Day 1	6.91	0.54	16.40	3.19
Week 1	8.02	2.30	21.21	3.09
Week 2	8.28	2.22	22.35	2.39
Week 3	8.70	2.09	28.23	2.85
Week 4	8.34	1.04	32.55	2.82
Week 5	7.13	1.25	33.05	2.52
Week 6	6.97	0.38	33.61	2.18

Panel B: 1985-1994 IPO Sample

Week	Mean	Median	Standard Deviation	Skewness
Day 1	10.19	4.41	16.34	2.49
Week 1	10.49	4.44	18.53	2.41
Week 2	10.37	4.69	21.11	2.53
Week 3	10.77	5.00	23.28	1.80
Week 4	11.96	6.25	25.72	1.90
Week 5	12.54	6.82	28.00	1.92
Week 6	13.19	7.69	31.02	2.75

Panel C: Pre-1934 Sample

Week	Mean	Median	Standard Deviation	Skewness
1	5.85	1.56	9.40	1.57
2	5.69	0.96	9.08	1.19
3	5.84	1.06	11.32	1.64
4	5.69	0.71	14.34	1.13
5	4.30	0.19	15.71	0.88
6	3.84	0.00	16.81	0.67

† Table 2 presents descriptive statistics for buy-and-hold IPO returns measured from the issue offer price for holding periods of upto six weeks following the IPO offer date. Panel A reports data for 208 IPOs made between June 1981 and July 1982, excluding spinoffs, unit IPOs and IPOs made by limited partnerships, closed-end funds and real estate investment trusts. Panel B presents data for 2723 initial public offerings made between 1985 and 1994, excluding spinoffs, unit IPOs and IPOs made by limited partnerships, closed-end funds and real estate investment trusts. For Panels A and B, IPO offer dates and prices were obtained from the New Issues database of Securities Data Corporation while the after-market prices were obtained from CRSP. Panel C presents data for a sample of 67 initial public offerings of common stocks made between 1923 and 1930. The issues were identified by reading the *Commercial and Financial Chronicle*, and were cross-checked by verifying data in *Moody's Industrial Manuals.* Price data were obtained from the *Commercial and Financial Chronicle* and the *Wall Street Journal.*

Table 3

Initial Price Risk of Form X-17A-1 and Other IPOs†

Characteristic	Form X-17A-1 IPOs	Other IPOs	t-statistic, difference
Number	46	162	
LOGAMT	2.00 (0.10)	1.72 (0.08)	3.42
GRSPREAD (%)	7.83 (0.13)	8.69 (0.07)	-9.89
OFFER	11.04 (0.60)	8.08 (0.32)	7.42
% PRESTIGIOUS	26.1 (6.48)	22.22 (3.27)	0.93
PARTIAL (%)	87.5 (1.73)	93.9 (0.92)	-5.57

† Table 3 reports averages of various characteristics of two subsamples of IPOs brought to the market between June 1981 and July 1982. The first column reports average characteristics of 46 IPOs for which a Form X-17A-1 was known to be filed, while the second column reports data for 162 other IPOs offered during the June 1981-July 1982 period. Columns 3 reports t-statistics for testing the significance of the difference in average characteristics of columns one and two. The subsamples are formed from a sample of all IPOs made between June 1981 and July 1982, excluding unit IPOs, spinoffs, and IPOs of limited partnerships, closed-end funds and real estate investment trusts. Numbers in parentheses are standard errors.

The variables in Table 3 are: *LOGAMT* - The natural logarithm of the issue size; *GRSPREAD* - The gross spread, i.e., the difference between the price at which an IPO is offered to the public and the price actually received by the issuer, normalized by the offer price; *OFFER* - The offer price of the IPO; *% PRESTIGIOUS* - The percentage of offers underwritten by a manager who was ranked among the top ten during the calendar year of the IPO; *PARTIAL* - The ratio of the offer price to the mid-point of the initial filing range.

Table 4

Probit Model Distinguishing Form X-17A-1 and Other IPOs[†]

Model	INTERCEPT	*LOGAMT*	*GRSPREAD*	*OFFER*	*RANK*	*PARTIAL*
1	-1.14	0.21				
	(-4.90)	(1.92)				
2	1.74		-0.30			
	(2.55)		(-3.64)			
3	-1.34			0.06		
	(-6.46)			(3.36)		
4	-0.77				0.09	
	(-6.71)				(0.41)	
5	0.76					-1.66
	(1.27)					(-2.53)

[†] Table 4 presents probit estimates in which the dependent variable takes the value 1 if a form X-17A-1 was filed for the IPO and the value zero otherwise. The independent variables are industry dummies based on the first digit of the SIC code and *LOGAMT* - The natural logarithm of the IPO's size; *GRSPREAD* - The gross spread, i.e., the difference between the price at which an IPO is offered to the public and the price actually received by the issuer, normalized by the offer price; *OFFER* - The offer price of the IPO; *RANK* - a dummy variable that takes the value 1 if the IPO underwriter was among the top ten during the calendar year of the IPO and the value zero otherwise; *PARTIAL* - The ratio of the offer price to the mid-point of the initial filing range. The data consist of 2723 IPOs offered between June 1981 to July 1982, excluding unit IPOs, spinoffs and IPOs of limited partnerships and IPOs of real estate investment trusts and closed-end funds. Numbers in parentheses denote t-statistics.

Table 5

Correlation Matrix of Independent Variables[†]

Variable	*LOGAMT*	*SPREAD*	*OFFER*	*RANK*	*PARTIAL*
LOGAMT	1.00	-0.67	0.79	0.35	0.06
SPREAD	-0.67	1.00	-0.72	-0.38	0.12
OFFER	0.79	-0.72	1.00	0.31	0.17
RANK	0.35	-0.38	0.31	1.00	-0.24
PARTIAL	0.06	0.12	0.17	-0.24	1.00

[†] Table 5 reports the correlation matrix of the following variables: *LOGAMT* - The natural logarithm of the IPO's size; *GRSPREAD* - The gross spread, i.e., the difference between the price at which an IPO is offered to the public and the price actually received by the issuer, normalized by the offer price; *OFFER* - The offer price of the IPO; *RANK* - a dummy variable that takes the value 1 if the IPO underwriter was among the top ten during the calendar year of the IPO and the value zero otherwise; *PARTIAL* - The ratio of the offer price to the mid-point of the initial filing range. The data consist of 208 IPOs offered between June 1981 and July 1982, excluding unit IPOs, spinoffs and IPOs of limited partnerships and IPOs of real estate investment trusts and closed-end funds.

Table 6

Return Distributions of Form X-17A-1 IPOs and Other IPOs†

Characteristic	Form X-17A-1 IPOs	Other IPOs	t-statistic, difference
DAY 1 RETURN (%)	0.18 (0.77)	8.94 (1.42)	-6.72
WEEK 1 RETURN (%)	0.62 (1.34)	10.56 (1.85)	-4.31
WEEK 4 RETURN (%)	0.43 (2.51)	10.88 (2.82)	-3.79
RETURN: WEEK 1-4	-0.13 (1.76)	-0.41 (1.44)	-0.18

† Table 6 presents descriptive statistics pertaining to the return distributions of 46 Form X-17A-1 IPOs, i.e., IPOs brought to the market during the June 1981-July 1982 period for which we know that forms X-17A-1 were filed, and 162 other IPOs brought to the market during the June 1981-July 1982 period, excluding unit IPOs, spinoffs, and IPOs of limited partnerships, closed-end funds and real estate investment trusts.

The characteristics reported here are: *DAY 1 RETURN* - The first day return on the IPO; *WEEK 1 RETURN* - The one-week return on the IPO measured from offer to closing price at the end of the first week after the offering; *WEEK 4 RETURN* - The four week return on the IPO measured from offer to closing price at the end of week four after the offering; *RETURN: 6-20* The average return of the sample between days 6 and 20 following the offer date. Numbers in parenthese denote standard errors.

Table 7

Initial Price Risk of Stabilized and Non-Stabilized IPOs: 1985-1994†

Characteristic	IPOs With		$vol_{1,2} > 15\%$		
	$r_1 = 0$	$r_1, r_2 = 0$	$r_1, r_2 = 0$	$r_1 \neq 0$	$r_1 < 0$
Number	408	214	168	2315	365
LOGAMT	3.16 (0.05)	3.30 (0.08)	3.28 (0.28)	2.80 (0.02)	2.75 (0.05)
GRSPREAD (%)	7.12 (0.05)	7.04 (0.06)	7.02 (0.07)	7.55 (0.03)	7.51 (0.06)
OFFER	10.70 (0.21)	11 (0.29)	11.12 (0.33)	10.60 (0.10)	10.23 (0.22)
% PRESTIGIOUS	29.7 (2.26)	34.1 (3.24)	28.9 (3.50)	22.5 (0.87)	22.5 (1.87)
PARTIAL (%)	0.89 (0.007)	0.875 (0.01)	0.877 (0.01)	0.99 (0.005)	0.92 (0.06)

† Table 7 reports selected characteristics of subsamples of IPOs offered between 1985 and 1994. Column 1 gives data for IPOs with a first-day return of zero; column two reports data for IPOs with zero return on the first two days of trading; column three reports data for a subsample of the column two IPOs with two-day turnover of at least 15%; column four reports data for IPOs with a non-zero first-day return, and column five gives data for all IPOs with a negative one-day return. All subsamples are formed from a sample of IPOs made between 1985 and 1994 excluding unit IPOs, spinoffs, and IPOs of limited partnerships, closed-end funds and real estate investment trusts.

The variables in Table 7 are: *LOGAMT* - The natural log of issue size; *GRSPREAD* - The gross spread – the difference between the price at which an IPO is sold to the public and the price received by issuers, normalized by the offer price; *OFFER* - The offer price of the IPO; *% PRESTIGIOUS* - The percentage of issues underwritten by a top-ten ranked manager during the calendar year of the IPO; *PARTIAL* - The ratio of the offer price to the mid-point of the initial filing range. Numbers in parentheses are standard errors.

Table 8

Probit Model – Supported and Unsupported IPOs in 1985-1994[†]

Model	INTERCEPT	*LOGAMT*	*GRSPREAD*	*OFFER*	*RANK*	*PARTIAL*
1	-0.61	0.23				
	(-4.50)	(5.28)				
2	1.81		-0.25			
	(5.34)		(-5.18)			
3	-0.09			0.02		
	(-0.76)			(1.40)		
4	0.00				0.23	
	(0.13)				(2.24)	
5	1.11					-1.16
	(3.46)					(-3.29)

[†] Table 8 presents estimates of a probit specification that models an underwriter's decision whether or not to stabilize an IPO. The dependent variable takes the value 1 if an IPO has a zero one-day return and zero if it had a negative one-day return. The independent variables are industry dummies based on the first digit of the SIC code and *LOGAMT* - The natural logarithm of the IPO's size; *GRSPREAD* - The gross spread, i.e., the difference between the price at which an IPO is offered to the public and the price actually received by the issuer, normalized by the offer price; *OFFER* - The IPO offer price; *RANK* - a dummy variable that takes the value 1 if the IPO underwriter was among the top ten for the calendar year and zero otherwise; *PARTIAL* - The ratio of the offer price to the mid-point of the initial filing range.

The data consist of 773 IPOs brought to the market between 1985 and 1994, with non-positive one-day returns, excluding unit IPOs, spinoffs and IPOs of limited partnerships and IPOs of real estate investment trusts and closed-end funds. Numbers in parentheses denote t-statistics.

Table 9

Stabilization-Adjusted Estimates of Mean and Variance of Initial IPO Returns†

Period	μ^a	σ^a	p^a
pre-1934	4.30 (2.42)	11.02 (10.13)	0.77 (8.77)
1985-1994	8.38 (18.72)	18.32 (122.13)	0.53 (55.31)

† Table 9 presents maximum likelihood estimates of price support specification (1), viz.,

$$\begin{aligned} r_i^* &= \mu + \epsilon_i \\ r_i &= r_i^*, \quad if \ r_i^* > 0 \\ r_i &= 0 \ \ with \, probability \ \ p \, if \, r_i^* \leq 0 \\ r_i &= r_i^* \ \ with \, probability \ \ (1-p) \, if \, r_i^* \leq 0 \end{aligned}$$

fitted to two sets of data. The first row in the table reports estimates of the specification fitted to a sample of 67 initial public offerings made between 1923 and 1930, while row 2 reports estimates for 2723 IPOs with offer dates between 1985 and 1994, excluding unit IPOs, spinoffs, and IPOs of limited partnerships, closed-end funds and real estate investment trusts.

Parameter p, whose ML estimate is (# zeros)/(# zeros + # negatives), denotes the probability of stabilization and μ and σ^2 denote the mean and cross-sectional variance of initial IPO returns, adjusted for the bias induced by price support. Numbers in parentheses denote t-statistics.

[a] All parameter estimates are significant at 1%.