

## Information Spillover Effects of IPOs using 2SLS

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*Abstract:* - There are several Initial Public Offerings (IPOs) regulatory changes implemented in Taiwan stock markets since 2005. One of those new mechanisms is to release the stock IPOs pricing rules to underwriters. The underwriters and listed companies have been growing up rapidly in recent years, and the whole offer size has become full-scaled. However, foreign scholars found that pioneer companies have many uncertainties in IPOs due to there isn't any information about offer price and proceeds to refer. When companies want to decide the appropriate offer price and proceeds, they have to spend a lot of time and money on information gathering. If there existed information spillover, and the information would be acquired from the other companies which had finished IPOs. Therefore, we try to research whether there existed information spillover in Taiwan IPOs market using 2SLS and Probit to analyze. By empirical results, there exist positive information spillover in offer price and listing price revision. For underwriters, underwriter rank is based on underwriter reputation, and the underwriters which have better rank usually couldn't get the high initial return.

*Key-Words:* - Initial Public Offerings (IPOs), information spillover, underwriting reputation, Two-Stage Least Squares (2SLS)

### 1 Introduction

In the initial stages of Taiwan securities market, there are only a limited number of listed companies in the issue market each year. And since securities transaction is in bad conditions, the desire for companies to finance through the capital market is not high. However, with the fast growth of the industry and commerce and the booming development of the whole economy both based on strong knowledge and capital intensity in Taiwan, the desire for domestic companies to finance through the capital market has been greatly strengthened. After a big sweeping revision of the law of Securities and Exchange in 1989, the revised law has relaxed restrictions of securities-dealer business and allowed them to transact business over the counter and finance through the capital market, which results in the fast growth of the numbers of securities dealers as well as their overall scale. The market has become more effective after new participants join in it, and the financing costs of companies have gradually reduced which results from the competition. Besides, in the course of pre-underwriting counseling and the underwriting business, the companies can gain better financial consultancy services than ever. By the end of

December 2007, in securities market the listed companies have amounted to 698, over-the-counter companies 547, and the securities floatation has been on a large scale.

The issuing firms shall make a seasoned equity offer over the counter following the initial public offering; generally, these firms need a professional organization to do underwriting business for them, and the organization refers to the Investment Bank abroad and the Underwriter at home. The companies must reach a certain condition when they initially apply for their stocks to be admitted to list (or be over-the-counter) for trading on that market. Besides, they also need to take such measures as application, examination, and the agreement on the date of listing and being over-the-counter. In the whole process, the Underwriters mainly act as intermediaries between those who have money to invest, and those who need capital (i.e. the issuing firms and investors). However, although the underwriting process has slightly difference resulting from the different rules on securities variants and underwriting methods, it can be divided into the two phrases-- "counseling period" and "underwriting period", and in the underwriting

period the offer prices fixing is the most important. However, in accordance with Carter and Manaster [14], Chen and Ritter [15], Dunbar [16], Grinblatt and Hwang [17] of examination and approval for listing of securities, if OTC transferring to TSEC companies don't reach the high degree of the decentralization of shares, then the amount of securities which haven't enough decentralization of shares are extracted to sell publicly according to relevant regulations. Therefore, the companies who don't reach the high degree of decentralization of shares will not have to conduct underwriting activities, and certainly don't have offer prices.

After a big sweeping revision of the law of Securities and Exchange in 1989, the revised law has relaxed restrictions of securities-dealer business and allowed them to transact business over the counter and finance through the capital market, which results in the fast growth of the numbers of securities dealers as well as their overall scale. As far as the public offer is concerned, it used to be calculated by the conventional formula of the market, but some studies show that there used to be larger difference between the prices calculated by the conventional formula and actual offering prices. Many foreign studies point out the reason that the offer prices are underpriced is the information asymmetric existed between issuing firms and underwriters. [3,4,30]

According to Benveniste et al. [7], the underwriter obtains offer prices and quantities of shares purchased from the potential investors in book building process which there exist the information spillover. One is the information spillover which investors reveal relevant information to the underwriter by themselves and the other is that other companies in the same industry need not to spend any cost to search relevant information and still can learn so as to perform the Initial Public Offerings (IPOs).

At present, there are many studies related to IPOs at home, such as the investigation with respect to the underpricing of offer prices, [1,3,4,6,17,19,31,33,35] the research with respect to the impact of underwriters' choice on IPOs, [13,16,17,21,23] and the investigation with respect to abnormal returns, [6,24,25,32] but there still is not a complete and perfect investigation on all circumstances of the stock underwriting. For this reason, this research is based on the empirical results of Benveniste et al. [8] and also includes such factors faced by the underwriters as the offer price fixing, the underpricing of offer prices, the

situation of initial return, and the success of IPOs or not.

## 2 Literature Review

The main reason for producing information spillover effects is that knowledge and technology have characteristics of public properties.[2,9,10] Benveniste et al. [8] discuss variables of the information spillover effects in IPOs which are based on four models. A detailed account of each model follows: (1) The information spillover effects and the offer price revision. (2) The information spillover effects on initial returns. (3) The information spillover effects and the completion probability of IPOs. (4) The choice of the underwriters.

### 2.1 The information spillover effects and the offer price revision

According to Benveniste et al. [7], if one company in the same emerging industry wants to issue IPOs first and faces the uncertainties in the offer prices and total issuing shares without precedents for reference, the company only spends a large amount of costs on searching relevant information by itself. Most of issuing firms obtain the offer prices and total shares desired to buy from investors through the Book Building method of underwriters [5,6]. Although the book building method can collect information revealed by many investors, the information revealed is easily available by the companies which want to issue IPOs at the same time [6].

Booth and Chua [12] indicate many IPOs are issued simultaneously in a short period of time, the information spillover effects will be produced and information costs of issuing firms will be reduced. Since issuing firms can obtain information free of charge through the observation of IPOs issued by other companies and the information obtained can be reused to different IPOs, there is the effects of reducing information costs. Therefore, if many IPOs are issued simultaneously and intensely in the period of initial listing for a company, then the issuing firm can spend less cost on searching information.

As Tufano [34] and Persons and Warther [28] state, it is difficult for IPOs pioneers to make internalization of the market information collected by themselves. In accordance with Benveniste et al.[7], due to the information externality, most companies are unwilling to be IPOs pioneers and all want to gain information through free riding as IPOs

followers. Benveniste et al. [8] think that IPOs pioneers have more intense effects of information spillover than that of IPOs followers. The uncertainties faced by IPOs pioneers are larger than IPOs followers, and IPOs pioneers must rely on themselves to spend a large amount of costs on searching relevant information directly from investors so as to learn the offer prices and total shares desired to purchase from the market. Therefore, the information spillover effects of IPOs pioneers are greater. However, since more underwriting information are exposed to become public properties, the information spillover effects of IPOs followers are less than those of IPOs pioneers [28].

Furthermore, the underwriter plays an important role in the underwriting process and must provide professional opinions for decisions on the offer prices and issuing shares. According to Pugel and White [29], the underwriters must pay more special attention to unsystematic risks of issuing firms when they do underwriting business; the underwriters consider the size of an issuing firm and years of founding the company as their agent variables; since the underwriters and investors are all more familiar with companies with large size and years of operational history, they run less risks of the underwriting. However, due to different capabilities and professional knowledge of each underwriter, they will use different coping strategies regarding the fixing methods of the offer prices and the number of issuing shares [14].

## **2.2 The information spillover effects on initial returns**

According to Stoughton and Zechner [32], Mello and Parsons [25] and Maug [24], the existence of the 'discount' phenomenon in IPOs is because institutional investors have functions of monitoring companies and adding the value of companies, thereby enjoying the benefit of IPOs discount. Benveniste and Spindt [6] think that the existence of abnormal phenomenon in initial returns is for compensating institutional investors who reveal information in the book building, thereby enjoying IPOs discount; besides, the more the number of issuing shares is revised and the larger the range of the offer prices is revised, the more the information is obtained in the book building, and therefore there are large initial returns to give institutional investors as compensation of their transferred information.

Furthermore, based on the model of Rock [31], Carter and Manaster [14] investigate the relationship between IPOs' returns and underwriter reputation, and they infer that underwriter reputation can show the extent to which informed investors participate in subscription of IPOs shares. Since the underwriters with higher reputation have a lower risk in IPOs, the informed investors have learned the stocks with a lower risk that bring in less return so as to they have no inclination to participate in the subscription of the stocks; At this time, the extent to which the offer prices of IPOs are on the low side is less than that of ordinary case. And commonly the underwriters with higher reputation have lower initial returns in IPOs and the degree of discount in stock issuing is less. Moreover, the underwriters with higher reputation usually collect higher underwriting fees; after their IPOs are issued, the degree of IPOs spread in the market is less. However, it is worthwhile for the issuing firms who want to take less risk to find the underwriters with higher reputation to issue IPOs since the degree of the issue of IPOs with discount is less and the information that the stocks are safe with lower risks is transferred to the market through the underwriters with higher reputation. Meanwhile, the underwriters with higher reputation can maintain their reputation by the choice of low-risk IPOs.

## **2.3 The information spillover effects and the completion probability of IPOs**

Benveniste et al. [8] point that the probability of successful completion of IPOs is affected by information spillover effects resulted from the process of the book building of issuing firms or other companies in the same industry desired to simultaneously issue IPOs. If information spillover effects resulted from the companies desired to simultaneously issue IPOs are more positive, it will add the possibilities of floatation completion of issuing firms. The underwriters also have an effect on the probability of successful completion of IPOs by issuing firms, since the underwriters with higher reputation will spread the costs of information collection to subsequent companies desired to issue IPOs so as to control the free-riding problem. Besides, the underwriters with higher reputation are often willing to do underwriting business for issuing firms with lower risks in order to maintain their reputation.

## **2.4 The choice of the underwriters**

As Benveniste et al. [8] state, the factor that determines the choice of the underwriters is the size of anticipated securities floatation. And think that

specific uncertainties of the issuing firms also have an effect on the choice of the underwriters. In accordance with Habib and Ljungqvist [18], the issuing firms with higher risks must have more information, so they will select the underwriters with higher reputation because the underwriters with higher reputation have capability of collecting more information. Furthermore, the underwriter reputation is one of the two important consideration factors of issuing firms to select the underwriters (the other is an analysis report of the market). Their observation points out that the competition among the underwriters aims to ensure the quality of the underwriting service and the advance of underwriter reputation, but not be blind competition through an increase or reduction in the service charge.

### 3 Research Method

This section firstly establishes the research hypotheses and then describes research samples, data resources, each variable definition and the research methods.

#### 3.1 Hypotheses formulation

##### 3.1.1 Listed companies (OTC transfer to TSEC companies not included)

According to Booth and Chua [12], the companies who simultaneously issue IPOs will produce information spillover effects. Therefore, issuing firms will revise the offer prices of their IPOs through the observation of IPOs status of other companies.

H1: There is positive influence of information spillover effects on the revision of offer prices.

According to Benveniste et al. [8], IPOs pioneers have a stronger inclination to revise the offer prices than IPOs followers.

H2: There is positive influence of IPOs pioneers on the revision of offer prices.

H3: There is negative impact of IPOs followers on the revision of offer prices.

Due to different capabilities and professional knowledge of each underwriter, good underwriters will provide better coping strategies regarding the fixing methods of the offer prices and the number of issuing shares so that more appropriate offer prices will be determined [14].

H4: There is positive influence of the choice of the underwriters on the revision of offer prices.

According to Pugel and White [29], in the process of the underwriting, the underwriters pay special attention to the specific uncertainties of issuing firms. They are more willing to do underwriting

business for issuing firms with lower uncertainties. Besides, the issuing firms with lower uncertainties have a smaller range of the revision for the offer prices.

H5: There is positive influence of the specific uncertainties of issuing firms on the revision of offer prices.

According to Benveniste and Spindt [6], the larger the range of the offer prices is revised, the more the information is obtained. To compensate the information providers, issuing firms will allow the discount on issue of IPOs and therefore the situation of abnormal initial returns occurs.

H6: There is positive influence of the revision of offer prices on initial returns.

According to Carter and Manaster [14], based on the model of Rock [31], the underwriters with higher rank have a lower risk in IPOs, and then the informed investors have learned the stocks with a lower risk that bring in less return so as to they have no inclination to participate in the subscription of the stocks; at the same time, the extent to which the offer prices of IPOs are on the low side is less than that of ordinary case.

H7: There is negative impact of the choice of the underwriters on initial returns.

According to Carter and Manaster [14], issuing firms with lower uncertainties often find the underwriters with higher rank to issue IPOs since the degree of the issue of IPOs with discount is less and the information that the stocks are safe with lower risks is transferred to the market through the underwriters with higher rank.

H8: There is positive influence of the specific uncertainties of issuing firms on initial returns.

Benveniste et al.(2003) think if the firms desired to issue IPOs simultaneously bring in more positive information spillover effects, then the completion probability of IPOs will be increased.

H9: There is positive influence of information spillover effects on the completion probability of IPOs.

Benveniste et al.(2003) think that before the trend for issuing IPOs occurs, IPOs pioneers has less probability of the IPOs completion than IPOs followers. Therefore, IPOs followers have larger probability to complete the issue of IPOs.

H10: There is negative impact of IPOs pioneers on the completion probability of IPOs.

H11: There is positive influence of IPOs followers on the completion probability of IPOs.

Benveniste et al.(2003) think that the underwriters have an effect on the completion probability of IPOs since the underwriters with higher reputation will spread the costs of information collection to

subsequent companies desired to issue IPOs so as to control the free-riding problem.

H12: There is positive influence of the choice of the underwriters on the completion probability of IPOs.

Benveniste et al.(2003) think that the firms with higher uncertainties probably can't complete IPOs due to the poor risks for them.

H13: There is negative impact of the specific uncertainties of issuing firms on the completion probability of IPOs.

According to Pugel and White (1988), the underwriters must pay more special attention to unsystematic risks of issuing firms when they do underwriting business; the underwriters consider the size of an issuing firm and years of founding the company as their agent variables; since the underwriters and investors are all more familiar with companies with large size and years of operational history, they run less risks of the underwriting. Therefore, the underwriters with higher rank often select the issuing firms with lower uncertainties so as to avoid the drop of their rank resulting from the issuing firms with higher uncertainties.

H14: There is negative impact of the specific uncertainties of issuing firms on the underwriter rank.

Benveniste et al.(2003) think that the quantities of the underwriting business through the underwriters are the main factor of determining the choice of the underwriters.

H15: There is positive influence of the situation of underwriter registration on the underwriter rank.

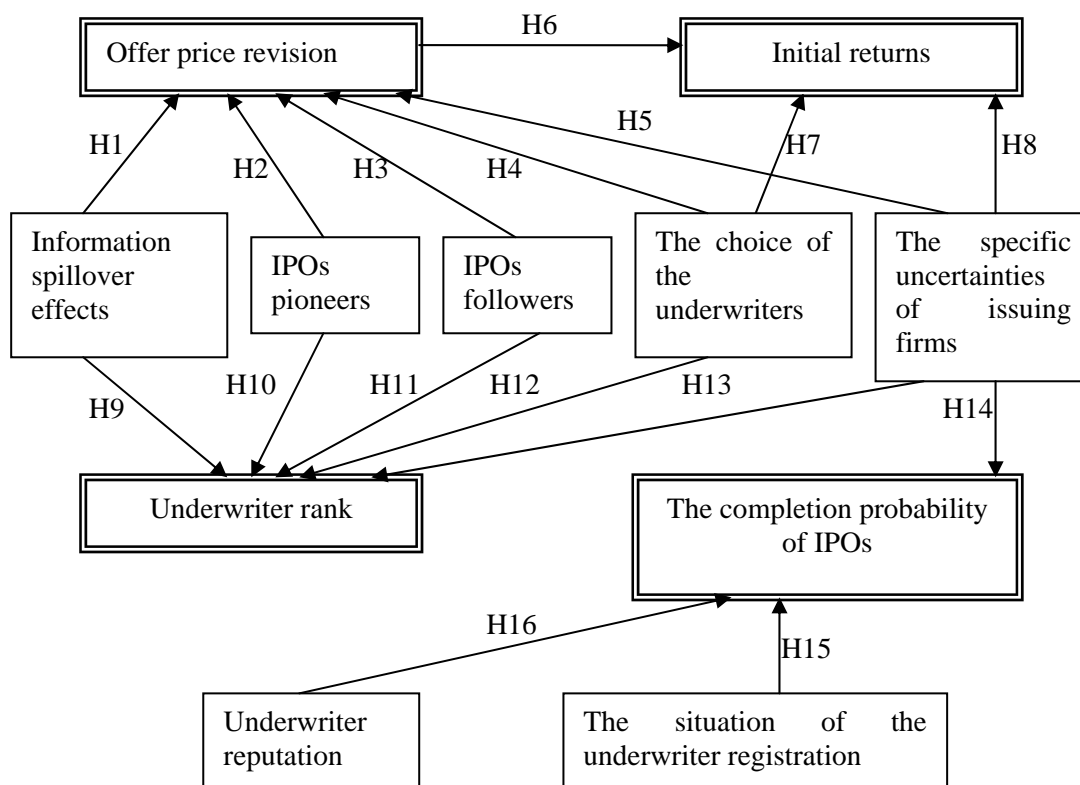
Chen and Ritter (1999) think that underwriter reputation is a key factor that issuing firms should consider when choosing an underwriter.

H16: There is positive influence of underwriter reputation on the underwriter rank.

On the basis of the above hypotheses, the impact of each independent variable on information spillover effects is shown as Table 1. And Figure 1 provides a schematic representation of the twenty-five hypotheses, identifying the relationships of various variables.

**Table 1** The projections that each independent variable of listed companies (OTC transfer to TSEC companies not included) has an effect on information spillover effects

Dependent variables	Independent variables and control variables	Projections
Offer price revision	Information spillover effects	□
	IPOs pioneers	□
	IPOs followers	□
	The specific uncertainties of issuing firms	□
	The choice of the underwriters	□
Initial returns	Offer price revision	□
	The specific uncertainties of issuing firms	□
	The choice of the underwriters	□
The completion probability of IPOs	Information spillover effects	□
	IPOs pioneers	□
	IPOs followers	□
	The specific uncertainties of issuing firms	□
	The choice of the underwriters	□
Underwriter rank	The situation of the underwriter registration	□
	Underwriter reputation	□
	The specific uncertainties of issuing firms	□



**Figure 1** the Research Model of listed companies (OTC transfer to TSEC companies not included)

### 3.1.2 OTC transfer to TSEC companies

If OTC transfer to TSEC companies has greater ownership dispersion, they will no need to perform public offerings, hence no need for fixing offer prices. However, the listing prices are fixed according to (1) weighted-average price of trading prices and quantities in recent days and (2) the conditions of the same industry and the market. Therefore, the study assumes that there exist information spillover effects while referring to listing prices of the same industry and the state of market, since the knowledge and technology have the features of public properties and they are the major cause of information spillover effects (Blomstrom, 1996; Blomstrom and Kokko, 1998; Anand and Galetovic, 2000). In addition, the variables such as the trend of IPOs and its completion probability are not applicable in the model, so they will be excluded; and the revision of offer prices will be changed into the revision of listing prices so as to investigate the information spillover effects of OTC transfer to TSEC companies. In view of the discussion above, the following hypotheses are established.

According to Booth and Chua (1996), the companies who simultaneously issue IPOs will produce information spillover effects. Therefore, issuing firms will revise the offer prices of their IPOs through the observation of IPOs status of other companies.

H17: The information spillover effects have a positive influence on the revision of listing prices.

According to Pugel and White (1988), in the process of the underwriting, the underwriters pay special attention to specific uncertainties relating to issuing firms. They are more willing to do underwriting business with issuing firms having lower uncertainties. Also, the issuing firms with lower uncertainties have their offer prices revised over a small range.

H18: Specific uncertainties relating to issuing firms have a positive influence on the revision of listing prices.

Due to different capabilities and professional knowledge of each underwriter, good underwriters will provide better coping strategies regarding the fixing methods of the offer prices and the number of issuing shares so that more appropriate offer prices will be determined (Carter and Manaster, 1990).

H19: The choice of the underwriters has a positive influence on the revision of listing prices.

According to Benveniste and Spindt (1989), the larger the range of the offer prices is revised, the more the information is obtained. To compensate the information providers, issuing firms will allow the discount on issue of IPOs and therefore the situation of abnormal initial returns occurs.

H20: The revision of listing prices has a positive influence on initial returns.

According to Carter and Manaster(1990), issuing firms with lower uncertainties often find the underwriters with higher rank to issue IPOs since the degree of the issue of IPOs with discount is less and the information that the stocks are safe with lower risks is transferred to the market through the underwriters with higher rank.

H21: Specific uncertainties relating to issuing firms have a positive influence on initial returns.

According to Carter and Manaster (1990), based on the model of Rock(1986), the underwriters with higher rank have a lower risk in IPOs, and then the informed investors have learned the stocks with a lower risk that bring in less return so as to they have no inclination to participate in the subscription of the stocks; at the same time, the extent to which the offer prices of IPOs are on the low side is less than that of ordinary case.

H22: The choice of the underwriters has a negative impact on initial returns.

Benveniste et al.(2003) think that the quantities of the underwriting business through the underwriters is the main factor for determining the choice of the underwriters.

H23: The situation of underwriter registration has a positive influence on the underwriter rank.

According to Pugel and White (1988), the underwriters must pay more special attention to unsystematic risks of issuing firms when they do

**Table 2** The projections that each independent variable of OTC transfer to TSEC companies has an effect on information spillover effects

Dependent variables	Independent variables and control variables	projections
Listing price revision	Information spillover effects	<input type="checkbox"/>
	Specific uncertainties relating to issuing firms	<input type="checkbox"/>
	The choice of the underwriters	<input type="checkbox"/>
Initial returns	Listing price revision	<input type="checkbox"/>
	Specific uncertainties relating to issuing firms	<input type="checkbox"/>
	The choice of the underwriters	<input type="checkbox"/>
Underwriter rank	The situation of the underwriter registration	<input type="checkbox"/>
	Underwriter reputation	<input type="checkbox"/>
	Specific uncertainties relating to issuing firms	<input type="checkbox"/>

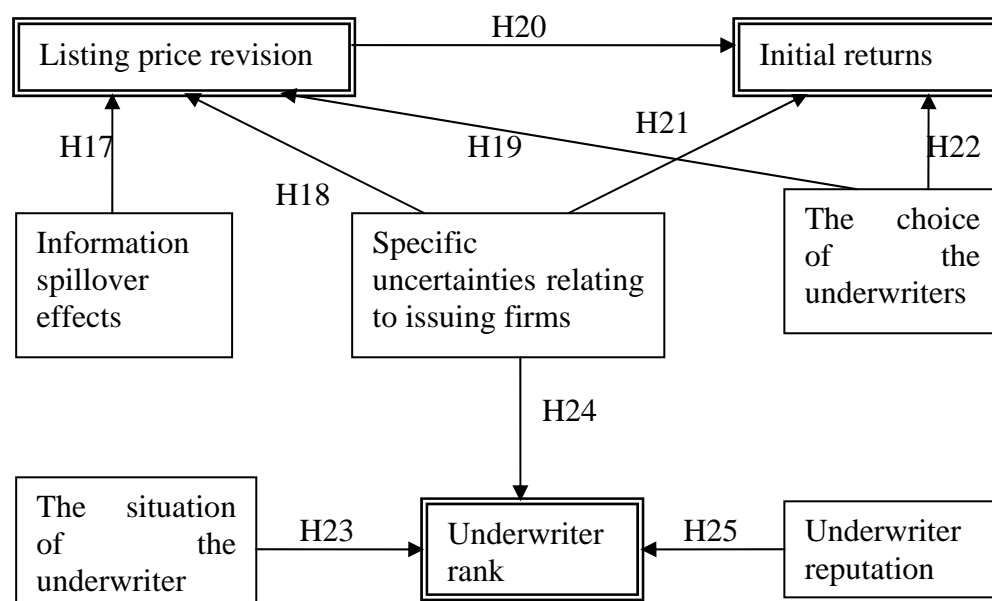
underwriting business; the underwriters consider the size of an issuing firm and years of founding the company as their agent variables; since the underwriters and investors are all more familiar with companies with large size and years of operational history, they run less risks of the underwriting. Therefore, the underwriters with higher rank often select the issuing firms with lower uncertainties so as to avoid the drop of their rank resulting from the issuing firms with higher uncertainties.

H24: Specific uncertainties have a negative impact on the underwriter rank.

The underwriter reputation is a key factor that issuing firms should consider when choosing an underwriter. Similar results are reported by Johnson and Miller (1988) and Carter and Manaster (1990) where a more refined and detailed classification of underwriter reputation is adopted and tested.

H25: The underwriter reputation has a positive influence on the underwriter rank.

On the basis of the above hypotheses, the impact of each independent variable on information spillover effects is concluded as shown as Table 2. And Figure 2 provides a schematic representation of the twenty-five hypotheses, identifying the relationships of various variables.



**Figure 2** Research Model of OTC transfer to TSEC

### 3.2 Definitions of variables

On the basis of the above hypotheses, we have defined each variable in the study and anticipated their directions.

#### 3.2.1 Listed companies (OTC transfer to TSEC companies not included)

- (1) The information spillover effects (ISpillover)  
Before the IPOs registration, issuing firms has taken the offer prices gained from other issuing firms in the same industry for reference (Benveniste et al.,2003).
- (2) What position of the issuing firm is in the trend of IPOs in the same industry (WPosition)  
The analysis of IPOs date of all issuing firms can be used to define the time window before and after the trend of IPOs and provide guidance for classification of IPOs pioneers and IPOs followers (Benveniste et al.,2003).
- (3) The situation of the underwriter registration (URegistered)  
In the situation, the underwriters are chosen by registered companies desired to issue IPOs and their period are one year; also, the number of the companies for which each underwriter does underwriting business and provides counseling service during this year will be aggregated. (Benveniste et al.,2003).
- (4) Underwriter reputation (UReputation)  
The scoring results of the underwriter rank are from the Securities and Exchange Commission (Xiahou Xinrong, 1993).
- (5) Offer price revision (OPRevision)

The divergence exists between the offer price after listing and provisional offer price for the listing application (Benveniste et al.,2003).

- (6) Initial returns (IReturn)  
On the first day of the listing, the closing price of initial returns minus the offer price (Benveniste et al.,2003).
- (7) The completion probability of IPOs (IPOsCompletion)  
Dummy variables are used to show whether IPOs are completed or not: 0 indicates the incompleteness, 1 indicates the completion (Benveniste et al.,2003).
- (8) Underwriter rank (URank)  
The 10 scales are used to measure the underwriter rank (Carter and Manaster,1990)
- (9) The specific uncertainties of issuing firms (Uncertainty)  
Specific uncertainties relating to issuing firms refer to uncertain number of years from establishment of the firm to its listing on Security Exchange (James,1992).
- (10) The choice of the underwriters (UChoice)  
The choice of the underwriter will follow the underwriter rank for the reference purpose (Benveniste et al.,2003).

#### 3.2.2 OTC transfer to TSEC companies

- (1) The information spillover effects (ISpillover)  
Before the IPOs registration, issuing firms has taken the offer prices gained from other issuing firms in the same industry for reference (Benveniste et al.,2003).
- (2) The situation of the underwriter registration (URegistered)



In the situation, the underwriters are chosen by registered companies desired to issue IPOs and their period are one year; also, the number of the companies for which each underwriter does underwriting business and provides counseling service during this year will be aggregated. (Benveniste et al.,2003).

(3) Underwriter reputation (UReputation)

The scoring results of the underwriter rank are from the Securities and Exchange Commission (Xiahou Xinrong, 1993).

(4) The listing prices are revised (LPRevision)

The divergence exits between the offer price after listing and provisional offer price for the listing application (Benveniste et al.,2003).

(5) Initial returns (IReturn)

On the first day of the listing, the closing price of initial returns minus the offer price (Benveniste et al.,2003).

(6) Underwriter rank (URank)

The 10 scales of the Carter and Manaster (1990) are used to measure the underwriter rank.

(7) The specific uncertainties of issuing firms (Uncertainty)

Specific uncertainties relating to issuing firms refer to uncertain number of years from establishment of the firm to its listing on Security Exchange (James,1992).

(8) The choice of the underwriters (UChoice)

The choice of the underwriter will follow the underwriter rank for the reference purpose (Benveniste et al.,2003).

### 3.3 Research Method

In recent years, substantive applications of the 2SLS estimator for latent variable models by Oczkowski and Farrell (1998), Oczkowski (2002) and Bollen and Biesanz (2002). Two-Stage Least Squares (2SLS) is a method that to consist on running Ordinary Least Squares (OLS) in two stages. First, we run OLS on the reduced form equations for each endogenous variable that appear as explanatory variables in the structural equations in the system. Then, Substitute the reduced-form  $\hat{Y}$  s (instrumental variables) for the  $Y$ s that appear on the right side (only) of the structural equations, and then estimate these revised structural equations with OLS.

#### 3.3.1 Listed companies (OTC transfer to TSEC companies not included)

$$OPRevision = \alpha_1 + \beta_1 ISpillover + \beta_2 WPosition + \beta_3 Uncertainty + \beta_4 UChoice + \varepsilon_1 \quad (1)$$

$$IReturn = \alpha_2 + \beta_5 OPRevision + \beta_6 Uncertainty + \beta_7 UChoice + \varepsilon_2 \quad (2)$$

$$IPOCompletion = \alpha_3 + \beta_8 ISpillover + \beta_9 WPosition + \beta_{10} Uncertainty + \beta_{11} UChoice + \varepsilon_3 \quad (3)$$

$$URank = \alpha_4 + \beta_{12} URegistered + \beta_{13} Uncertainty + \beta_{14} UReputation + \varepsilon_4 \quad (4)$$

**Step1.** Apply standard ordinary least squares (OLS) to eqns(1),(2),(3)and (4) by endogenous variables.

$$OP\hat{R}evision = \alpha_5 + \beta_{15} ISpillover + \beta_{16} WPosition + \beta_{17} Uncertainty + \beta_{18} U\hat{C}hoice + \varepsilon_5 \quad (5)$$

$$I\hat{R}eturn = \alpha_6 + \beta_{19} OP\hat{R}evision + \beta_{20} Uncertainty + \beta_{21} U\hat{C}hoice + \varepsilon_6 \quad (6)$$

$$I\hat{P}OCompletion = \alpha_7 + \beta_{22} ISpillover + \beta_{23} WPosition + \beta_{24} Uncertainty + \beta_{25} U\hat{C}hoice + \varepsilon_7 \quad (7)$$

$$U\hat{C}hoice = \alpha_8 + \beta_{26} URegistered + \beta_{27} Uncertainty + \beta_{28} UReputation + \varepsilon_8 \quad (8)$$

**Step2.** Transforming the equation by  $OP\hat{R}evision$  and  $U\hat{C}hoice$  to run ordinary least squares (OLS).

$$OP\hat{R}evision = \alpha_9 + \beta_1 ISpillover + \beta_2 WPosition + \beta_3 Uncertainty + \beta_4 U\hat{C}hoice + \varepsilon_9 \quad (9)$$

$$I\hat{R}eturn = \alpha_{10} + \beta_5 OP\hat{R}evision + \beta_6 Uncertainty + \beta_7 U\hat{C}hoice + \varepsilon_{10} \quad (10)$$

$$I\hat{P}OCompletion = \alpha_{11} + \beta_8 ISpillover + \beta_9 WPosition + \beta_{10} Uncertainty + \beta_{11} U\hat{C}hoice + \varepsilon_{11} \quad (11)$$

$$U\hat{C}hoice = \alpha_{12} + \beta_{12} URegistered + \beta_{13} Uncertainty + \beta_{14} UReputation + \varepsilon_{12} \quad (12)$$

### 3.3.2 OTC transfer to TSEC companies

The assumption of Two-Stage Least Squares (2SLS) methods list as below:

$$LP\text{ Revision} = \alpha_{13} + \beta_{12}ISpillover + \beta_{13}Uncertain\ y + \beta_{14}UChoice + \varepsilon_{13} \quad (14)$$

$$I\text{ Return} = \alpha_{14} + \beta_{15}LP\text{ Revision} + \beta_{16}Uncertain\ y + \beta_{17}UChoice + \varepsilon_{14} \quad (15)$$

$$URank = \alpha_{15} + \beta_{18}U\text{ Re gistered} + \beta_{19}Uncertain\ y + \beta_{20}U\text{ Re putation} + \varepsilon_{15} \quad (16)$$

**Step1.** Apply standard ordinary least squares (OLS) to eqns(1),(2),(3)and (4) by endogenous variables.

$$LP\hat{R}e\text{ vision} = \alpha_{16} + \beta_{21}ISpillover + \beta_{22}Uncertain\ y + \beta_{23}UChoice + \varepsilon_{16} \quad (17)$$

$$I\text{ Return} = \alpha_{17} + \beta_{24}LP\hat{R}e\text{ vision} + \beta_{25}Uncertain\ y + \beta_{26}U\hat{C}hoice + \varepsilon_{17} \quad (18)$$

$$U\hat{C}hoice = \alpha_{18} + \beta_{27}U\text{ Re gistered} + \beta_{28}Uncertain\ y + \beta_{29}U\text{ Re putation} + \varepsilon_{18} \quad (19)$$

**Step2.** Transforming the equation by  $OP\hat{R}e\text{ vision}$  and  $U\hat{C}hoice$  to run ordinary least squares (OLS).

$$LP\hat{R}e\text{ vision} = \alpha_{19} + \beta_{21}ISpillover + \beta_{22}Uncertain\ y + \beta_{23}U\hat{C}hoice + \varepsilon_{19} \quad (20)$$

$$I\text{ Return} = \alpha_{20} + \beta_{24}LP\hat{R}e\text{ vision} + \beta_{25}Uncertain\ y + \beta_{26}U\hat{C}hoice + \varepsilon_{20} \quad (21)$$

$$U\hat{C}hoice = \alpha_{21} + \beta_{27}U\text{ Re gistered} + \beta_{28}Uncertain\ y + \beta_{29}U\text{ Re putation} + \varepsilon_{21} \quad (22)$$

### 3.4 Sources of Data

Data from financial statements of 379 electronic industry companies were collected using the Taiwan Security Exchange (TSE) database during 1985-2007 years. After elimination of older and less material, the final samples of the study were 309 companies; among them there were 129 OTC transfer to TSEC companies.

## 4 Empirical results and analysis

### 4.1 Assessment of the measurement model

The research institute has collected 309 samples. The number of listed companies each year is shown in Table 3.

**Table 3.** The number of listed companies in electronic industry each year

Items/years	1985~1990	1991~1995	1996~2000	2001~2007	Total
Total samples for listed companies	12	32	86	179	309
OTC transfer to TSEC companies	0	0	25	104	129
Listed companies (OTC transfer to TSEC not included)	12	32	61	75	180

Table 4. Indicates that in electronic industry the average years for the listing of all companies are six years and the least years is one year. If the classification is performed according to sub-industries shown in Behavioral Research in Accounting of 2005 year, we can find that component development companies are in the majority and the network and telecommunication industry is in the minority. However, in sub-industry classification, the longest average years (i.e. 7.66 years) of IPOs occur in computer system industry

and the longer average years (i.e. 6.63 years) of IPOs occur in IC industry.

In features of securities floatation, the ranks of the underwriters chosen by most listed companies are calculated through 10 scales of the Carter-Manaster and the average value is 5.84 points. The listed companies prefer to choose the underwriters with higher rank. Among these listed companies, 145 companies have revised original offer prices and the average range of revision is 12.34%, least range 43.16% and biggest range 401.21%.

**Table 4.** The descriptive statistic analysis for the listed companies of electronic industry

The listed companies of electronic industry						
	Observed number	Average number	Standard deviation	Minimum value	Median	Maximum value
Total of companies	309					
<b>Company characteristics</b>						
The number of years of IPOs (year)	309	6.04	4.81	0.13	4.63	44.26
<b>Sub-industry classification</b>						
Computer system	30	7.66	7.51	1.77	7	44.28
Network and telecommunication	30	5.02	4.031	0.54	3.71	16
Photoelectricity	53	5.97	4.09	0.37	5	17.74
IC	40	6.63	4.85	0.15	5	20.38
Components	68	5.78	4.78	1.5	5	21.33
Other (1)	44	5.59	3.86	0.42	5	18.38
Other (2)	40	4.24	2.01	0.72	4	9.39
<b>Features of securities floatation</b>						
Underwriter rank	292	5.83973	2.61443	0	6.6	9
The registered number of shares (million)	309	4362.84	14615.03	139.78	884.00	198452.34
The offer price (NT\$ each share)	187	60.96744	42.51628	10.5	48	375
The offer price revised	145	0.12342	0.43381	-0.43161	0.00032	4.01213
Initial return (NT\$)	269	4.26372	20.42208	-61.5	2.8	284

## 4.2 The analysis of model

(1) The revision of offer prices: As to the revision of offer prices, we mainly investigate whether the offer-price fixing is influenced by the position where listed companies are located in the trend of IPOs and the offer prices fixed by companies simultaneously listed on Security Exchange. As shown in Table5, the regression model has 23% of explanatory power. The information spillover has a positive influence on the revision of offer prices and the IPOs followers have a negative impact on the revision of offer prices, and the p values of the two independent variables are 0.000.

(2) Initial returns: In regression model of initial returns, the choice of the underwriter shows a significant impact, and its p value is 0.034. That indicates the underwriter with higher rank has less degree of discount on the issue of IPOs and gained less initial returns.

(3) The completion probability of IPOs: The regression model has 44.8% of explanatory power; the variables showing significance are the information spillover, IPOs pioneers, and IPOs followers, their p values 0.000, 0.000, and 0.004, respectively. That indicates if there exists the information spillover in the companies simultaneously listed on Security Exchange (i.e. listed companies refer to their own offer prices each other), then their IPOs are completed more likely with the situation.

(4) The underwriter rank: In regression model of the underwriter rank, the underwriter reputation shows significance and its p value is 0.000. That indicates the higher the underwriter reputation (i.e. the underwriter has less illegal records), the better the underwriter rank.

**Table 5.** The analysis results for the model of listed companies (OTC transfer to TSEC companies included in the analysis for the trend of IPOs)

Independent variable	The revision of offer prices(2SLS)		Initial returns(2SLS)		The completion probability of IPOs (Probit)		The underwriter rank(OLS)	
	$\beta$	p	$\beta$	p	$\beta$	p	$\beta$	p
The revision of offer prices			0.987	0.607				
Information spillover	0.004	0.000***			0.027	0.000***		
Dummy=1 if IPOs pioneers (365 days)	0.032	0.638			-1.348	0.000***		
Dummy=1 if IPOs followers (730 days)	-0.358	0.000***			0.660	0.004**		
Specific uncertainties relating to issuing firms	4.76E-06	0.731	7.37E-06	0.982	-7.89E-06	0.806	-5.95E-05	0.224
The choice of the underwriter	0.020	0.117	-0.664	0.034**	0.034	0.335		
The situation of the underwriter registration							7.54E-09	0.424
The underwriter reputation							0.389	0.000***
R <sup>2</sup>	0.250		0.033		0.448		0.196	
Adjusted R <sup>2</sup>	0.230		0.012		0.444		0.188	

Note: \*, \*\*, \*\*\* indicate there is significance under the level of verification for 10%, 5%, and 1%, respectively

(1) The revision of offer prices: As shown in Table 6., the regression model has 44.2% of explanatory power; the information spillover has a positive influence on the revision of offer prices and the IPOs followers have a negative impact on the revision of offer prices, and the p values of the two independent variables are 0.000; but control variables such as specific uncertainties relating to issuing firms and the choice of the underwriter have no significant impact on the revision of offer prices.

(2) Initial returns: In regression model of initial returns, the choice of the underwriter shows a significant impact, and its p value is 0.074. That indicates the underwriter with higher rank has less

degree of discount on the issue of IPOs and gained less initial returns.

(3) The completion probability of IPOs: The regression model has 22% of explanatory power; the variables showing significance are the information spillover, IPOs pioneers, and IPOs followers, their p values 0.000, 0.009, 0.022, and 0.059, respectively.

(4) The underwriter rank: In regression model of the underwriter rank, the underwriter reputation shows significance and its p value is 0.000. That indicates the higher the underwriter reputation (i.e. the underwriter has less illegal records), the better the underwriter rank.

**Table 6.** The analysis results for the model of listed companies (OTC transfer to TSEC companies not included in the analysis for the trend of IPOs)

Independent variable	The revision of offer prices (2SLS)		Initial returns (2SLS)		The completion probability of IPOs (Probit)		The underwriter rank (OLS)	
	$\beta$	p	$\beta$	p	$\beta$	p	$\beta$	p
The revision of offer prices			0.285	0.822				
Information spillover	0.015	0.000***			0.019	0.000***		
Dummy=1 if IPOs pioneers (365 days)	0.134	0.1873			-0.098	0.009***		
Dummy=1 if IPOs followers (730 days)	-0.096	0.000***			0.491	0.022**		
Specific uncertainties relating to issuing firms	1.40E-05	0.391	7.91E-05	0.794	-3.57E-05	0.558	-1.89E-05	0.799
The choice of the underwriter	0.008	0.579	-0.433	0.074*	0.116	0.059*		
The situation of the underwriter registration							5.24E-09	0.599
The underwriter reputation							0.428	0.000***
R <sup>2</sup>	0.461		0.022		0.261		0.222	
Adjusted R <sup>2</sup>	0.442		0.019		0.220		0.208	

Note: \*, \*\*, \*\*\* indicate there is significance under the level of verification for 10%, 5%, and 1%, respectively

## 5 Conclusion and limitation

The study has four regression models. As shown by the results, in the section ‘Listed companies (OTC transfer to TSEC companies not included)’, the information spillover effects and IPOs followers show significant impact on the revision of offer prices under the verification level of 1%; the choice of the underwriter has an effect on initial returns; the information spillover effects, IPOs pioneers and IPOs followers have an effect on the completion probability of IPOs; moreover, the underwriter reputation has an effect on the underwriter reputation. In the section “OTC transfer to TSEC

companies”, the information spillover effects have an effect on the revision of listing prices; specific uncertainties relating to issuing firms have an effect on initial returns; and specific uncertainties relating to issuing firms and the underwriter reputation both have an effect on the underwriter reputation. Since listed companies (OTC transfer to TSEC companies not included) or OTC transfer to TSEC companies all have information spillover effects, the listed companies can refer to the data on IPOs that have been issued in the same industry while fixing the offer prices.

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