Do IPO issuers self-select commercial bank underwriters?

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ABSTRACT

This study explores whether commercial bank underwriters attract IPO firms with different characteristics and whether private information plays a role in the selection of commercial banks as underwriters of IPOs with regard to gross spread and initial return. The results from OLS regressions show that underwriter choice between investment bank and commercial bank does not make any difference in neither gross spread nor the initial return. However, results from self-selection regression models suggest that commercial bank underwriter choice actually causes significantly higher gross spread but it is exactly offset by the negative effect of the adjustment term for selection bias (i.e., inverse mill's ratio), causing no observed difference in gross spread found in OLS. This latter result can be interpreted as indicating that IPOs indeed self-select commercial bank underwriters probably because they know they can reduce gross spread by using commercial banks rather than investment banks as underwriters, which OLS result cannot show.

Keywords: self-selection, commercial bank underwriters, initial public offerings

INTRODUCTION

One notable big change happened in 1999 in U.S. that significantly reshaped the landscape of the IPO markets. It was the demolition of walls between commercial banking and investment banking. Before 1933, both commercial and investment banks were able to underwrite securities but because of the perception that this banking convention contributed to the stock market crash in 1930 and subsequent world-wide depression in 1930s, *the Banking Act of 1933, which is also called the Glass-Steagall Act,* was enacted *to* limit commercial banks' security underwriting activities and affiliations of commercial banks with securities firms.

With the confidence built over decades on the financial markets' stability, while still being debated on its effect, congressional efforts to "repeal the Glass–Steagall Act" resulted in the 1999 Gramm–Leach–Bliley Act (GLBA), which repealed the two provisions restricting affiliations between banks and securities firms. This opened up a legal way for commercial banks to be involved in security issuance and distribution business, which traditionally investment banks dominated.

This study, motivated by this significant change in the competition structure of U.S. IPO markets, investigates which IPO characteristics are related to the selection of commercial banks as underwriters and whether private information is playing a role in selecting commercial bank underwriters with regard to gross spread and initial return.

LITERATURE REVIEW

Researchers explored several different issues on the impact of commercial banks in securities underwriting. Bhargava and Fraser (1998), using 50 largest BHCs and Fed announcements over 1987-1996, found that positive abnormal returns for commercial banks when the initial and limited powers were granted by the Fed but negative abnormal returns and increases in risk after authorization to engage in underwriting corporate debt and equity was given. Roten and Mullineaux (2002), using 1995-1998 debt underwriting data, finds that commercial bank affiliated firms experience lower gross spreads than traditional investment banks do. Beneda and Kwon (2004), using 1995-1998 IPO data, finds that average underpricing of IPOs declined significantly from 23% to 17.4% after Fed's decision on relaxing revenue constraints of commercial banks in 1996. They also found that underwriter fee did not change after the Fed's same decision. Roten, Mullineaux (2005), using 1995-1999 IPO and SEO data, explores whether there are significant differences in underwriter compensation on equity issues underwritten by Section 20 firms and investment banks. They show that IPO gross spreads at Section 20 underwriters are less sensitive to scale economies, reputation, uncertainty, third party monitoring and pricing performance. This is consistent with theories that suggest that commercial banks have unique monitoring capabilities and/or technologies for managing information. Kim, Palia and Saunders (2008), using SDC's 1975-2004 IPO, SEO and Debt data, shows that underwriting spreads of issues underwritten by commercial banks are significantly lower. Fields, Bhagava, and Saunders (2003) examine differences in the total issuance costs (gross spread and underpricing) of IPOs underwritten during the sample period of 1991-1997. They find that the total issuance costs are significantly lower in IPOs underwritten by commercial banks: Gross spread was not different but underpricing was less with IPOs underwritten by commercial banks than those by investment banks. Long term performance of

IPOs underwritten by commercial banks was significantly higher than comparable IPOs underwritten by investment banks. Benzoni and Schenone (2010), using 1998-2000 IPO data, examines the long-term return performance of IPOs underwritten by relationship banks. They find that one to three-year long-term return performance of IPOs underwritten by relationship banks are similar to those of matched IPOs underwritten by non-relationship underwriters. The result holds when the returns' skewness and cross-sectional correlation is accounted for. Research works mentioned above mostly focused on the difference in underwriting costs, underpricing and long-term performance between IPOs underwritten by investment banks and commercial banks.

Above research works used data from either the transition period when the wall between commercial banks and investment banks is loosened or from the period when the Glass–Steagall Act was completely lifted, and found generally in support of commercial banks' certification role in security underwriting.

Separated from the above research works, Puri (1996) used pre-Glass-Steagall data, a very unique data, and found that when both commercial banks and investment banks were allowed to underwrite securities, investors were willing to pay higher prices for securities underwritten. This means that commercial banks have some advantage to underwrite securities and anyone can expect the same effect to exist after the repeal of Glass–Steagall Act.

Puri (1996)'s findings are not surprising from the view of finance literature. For example, commercial banks are often described as delegated monitors in finance literature. For example, they pool depositors' money and make loans. Afterwards they monitor on behalf of depositors whether borrowers are using the money as promised. Through this monitoring process, commercial banks get a lot of information, especially credit related information, about borrowers. In contrast, investment banks do not have much prior information on security issuers. As a result, they have to spend a lot of time analyzing the available information to be able to estimate the right price for IPO shares.

Supposedly information commercial banks are collecting from traditional commercial banking business would be helpful in underwriting securities. Several studies found the supporting evidence of this. For example, Hebb (2002), using 1995-1998 IPO data, finds that the underpricing of commercial bank underwritten IPOs (as co-managers of the syndicate) where the issuer had a previous banking relationship with the underwriter is significantly lower than those underwritten by investment banks. This could be the evidence that the market views commercial banks have better information to price IPOs rather than impeded by the potential conflicts of interest. Through a more sophisticated empirical design, Schenone (2004), using 1998-2000 data, investigates whether a certain type of previous relationship between an IPO issuer and underwriter can mitigate the information asymmetry and results in lower underpricing. She finds that when there is a pre-IPO lending relationship rather than debt underwriting relationship, underpricing is more significantly lowered. In a similar context, Silva (2010), using 1998-2006 SEO data, finds that an underwriter is better able to certify an equity issue when it has a lending relationship with the issuing firm. She finds that when the underwriter has a lending relationship with the issuer, the announcement return of SEO issuer is better, information asymmetry is reduced, and market maker's contribution to price discovery and liquidity is reduced.

While underwriter's lending relationship with the issuer has been shown to lower underpricing and underwriting costs in several research works, the very essence of what causes lower underpricing and underwriting costs of IPOs is less clear: Whether it is the proprietary information commercial banks collect about IPO issuers through lending relationship or whether

it is the potential guarantee of commercial banks to the IPO issuers that they will lend money when needed after the IPO or both or even something else. In fact, most recent two studies, Krishnan (2013) and Chen et. al. (2013), show that commercial banks are competing to earn the underwriting mandate by offering lower underwriting costs for IPOs and promising lower interest rate for the concurrent or possible future loans. This effort of commercial banks is not very surprising since Rajan (1992) showed that many firms move to capital market debt even when their banks are willing to lend them more maybe because of banks' control. Thus, if, indeed, there is something else special in commercial banks' underwriting beyond using proprietary information from the past lending relationship, it may be necessary to investigate empirically, whether there is private information at play in commercial banks' underwriting, in general, because focusing on the past lending relationship may not depict the accurate picture. Furthermore, there have been a lot of regulations around the turn of the century that could significantly have changed the security underwriting business such as 1999 Gramm–Leach–Bliley Act (GLBA), 2000 Regulation Fair Disclosure, and 2003 Sarbane-Oxley ACT etc. Hence, operations of investments banks and commercial banks in security underwriting could have been changed significantly, which naturally would affect underwriting cost and initial return iof IPOs and how they make IPOs float.

However, there is a challenge in testing whether private information is playing a role in the selection of commercial banks as underwriters, in general. Since IPO issuers' decision to use commercial or investment bank underwriter is a self-selection, from an econometrics' stand point, investigating whether private information in general through underwriter choice is playing a role in determining underpricing and/or underwriting costs in multivariate analysis poses self-selection bias. However, currently, only Puri (1996) and Schenone (2004) accounted for this issue.

This study, using 1998-2008 IPO data, investigates whether private information in general through underwriter choice is playing a role in determining underpricing and/or underwriting costs (i.e., gross spread) in multivariate analyses.

DATA, VARIABLE CONSTRUCTION, AND ECONOMETRIC MODEL

Data and Variable Construction

Data are from SDC Global New Issues database for the period 1998-2008. The data contains the firm commitment offerings for the given data period. Extracted were the offer price and number of shares offered from SDC. IPOs with offer prices below $5 were excluded because it is well known that penny stocks are significantly different from the others. Data on underwriter quality and all-star analyst coverage were from Jay Ritter's web site. The Loughran and Ritter (2004)'s updated underwriter rank of the original Carter and Manaster (1990) measures were used. Underwriter rank ranges from 0 for the lowest quality to 9.1 for the highest quality underwriters. After the screening as described above, the sample of 1,586 firm commitment offerings with complete data for the univariate analyses and for the multivariate analyses was identified.

As control variables for gross spread and initial return regressions, this study identified several groups of variables. First group of variables are uncertainty measures that have previously been shown to be positively related to IPO underpricing. As far as they are related to information uncertainty about the issuer, these measures can affect the initial return and gross

spread of IPOs. In addition, this study considers two variables related to a firm's level of uncertainty: sales, and age. Higher sales and age should indicate lower uncertainty.

The second group of variables are some issue characteristics that can affect initial return and gross spread as they proxy for either uncertainty regarding the IPO's valuation or the level of information asymmetry, or both. Accordingly, these issue characteristics can be linked to uncertainty regarding issue valuation, or information asymmetry, or both, including the file price update, underwriter quality, the number of days in lockup, the number of days in registration, and offer price. The percentage price adjustment and related variables were used in the literature extensively. (Hanley 1993; Bradley and Jordan, 2002; Loughran and Ritter 2002). The importance of underwriter rank has been researched in Carter and Manaster (1990) and Carter, Dark, and Singh (1998). Beatty and Welch (1996) and Loughran and Ritter (2004), among others, also present evidence that the relationship between underwriter quality and underpricing had reversed from the negative relationship of the 1980's to a positive relationship in the 1990's. The underwriter rankings from the Loughran and Ritter (2004) study, which are a modification of the Carter and Manaster and Carter, Dark, and Singh ratings, were obtained from Jay Ritter's web site and used in this study. Lastly, lockup dummy was used as another control variable since more uncertain IPOs tend to have longer lock up period.

Two dependent variables in this study are initial return and gross spread of IPOs. Initial return is the first trading day closing price minus offer price. Gross spread is the difference between the offered amount and the proceeds to the issuer. Age is filing year minus founding year of the issuer. Underwriter Rank is the Loughran and Ritter (2004) update of the Carter and Manaster (1990) measures ranging from 0 for lowest quality to 9.1 for highest quality underwriters. Sales is the sales before IPO. Offer Price is the offer price of the issue. Price Update is (offer price-filing midpoint)/filing midpoint. Market capitalization is offer price multiplied by the number of shares outstanding right after the offer. Lockup days is natural logarithm of lockup days of the issue. Registration Period is the number of days between filing date and issue date of the issue. We chose one instrumental variables for commercial bank dummy from the literature: CB PCT Prior QT IPO is the average percentage of commercial bank managers in every IPO syndicate during the quarter prior to the filing date of the issue.

Econometric Model

Let's denote underwriting cost of firm i as C_i (i.e. underwriting spread and underpricing in this study). Then the estimation of underwriting cost can be modeled as

$$C_i = CB_i + X_i\beta + \varepsilon_i \quad (1)$$

where α is an unbiased estimate of the average effect of commercial bank underwriting and Commercial Bank dummy variable (CB_i) has value of one if the Bank Holding Company's Section 20 security affiliate assumes the role of a lead manager, joint lead manager, or co-manager of the issue and zero otherwise. X_i are factors affecting underwriting costs of IPOs.

To allow heterogeneous treatment effect of X_i, think of two separate underwriting cost estimation equations as follows.

$$C_{1i} = \alpha_1 + X_i\beta_1 + \varepsilon_{1i} \quad (2)$$

$$C_{0i} = \alpha_0 + X_i\beta_0 + \varepsilon_{0i} \quad (3)$$

where C_{1i} is underwriting cost of firm i when the issue is underwritten by commercial banks and C_{0i} is underwriting cost of firm i when the issue is underwritten by investment banks. Then $(\alpha_1 - \alpha_0) + X_i(\beta_1 - \beta_0)$ is the average effect of commercial bank underwriting.

However, like many corporate finance decisions, underwriter choice at the time of IPOs (Initial Public Offerings) of equity shares usually are deliberate decisions by firms or their managers to self-select into their preferred choices. Therefore, in the empirical model of explaining whether commercial bank underwriters and investment bank underwriters have different effect on IPO underpricing or underwriting cost, this could be problematic.

To address this problem, called self-selectivity, of underwriter choice, it is necessary to separate self-selection effect from underwriter choice effect. This can be done by adding self-selection adjustment term (i.e., inverse mill's ratio) to the eq. (1).

To see how this can be done, let Z_1 be factors affecting CB_i (i.e., underwriter choice) but not C_i (i.e., underwriting costs) and let υ_i be unobservable factors affecting CB_i.

Then $CB_i^* = \gamma(C_{1i} - C_{0i}) + Z_i\delta + \upsilon_i$ (4)

where $CB_i = 1$ if $CB_i^* > 0$; $CB_i = 0$ if $CB_i^* \leq 0$ and γ is the extent to which the effect of underwriter on C_i directly influence CB_i.

In (4), C_{1i} and C_{0i} are not both observed for each firm. If (2) and (3) are substituted into (4) to get reduced form model of CB_i,

$$CB_i^* = \alpha + X_i\beta + Z_i\delta + u_i \quad (5)$$

where $u_i = \gamma(\varepsilon_{1i} - \varepsilon_{0i}) + \upsilon_i$, $\alpha = \alpha_1 - \alpha_0$, $\beta = \gamma(\beta_1 - \beta_0)$ and ε_{1i}, ε_{0i}, and u_i are jointly normally distributed with variance-covariance structure as in eq. (6).

$$\text{Cov}\ (\upsilon_i, \varepsilon_{1i}, \varepsilon_{0i}) = \begin{pmatrix} 1 & \sigma_{u1} & \sigma_{u0} \\ \sigma_{u1} & \sigma_{11} & \sigma_{10} \\ \sigma_{u0} & \sigma_{10} & \sigma_{00} \end{pmatrix} \quad (6)$$

If CB_i is endogenous, reduced form of (5) can be estimated through probit to get inverse mill's ratio and eqs. (2) and (3) can be revised as follows.

$$C_{1i} = \alpha_1 + X_i\beta + \sigma_{u1}\frac{\varphi[X_i\hat{\beta}+Z_i\hat{\delta}]}{\Phi[X_i\hat{\beta}+Z_i\hat{\delta}]} + e_{1i} \quad (7)$$

$$C_{0i} = \alpha_0 + X_i\beta - \sigma_{u0}\frac{\varphi[X_i\hat{\beta}+Z_i\hat{\delta}]}{(1-\Phi[X_i\hat{\beta}+Z_i\hat{\delta}])} + e_{0i} \quad (8)$$

where, $\frac{\varphi[X_i\hat{\beta}+Z_i\hat{\delta}]}{\Phi[X_i\hat{\beta}+Z_i\hat{\delta}]}$ and $\frac{-\varphi[X_i\hat{\beta}+Z_i\hat{\delta}]}{(1-\Phi[X_i\hat{\beta}+Z_i\hat{\delta}])}$ are inverse mill's ratios for commercial bank underwritten issues and investment bank underwritten issues respectively.

In this case, the average effect of commercial bank underwriting on the underwriting costs can be estimated as follows (Endogenous Switching Regression).

$$E(C_{1i} - C_{0i}|X_i) = (\alpha_1 - \alpha_0) + X_i\beta + (\sigma_{u1}\frac{\varphi[X_i\hat{\beta}+Z_i\hat{\delta}]}{\Phi[X_i\hat{\beta}+Z_i\hat{\delta}]} - \sigma_{u0}\frac{\varphi[X_i\hat{\beta}+Z_i\hat{\delta}]}{(1-\Phi[X_i\hat{\beta}+Z_i\hat{\delta}])}) \quad (9)$$

If σ_{u1} is constrained to be the same as σ_{u0} (i.e., Treatment Effect Model),

eq. (9) becomes $E(C_{1i} - C_{0i}|X_i) = (\alpha_1 - \alpha_0) + X_i\beta + \sigma_u(\frac{\varphi[X_i\hat{\beta}+Z_i\hat{\delta}]}{\Phi[X_i\hat{\beta}+Z_i\hat{\delta}]} - \frac{\varphi[X_i\hat{\beta}+Z_i\hat{\delta}]}{(1-\Phi[X_i\hat{\beta}+Z_i\hat{\delta}])})$ (10)

Based on the discussion above, our three regression models are:

OLS:

$C_i = \alpha_{0.OLS} + \theta_{OLS}CB_i + X_i\beta_{OLS} + \varepsilon_i$ (11),

where X_i includes log age, log proceeds, log market cap, underwriter rank, internet dummy, tech dummy, price update, Nasdaq dummy, offer price, overhang, log lockup days, log registration period, venture backed dummy, all-star coverage dummy, hot market dummy, bubble period dummy, negotiated management fee dummy, integer offer price dummy, and number of managers.

Treatment Effect Model:

First, the underwriter selection probit model is

$CB_i^* = \alpha + X_i\beta + Z_i\delta + \mathrm{u}_i,$

where X_i is defined the same as above and Z_i (instrument) is average percentage of commercial bank managers in every IPO syndicate during the quarter prior to the filing date of the issue (CB PCT Prior QT IPO).

Second, the outcome model (gross spread or initial return regression model) is

$$C_i = \alpha_0 + \theta_{TT}CB_i + X_i\beta + \sigma_{\mathrm{u}}\left(\frac{\varphi[X_i\hat{\beta} + Z_i\hat{\delta}]}{\Phi[X_i\hat{\beta} + Z_i\hat{\delta}]} - \frac{\varphi[X_i\hat{\beta} + Z_i\hat{\delta}]}{(1 - \Phi[X_i\hat{\beta} + Z_i\hat{\delta}])}\right) + \varepsilon_i \quad (12)$$

where X_i is defined the same as above and inverse mills ratio (IMR) is $\left(\frac{\varphi[X_i\hat{\beta}+Z_i\hat{\delta}]}{\Phi[X_i\hat{\beta}+Z_i\hat{\delta}]} - \frac{\varphi[X_i\hat{\beta}+Z_i\hat{\delta}]}{(1-\Phi[X_i\hat{\beta}+Z_i\hat{\delta}])}\right)$, and its coefficient, σ_{u}, is estimated and reported in table 3 Panel B.

Endogenous Switching Model:

$$C_i = \alpha_0 + \theta_{SW}CB_i + X_i\beta + \sigma_{\mathrm{u1}}\frac{\varphi[X_i\hat{\beta} + Z_i\hat{\delta}]}{\Phi[X_i\hat{\beta} + Z_i\hat{\delta}]} - \sigma_{\mathrm{u0}}\frac{\varphi[X_i\hat{\beta} + Z_i\hat{\delta}]}{(1 - \Phi[X_i\hat{\beta} + Z_i\hat{\delta}])} + \varepsilon_i \quad (13),$$

where X_i is defined the same as above and inverse mills ratio (IMR) is $\frac{\varphi[X_i\hat{\beta}+Z_i\hat{\delta}]}{\Phi[X_i\hat{\beta}+Z_i\hat{\delta}]}$ for commercial bank underwritten IPOs and $-\frac{\varphi[X_i\hat{\beta}+Z_i\hat{\delta}]}{(1-\Phi[X_i\hat{\beta}+Z_i\hat{\delta}])}$ for investment bank underwritten IPOs. Their respective coefficients, σ_{u1} and σ_{u0} will be estimated and reported in table 4.

Note $\theta_{OLS} = \theta_{TT} + Selection\ Effect$

$$= \theta_{TT} + \sigma_{\mathrm{u}}\left(\frac{\varphi[X_i\hat{\beta}+Z_i\hat{\delta}]}{\Phi[X_i\hat{\beta}+Z_i\hat{\delta}]} - \frac{\varphi[X_i\hat{\beta}+Z_i\hat{\delta}]}{(1-\Phi[X_i\hat{\beta}+Z_i\hat{\delta}])}\right) in\ eqs.\ (11) and\ (12)$$

$$and\ \theta_{OLS} = \theta_{SW} + Selection\ Effect$$

$$= \theta_{SW} + \sigma_{\mathrm{u1}}\frac{\varphi[X_i\hat{\beta} + Z_i\hat{\delta}]}{\Phi[X_i\hat{\beta} + Z_i\hat{\delta}]} - \sigma_{\mathrm{u0}}\frac{\varphi[X_i\hat{\beta} + Z_i\hat{\delta}]}{(1 - \Phi[X_i\hat{\beta} + Z_i\hat{\delta}])}\ in\ eqs.\ (11)\ and\ (13).$$

In (12) of the underpricing/underwriting cost regression (outcome or structural model), the coefficient of commercial bank dummy variable captures the effect of commercial bank underwriter and coefficient of Inverse Mill's ratio will capture effect of private information. However, all slope coefficients, including those of inverse Mill's ratios, are constrained to be the same between IPOs underwritten by commercial banks and by investment banks.

But in (13), endogenous switching model allows the coefficients of inverse mill's ratios to be different between IPOs underwritten by commercial banks and by investment banks.

In a variation of endogenous switching model, two separate structural models can be run between IPOs underwritten by commercial banks and by investment banks and in the model commercial bank underwriter dummy will not appear in the structural regression. Thus in this case, the effect of commercial bank underwriter will be captured by the difference in slope coefficients between two sub-samples.

EMPIRICAL RESULTS

Summary Statistics

Table 1 summarizes the variables and provides simple t-test of mean difference between IPOs underwritten by investment banks and by commercial banks. Initial return is significantly higher in commercial bank underwritten IPOs but gross spread is higher with investment bank underwritten IPOs. Age is not different between in investment bank underwritten IPOs and commercial bank underwritten IPOs.

Underwriter rank, % of venture backed, and offer price are significantly higher and lockup days and registration period are significantly shorter in commercial bank underwritten IPOs. This implies that IPO issues underwritten by commercial banks are relatively better quality and better certified but not because of higher information uncertainty but because of the need to raise much more capital as the below discussion shows.

Market capitalization, sales before IPO, proceeds, % of simultaneous international offer, and number of managers are significantly higher in commercial bank underwritten IPOs. This means that IPO issues underwritten by commercial banks are much bigger sizes, which can be translated as higher difficulty of floating.

Hot market issues and bubble period issues are more in commercial bank underwritten IPOs. This implies that commercial bank underwritten IPOs used high demand periods for IPOs to make floating easier.

% of negotiated management fee is lower in commercial bank underwritten IPOs and % of issues with integer offer price are higher in investment bank underwritten IPOs. This means that issuers of commercial bank underwritten IPOs had lower bargaining powers in the offering process perhaps because the issue is much bigger and hence more difficult to float than those underwritten by investment banks.

Overall firms who are much bigger, better quality, better certified tend to choose commercial banks as underwriters of their IPOs not because there is higher level of information uncertainty but because simply it facilitates the floating better. It seems plausible in this situation that those firms would take advantage of going public during high demand period of IPOs and will have lower bargaining power in the IPO process.

OLS Regression Results

While it is shown that initial return is significantly higher in commercial bank underwritten IPOs but gross spread is higher with investment bank underwritten IPOs in univariate analysis in prior section, multiple regression results in table 2 show that there is no difference in both gross spread and initial return between commercial bank underwritten IPOs and investment bank underwritten IPOs. After controlling variables proven affecting initial return and gross spread, commercial bank underwritten IPOs do not experience significantly different initial return or gross spread. Among control variables of gross spread, log proceeds underwriter rank, Nasdaq dummy, offer price, and number of managers have significant negative effect on gross spread and price update and log registration period have significant positive effect on gross spread. Among the control variables of initial return, log age, and log proceeds have significant negative effect on initial return, and log market capitalization, price update, offer price, venture dummy, and hot market dummy have significant positive effect on initial return. Findings here is consistent with the findings of Fields, Bhagava, and Saunders (2003), who find that gross spread was not different. But they found that underpricing was less with IPOs underwritten by commercial banks than those by investment banks, which is exactly opposite to

the finding here. The difference could have been due to the data period difference. Their data ends in 1997 and our data starts in 1999.

Treatment effect regression results

Considering underwriter choice is not likely a random assignment but rather an issuing firm's deliberate selection, it is reasonable that commercial bank dummy's effect on gross spread and initial return may have self-selection bias.

To address this self-selection bias, we use treatment effect model. Treatment effect regression uses probit to estimate inverse mill's ratio (nonlinear adjustment variable of selection bias) in a reduced form regression and add the estimated inverse mill's ratio as an adjustment variable of selection bias in the structural equation as seen in table 3. Panel A presents probit regression where commercial bank dummy is regressed on all exogenous variables and one additional instrument. One instrument used is CB PCT Prior QT IPO. *CB PCT Prior QT IPO* is the average percentage of commercial bank managers in every IPO syndicate during the quarter prior to the filing date of the issue. Similar instruments were used in Jeon and Ligon (2011). Correlation analysis confirms that this variable highly correlated with neither gross spread nor initial return but significantly correlated with commercial bank dummy. The instrument is a strong predictor of commercial bank dummy as shown in the first stage regression.

The effect of commercial bank dummy will be captured by itself in the structural equation and the model can be estimated by Heckman's two-step method. Table 3 reports the results.

In panel B of table 3, compared to OLS regression results in prior section, the coefficient of commercial bank dummy is significant and positive (0.46). Since $\theta_{OLS}(-0.0015) = \theta_{TT}(0.4662) + Selection\ Effect,$ the implied commercial bank underwriter selection effect is -0.4677(=-0.0015-0.4662). The coefficient ($\sigma_u\ in\ eq\ (12)$) of selection bias adjustment variable, inverse mill's ratio, is significant and negative in gross spread regression (-0.29). So there is significant selection effect in commercial bank underwriting choice. But since selection bias adjustment terms are constrained to have the same sign in this model, the direction of the selection effect is less than clear, while it indicates the significant negative selection.

In gross spread regression, likelihood ratio test result for maximum likelihood method confirms that correlation between error terms in the first and second stage regressions is significant, indicating that adjustment for selection bias is necessary. But in the initial return regression, the same test confirms that correlation between error terms in the first and second stage regressions is not significant, indicating that adjustment for selection bias is not necessary.

Variation of treatment effect model regression results

As stated in the prior section, a generic treatment effect model does not allow inverse mill's ratios of commercial bank underwritten IPOs and investment bank underwritten IPOs to have different coefficients.

But it is possible they have different coefficients, even different signs. In this section we explore this possibility. To be able to implement the idea, we create two interaction terms: commercial bank dummy*inverse mills and (1-commercial bank dummy)*inverse mills. Please note in equation (12), inverse mill ratios (IMRs) for commercial bank underwritten IPOs and

investment bank underwritten IPOs are differently defined and hence there is no econometric problems (i.e. linear dependence problem).

Consistent with results from Treatment effect regression in prior section, in table 4, it is shown that in gross spread regression, the coefficient (σ_{u1}) of adjustment term (inverse mill's ratio) for selection for IPOs underwritten by commercial banks is significant and negative (-0.577%). Since $\theta_{OLS}(-0.0015) = \theta_{SW}(0.5384) + Selection\ Effect,$ the implied commercial bank underwriter selection effect is -0.5399(=-0.0015-0.5384). The negative sign (i.e., negative selection effect) indicates that IPO issuers who selected commercial bank underwriters paid less gross spread than average gross spread of the population. So this can be interpreted that the significant selection effect indicated by inverse mill's ratio in the treatment effect regressions of gross spread in the prior section is due to the negative selection effect for commercial bank underwritten IPOs. This means that unobservables (i.e. private information) that lowers gross spread are related to unobservables that raises the probability of commercial bank underwriter choice. In other words, the firms actually choosing commercial bank underwriters have below average gross spread. If the firms choosing investment bank underwriters had chosen commercial bank underwriters instead, their gross spreads would have exceeded that of the observed commercial bank underwritten IPO firms. This result is consistent with the univariate results, where it is shown that firms who need to raise more capital tend to choose commercial banks as underwriters of their IPOs maybe because, otherwise, they will pay higher underwriting cost due to much bigger size of the issue.

CONCLUSION

Prior research conjectured that firms with less information available to investors have more incentives to choose commercial banks as their underwriters, because commercial banks can provide information gap between issuing firms and investors by disclosing the proprietary information they acquired through prior lending relationship with the issuing firms.

While prior research found the support of lower gross spread for commercial bank underwritten IPOs, this study uses more recent IPO data for 1998-2008 period, which seems characterized by much bigger, and better quality IPOs underwritten by commercial banks than those by investment banks. Therefore, it seems that IPOs underwritten by commercial banks during this period have quite different characteristics as opposed to relatively information poor IPOs underwritten by commercial banks before the turn of the century.

This study investigates whether commercial banks have different clienteles in the IPO underwriting market and whether private information related to commercial banks as underwriter choice has a significant effect on gross spread and initial return of IPOs.

Results of this study suggest IPOs who are much bigger (e.g., three times bigger in market capitalization, sales, and two times bigger in proceeds) better quality, better certified (by higher rank underwriters and venture capitals) tend to choose commercial banks as underwriters of their IPOs not necessarily because there is higher level of information uncertainty but most likely because it facilitates the floating better. It seems that to raise much more proceeds ($127.85 mil vs. $62.2 mil), commercial bank underwriters tend to set offer price higher ($14.8 vs. $11.3), update price more (6.2% vs. -2.1%), offer the issue during high demand periods of IPOs and internationally, recruit more co-managers (13 vs. 6), and provide more all-star analyst coverage (20% vs. 8.1%).

Most importantly, in treatment effect model and endogenous switching model, private information related to commercial bank underwriter choice seems to affect gross spread, but not initial return perhaps because underwriters may have not the complete control of the initial return. This study interprets this result as indicating that some IPOs indeed self-select commercial bank underwriters probably because they know they can reduce gross spread by using commercial banks rather than investment banks as underwriters, which OLS result cannot show.

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Table 1
Summary Statistics

Gross spread is (the difference between the offered amount and the proceeds to the issuer)*100/proceeds. *Initial return* is the first trading day closing price minus offer price. *Firm Age* is filing year minus founding year of the issuer. *Market capitalization* is the number of shares outstanding times share price right after the IPO. *Underwriter Rank* is the Loughran and Ritter (2004) update of the Carter and Manaster (1990) measures ranging from 0 for lowest quality to 9.1 for highest quality underwriters. *Sales* is the sales before IPO. Technology Sector is the dummy that has value 1 if the issue is in the tech sector and zero otherwise. *Price Update* is (offer price-filing midpoint)/filing midpoint. *Nasdaq Listed* is a dummy that has value of 1 if the issue is listed in Nasdaq and zero otherwise. *Exchange Listed* is a dummy that has value of 1 if the issue is listed in NYSE, AMEX, or Nasdaq and zero otherwise. *Offer Price* is the offer price of the issue. *Lockup days* is lockup days of the issue. *Overhang* is the ratio of shares retained by non-selling shareholders relative to shares sold in an IPO. *Proceeds* is issue amount minus gross spread amount. *Registration Period* is the number of days between filing date and issue date of the issue. *Venture backed* is a dummy that has value one if the issue is venture backed and zero otherwise. *All Star covered* is a dummy that has value one if the issue is covered by all-star analysis within a year from the IPO and zero otherwise. *Hot market issue* is a dummy that has value one if the IPO is issued during months when average initial return is higher than historical average and zero otherwise. *Bubble Period Issue* is a dummy that has value one if the IPO is issued in 1999 or 2000 and zero otherwise. *International Offer* is a dummy that has value one if the IPO is issued internationally and zero otherwise. *Number of managers* is the number of managers of the issue. *Commercial Bank as Manager (CB)* is a dummy that has value of one if the Bank Holding Company's Section 20 security affiliate assumes the role of a lead manager, joint lead manager, or co-manager of the issue and zero otherwise. *Negotiated Management Fee* is a dummy that has value one if the management fee is negotiable and zero otherwise. *Integer Offer Price* is a dummy that has value one if the issue's offer price is integer and zero otherwise. *CB PCT Prior QT IPO* is the average percentage of commercial bank managers in every IPO syndicate during the quarter prior to the filing date of the issue. * indicates statistical significance at 10% level. ** indicates statistical significance at 5% level. *** indicates statistical significance at 1% level.

Variable	Total	Investment Bank	Commercial Bank	Mean Difference
Gross Spread	6.95%	7.33%	6.84%	0.494%***
Initial Return	36.32%	17.97%	41.41%	-23.441%***
Firm Age	13.62	12.55	13.91	-1.355
Market Capitalization ($1,000)	884,210	350,000	1,000,000	-670,000***
Underwriter Rank	7.84	6.381	8.246	-1.866***
Sales ($1,000)	250.94	97.48	291.5	-194.025**
Technology Sector	64.88%	57.60%	66.90%	-9.4%***
Price Update	4.41%	-2.10%	6.20%	-8.3%***
Nasdaq Listed	80.08%	71.50%	82.40%	-10.9%***
Exchange Listed	96.22%	91.00%	97.70%	-6.7%***
Offer Price	14.04	11.3	14.8	-3.49***
Lock Up Days	157.47	174.77	151.68	23.09***
Overhang	2.75	3.12	2.64	0.483*
Proceeds ($mil)	113.61	62.2	127.85	-65.65***
Registration Period (Days)	108.79	119.87	105.72	14.146**
Venture Backed	53.03%	39.50%	56.80%	-17.2%***
All Star Covered	17.40%	8.10%	20.00%	-11.8%***
Hot Market Issue	55.04%	39.50%	59.30%	-19.8%***
Bubble Period Issue	42.37%	16.30%	49.60%	-33.3%***
International Offer	27.99%	12.50%	32.30%	-19.8%***
Number of Managers	11.73	6.12	13.29	-7.17***
Commercial Bank as Manager (CB)	19.63%	0.00%	25.10%	-25.1%***
Negotiated Management Fee	18.79%	39.50%	13.00%	26.5%***
Integer Offer Price	88.40%	79.70%	90.80%	-11.2%***
CB PCT Prior QT IPO	89.67	79.54	92.48	-12.94***
N	1586	344	1242	

Table 2
OLS regression results

Initial return is the first trading day closing price minus offer price. *Gross spread* is (the difference between the offered amount and the proceeds to the issuer)*100/proceeds. *Log(age)* is the natural logarithm of (1+age) of IPO firm at IPO. *Underwriter Rank* is the Loughran and Ritter (2004) update of the Carter and Manaster (1990) measures ranging from 0 for lowest quality to 9.1 for highest quality underwriters. *Log(Sales)* is natural logarithm of the sales before IPO. *Tech dummy* is the variable which has value 1 if the issuer belongs to the tech industry. *Price Update* is (offer price-filing midpoint)/filing midpoint. *Nasdaq dummy* is 1 if the issue's primary exchange is in Nasdaq, and zero otherwise. *Offer Price* is the offer price of the issue. *Log(Lockup days)* is natural logarithm of lockup days of the issue. *Log(Days in registration)* is natural logarithm of registration periods (in days) of the issue. *Bubble dummy* has one if issues year is 1999 or 2000 and zero otherwise. *Commercial Bank* has one if the Bank Holding Company's Section 20 security affiliate assumes the role of a lead manager, joint lead manager, or co-manager of the issue. * indicates statistical significance at 10% level. ** indicates statistical significance at 5% level. *** indicates statistical significance at 1% level.

	Gross Spread		Initial Return	
Variable	Coeff	Std. Err	Coeff	Std. Err
Log(Age)	0.0001	0.0148	-0.0297**	0.0135
Log(Proceeds)	-0.4581***	0.0269	-0.2842***	0.0246
Log(Market Cap)	-0.0043	0.0173	0.2567***	0.0158
Underwriter Rank	-0.0277***	0.0081	-0.0001	0.0074
Internet Dummy	0.0040	0.0362	0.0985***	0.0331
Tech Dummy	-0.0427	0.0324	-0.0108	0.0297
Price Update	0.5866***	0.0568	0.8167***	0.0519
Nasdaq Dummy	-0.2012***	0.0387	0.0366	0.0354
Offer Price	-0.0165***	0.0034	0.0085***	0.0031
Overhang	-0.0013	0.0029	-0.0029	0.0026
Log(Lockup days)	0.0141**	0.007	0.0077	0.0064
Log(Registration Period)	0.0529***	0.0172	-0.0068	0.0158
Venture Backed Dummy	0.0408	0.0315	0.0650**	0.0288
All Star Coverage Dummy	0.0231	0.0371	0.0374	0.0339
Hot Market Dummy	0.0323	0.0399	0.0797**	0.0365
Bubble Period Dummy	-0.0344	0.0458	0.0624	0.0419
Negotiated MGT Fee Dummy	-0.0056	0.0392	-0.0012	0.0358
Integer Price Dummy	0.1138***	0.0423	0.0166	0.0387
Number of Managers	-0.0082***	0.0019	0.0003	0.0017
Commercial Bank Dummy	-0.0015	0.039	0.0113	0.0356
Constant	9.2431***	0.1995	-1.9736***	0.1824
N	1586		1586	
R-Square	0.4777		0.5045	

Table 3

Treatment Effect Model (Two-Step Method)

Initial return is the first trading day closing price minus offer price. *Gross spread* is (the difference between the offered amount and the proceeds to the issuer)*100/proceeds. *Log(age)* is the natural logarithm of (1+age) of IPO firm at IPO. *Underwriter Rank* is the Loughran and Ritter (2004) update of the Carter and Manaster (1990) measures ranging from 0 for lowest quality to 9.1 for highest quality underwriters. *Log(Sales)* is natural logarithm of the sales before IPO. *Tech dummy* is the variable which has value 1 if the issuer belongs to the tech industry. *Price Update* is (offer price-filing midpoint)/filing midpoint. *Nasdaq dummy* is 1 if the issue's primary exchange is in Nasdaq, and zero otherwise. *Offer Price* is the offer price of the issue. *Log(Lockup days)* is natural logarithm of lockup days of the issue. *Log(Days in registration)* is natural logarithm of registration periods (in days) of the issue. *Bubble dummy* has one if issues year is 1999 or 2000 and zero otherwise. *Commercial Bank* has one if the Bank Holding Company's Section 20 security affiliate assumes the role of a lead manager, joint lead manager, or co-manager of the issue. *CB PCT Prior QT IPO* is the average percentage of commercial bank managers in every IPO syndicate during the quarter prior to the filing date of the issue. * indicates statistical significance at 10% level. ** indicates statistical significance at 5% level. *** indicates statistical significance at 1% level.

Panel A. Probit Model

Dependent Variable: Commercial Bank

Variable	Coeff	Std. Err
Log(Age)	0.0054	0.0489
Log(Proceeds)	0.4590***	0.1070
Log(Market Cap)	0.1380**	0.0667
Underwriter Rank	0.0969***	0.0220
Internet Dummy	-0.1120	0.1385
Tech Dummy	0.0353	0.1111
Price Update	-0.5541**	0.2456
Nasdaq Dummy	0.1974	0.1276
Offer Price	0.0117	0.0137
Overhang	-0.0363**	0.0166
Log(Lockup days)	0.0764***	0.0279
Log(Registration Period)	-0.0015	0.0542
Venture Backed Dummy	0.3092***	0.1084
All Star Coverage Dummy	-0.0059	0.1437
Hot Market Dummy	-0.2192*	0.1217
Bubble Period Dummy	0.7804***	0.1849
Negotiated MGT Fee Dummy	-0.3337***	0.1146
Integer Price Dummy	0.1188	0.1267
Number of Managers	0.1026***	0.0104
CB PCT Prior QT IPO	4.9206***	1.0831
Constant	-6.1970***	0.7643
N	1586	
Pseudo R-Square	0.3907	

Table 3. Continued.

Panel B. Outcome Regression

	Gross Spread		Initial Return	
Variable	Coeff	Std. Err	Coeff	Std. Err
Log(Age)	0.0007	0.0147	-0.0297**	0.0135
Log(Proceeds)	-0.5129***	0.0295	-0.2876***	0.0271
Log(Market Cap)	-0.0147	0.0173	0.2561***	0.0159
Underwriter Rank	-0.0441***	0.0089	-0.0011	0.0081
Internet Dummy	0.0151	0.0361	0.0992***	0.0332
Tech Dummy	-0.0367	0.0323	-0.0104	0.0297
Price Update	0.6339***	0.0575	0.8196***	0.0529
Nasdaq Dummy	-0.2409***	0.0395	0.0341	0.0363
Offer Price	-0.0169***	0.0034	0.0085***	0.0031
Overhang	0.0017	0.0029	-0.0028	0.0027
Log(Lockup days)	0.0085	0.0071	0.0073	0.0065
Log(Registration Period)	0.0481***	0.0172	-0.0071	0.0158
Venture Backed Dummy	0.0118	0.0320	0.0632**	0.0295
All Star Coverage Dummy	0.0321	0.0369	0.0380	0.0340
Hot Market Dummy	0.0526	0.0399	0.0810**	0.0367
Bubble Period Dummy	-0.1237**	0.0499	0.0569	0.0459
Negotiated MGT Fee Dummy	0.0579	0.0416	0.0027	0.0382
Integer Price Dummy	0.0873**	0.0425	0.0150	0.0391
Number of Managers	-0.0122***	0.0021	0.0000	0.0019
Commercial Bank Dummy	0.4662***	0.1131	0.0400	0.1041
Inverse Mills Ratio (IMR)	-0.2972***	0.0675	-0.0183	0.0621
Constant	9.5323***	0.2090	-1.9558***	0.1922
N	1586		1586	
R-Square	0.4837		0.5042	

Table 4
Endogenous Switching Regression results

Initial return is the first trading day closing price minus offer price. *Gross spread* is (the difference between the offered amount and the proceeds to the issuer)*100/proceeds. *Log(age)* is the natural logarithm of (1+age) of IPO firm at IPO. *Underwriter Rank* is the Loughran and Ritter (2004) update of the Carter and Manaster (1990) measures ranging from 0 for lowest quality to 9.1 for highest quality underwriters. *Log(Sales)* is natural logarithm of the sales before IPO. *Tech dummy* is the variable which has value 1 if the issuer belongs to the tech industry. *Price Update* is (offer price-filing midpoint)/filing midpoint. *Nasdaq dummy* is 1 if the issue's primary exchange is in Nasdaq, and zero otherwise. *Offer Price* is the offer price of the issue. *Log(Lockup days)* is natural logarithm of lockup days of the issue. *Log(Days in registration)* is natural logarithm of registration periods (in days) of the issue. *Bubble dummy* has one if issues year is 1999 or 2000 and zero otherwise. *Commercial Bank* has one if the Bank Holding Company's Section 20 security affiliate assumes the role of a lead manager, joint lead manager, or co-manager of the issue. *CB PCT Prior QT IPO* is the average percentage of commercial bank managers in every IPO syndicate during the quarter prior to the filing date of the issue. * indicates statistical significance at 10% level. ** indicates statistical significance at 5% level. *** indicates statistical significance at 1% level.

	Gross Spread		Initial Return	
Variable	Coeff	Std. Err	Coeff	Std. Err
Log(Age)	-0.0009	0.0146	-0.0303**	0.0135
Log(Proceeds)	-0.5237***	0.0295	-0.2915***	0.0272
Log(Market Cap)	-0.0135	0.0173	0.2565***	0.0159
Underwriter Rank	-0.0472***	0.0089	-0.0022	0.0082
Internet Dummy	0.0188	0.0359	0.1006***	0.0332
Tech Dummy	-0.0383	0.0321	-0.0110	0.0297
Price Update	0.6238***	0.0573	0.8159***	0.0529
Nasdaq Dummy	-0.2226***	0.0396	0.0408	0.0366
Offer Price	-0.0166***	0.0034	0.0086***	0.0031
Overhang	0.0022	0.0029	-0.0026	0.0027
Log(Lockup days)	0.0063	0.0071	0.0065	0.0065
Log(Registration Period)	0.0460***	0.0171	-0.0078	0.0158
Venture Backed Dummy	0.0024	0.0320	0.0598**	0.0295
All Star Coverage Dummy	0.0285	0.0368	0.0367	0.0340
Hot Market Dummy	0.0537	0.0398	0.0813**	0.0367
Bubble Period Dummy	-0.1801***	0.0517	0.0363	0.0478
Negotiated MGT Fee Dummy	0.0782*1	0.0417	0.0102	0.0385
Integer Price Dummy	0.0714*	0.0425	0.0092	0.0393
Number of Managers	-0.0152***	0.0022	-0.0011	0.0021
Commercial Bank Dummy	0.5384***	0.1141	0.0665	0.1054
IMR*Commercial	-0.5772***	0.0984	-0.1209	0.0909
IMR*(1-Commercial)	-0.2379***	0.0689	0.0035	0.0637
Constant	9.6669***	0.2109	-1.9065***	0.1948
N	1586		1586	
R-Square	0.4884		0.5046	