

# Winner's Curse in Initial Public Offering Subscriptions with Investors' Withdrawal Options

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## Abstract

Contrary to fixed-priced initial public offering (IPO) subscribers in many other countries, IPO subscribers in Taiwan own the option to withdraw from their IPO allocations after learning the allocation rate (*ALLOC*). Investors' option to withdraw reduces the information asymmetry between informed investors and uninformed investors but increases the firm-commitment underwriting risk. We show that under investors' option to withdraw, uninformed investors can improve their performance by learning from the *ALLOC* and/or the withdrawal rate. Consequently, firm-commitment underwriters will absorb more overpriced shares. Unless underwriters are compensated directly by issuers, IPOs should be more underpriced to compensate underwriting activities under investors' option to withdraw.

**Keywords** Firm-commitment; Fixed-priced offerings; Initial public offerings; Investors' option to withdraw; Winner's curse

*JEL Classification:* G24, G38

## 1. Introduction

Previous studies, such as Loughran *et al.* (1994), Ibbotson and Ritter (1995), Ritter (1998), and Ljungqvist and Wilhelm (2002) document that initial public offerings (IPOs) are underpriced in many countries. Rock (1986) provides a winner's curse model to explain IPO underpricing under the asymmetric information between

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informed and uninformed investors. The winner's curse model is considered as one of the explanations for IPO underpricing. If an IPO is overpriced, the informed investors will withdraw from the market and then the uninformed investors become more likely to receive a larger allocation. By contrast, when an issue is underpriced, the uninformed investors are likely to receive a smaller allocation. Because the uninformed investors will compete with the informed investors, the issuer must compensate the uninformed so that they will join the market. That is, the underpricing of IPOs is to compensate the uninformed investors and induce them to purchase IPO shares.

Ljungqvist (2005) argues that the winner's curse model has the following implications. First, after adjusting for the possibility of winning an IPO allocation, uninformed investors earn zero initial return and informed investors earn only enough conditional returns to cover their costs of being informed. Second, with greater the ex-ante uncertainty, there is more underpricing. Third, reducing the information asymmetry between informed and uninformed investors can reduce the extent of underpricing.

Amihud *et al.* (2003), Keloharju (1993), Koh and Walter (1989), and Levis (1993) support the presence of the winner's curse in IPO markets. Under the winner's curse, the uninformed investors will not participate in the IPO market when IPOs are fairly priced. Loughran *et al.* (1994) notice that underpricing is lower when the offer price is set after ascertaining information about the demand for the IPO shares. However, for fixed-priced offerings, IPO offer price is set well in advance. Typically, the subscription period lasts for several days so that investors can place their orders. During the subscription period, the revealed information about the demand for the IPOs may be good, but the issuers and underwriters also face the risk that the revealed information could be bad. Consequently, issuers and underwriters underprice the offers to make failure less likely when the offer price has to be set in advance. Chowdhry and Sherman (1996) argue that the problem of information leakage during the subscription period for fixed-priced offering is worse when investors have to pay in advance for the shares they subscribe to.

For most of fixed-priced offering markets, such as Hong Kong, Israel, Singapore, Thailand and the UK, IPO subscribers have to pay for their subscription in advance to guarantee the subscription. However, investors in Taiwan do not have to pay in advance for their IPO subscriptions. Instead, they can even withdraw their subscriptions after winning IPO allocations by simply not paying for their allocations.<sup>1</sup>

In Taiwan, IPO shares can be offered to the public through either hybrid auction or fixed-price methods. Security law in Taiwan prohibits IPOs issued through book-building. Taiwan's hybrid auctioned IPOs consists of competitive bidding for 50% of the IPO shares and fixed-price offering for the remaining 50%.

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<sup>1</sup>Similarly, investors in South Korea have a put option to return IPO shares to the issuers if the IPO aftermarket price drops significantly. Investors in India also have the option to renege on their allocations. We thank an anonymous referee for raising this point.

More than 90% of the IPOs in Taiwan are issued using the fixed-price method. For fixed-price IPOs in Taiwan, shares are publicly subscribed to and each investor can subscribe to only one lot of IPO shares. Each lot is typically restricted to 1000 shares. Only domestic individual investors can subscribe to IPO shares.<sup>2</sup> For under-subscribed IPOs, every subscriber wins an extra allocation of 1000 shares. For over-subscribed IPOs, winners are determined by public lottery drawing. When winners of IPO allocations are determined, the total number of subscriptions and list of winners are announced by underwriters on the lottery drawing date. The most important feature of the fixed-priced IPO mechanism in Taiwan is that winners of IPO allocations own the option to withdraw from their allocations after learning the allocation rate (*ALLOC*). Allocation winners have 7 days to decide to withdraw from their allocations or to pay for their allocations. Subscriptions to different issues are independent. Withdrawing from one issue has no impact on an investor's ability to subscribe to future issues. If a firm-commitment offering is oversubscribed and all the winners pay for their allocations, the IPO distribution is completed. If the offering is undersubscribed or some of the winners withdraw from their allocations, the underwriters have to purchase the unpaid or unsubscribed shares. The process of going public in Taiwan is expressed in Figure 1.

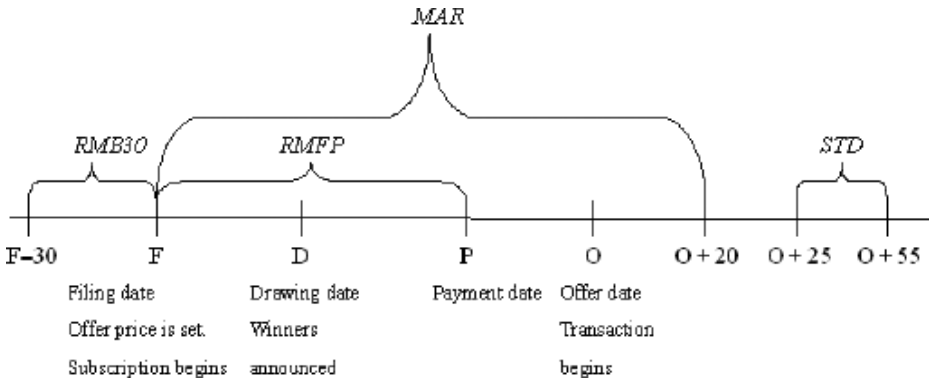
Busaba *et al.* (2001) show that when issuers own the option to withdraw from IPOs during the pre-market period, IPO underpricing is reduced because the issuers' bargaining power is strengthened. In the present paper, we find a different situation during the pre-market period: once investors own the option to withdraw from their allocations, can investors ask for more underpricing because of their strengthened bargaining power?

Compared to the traditional winner's curse scenario, uninformed subscribers have no idea about the demand for a certain IPO. In most IPO markets, uninformed subscribers pay in advance for their subscriptions, win allocations of under-subscribed offerings and suffer losses. However, if uninformed subscribers have a chance to reconsider their subscriptions after winning allocations, the uninformed winners could withdraw from undersubscribed allocations. Faced with investors' withdrawal options, underwriters might tend to set the offer price low enough to avoid investors' withdrawing, transferring the burden to the issuers. However, Beatty and Ritter (1986) argue that if an underwriter underprices IPOs too much, he or she will lose potential future issuers. Therefore, an underwriter would develop

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<sup>2</sup>Institutional investors are not allowed to participate in fixed-priced offerings in Taiwan. We hypothesize that individual investors consist of informed and uninformed individuals. Individual investors, such as well-backed analysts, who are willing to spend considerable resources on research about issuers' past earnings, quality of management, and prospects for the industry, for example, become informed individual investors. Hsieh (2009) confirms the existence of informed individual investors in Taiwan. Informed investors are assumed to have superior information about the terminal value of an asset (Grossman, 1976). In the present paper, informed investors are meant to be 'informed individual investors'.

Figure 1 The timeline of going public and the window period of variable measurement.



This figure describes the process of going public in Taiwan and explicitly defines the window period of each variable measurement. 'F' denotes the filing date; 'F - 30' is the day 30 days before the filing date; 'D' is the drawing date; 'P' is the final payment day for winners to pay for allocations; 'O' is the offer date; 'O + 20' is the day 20 days after the offer date; 'O + 25' is the day 25 days after the offer date; 'O + 55' is the day 55 days after the offer date. *RMB30* is the market return from 'F - 30' to 'F'; *RMFP* is the market return from 'F' to 'P.' *MAR* is the initial public offering (IPO) initial return measured from 'F' to 'O + 20.' *STD* is the proxy for IPO uncertainty measured by the standard deviation of daily returns from 'O + 25' to 'O + 55.'

a reputation on pricing IPOs and earn a return on his or her reputation. To avoid losing market shares, underwriters should not set the offer price too low. Consequently, the winner's curse in IPO could be effectively alleviated by the winners' option to withdraw after learning the *ALLOC*.

With this special feature in Taiwan IPO markets, we would like to examine the effect of investors' option to withdraw on subscription (or allocation), withdrawal, and IPO underpricing. Would investors always subscribe to IPO shares because they own the option to withdraw from allocations? Can investors learn from subscription (or allocation) to pay or to withdraw from their allocations? Do investors benefit from the option to withdraw? Are firm-commitment underwriters worse off under the investors' option to withdraw?

The remaining of this paper is organized as follows. Section 2 describes the data and descriptive statistics. Subscription, allocation, and withdrawal are examined in section 3. We discuss the uninformed investors' performance in section 4. Section 5 examines the firm-commitment underwriters' return. Finally, section 6 provides conclusions.

## 2. Data and Descriptive Statistics

Our sample consists of 315 fixed-priced IPOs issued in Taiwan during 1995–2003. The sample starts in 1995 because the Taiwan Stock Exchange began to record data on the proportion of IPO allocation winners withdrawing from their allocations in that year. The data for IPO characteristics, including the filing

date, the final payment date, the offer price, the number of shares offered, the number of total subscriptions, the number of allocations withdrawn, and the lead underwriters were downloaded from the website of the Chinese Securities Association. Daily market returns measured by the Taiwan Stock Exchange Market Index and daily stock returns of IPOs were collected from the *Taiwan Economic Journal* database.

Initial return is typically used to measure IPO underpricing. Due to the 7% price limits in Taiwan stock markets, the IPO day 1 return is not suitable for measuring IPO underpricing. Instead, we use the 20-day market-adjusted return (*MAR*) as the initial return for measuring IPO underpricing. *MAR* is explicitly defined as:

$$MAR = \frac{P_{20} - P_0}{P_0} - \frac{I_{20} - I_0}{I_0}, \quad (1)$$

where  $P_0$  = the offer price, which is set on the IPO filing date;  $P_{20}$  = the IPO close price on the 20th day after the offer date;  $I_{20}$  = market index on day 20 after the offer date; and  $I_0$  = the market index on the IPO filing date.

The *ALLOC* in Taiwan is also available. *ALLOC* is equal to 1 when an IPO is undersubscribed, and it is defined as the ratio of the number of shares offered to the number of shares subscribed when oversubscribed. *ALLOC* is dependent on the demand (or subscription) for an IPO. Amihud *et al.* (2003) show that without investors' withdrawal options, the negative relation between the *ALLOC* and IPO underpricing supports the winner's curse hypothesis.

In Taiwan, IPO allocation winners can think twice about their subscription. Winners can withdraw from their subscriptions after the information of allocation is revealed. *PAY* is the proportion of winners who pay for their allocations. *NONPAY* is the proportion of winners who withdraw from their allocations. Clearly,  $PAY = 1 - NONPAY$ .

*PROCD* is the IPO proceeds (the product of the offer price and the number of shares offered). *LPROCD* is the logarithm of the proceeds and is the measure for offer size. Ritter (1987) and Amihud *et al.* (2003) indicate that offer size is related to the uncertainty of an IPO and is also significant for the *ALLOC*.

For fixed-priced offerings, issuers and underwriters have to file the IPO offer price to the Securities and Exchange Commission (SEC) on the filing date. The market return prior to the IPO filing date should be useful for the issuers and underwriters in setting the offer price. In the present paper, we use the market return 30 days before the IPO filing date (*RMB30*) as the market condition prior to the filing date. If the offer price is fully adjusted to the prior market return, the IPO initial return is not dependent on the prior market return. However, if the offer price is underadjusted or overadjusted to the prior market return, the IPO initial return is positively or negatively related to the prior market return.

After the offer price is set, investors start to subscribe to IPO shares. After an investor wins an IPO allocation, he or she can still withdraw from his or her allocation, depending on the market condition prior to the final payment date. The

market return from the filing date to the final payment date (*RMFP*) is used to measure the market condition after the filing date and before the payment date.

Ritter (1984) proposes the standard deviation of IPO daily return in the aftermarket as proxy for uncertainty and finds a positive relationship between this proxy and underpricing. In the present paper, because we use the first 20 day returns as the IPO initial return, we use the standard deviation of IPO daily returns (*STD*) in the aftermarket, days +25 to +54, as proxy for IPO uncertainty.<sup>3</sup> We examine the effect of uncertainty on IPO underpricing and on excess demand. The window period of each variable measurement is expressed in Figure 1.<sup>4</sup>

Table 1 reports the IPO statistics and the correlation coefficients among the IPO characteristics. Panel A of Table 1 indicates that the average initial return is 23.05% with median = 11.34%, implying that IPOs in Taiwan are underpriced. The average *ALLOC* is 27.89%, with median = 3.88%. Because IPOs are underpriced, the IPO *ALLOC* is fairly low. Half of the IPOs in our sample have an *ALLOC* lower than 3.88%, and with such a low *ALLOC*, a winner would probably pay for his or her allocation. The mean payment rate for an allocation is 72.05%, with median = 95.99%. The average proceeds are NT\$706.07m, while the median is NT\$138.32m and the maximum is NT\$130 437m, implying that IPO proceeds are skewed to the right. The market return 30 days before the filing date is 4.32%, with median = 1.16%. The positive market return 30 days prior to the filing date indicates that issuers tend to offer their shares to the public when the stock market is not declining. On average, there are 25.38 days from the IPO filing date to the final date to pay for an allocation, and the market return over this period is -0.78%, with median = -0.51 (not reported in Table 1). The negative mean and the median of the market return from the filing date to the payment date along with the positive market return 30 days before the filing date imply that issuers choose good timing to file issuance. However, the stock market declines a little after issuers' file issuance. The uncertainty of an IPO measured by the standard deviation of daily returns over [+25, +54] in the aftermarket is 2.85%.

<sup>3</sup>Because *STD* is measured over the window [+25, +54] in the aftermarket, *STD* is not available at the time point of subscription or paying for allocation. However, *STD* is simply a proxy for IPO uncertainty that investors imagine. Therefore, we follow Amihud *et al.* (2003) to use the standard deviation of IPO aftermarket returns to examine the effect of IPO uncertainty on IPO excess demand and initial return. Because *STD* is a look-ahead variable, we also treat *STD* as endogenous and reach qualitatively similar results using two stage least squares regression models.

<sup>4</sup>The mean, minimum, median, and maximum of the number of days from payment date (P) to offer date (O) are 28.36, 3, 30, and 116, respectively. The mean, minimum, median, and maximum of the number of days from filing date (F) to O + 20 are 74.69, 40, 74, and 392, respectively.

**Table 1** Descriptive statistics and correlation coefficients of initial public offering characteristics

This table reports the descriptive statistics and correlation coefficients of initial public offering (IPO) characteristics. The sample includes 315 IPOs issued in Taiwan over the period 1995–2003. We obtain IPO disclosure and stock returns from the website of the Chinese Securities Association and the *Taiwan Economic Journal* data set, respectively. *MAR* is the IPO initial return. *ALLOC* is the allocation rate. *PAY* is the payment rate. *NONPAY* is the withdrawal rate. *PROCD* is the IPO proceeds. *RMB30* is the market return 30 days before the filing date. *RMFP* is the market return from the filing date to the final payment date. *STD* is IPO uncertainty measured by the standard deviation of daily returns in the aftermarket [+25, +54]. Panel A reports the statistics for IPO characteristics and panel B reports the correlation coefficients. \*\*\*, \*\*, and \* represent the significance levels of 1%, 5%, and 10%, respectively.

Panel A: Descriptive statistics						
Variable	Mean (%)	Standard deviation (%)	Minimum (%)	Medium (%)	Maximum (%)	
<i>MAR</i>	23.05	48.84	-49.92	11.34	243.37	
<i>ALLOC</i>	27.89	39.89	0.23	3.88	100.00	
<i>PAY</i>	72.05	34.33	3.16	95.99	100.00	
<i>NONPAY</i>	27.85	34.33	0.00	4.01	96.84	
<i>PROCD</i> (million NT\$)	706.07	7344.16	16.45	138.32	130.437	
<i>RMB30</i>	4.32	12.34	-19.41	1.16	35.11	
<i>RMFP</i>	-0.78	7.94	-20.42	-0.51	25.26	
<i>STD</i>	2.85	0.99	0.37	2.80	5.26	
Panel B: Correlation coefficients						
	<i>ALLOC</i>	<i>NONPAY</i>	<i>PROCD</i>	<i>RMB30</i>	<i>RMFP</i>	<i>STD</i>
<i>MAR</i> (p-value)	-0.408*** (0.000)	-0.517*** (0.000)	-0.019 (0.735)	0.350*** (0.000)	0.225*** (0.000)	0.224*** (0.000)
<i>ALLOC</i> (p-value)		0.809*** (0.000)	0.097* (0.084)	-0.408*** (0.000)	-0.144** (0.011)	-0.044 (0.437)
<i>NONPAY</i> (p-value)			0.094* (0.096)	-0.499*** (0.000)	-0.285*** (0.000)	-0.065 (0.252)
<i>PROCD</i> (p-value)				-0.057 (0.312)	-0.061 (0.278)	-0.027 (0.629)
<i>RMB30</i> (p-value)					0.064 (0.255)	0.058 (0.306)
<i>RMFP</i> (p-value)						-0.003 (0.964)

From panel B, we can see that the IPO initial return is negatively related to the *ALLOC* and the withdrawal rate, and positively related to the market return prior to the final payment date and IPO uncertainty. The *ALLOC* is negatively related to the market return prior to the filing date. The withdrawal rate is positively related to the *ALLOC* and negatively related to the market return between the filing date and the payment date.

The negative relationship between the initial return and the *ALLOC* is somewhat supportive of the winner's curse. However, the negative relation between the initial return and the *ALLOC* along with the negative relationship between the initial return and the withdrawal rate implies that investors can escape from 'cold' IPOs and join 'hot' IPOs using the *ALLOC* information. The positive relation between the market return prior to the filing date and a initial return imply that the offer price is set with only partial adjustment to the prior market conditions. The after-market standard deviation of the IPO daily return shows that IPOs with higher uncertainty tend to experience higher initial returns.

The positive relation between the *ALLOC* and the withdrawal rate implies that the winners are more likely to withdraw to avoid the winner's curse when an offering is less subscribed. However, when an offering is oversubscribed and the *ALLOC* is low, winners tend to pay for their allocations to earn the IPO initial return. Investors tend to subscribe to IPOs when the market is up prior to the filing date, leading to a negative relation between the *ALLOC* and the market return before the filing date. The market return 30 days prior to the filing date and the market return from the filing date to the final payment date indicate that the withdrawal rate depends on the market conditions before the investors have to make a final decision to pay or to withdraw.

Univariate analyses show that IPOs are underpriced and that the initial return is negatively related to the *ALLOC*, implying the presence of the winner's curse (see Table 1). However, the positive relationship between the *ALLOC* and the withdrawal rate indicates that the uninformed investors can avoid the winner's curse by withdrawing from allocations after learning the *ALLOC*.<sup>5</sup>

### 3. Subscription, Allocation, and Withdrawal

Before subscription, IPO subscribers in Taiwan realize that they own the option to withdraw from allocations. After winning allocations, if winners feel that the IPO

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<sup>5</sup>From Table 1, we can see that the means and medians of *MAR*, *ALLOC*, *PAY*, *NONPAY*, *PROCD*, *RMB30*, and *RMFP* are far apart implying the existence of extreme observations. *ALLOC*, *PAY*, and *NONPAY* are U-shaped and, therefore, are transformed by logistic transformation (see Amihud *et al.*, 2003). We further winsorize our data by deleting the observations with *MAR*, *PROCD*, *RMB30*, or *RMFP* larger (or smaller) than the mean plus (or minus) three times the corresponding standard deviation. Our winsorized data consist of 306 IPOs. We reach qualitatively similar results with the full sample and the winsorized sample.



allocations are bad deals, they can withdraw from their allocations by not paying for them. If winners feel that the allocations are good deals, they can pay for the allocations. Investors must learn valuable information both from the market condition (public information) and from the demand for the IPOs (private information) to make the right decision to pay or to withdraw. The problem is that if investors always subscribe owing to the option to withdraw from allocations, the subscription rate will always be high and, therefore, the subscription rate (or *ALLOC*) reveals no valuable private information to the subscribers. If investors do not always subscribe but they subscribe based on their private information on the demand for the IPOs instead, then the subscription rate or the *ALLOC* is valuable to the winners to make decisions to pay or to withdraw. Thus we ask: Does the *ALLOC* provide valuable private information? Do winners depend on this information to withdraw? In this section, we examine whether investors always subscribe under the option to withdraw, why winners withdraw, and whether uninformed investors are subject to the winner's curse when they subscribe.<sup>6</sup>

### 3.1 Do Investors Always Subscribe Given the Option to Withdraw from Allocations?

The *ALLOC* is determined by the total number of subscriptions and the total number of shares offered. IPO subscription is driven by the demand for the offerings. We expect that the higher the market return prior to subscribing, the higher the demand for the IPOs,<sup>7</sup> and that the lower the uncertainty of the IPOs, the higher the demand. If there exist informed investors in the IPO markets, the demand for IPOs would be stronger when IPOs are underpriced. However, the demand would be weaker for less underpriced IPOs. Therefore, we hypothesize that the *ALLOC* is a function of IPO initial return, market return prior to the subscribing date (the IPO filing date), and IPO uncertainty.

In the allocation model, because the *ALLOC* is a U-shaped distributed (68 out of 315 IPOs have *ALLOC* = 1 and 44 out of 315 IPOs have *ALLOC* < 1%) we follow Amihud *et al.* (2003) to use the logistic transformation of the allocation,

$$ALLOCT = \log[(ALLOC + a)/(1 - ALLOC + a)], \quad (2)$$

where  $a = 0.5/315$ ,<sup>8</sup> to accommodate the cases where *ALLOC* = 1 or is practically 0. The results are reported in Table 2.

<sup>6</sup>We reach qualitatively similar results when including year dummies to the regressions to control for potential time-varying effects. Regression results with year dummies are available from the author upon request.

<sup>7</sup>If issuers over-adjust the offer price to the recent market return, the demand for the IPOs should be lower when the market return prior to subscribing is high. However, Table 1 indicates that the initial return is positively related to the market return prior to subscribing, implying that issuers partially adjust the offer price to the recent market return. Hence, we expect that demand for IPOs is higher when recent market return is high.

<sup>8</sup>The term  $a = 0.5/N$ , where  $N$  is the sample size.

**Table 2** Determinants of allocation rate

This table examines the determinants of investors' allocation rate and reports results from regressing the allocation rate on initial public offering (IPO) characteristics. *ALLOCT* is the logistic transformation of the allocation rate. *MAR* is IPO initial return. *RMB30* is the market return 30 days before the filing date. *LPROCD* is the logarithm of IPO proceeds. *STD* is IPO uncertainty measured by the standard deviation of daily returns in the aftermarket [+25, +54]. In Taiwan, investors own the option to withdraw from their allocations. We investigate whether investors always subscribe due to the option to withdraw. The t-values are in parentheses; standard errors use White's (1980) robust estimation. \*\*\* and \*\* represent the significance levels of 1% of 5%, respectively.

	Dependent variable: <i>ALLOCT</i>	
Intercept (t-value)	9.905** (2.57)	7.957** (2.17)
<i>MAR</i> (t-value)		-2.716*** (-6.10)
<i>RMB30</i> (t-value)	-14.234***(-8.31)	-10.508*** (-6.07)
<i>LPROCD</i> (t-value)	-0.516*** (-2.62)	-0.430** (-2.31)
<i>STD</i> (t-value)	-23.723 (-1.12)	4.472 (0.22)
Adjusted R <sup>2</sup>	18.30%	26.83%
Probability > F	0.000	0.000
N	315	315

Table 2 has two models: one includes IPO underpricing measured by *MAR*; the other does not. Informed investors have information on IPO underpricing; uninformed investors, however, do not. In other words, uninformed investors cannot make their decisions regarding subscriptions based on *MAR*. Instead, informed investors can subscribe depending on *MAR*. Table 2 indicates that investors tend to subscribe to IPO shares when the market return prior to subscription is high, leading to a low *ALLOCT*. Moreover, investors subscribe more to large size IPOs. Without IPO underpricing, the prior market return is the most significant factor for investors to subscribe (coefficient = -14.234, t = -8.31). Nevertheless, with *MAR* in the model, we can see that *MAR* is the factor most influential to subscription (coefficient = -2.716, t = -6.10).

From Table 2, we realize that investors' subscription (or *ALLOCT*) is significantly dependent on IPO underpricing, prior market return, and size of proceeds, implying that investors do not always subscribe if they own the option to withdraw from allocations. If investors always subscribe owing to the option to withdraw, the *ALLOCT* would not significantly depend on IPO characteristics, such as IPO initial return, prior market return, or IPO proceeds. Because investors subscribe to IPO shares according to IPO underpricing, the *ALLOCT* will be able to provide valuable information for winners regarding whether to pay or to withdraw.

### 3.2 Why Do Winners Withdraw?

After subscription, for undersubscribed offerings, all the subscribers are winners. However, for oversubscribed offerings, winners are determined by a lottery drawing

and the list of winners as well as total number of subscriptions is released to the public. After notification as an allocation winner, the winner has 7 days to decide to pay or to withdraw from the allocation. That is, winners can pay or withdraw after learning the *ALLOC*.

In the withdrawal model, winners decide to pay or to withdraw conditioned on the available information, including the *ALLOC*, the market return prior to subscription, the market return during the period from subscription to withdrawal, and the size of proceeds. Uninformed winners have no idea about the IPO initial return. Informed winners, however, are informed about the IPO initial return. Therefore, we establish the withdrawal models (with and without initial return) to investigate why winners withdraw.

Similar to the transformation of the *ALLOC*, we use the logistic transformation of the withdrawal rate,

$$NONPAYT = \log[(NONPAY + a)/(1 - NONPAY + a)], \quad (3)$$

where  $a = 0.5/315$ , to accommodate the cases where  $NONPAY = 1$  or is practically 0.

Table 2 shows that investors do not always subscribe, even with the option to withdraw, implying that the *ALLOC* is valuable for revealing the demand for the IPO. However, do winners take advantage of this valuable information to withdraw? Table 3 reveals that as market return prior to subscription or market return prior to the final payment date is high, winners are less likely to withdraw. Similar to

Table 3 Determinants of withdrawal rate

This table discusses how allocation winners decide to pay for or to withdraw from their allocations and reports the results from regressing the withdrawal rate on initial public offering (IPO) characteristics. *NONPAYT* is the logistic transformation of the withdrawal rate. *MAR* is the IPO initial return. *ALLOCT* is the logistic transformation of the allocation rate. *RMB30* is the market return 30 days before the filing date. *RMFP* is the market return from the filing date to the final payment date. *LPROCD* is the logarithm of IPO proceeds. The allocation rate and the market return prior to the payment date are public information for all the investors. The IPO underpricing could be available for the informed investors but not for the uninformed. Offer size is used as a control variable in the regression. The t-values are in parentheses; standard errors use White's (1980) robust estimation. \*\*\* and \* represent the significance levels of 1% and 10%, respectively.

	Dependent variable: <i>NONPAYT</i>	
Intercept (t-value)	-3.028* (-1.87)	-2.960* (-1.91)
<i>MAR</i> (t-value)		-1.110*** (-5.45)
<i>ALLOCT</i> (t-value)	0.447*** (18.15)	0.405*** (16.33)
<i>RMB30</i> (t-value)	-6.243*** (-7.66)	-5.326*** (-6.68)
<i>RMFP</i> (t-value)	-5.849*** (-5.08)	-4.724*** (-4.22)
<i>LPROCD</i> (t-value)	0.075 (0.88)	0.081 (0.99)
Adjusted R <sup>2</sup>	68.76%	71.41%
Probability > F	0.000	0.000
N	315	315

Lowry and Schwert (2002), the market information before IPO filing is simply partially incorporated into the offer price. Consequently, the withdrawal rate is negatively related to the market return before the filing date. The *ALLOC* is the most significant factor for winners to withdraw. For the model without *MAR* as an independent variable, *ALLOCT* is significant at the 1% level, with t-value = 18.15, indicating that winners tend to withdraw when faced with a high *ALLOC*. Column 2 of Table 3 also points out that winners are more likely to withdraw from IPOs of low initial returns. Even with the initial return included in the withdrawal model, the *ALLOC* is still the most significant factor for withdrawal (coefficient = 0.405, t-value = 16.33).

Table 3 shows that winners tend to withdraw when the market return prior to withdrawal is poor, when the *ALLOC* is high, and/or when IPOs are less underpriced.

### 3.3 Does the Winner's Curse Hold under Investors' Option to Withdraw?

The winner's curse indicates that uninformed investors are more likely to win overpriced offerings rather than underpriced offerings because the informed investors will join underpriced IPOs and escape from overpriced ones. Amihud *et al.* (2003) argue that the winner's curse implies a negative relation between the IPO initial return and the *ALLOC*. However, uninformed investors can withdraw from allocations after learning the *ALLOC* in Taiwan IPO markets. Does a negative relation between the initial return and the *ALLOC* indicate that uninformed investors suffer from the winner's curse when they own the option to withdraw after being allocated IPO shares? If both informed and uninformed investors subscribe to IPO shares no matter how much IPOs are overpriced because they own the option to withdraw from allocations, then the *ALLOC* will always be low and will provide no valuable information to winners. When uninformed investors cannot obtain useful information from the *ALLOC*, they still suffer from the winner's curse even with the option to withdraw. In this case, informed investors withdraw from overpriced allocations but not from underpriced allocations. However, uninformed investors withdraw from both overpriced and underpriced allocations or never withdraw. Consequently, no relation between the initial return and the *ALLOC* along with a positive relation between the initial return and the withdrawal rate still implies the validity of the winner's curse and, therefore, IPOs still have to be underpriced to attract uninformed investors to join IPO markets, even when investors own the option to withdraw.

Even with the option to withdraw, if informed investors subscribe to underpriced offerings only and uninformed investors subscribe to both underpriced and overpriced offerings, then the relation between the initial return and the *ALLOC* will be negative. However, the uninformed investors can still learn from the *ALLOC* to withdraw from overpriced IPOs.

In section 3.1, we showed that the *ALLOC* is not always high and the withdrawal rate is significantly dependent on the *ALLOC*. That is, the informed

investors tend to subscribe to underpriced IPOs only, leading to valuable information from the *ALLOC*. Therefore, with the winner's option to withdraw, the relation between the initial return and the *ALLOC*, is still negative. However, because uninformed winners can learn from the *ALLOC*, the negative relationship between the initial return and the *ALLOC* is alleviated by the winner's option to withdraw. In other words, the winner's curse is mitigated by the winner's option to withdraw from allocations.

We establish the following models to examine whether the winner's curse holds, whether the winner's curse is alleviated, and whether the information regarding the *ALLOC* is absorbed by the withdrawal rate:

$$MAR = f(ALLOC, \text{ other control variables}) \quad (4)$$

$$MAR = f(ALLOC, ALLOC*NONPAYT, \text{ other control variables}) \quad (5)$$

$$MAR = f(ALLOC, NONPAYT, \text{ other control variables}). \quad (6)$$

Columns 1 and 2 of Table 4 indicate that the *ALLOC* is negatively related to the initial return, implying that informed investors tend to subscribe to underpriced IPOs and escape from overpriced IPOs. Hence, if winners do not own the option to withdraw, uninformed winners are subject to the winner's curse. In addition to the *ALLOC*, the initial return is positively related to the market return prior to the filing date, the market return from subscription to withdrawal, and IPO uncertainty. The positive relation between the initial return and the market return prior to the filing date implies that an offer price is only partially adjusted to the market condition on the filing date. Column 3 of Table 4 indicates that:

$$\begin{aligned} MAR = & -0.435 - 0.028 ALLOC + 0.012 ALLOC*NONPAYT \\ \text{t-value} & (-1.02) \quad (-4.20)^{***} \quad (3.93)^{***} \\ & + \text{ other variables} + \epsilon. \end{aligned} \quad (7)$$

The significantly positive coefficient of *ALLOC\*NONPAYT* means that the negative relation between *MAR* and *ALLOC* is mitigated by *NONPAYT*. Equation (7) can be rephrased as:

$$\begin{aligned} MAR = & - 0.435 - (0.028 - 0.012 NONPAYT)*ALLOC \\ & + \text{ other variables} + \epsilon. \end{aligned} \quad (8)$$

Equation (8) means that *NONPAYT* increased by 1 point leads to the magnitude of the relationship between *MAR*, and *ALLOC* decreases by 0.012 points. That is, winners' withdrawal can alleviate the negative relation between the initial return and the *ALLOC*, implying that the winner's curse problem can be mitigated by withdrawing from allocation.

Furthermore, column 4 of Table 4 reveals that the *ALLOC* is not significantly related to the initial return once the withdrawal rate is included in the model

**Table 4** The effects of allocation and withdrawal on initial public offering underpricing

This table examines how initial public offering (IPO) underpricing is influenced by the allocation rate and how the withdrawal rate influences the effect of the allocation rate on the initial return. This table reports the results from regressing the IPO initial return on the allocation rate, the withdrawal rate, and the interaction of the allocation rate and the withdrawal rate. The market return, proceeds size, and the uncertainty of the offerings are used as control variables. *MAR* is the IPO initial return. *ALLOCT* is the logistic transformation of the allocation rate. *NONPAYT* is the logistic transformation of the withdrawal rate. *RMB30* is the market return 30 days before the filing date. *RMFP* is the market return from the filing date to the final payment date. *LPROCD* is the logarithm of the IPO proceeds. *STD* is IPO uncertainty measured by the standard deviation of daily returns in the aftermarket [+25, +54]. The t-values are in parentheses; standard errors use White's (1980) robust estimation. \*\*\*, \*\*, and \* represent the significance levels of 1%, 5%, and 10%, respectively.

	Dependent variable: <i>MAR</i>			
Intercept	0.171***	-0.422	-0.435	-0.531
(t-value)	(6.63)	(-0.96)	(-1.02)	(-1.26)
<i>ALLOCT</i>	-0.050***	-0.036***	-0.028***	-0.005
(t-value)	(-8.37)	(-5.65)	(-4.20)	(-0.58)
<i>ALLOCT*NONPAYT</i>			0.012***	
(t-value)			(3.93)	
<i>NONPAYT</i>				-0.070***
(t-value)				(-4.85)
<i>RMB30</i>		0.816***	0.599***	0.378*
(t-value)		(3.84)	(2.79)	(1.69)
<i>RMFP</i>		1.039***	0.831***	0.621**
(t-value)		(3.47)	(2.79)	(2.06)
<i>LPROCD</i>		0.016	0.014	0.019
(t-value)		(0.73)	(0.65)	(0.89)
<i>STD</i>	9.600***	9.618***	7.106***	7.552***
(t-value)	(3.93)	(4.05)	(2.95)	(3.24)
Adjusted R <sup>2</sup>	21.93%	27.42%	30.66%	32.35%
Probability > F	0.000	0.000	0.000	0.000
N	315	315	315	315

(t-value for *ALLOCT* = -0.58, t-value for *NONPAYT* = -4.85), implying that the effect of *ALLOCT* on *MAR* is absorbed by *NONPAYT*. In other words, uninformed investors can learn from the *ALLOCT* to withdraw. Table 4 shows that the winner's curse still holds in Taiwan IPO markets even under investors' option to withdraw from allocations. However, the winner's curse is mitigated by the winner's option to withdraw after winning an allocation.

#### 4. Uninformed Investors' Profit under Investors' Option to Withdraw

Table 1 reveals that Taiwan IPOs are on average underpriced by 23.05%. However, Rock's (1986) winner's curse model proposes that uninformed investors earn zero abnormal returns on IPOs due to adverse selection. In equilibrium, we expect the

uninformed strategy to not produce positive initial returns. Similar to Amihud *et al.* (2003), we assume that uninformed investors subscribe to a fixed amount for each and every IPO (or subscribe randomly to some IPOs). Winners, however, in Taiwan own the option to withdraw. We, therefore, further assume that winners of uninformed strategy pay (or withdraw) a fixed amount for each and every IPO (or pay randomly to some IPOs). The allocation-weighted initial return is given by:

$$ALLOCMAR = ALLOC * MAR. \quad (9)$$

Similarly, the allocation-and-payment-weighted initial return is:

$$PAYALLOCMAR = PAY * ALLOC * MAR. \quad (10)$$

The descriptive statistics of IPO initial return are reported in Table 5. Table 5 shows that the IPO initial return is significantly positive, with mean = 23.05% and t-value = 8.37. However, the allocation-weighted initial return is significantly negative, with mean = -1.5% and t-value = -2.32. The negative allocation-weighted initial return does not mean that uninformed investors suffer losses on average. If this were the case, uninformed investors would escape from the IPO markets. Because winners still can withdraw from their allocations, we measure uninformed investors' return by allocation-and-payment-weighted initial return. Investors can earn IPO initial returns only when they win allocations and pay for them. The allocation-and-payment-weighted initial return is insignificantly different from zero, with mean = 0.43% and t-value = 1.61. Consistent with the winner's curse, uninformed investors in Taiwan earn no abnormal returns in equilibrium, even with the option to withdraw from allocations.

If uninformed investors subscribe to a fixed amount for each and every IPO (or subscribe randomly to some IPOs) and do not withdraw from their allocations, the uninformed investors earn allocation-weighted initial returns. If uninformed investors subscribe to a fixed amount of each and every IPO (or subscribe randomly to some IPOs) and pay a fixed amount for each and every IPO (or pay randomly to some IPOs), the uninformed investors earn allocation-and-payment-weighted initial returns. Uninformed investors should have no private information related to the IPOs, but they could improve their performance by conditioning their subscription and withdrawal on publicly available information.

Table 5 shows that the allocation-weighted initial return is significantly negative. Because uninformed investors own the option to withdraw from allocations, the allocation-and-payment-weighted initial return could be a better proxy for uninformed investors' return than the allocation-weighted initial return. On average, the allocation-and-payment-weighted initial return is insignificantly different from zero. Table 6 indicates that the allocation-weighted initial return (panel A) and the allocation-and-payment-weighted initial return (panel B) are significantly negatively related to the *ALLOC*, implying that uninformed investors can improve their performance by learning the *ALLOC*. Moreover, we also show that uninformed investors could even improve their performance by withdrawing from allocations,

**Table 5** Descriptive statistics on initial public offering initial return, with adjustment for allocation rate and payment rate

Initial public offering (IPO) initial return is decomposed into the initial return weighted by the allocation rate, the initial return weighted by the allocation rate and the payment rate, and the initial return weighted by the underwriter's purchase. *MAR* is the IPO initial return. *ALLOC* is the allocation rate. *PAY* is the payment rate, which equals 1 minus the withdrawal rate. *UWBUY* is the proportion of the underwriter's purchase on IPO shares to total number of IPO shares offered. Because Taiwan underwriters retain 15% of IPO shares and sell the remainder to the public, the underwriter's purchase (*UWBUY*) equals  $0.15 + 0.85 \times \text{withdrawal rate}$  if IPOs are oversubscribed; otherwise, underwriter's purchase equals  $0.15 + 0.85 \times [(1 - \text{ALLOC}) \times \text{NONPAY}]$ .  $\text{ALLOCMAR} = \text{ALLOC} \times \text{MAR}$ .  $\text{PAYALLOCMAR} = \text{PAY} \times \text{ALLOC} \times \text{MAR}$ .  $\text{UWMAR} = \text{UWBUY} \times \text{MAR}$ . All the IPOs in the sample are firm-commitment offerings. The t-values are for  $H_0$ : mean = 0. \*\*\* and \*\* represent the significance levels of 1% and 5%, respectively.

	Mean	t-value	Minimum	Median	Maximum
<i>MAR</i>	23.05%	8.37***	-49.92%	11.04%	243.37%
<i>ALLOCMAR</i>	-1.50	-2.32**	-49.92	0.28	53.03
<i>PAYALLOCMAR</i>	0.43	1.61	-19.21	0.25	38.69
<i>UWMAR</i>	1.28	1.50	-49.86	2.79	52.99

conditioned on the flow of withdrawal made by other investors. This is similar to the scenario of information cascade proposed by Welch (1992).<sup>9</sup> Even if uninformed winners cannot learn information about the withdrawal rate, they can still learn from the allocation. Table 6 shows that uninformed investors can improve their return by withdrawing from IPOs with high *ALLOC* or by paying for those with low *ALLOC*. However, if uninformed investors can learn from the flow of withdrawal, the withdrawal rate absorbs the information from the *ALLOC* to improve their performance. When uninformed investors learn from the flow of withdrawal, the information on allocation becomes insignificant.

Uninformed investors can improve their performance by learning from allocation and/or withdrawal. Table 7 further examines the uninformed investors' return based on the *ALLOC* and the withdrawal rate. Panel A of Table 7 indicates that for those IPOs with low *ALLOC* (lower than 0.2), uninformed investors earn 1.068% on average, with t-value = 4.875. By contrast, uninformed investors will suffer losses of -1.903%, with t-value = -2.110 for IPOs with *ALLOC* higher than 0.8. Panel B of Table 7 points out that uninformed investors can earn significantly positive return on IPOs with low withdrawal rates (withdrawal rates lower than 0.2) and suffer significant losses on IPOs with high withdrawal rates (withdrawal rates higher than 0.6).

<sup>9</sup>Amihud *et al.* (2003, p.55) state that 'Investors could improve their performance by choosing to participate in IPOs conditional on the flow of orders entered by other investors. This resembles the scenario described by Welch (1992), which leads to information cascade. ... Many investors could obtain coarse information about the extent of demand by talking to other investors and to brokers.'



**Table 6** Improving uninformed investors' return by learning from the allocation rate and/or the withdrawal rate

This table examines whether uninformed investors can improve their performance by learning the information from the allocation rate and the withdrawal rate. *MAR* is the initial public offering initial return. *ALLOCMAR* is the allocation rate. *PAY* is the payment rate, which equals 1 minus the withdrawal rate. *ALLOCMAR* = *ALLOCMAR*\**MAR*. *ALLOCT* is the logistic transformation of the allocation rate. *RMB30* is the market return 30 days before the filing date. *PAYALLOCMAR* = *PAY*\**ALLOCMAR*. *NONPAYT* is the logistic transformation of the withdrawal rate. *RMFP* is the market return from the filing date to the final payment date. Panel A reports uninformed investors' return, which can be measured by the allocation-weighted initial return (*ALLOCMAR*) if they do not execute their option to withdraw. Panel B reports uninformed investors' return, which can be measured by the allocation-and-payment-weighted initial return (*PAYALLOCMAR*) if they may execute their option to withdraw randomly. The t-values are in parentheses; standard errors use White's (1980) robust estimation. \*\*\* and \*\* represent the significance levels of 1% and 5%, respectively.

Panel A: Dependent variable: <i>ALLOCMAR</i>	
Intercept (t-value)	-0.026*** (-4.27)
<i>ALLOCT</i> (t-value)	-0.010*** (-6.93)
<i>RMB30</i> (t-value)	0.062 (1.16)
Adjusted R <sup>2</sup>	12.85%
Probability > F	0.000
N	315
Panel B: Dependent variable: <i>PAYALLOCMAR</i>	
Intercept (t-value)	-0.005 (-1.51)
<i>ALLOCT</i> (t-value)	-0.000 (-0.24)
<i>NONPAYT</i> (t-value)	-0.004*** (-2.19)
<i>RMB30</i> (t-value)	0.030 (1.22)
<i>RMFP</i> (t-value)	-0.014 (-0.42)
Adjusted R <sup>2</sup>	6.55%
Probability > F	0.000
N	315

**Table 7** Uninformed investors' return conditioning on allocation rate and withdrawal rate

This table examines uninformed investors' return given their options to withdraw from the allocations. *MAR* is IPO initial return. *ALLOC* is the allocation rate. *PAY* is the payment rate, which equals 1 minus the withdrawal rate. *PAYALLOC* = *PAY*\**ALLOC*\**MAR*. *NONPAY* is the withdrawal rate. Uninformed investors' return is measured by the allocation-and-payment-weighted initial return (*PAYALLOC*-*MAR*). Samples are split into groups conditioning on the allocation rate or the withdrawal rate. Panel A reports the descriptive statistics of *PAYALLOC* conditioning on the allocation rate and panel B reports the descriptive statistics of *PAYALLOC* conditioning on the withdrawal rate. \*\*\* and \*\* represent the significance levels of 1% and 5%, respectively.

Panel A: Conditioning on the allocation rate (*ALLOC*)

Range of allocation rate	N	Mean	t-value	Minimum	Median	Maximum
[0,0.2)	218	1.068%	4.875***	-1.243%	0.422%	33.395%
[0.2,0.4)	18	1.117	1.149	-2.768	-0.682	12.241
[0.4,0.6)	6	3.623	1.286	-2.259	0.201	13.475
[0.6,0.8)	4	-1.796	-1.941	-3.440	-1.967	0.188
[0.8,1.0]	69	-1.903	-2.110**	-19.214	-1.559	38.691

Panel B: Conditioning on the withdrawal rate (*NONPAY*)

Range of withdrawal rate	N	Mean	t-value	Minimum	Median	Maximum
[0,0.2)	189	1.555%	4.715***	-0.776%	0.497%	38.691%
[0.2,0.4)	15	1.274	1.457	-2.204	0.458	11.337
[0.4,0.6)	27	-1.567	-1.360	-19.214	-0.511	6.214
[0.6,0.8)	42	-2.018	-2.453**	-14.777	-1.289	14.096
[0.8,1.0]	42	-1.187	-2.713***	-9.686	-0.950	9.357

**Table 8** Correlation coefficients among allocation rate, withdrawal rate, predicted withdrawal rate, and underpricing

This table measures how the predicted withdrawal rate correlated to the actual withdrawal rate, allocation rate, and initial return. *Predicted NONPAY* is the predicted withdrawal rate estimated from the following regression:  $Predicted\ NONPAY = -2.960 - 1.110\ MAR + 0.405\ ALLOC - 5.326\ RMB30 - 4.724\ RMFP + 0.081\ LPROCD$ . *NONPAY* is the logistic transformation of the withdrawal rate. *MAR* is the IPO initial return. *ALLOC* is the logistic transformation of the allocation rate. *RMB30* is the market return 30 days before the filing date. *RMFP* is the market return from the filing date to the final payment date. *LPROCD* is the logarithm of initial public offering proceeds. \*\*\* represents the significance of 1%.

	<i>NONPAY</i>	<i>ALLOC</i>	<i>MAR</i>
<i>Predicted NONPAY</i> (p-value)	0.801 (0.000)***	0.968 (0.000)***	-0.412 (0.000)***
<i>NONPAY</i> (p-value)		0.809 (0.000)***	-0.518 (0.000)***
<i>ALLOC</i> (p-value)			0.408 (0.000)***

We show, in Table 3, that investors' withdrawal is significantly dependent on the *ALLOC*, the market return prior to the payment date, and IPO underpricing. Uninformed investors, even though they have no idea about IPO underpricing, can

**Table 9** Uninformed investors' expected return using predicted withdrawal rate

This table measures uninformed investors' expected return if they expect to withdraw using the predicted withdrawal rate. The predicted withdrawal rate is estimated from the following regression:

$$\text{Predicted } NONPAYT = -2.960 - 1.110 \text{ } MAR + 0.405 \text{ } ALLOCT - 5.326 \text{ } RMB30 - 4.724 \text{ } RMFP + 0.081 \text{ } LPROCD.$$

*NONPAYT* is the logistic transformation of the withdrawal rate. *MAR* is the IPO initial return. *ALLOCT* is the logistic transformation of the allocation rate. *RMB30* is the market return 30 days before the filing date. *RMFP* is the market return from the filing date to the final payment date. *LPROCD* is the logarithm of IPO proceeds. *ALLOC* is the allocation rate. *PAY* is the payment rate, which equals 1 minus the withdrawal rate. We assume that uninformed investors expect to withdraw if the predicted withdrawal rate is higher than a certain level 'A,' e.g. A = 0, 0.2, A = 0.4, A = 0.6, A = 0.8, or A = 1. Panel A reports the descriptive statistics of uninformed investors' expected return, which equals to *ALLOCMAR* if uninformed investors do not withdraw; or equals to zero if they withdraw. Panel B reports the descriptive statistics of the difference between the uninformed strategy, which is measured by the allocation-and-payment-weighted initial return (*PAYALLOCMAR*) and the corresponding value from panel A. \*\*\*, \*\*, and \* represent the significance levels of 1%, 5%, and 10%, respectively.

	N	Mean	t-value	Minimum	Median	Maximum
<b>Panel A: Uninformed investors' expected return</b>						
A = 0	315	0%	0	0%	0%	0%
A = 0.2	315	0.911	4.562***	-13.423	0.145	33.944
A = 0.4	315	0.718	3.315***	-18.101	0.146	33.944
A = 0.6	315	0.606	2.581**	-22.415	0.150	33.944
A = 0.8	315	-0.622	-1.536	-40.239	0.182	33.944
A = 1	315	-1.500	-2.315**	-49.921	0.283	53.026
<b>Panel B: Difference between the uninformed strategy and uninformed investors' return</b>						
A = 0	315	-0.432%	-1.605	-38.691%	-0.245%	19.215%
A = 0.2	315	0.478	2.246**	-38.691	0.003	19.214
A = 0.4	315	0.285	1.285	-38.691	0.002	19.214
A = 0.6	315	0.173	0.744	-38.691	0.002	19.214
A = 0.8	315	-1.054%	-3.399*	-38.691	-0.001	14.777
A = 1	315	-1.932	-4.202***	-40.235	0.001	43.688

withdraw from their allocation by learning from the *ALLOC* and from the market return prior to the payment date. From public information, we predict the uninformed investors' logistic transformation of withdrawal rate is<sup>10</sup>:

$$\begin{aligned} \text{Predicted } NONPAYT = & -3.028 + 0.447 \text{ } ALLOCT - 6.243 \text{ } RMB30 \\ & - 5.849 \text{ } RMFP + 0.075 \text{ } LPROCD. \end{aligned} \quad (11)$$

Table 8 reveals that the predicted withdrawal rate is significantly correlated to the actual withdrawal rate, *ALLOC*, and IPO initial return. We assume that uninformed investors make their decisions to pay or to withdraw given the predicted withdrawal

<sup>10</sup>Coefficients of equation (11) are obtained from Table 3.

rate. Uninformed investors withdraw when the predicted withdrawal rate is high enough. We analyze the uninformed investors' return assuming uninformed investors withdraw when the predicted withdrawal rate is higher than 0, 0.2, 0.4, 0.6, 0.8, or 1.0. The argument that investors withdraw when the predicted withdrawal rate is higher than 0 means investors always withdraw. However, when investors withdraw as the predicted withdrawal rate is higher than 1 implies that investors never withdraw. Table 9 indicates that with a predicted withdrawal rate, uninformed investors earn no abnormal return overall. Uninformed investors will suffer losses of  $-1.5\%$  ( $t$ -value =  $-2.315$ ) if they never withdraw. However, uninformed investors can earn positive returns on IPOs if they expect to withdraw from those with a predicted withdrawal rate higher than 0.6.

We hypothesize that uninformed investors follow an uninformed strategy to withdraw a fixed amount from each and every IPO (or withdraw randomly from some IPOs). Panel B of Table 9 measures how uninformed investors earn more expected returns than with the uninformed strategy based on the predicted withdrawal rate. Panel B of Table 9 indicates that if uninformed investors expect to withdraw only from IPOs with predicted withdrawal rates higher than 0.8, they earn less than with the uninformed strategy by 1.054%. Investors who expect to never withdraw will earn 1.932% less than with the uninformed strategy. However, if uninformed investors expect to withdraw from IPOs with predicted withdrawal rates higher than 0.2, they earn 0.478% more than with the uninformed strategy.

## 5. Underwriter's Profit under Investors' Option to Withdraw

Investors' option to withdraw after learning IPO allocations allows uninformed investors to reconsider their subscriptions. We have already shown that uninformed investors can learn from the *ALLOC* to withdraw. With the investors' option to withdraw, uninformed investors do not need much underpricing to cover their losses on overpriced IPO as if they did not own the option to withdraw. When uninformed investors do not own the option to withdraw, they suffer losses on overpriced allocations. However, with the option to withdraw, uninformed investors tend to withdraw from overpriced allocations, leading to the fact that firm-commitment underwriters have to absorb unpaid overpriced allocations. Therefore, we argue that under the investors' option to withdraw, underwriters are more likely to purchase overpriced offerings.

Underwriters do not earn any underwriting fee when underwriting IPOs in Taiwan. Instead, underwriters in Taiwan can retain 15% of the IPO shares and benefit from the underpricing of IPOs. Table 1 indicates that the average underpricing of IPOs in Taiwan is 23.05%. Retaining 15% of IPO shares along with IPO underpricing allows underwriters to earn 3.46% of IPO proceeds on average if IPOs are oversubscribed and allocation winners cannot withdraw.

For firm-commitment IPOs, underwriters have to buy unsubscribed or unpaid shares. That is, underwriters will buy (*UWBUY*):

$$UWBUY = \begin{cases} 0.15 + 0.85 * \text{withdrawal rate, if allocation rate} < 1 \\ 0.15 + 0.85 * (1 - OVERSUB * (1 - \text{withdrawal rate})), \text{ otherwise} \end{cases} \quad (12)$$

An underwriter's return ( $UWMAR$ ) is thus measured by:

$$UWMAR = UWBUY * MAR. \quad (13)$$

Table 5 shows that underwriters earn 1.284% on underwriting IPOs because they absorb unsubscribed and unpaid overpriced IPO shares. Firm-commitment underwriting along with investors' option to withdraw causes underwriters to earn 2.18% less than for the case where IPOs are fully subscribed and investors cannot withdraw ( $3.46 - 1.28\% = 2.18\%$ ).

How can issuers ask underwriters to underwrite IPOs with less profit? We attempt to measure how underwriters earn more under investors' options to withdraw through IPO underpricing. We hypothesize that IPOs are underpriced by 1–5% and estimate the respective  $ALLOC$ , withdrawal rates, underwriters' purchases, underwriters' returns, and uninformed investors' returns. When IPOs are more underpriced, investors tend to subscribe to more IPO shares and withdraw less allocations, leading to fewer shares to be purchased by underwriters. When IPOs are more underpriced, underwriters will be better off because they retain 15% of IPO shares.

When IPOs are more underpriced, we expect that IPOs receive more subscriptions. We define the oversubscription rate ( $OVERSUB$ ) as:

$$OVERSUB = \frac{\text{number of subscriptions}}{\text{number of IPO shares issued}}. \quad (14)$$

$OVERSUB$  is significantly dependent on the IPO initial return. The relation between  $OVERSUB$  and the IPO initial return is:

$$\begin{aligned} OVERSUB &= 33.017 + 57.054 MAR \\ &\quad \text{(t-value)} \qquad \qquad \qquad \text{(9.42)} \\ \text{adj-R}^2 &= 21.85\%. \end{aligned} \quad (15)$$

Therefore, we assume that  $OVERSUB$  increases by 57.054% when  $MAR$  increases by 1%.

With the predicted oversubscription rate, we can easily measure the predicted  $ALLOC$ . The predicted  $ALLOC$  is 1 when the oversubscription rate is less than 1; otherwise the predicted  $ALLOC$  is simply the reciprocal of the oversubscription rate. Using the results in Table 3, we estimate the predicted withdrawal rate as follows:

$$\begin{aligned} \text{Predicted } NONPAYT &= -2.960 - 1.110 MAR + 0.405 ALLOCT \\ &\quad - 5.326 RMB30 - 4.724 RMFP + 0.081 LPROCD. \end{aligned} \quad (16)$$

Note that equation (16) is the predicted uninformed investors' withdrawal rate. Equation (14) instead is the predicted withdrawal rate for all the investors. Table 10 reports that uninformed investors earn no abnormal return even with the option to

**Table 10** The returns of underwriter and uninformed strategy when initial public offerings are more underpriced

This table measures when initial public offerings (IPOs) are underpriced. We hypothesize that IPOs are more underpriced by 1–5% to examine the return of the underwriter and uninformed strategy. *MAR* is the IPO initial return. *ALLOC* is the allocation rate. *PAY* is the payment rate, which equals 1 minus the withdrawal rate. *UWBUY* is the proportion of the underwriter's purchase on IPO shares to total number of IPO shares offered. Because Taiwan underwriters retain 15% of IPO shares and sell the remainder to the public, underwriter's purchase (*UWBUY*) equals  $0.15 + 0.85 \times \text{withdrawal rate}$  if IPOs are oversubscribed; otherwise, underwriter's purchase equals  $0.15 + 0.85 \times [(1 - \text{ALLOC}) \times \text{NONPAY}]$ .  $\text{PAY} \times \text{ALLOC} \times \text{MAR}$ .  $\text{UWMAR} = \text{UWBUY} \times \text{MAR}$ . When no more underpricing is added, the reported numbers are calculated from the actual data. When more underpricing is added, *UWBUY*, *UWMAR*, and *PAYALLOCMAR* are calculated using the predicted allocation rate and the predicted withdrawal rate. \*\*\* and \*\* represent the significance levels of 1% and 5%, respectively.

	<i>ALLOC</i> (%)	<i>NONPAY</i> (%)	<i>UWBUY</i> (%)	<i>UWMAR</i> (%)	<i>PAYALLOCMAR</i> (%)
<i>MAR</i> + 0% (t-value)	27.886	27.948	42.217	1.284 (1.503)	0.432 (1.605)
<i>MAR</i> + 1% (t-value)	25.956	19.986	32.567	2.234*** (3.220)	0.356 (1.418)
<i>MAR</i> + 2% (t-value)	20.509	12.545	25.561	3.041*** (5.478)	0.135 (0.427)
<i>MAR</i> + 3% (t-value)	15.461	10.460	23.846	3.417*** (6.554)	0.308 (1.149)
<i>MAR</i> + 4% (t-value)	12.624	9.499	23.039	3.705*** (7.320)	0.451** (1.975)
<i>MAR</i> + 5% (t-value)	10.779	8.853	22.493	3.963*** (7.994)	0.555*** (2.767)

withdraw from IPO allocations. However, the investors' option to withdraw helps uninformed investors escape from overpriced offerings, leading to firm-commitment underwriters' suffering losses. Table 10 indicates that underwriters earn 1.284% on underwriting IPOs in Taiwan. Underwriters must be compensated or they will withdraw from IPO underwriting markets; but what might happen if IPO issuers attempt to underprice more to help underwriters earn more? Table 10 reveals that IPOs have to be underpriced by approximately 4% more to make underwriters earn the return of the scenario where IPOs are fully subscribed and investors cannot withdraw. However, with 4% more initial returns, using the uninformed strategy can result in significantly positive returns. Hence, issuers should not underprice IPOs by 4% more only to allow underwriters to earn 2.421% more and to make the uninformed strategy profitable. Instead, issuers should compensate underwriters 2.421% directly by side payment. If issuers underprice IPOs by 5% more, underwriters can simply earn 2.679% more ( $3.963\% - 1.284\% = 2.679\%$ ). Consequently, if underwriters cannot be compensated by the issuers directly, IPOs will be even more underpriced, rather than less underpriced under investors' option to withdraw.

## 6. Conclusion

Initial public offerings are typically underpriced. Although the underpricing of IPOs is considered as the major cost for issuing firms to go public, issuers would

be better off with less IPO underpricing. However, Rock (1986) argues that IPOs should be underpriced to compensate the uninformed investors for the cost of adverse selection. With most fixed-price IPO markets, investors have to pay in advance to subscribe to IPO shares. By contrast, Taiwan IPO subscribers can withdraw from IPO allocations after learning the allocation information. The present paper investigates the effect of investors' option to withdraw from allocation using the data from Taiwan. We argue that under investors' option to withdraw, the winner's curse still holds and that uninformed investors require less underpricing to join IPO markets once underwriters can be compensated directly by the issuers.

In this paper, we find that under investors' option to withdraw, the *ALLOC* or the oversubscription rate is significantly dependent on the IPO initial return and the market return prior to the IPO filing date. The significant relation between the allocation and the IPO initial return implies that investors do not always subscribe to IPO shares, and that the *ALLOC* provides valuable information to the uninformed investors. With the option to withdraw, uninformed investors can learn from the *ALLOC* to either pay or withdraw because the withdrawal rate is significantly positively related to the *ALLOC*.

With the option to withdraw, uninformed investors tend to withdraw from those IPOs with a high *ALLOC*. We show that uninformed investors can improve their performance by withdrawing from IPOs of either high *ALLOC* or high withdrawal rate. Consequently, uninformed investors can escape from overpriced offerings by learning from the *ALLOC* and/or the withdrawal rate.

We also show that even though the IPO initial return is significantly positive, the allocation-weighted initial return is significantly negative. However, the negative allocation-weighted initial return does not mean uninformed investors will suffer losses because they own the option to withdraw from allocations. We show that the allocation-and-payment-weighted initial return is insignificant, implying that uninformed investors earn no abnormal returns and that the winner's curse holds in Taiwan, even under investors' option to withdraw. However, the negative allocation-weighted initial return along with the insignificant allocation-and-payment-weighted initial return implies that uninformed investors will require more underpricing to join the IPO market if they do not own the option to withdraw.

We demonstrate that with the option to withdraw from allocation uninformed investors can be better off because they can withdraw from overpriced offerings. When uninformed investors can withdraw from overpriced offerings, the firm-commitment underwriters will have to purchase overpriced shares. Consequently, underwriters tend to suffer losses under investors' option to withdraw. We also show that, to compensate underwriters for underwriting activities, it is not wise for the issuers to compensate underwriters indirectly through IPO underpricing. Instead, issuers should compensate underwriters directly, or IPOs will be even more underpriced.

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## Appendix

An Excerpt of Chinese Securities Association Regulations Governing Underwriting and Resale of Securities by Securities Firms



### Section Three: Allocation by Public Subscription

#### *Article 53*

For an offering by public subscription, the underwriter shall make a public announcement of an offering for 2 consecutive days before commencement of the offering. The underwriter shall, together with the broker, undertake the following matters within the following times regarding public subscription, lottery, and lottery winner withholdings:

1. Day One: Date of commencement of subscription and commencement of offering periods for underwriting;
2. Day Four: Date of closure of subscription. Deadline for payment of subscription fee (NT\$30 per subscription) to correspondent bank;
3. Day Five: Date of withholding of subscription fee. Correspondent bank of the broker undertakes matters regarding withholding of subscription fee;
4. Day Six: Date of settlement of subscription fee;
5. Day Seven: Date of public lottery drawing. TSEC undertakes drawing. Lead underwriter announces list of winners. TSEC shall produce and send report of winner information to each broker. TSEC shall compile and report the information to the lead underwriter for provision to subscribers for their review;
6. Day Eight: Underwriter shall issue, within 2 days by registered post, lottery winner notification slip, prospectus (or subscription form), or subscription waiver declaration to each lottery winner;
7. Day Fourteen: Deadline for reception from the lottery winner of the subscription waiver declaration. Deadline for payment by lottery winner to correspondent bank of the subscription payment, and costs of posting the lottery winner notification slip and related material;
8. Day Fifteen: Date of withholding of subscription payment and lottery winner notification fee (NT\$50 for each winner); and
9. Day Sixteen: Date of settlement of the subscription payment and lottery winner notification fee.