

Adverse Selection and Underpricing of Initial Public Offerings

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逆選擇과 最初公募株의 割引發行

이 기 환

국문요약

本稿는 기업공개시 발행되는 最初公募株 (initial public offerings)의 가격이 증권시장(유통시장)에서 형성되는 市場價格에 비해 낮게 결정되는 현상의 원인을 Rock (1986)의 逆選擇模型을 이용해 실증 분석하고 있다. 일반적으로 기업은 설립 후 일정 기간이 경과하게 되면 증시에서 주식을 일반투자자들에게 매각함으로써 기업을 공개하게 된다. 이 때 발행주식의 가격이 시장가격에 비해 낮게 책정되는 현상이 나타나 투자자들은 초과수익률을 달성할 수 있다. 그러나 투자자의 초과수익률은 공개기업의 입장에서 볼 때는 손실을 초래하는 것으로 볼 수 있다.

그런데 이처럼 기업공개시 발행되는 最初公募株가 시장가격에 비해 왜 낮게 발행되는지에 대한 설명은 信號假說, 第 3者 保證假說, 暗默的 保險假說 등에 의해 규명이 시도되고 있다. 本稿는 특히 투자자를 정보소유 투자자 (informed investor)와 정보비소유 투자자 (uninformed investor)로 나누어 발행시장에서의 逆選擇으로 인해 투자손실을 경험하게 될 확률이 높은 정보비소유 투자자를 시장에 계속 머물도록 하기 위해서는 적어도 무위험투자수익률을 제공하여 주어야 한다는 Rock(1986)의 모형을 실증적으로 검증하고 있다. 영국의 89개 기업의 最初公募株를 이용한 실증분석에서 공개기업의 최초공모주에 대한 수요가 높을수록 초과수익률이 높아 시장가격에 비해 낮게 발행되는 소위 우량공모주에 대해서는 정보소유투자자가 대량으로 청약하여 19.89배의 청약률을 시현하여 정보비 소유투자자를 우량공모주의 배정에서 배제할 가능성이 높은 것으로 조사되었다. 반면에 負의 수익률을 시현한 最初公募株에 대한 청약률은 상대적으로 낮아 (3.58배) 정보비소유 투자자는 비우량공모주에 대해서는 비교적 많은 배정을 받아 많은 투자 손실을 경험하게 될 수 있는 현상이 나타나 우리의 실증분석 결과는 Rock의 역선택 모형을 지지하고 있는 것으로 보인다. 최초공모주에 대한 수요 정도를 나타내는 청약배수와 최초수익률과의 관계를 보기 위해 회귀분석한 결과에서도 정의 관계가 나타나 영국의 최초공모주시장에서 역선택의 현상이 나타날 가능성이 있음을 보였다. 그

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러나 이러한 역선택에 직면하는 정보비소유 투자자들의 가중평균수익률이 負의 수익률을 시현하여, 발행시장을 활성화하기 위해서는 정보비소유 투자자들에게 적어도 무위험수익률에 해당하는 만큼의 수익률을 보장해 주어야 한다는 주장은 지지되지 않고 있다.

1. Introduction

Many financial economists put forward theories to explore the puzzle of underpricing of new issues and also analysed the phenomenon of underpricing employing theoretical models suggested. In this article, we will attempt to examine the reason of underpricing of initial public offerings (IPOs) in the spirit of Rock's model (1986) which is based on the asymmetric information and rationing of new shares between the informed and the uninformed investors. His model provides a theoretical model in which unseasoned new issues are underpriced. Rock's model implies that the firm going public should offer the new shares at a discount price in order to entice the uninformed investors to stay in the new issues market. In addition, Rock's model explains the underpricing phenomenon of initial public offerings in the market in which the supply of initial public offerings by the issuing firms is inelastic to the demand of investors. Therefore, Rock's model could also provide an explanation on heavy rationing of new shares in the IPOs market. Further this model can be applied to explanation of the relation between the subscription times for initial public offerings and the degree of underpricing of IPOs.

In particular, in the UK, the firms going public by an offer for sale usually publish the results of subscription and allocation in the newspapers, and this published allotment data enable to test Rock's model. Utilising these data, we will attempt to test directly Rock's adverse selection model.

The structure of this paper is as follows. Section 2 gives a review of implication of Rock's model for an empirical analysis in explanation of underpricing of initial public offerings and surveys the existing empirical studies on the adverse selection model. In section 3, we will describe the sample to be used and will discuss the methodology to be employed in our study. The empirical findings will be presented in section 4 and section 5 presents the conclusions.

2. Rock's Adverse Selection Model

This section will give a brief review of the implication of Rock's model for underpricing

of new issues and then will provide the results of empirical studies based on Rock's adverse selection model.

2.1 The Implication of Rock's Model

Rock's model is basically founded on the asymmetric information between the participants in the IPOs market. Theoretical models which are anchored on the informational asymmetry between the related parties in the valuation of new issues can be largely classified into two types¹⁾. The first one is Rock's model (1986) which is grounded on the information difference between the informed and the uninformed potential investors. More recently this model has attracted many authors and the results of many empirical studies²⁾ on the underpricing of new issues have been found to be consistent with the implications of this model. Secondly, Baron (1982) developed the model which focuses on the asymmetric information between the issuing firm and the underwriter. However the implication of this model is not supported by empirical studies (see Muscarella and Vetsuypens (1989) and Barry et al.(1990)).

Let us discuss the main implications of Rock's adverse selection model. In Rock's model, the issuer and the underwriter are assumed to be uncertain about the market price (v) of IPOs which will be established in the secondary market. Thus, they are regarded as the uninformed investors' group³⁾. This assumption is different from that of the signalling theory based on the assumption of the information asymmetry between the inside investor and the outside investor.

It is further posited that investors are also uncertain about the market price of new shares. However, the model assumes that some investors could become informed through investing their resources in collecting information. In Rock's model the investors are divided into two groups: the informed investors⁴⁾ who expend resources in collecting

1) See Smith (1986), p.21.

2) This model has been supported by the following studies: Ritter(1984), Beatty and Ritter (1986), Koh and Walter (1989), and Levis (1990).

3) This assumption is based on the following arguments. First, the issuing firm and underwriter give up their informational advantage by disclosing a variety of information about the issuing firm through prospectus. Second, their knowledge about the issuing firm and the market is less than that of all the individual participants in the market. Even though Rock's argument on this classification is convincing, there are still some doubts about the credibility of information disclosed by owners of firms and the accurate interpretation of revealed information by the outside investors.

4) It is assumed that the informed investors have perfect information about the market price (v) of initial public offerings, and that they cannot borrow securities or short-sell and further cannot sell their information. The demand of informed investors is no greater than the mean value of the new shares offered.

information and the uninformed investors who do not incur the information collecting cost and whose knowledge about the market value is therefore limited compared to the informed investors. Then the behaviour of these two investors in the new issues market could affect the subscription for new issues, the allotment of these and further the degree of underpricing. According to the spirit of Rock's model, a positive association between the subscription levels and the degree of underpricing would be predicted and an empirical test on this prediction could be made through investigating the relationship between ex post times of subscription and realised aftermarket performance.

In addition, Rock's model assumes that there are two types of IPOs: good issues and bad issues. The former can be defined as the initial public offerings whose market price (v) exceeds the offer price (p) and the latter is defined as the issues whose market price (v) is below the offer price (p). In particular, an offer price, p , will be set by the firm and underwriter in the process of firms going public and the purchase orders are sought from the investing public at this price. According to whether the level of an offering price is above or below the expected market price, the demand fluctuates and the issuing firm would face either excess demand or excess supply. The excess demand for good issues will result in oversubscription and heavy rationing and these new shares would show positive return in the aftermarket. However, the demand for bad issues would be smaller and might result in undersubscription.

Now let us look at the subscription for and the allotment of new shares in this model. It is assumed that an allotment is by lottery: the incoming orders are drawn at random and filled in their entirety until there are either no more orders (undersubscribed) or no more shares (oversubscribed). If the issue is oversubscribed, the new shares are rationed in proportion to the excess demand. However, in the allocation of initial public offerings of the UK privatisations, small investors are favourably treated. Their probability of receiving an allocation is higher than that of large investors. In fact, small investors in the actual allocation of new issues of private firms going public would tend to receive more shares than large investors.

In subscription of new shares, the informed investors who have superior information will apply only for good issues. This selective application of informed investors would create an adverse selection problem to the uninformed investors and the demand for these good issues would be greater because of active participation of both the informed and uninformed investors. This implication could be tested empirically through investigating the relationship between the underpricing of IPOs and the subscription times for IPOs. Utilising subscription levels, we could calculate the weighted return by the probability of obtaining an allocation of new shares in order to explore whether the weighted return covers the risk-free rate of return.

In particular, under the assumption of this model that there is no preference in the allotment process of new issues, the uninformed investors would face a bias in the probability of obtaining an allocation for good (underpriced) and bad (overpriced) issues. That is, for the uninformed investors who apply randomly for any issues without accurate information about the market price, v , the probability of receiving bad issues ($v < p$) is higher than the probability of obtaining good IPOs ($v > p$). Further, the disproportionate allotment of overpriced new issues causes the uninformed investors to face a winner's curse due to the adverse selection in the IPOs market. If they continue to experience this adverse selection in purchasing new issues, they would withdraw from the IPOs market. If in the IPOs market there are only informed investors who subscribe only for good issues, the issuing firms or underwriter would end up holding the shares if new shares are overpriced. They could not sell successfully new shares in the new issues market due to the lack of demand and they could face the damage of their reputation in the stock market. It is therefore important to keep uninformed investors in the new issue market in order to sell new shares. So underpricing is used to compensate the uninformed investors for their adverse selection. For the informed investor, this underpricing is also the compensation for the cost of information collection. Thus, Rock's model implies that the average return realised in IPOs investment will depend not only on the market price in the aftermarket but also upon the probability of receiving an allocation of good issues ($v > p$).

This implication could be related to Rock's argument that "the crucial empirical test of the model involves observing the degree to which new shares are rationed on the offer date. If the model is correct, weighting the returns by the probability of receiving an allocation should leave the uninformed investors earning the riskless rate."⁵ This empirical implication could be tested through examining the relationship between the degree of subscription and the extent of underpricing of each issue. More direct tests could be carried out by exploring whether the weighted average excess return, which is the return weighted by the probability of obtaining an allocation, could cover the riskless rate of return to compensate for winner's curse⁶.

2.2 Previous Studies on Rock's Model

5) See Rock (1986), p.205.

6) On the other hand, in Rock's model, the sources of the adverse selection problem are assumed to be uncertainty and asymmetric information. Therefore, the model predicts that the higher risk offerings would show greater underpricing; and further the underpricing of the IPOs in less efficient market, where informational asymmetry among the investors is greater, would be greater.

Table 1 gives a summary of the existing empirical results on Rock's adverse selection model. As presented in Table 1, Rock's model has recently been treated as one of the most influential theories explaining the underpricing of new issues and many empirical studies on pricing of IPOs are also carried out in terms of Rock's adverse selection model.

The first application of Rock's model to the explanation of underpricing of initial public offerings was carried out by Ritter's (1984) study on the hot issue market. He attempts to explain the hot issue market as equilibrium phenomena caused by the relationship between uncertainty and underpricing. And for his empirical investigation, as surrogates for the risk of firm⁷⁾ he used firm's annual sales in the most recent year prior to going public and the daily standard deviation of returns during the first 20 days of trading. Raw returns unadjusted for the market movement are used as a measure of underpricing of new issues. The average initial returns for hot issue and cold markets was 48.4% and 16.3%, respectively.

Table 1. Existing Studies on Rock's Adverse Selection Mode

Study	Sample			Methodology	Results
	Country	Period	Size		
Ritter (1984)	US	1977-82	1,028	.comparison of underpricing difference of IPO .regression analysis	positive relation between underpricing and uncertainty
Beatty and Ritter (1986)	US	1977-82	1,028	regression analysis (WLS)	positive association between the expected underpricing and uncertainty.
Koh and Walter (1989)	Singapore	1973-87	66	.examining the extent of underpricing by application .regression analysis	The extent of underpricing covers the riskless rate.
Levis (1990)	UK	1985-90	123	.examining the size of underpricing by investor group .regression analysis	The degree of underpricing covers risk-free. positive relation between underpricing size and subscription times
Kang (1991)	Korea	1989-90	78	examining the underpricing extent by subscription amount	the negative relationship between the degree of underpricing and the probability of obtaining new issues
Lee (1994)	UK	1985-90	41	examining underpricing of IPOs of privatised UK companies by subscription amount	the positive relationship between underpricing extent and subscription times

7) In addition, Ritter suggests the book value of equity and the age of firm as the risk proxy.

Ritter (1984) found that the extent of underpricing is positively related to proxies of uncertainty about the expected value of firm. That is, the lower sales (higher-risk) firms not only show greater initial returns but also greater variation in their initial returns. And the result using the return variance proxy is similar to the case employing the sales size. In Ritter's study, the hot issues markets showing higher excess initial returns are observed when the offerings of high-risk firms are an unusually great fraction of IPOs in some periods. The greater underpricing for this hot issues market is attributed to natural resources-related issues. In particular, this contention is based on the finding that the natural resource issues show greater underpricing and further there is a large difference of average initial returns between hot and cold issue markets.

Following Ritter's (1984) study, Beatty and Ritter (1986) attempt to test the hypothesis empirically on the positive association between the ex ante uncertainty about the value of new issues and the expected underpricing, which is predicted in Rock's model. Using two proxies for ex ante uncertainty such as the number of uses of proceeds listed in the prospectus⁸⁾ and the gross proceeds, Beatty and Ritter (1986) report a positive association between the risk of IPOs and underpricing. Specifically, their empirical analysis shows that underpricing of IPOs is positively associated with the number of uses for proceeds and is negatively related to the size of gross proceeds. And this underpricing equilibrium is enforced by the investment bankers who have reputation capital in the new issues market. They argue that the investment banker who departs from the underpricing equilibrium will lose their potential customers.

As reviewed above, these two empirical studies did not attempt the direct test of Rock's model because of unavailability of data. Recently Koh and Walter (1989), Levis (1990), Kang (1991) and Lee (1994), however, tested directly the implication of Rock's model using Singapore IPOs, the UK new issues, Korean IPOs and the IPOs of the privatised British companies. In particular, the availability of the data on the allocation results of IPOs and institutional arrangements for new issues in Singapore allow a direct test of the major empirical implication of Rock's (1986) model, where the returns weighted by the probability of receiving an allocation should leave uninformed investors earning the risk-free rate of return. This is empirically confirmed by the finding that uninformed investors' initial excess returns are not statistically different from the risk-free rate of return. Specifically, it is found that the unseasoned issues' anomaly disappears when the rationing associated with new issues is incorporated into the analysis. And the winner's curse is strongly evident in allocation patterns utilized in Singapore. Finally, it is shown that rationing is applied more stringently in underpriced than in overpriced issues. This is

8) This is derived from a result of Securities and Exchange Commission (SEC) regulation. The SEC regulation requires more speculative new issues to provide relatively detailed specifications of the uses of proceeds raised (Beatty and Ritter, 1986, p.218).

confirmed by a strong positive correlation between oversubscription levels and initial returns. These results are consistent with Rock's argument that this bias produces an equilibrium offer price with a finite discount sufficient to attract uninformed investors to the issues.

In the study of pricing of IPOs sold on the London stock market, Levis (1990) found that the underpricing phenomenon can be partially explained in terms of Rock's model. As with previous empirical evidence, positive initial returns for initial public offerings are documented. He argues that such returns can be explained by the combined effect of the winner's curse problem and the institutional feature of the settlement mechanism in the UK IPOs market. His main proposition could be supported by the evidence that the average market-adjusted returns realised on the first day of the aftermarket on oversubscribed issues would be just enough to cover the losses incurred in undersubscribed offerings and the interest rate costs involved when applying for new issues. Attempts to circumvent the winner's curse problem and interest rate costs by careful selection of offerings to apply for are unlikely to succeed if one relies entirely on publicly available information.

In recent years, Kang (1991) tested Rock's model using Korean IPOs data. He found that the degree of underpricing of new issues is negatively related to the probability of obtaining IPOs. In the investigation of pricing of new issues of privatised UK companies between 1979 and 1990, Lee (1994) observed that the adverse selection appears in the process of rationing of new shares and there is the positive association between the extent of underpricing and subscription times.

3. Data and Methodology

This section gives a description of the sample and a discussion of methodology for an empirical analysis.

3.1 Data

Our empirical test of Rock's (1986) model was conducted using 89 IPOs extracted from a total sample firms of 512 that were listed on the Official List (main market) and the unlisted securities market (USM) between 1985 and 1990. These 89 firms were newly admitted to the British stock market through an offer for sale. We identified our sample data through examining 'Companies Newly Admitted to Listing' in the Quality of Markets

Quarterly or the Stock Exchange Quarterly of London Stock Exchange and column of 'New Issues' in the Investors Chronicle. And the basic data such as issuing price, method of offering, offering date were also collected from the above two sources.

Then through the investigation of newspapers we collected the data on subscription levels and allocation results that are critical information in our study conducting an empirical test of Rock's model. In the UK new issue market, the allocation details are available only for IPOs employing 'offer for sale' method. The subscription levels which would be the most important data in our empirical test were collected mainly from the Financial Times, with some provided by merchant banks involved in flotation. Oversubscription multiples for each issues indicates the degree of demand for new issues and a barometer on whether the unseasoned new issues are either good or bad. Furthermore the investors will be immediately informed of their probability of receiving an allotment for their application through the published subscription results.

The share price data of initial public offerings of the sample firms were collected from DATASTREAM which is on-line share price database. FTA All-Share Index data for adjusting market movement were also collected from DATASTREAM.

3.2 Methodology

In the direct test of Rock's model, the most difficult issues is how to classify the investors into the informed and uninformed investors and furthermore how to estimate the rate of return compensating for the losses caused by the adverse selection of the uninformed investor. In fact, in US, it is impossible to test Rock's model directly because the investment banks would avoid publishing the allocation details of new issues. On the other hand, the availability of allocation results in the UK and Singapore enabled Levis (1990) and Koh and Walter (1989) to carry out direct tests of Rock's model in each market.

Looking at their empirical methods, both studies have classified the investors into the uninformed and informed investors according to the size of application for IPOs. In this way, Levis (1990) divides the subscribers into 13 groups according to the size of the application, and Koh and Walter (1989) divide the application strategies ranging from 1 to 100 lots, which one lot is 1,000 shares. Further both Levis (1990) and Koh and Walter (1989) estimate the abnormal returns weighting the probability of obtaining an allocation by the size of application for new issues. Interest and other costs related to the application size are reflected on the computation of abnormal return. In reality, although the classifications of Koh and Walter (1989) and Levis (1990) are convincing, the application basis and the method of allocation are very different across the IPOs. Instead,

in our study, the classification of investors is made on the basis of the extent of initial returns realised in the aftermarket. That is, the investors who applied for the IPOs that showed positive market adjusted returns are regarded as the informed investors. This classification could reflect Rock's argument that the informed investors only submit their purchase orders for the underpriced IPOs and the uninformed investors subscribe randomly for any issues. Based on this classification we attempt to test Rock's adverse selection model.

The market-adjusted return⁹⁾ is used as a measure of performance of IPOs. In addition, the market-adjusted returns weighted by the probabilities of receiving an allocation have been computed in order to confirm the adverse selection or the winner's curse which the uninformed investors would often face. In the first place, considering the mechanism of IPOs allocation in the UK new issues market, in which rationing of IPOs is in proportion to the excess demand, the probability of receiving an allocation of new issues, b , could be obtained from the observation of the times subscribed for each IPO and it can be expressed as follows.

$$b_i = \min\left(\frac{1}{SUBT_i}, 1\right) \quad (1)$$

where, $SUBT_i$ = times subscribed for each IPO

Further, WAR_i , the initial excess returns weighting the probabilities of obtaining an allotment of new issues can be estimated in the following way.¹⁰⁾

$$WAR_i = [((b_i)P_{it} + (1 - b_i)OP_i) / OP_i - 1] \quad (2)$$

where, P_{it} = share price at time, t (that is, first trading day)

OP_i = offer price of each issue.

4. Empirical Findings

Now we will present our empirical results and discuss the meanings of empirical

9) In particular, Levis (1990) also estimates the abnormal return for each IPO employing the market-adjusted return approach.

10) We actually computed WAR as following: $WAR_i = b_i * AR_i$ Where AR_i is market-adjusted abnormal return of each issue.

analysis in terms of Rock's adverse selection model. As shown in Table 2, 89 IPOs by offer for sales show, on average, positive market-adjusted returns of 7.8% and of 89 IPOs, 60 issues exhibit positive initial excess returns and their average market-adjusted return is around 14.6 per cent. IPOs of 29 companies were overpriced and they show average market-adjusted return of -6.1%.

Seeing the demand by type of IPOs for good (underpriced) issues, the average subscription level is 19.84 times the number of shares available while for bad (overpriced) issues the demand is 3.58 times the number of shares offered, showing a 5.5 times greater demand for underpriced stock. This evidence might be in line with Rock's argument that the good issues ($v > p$) would attract both informed and uninformed investors and therefore the demand for those good new issues will greatly exceed the supply. Even though the average subscription levels for both issues are oversubscribed (14.54 times), the degree of oversubscription for good issues is greater than that of bad issues. Therefore the probability of obtaining good new issues in the IPOs market is much less than the probability of receiving bad issues. In the process of offerings and allocation of new shares, the adverse selection problem would appear. Table 2 implies that the degree of underpricing estimated by the market-adjusted return is positively related with the times subscribed.

Table 2. Demand and Excess Returns by Type of IPOs

	Underpriced IPOs	Overpriced IPOs	All IPOs
Number of Observations	60	29	89
Demand(Times Subscribed)	19.84 (23.36)	3.58 (5.70)	14.54 (20.86)
Probability of Receiving an Allocation	.24 (.28)	.67 (.38)	.38 (.37)
AAR1	.146 (.112)	-.061 (.087)	.078 (.143)
WAR1	.019 (.025)	-.056 (.090)	-.005 (.066)
STD	.04 (.02)	.02 (.02)	.03 (.02)
Proceeds (mil. £)	44.46 (136.19)	18.75 (33.05)	36.08 (113.71)

Notes: . Standard deviation in parenthesis

. AAR1 : Average market-adjusted abnormal return on the first trading day.

. WAR1 : Weighted average market-adjusted return on the first trading day.

. STD : Daily standard deviation of market adjusted returns in the first 25 days of trading

In addition, Figure 1 shows the relationship between aftermarket performance estimated by the market-adjusted return (AR_1)¹¹⁾ and the demand of new issues (subscription levels). This scatter diagram shows that the variation of the subscription levels is large across the sample IPOs and this is confirmed by large standard deviation of 20.86 against mean level of 14.54 times for 89 issues (see Table 2). In this figure, the demand curve for IPOs slopes upward because the higher the initial return of new issues, the more investors would apply for those issues. That is, the scatter diagram implies that the initial return of new issues is an increasing function of the demand for new issues.

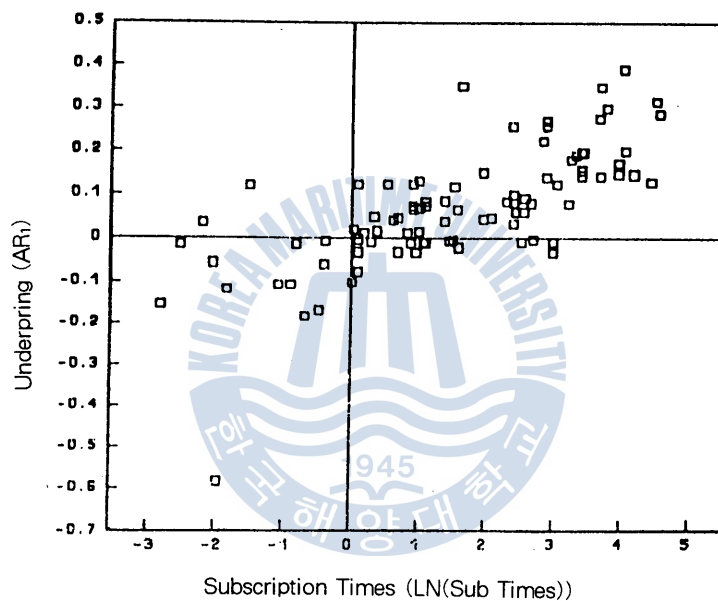


Figure 1. The Relationship between Market Adjusted Returns and Subscription Levels

As presented in Table 3, the regression results also confirm the strong positive relationship between the degree of underpricing and the level of subscription. In both the log-linear regression and linear models, the estimated coefficients for the subscription level are statistically significant. In particular, in the log-linear model, around 50% of the variability of the initial excess returns is explained by the variable of the degree of subscription.

11) AR_1 is the market-adjusted abnormal return of each issue on the first trading day.

Table 3. Regression of Abnormal Return on Subscription Level

$$MODEL1: LN(1 + AR1) = b_0 + b_1(LNSUBT_i) + \varepsilon_i$$

Variables in the Equation					
Variable	b	SE b	Beta	T	Sig T
LNSUBT	.054612	.005868	.706337	9.307	.0000
(Constant)	-.016414	.013691		-1.199	.2338

Adjusted R Square: .49315

F = 86.62214; Singif F = .0000

$$MODEL2: AR1 = b_0 + b_1SUBT_i + \varepsilon_i$$

Variables in the Equation					
Variable	b	SE b	Beta	T	Sig T
SUBT	.004254	5.81355e-04	.617215	7.317	.0000
(Constant)	.016616	.014726		1.128	.2623

Adjusted R Square: .37384

F = 53.53904; Singif F = .0000

As examined above, our findings are consistent with Rock's adverse selection model: it is thought that both the informed and the uninformed investors would submit their purchase orders for good (underpriced) issues and this behaviour of both investors results in higher demand (measured by subscription levels). On the other hand, for bad (overpriced) issues, it is assumed that only uninformed investors would subscribe for them and therefore the supply of new shares will exceed the demand, undersubscribed. The higher demand for underpriced issues and lower demand for overpriced issues could confirm the existence of the winner's curse problem or adverse selection problem because the chance that the uninformed investors receive bad (overpriced) issues is higher than the probability of obtaining an allocation in good (underpriced) issues. Our finding, thus, confirms Rock's argument that the uninformed investors could face winner's curse or adverse selection in the investment of new shares in the IPOs market. Further, the

probability that those bad IPOs will be rationed to the uninformed investors is higher and this would often cause the uninformed investors to experience losses in investing in new issues and this too will result in winner's curse. Therefore, IPOs should be issued at a discount relative to the market price in order to entice and keep the uninformed investors staying in the IPOs market.

In addition, the adverse selection or winner's curse problem is confirmed by Table 4 that classifies IPOs according to whether the issues was oversubscribed or undersubscribed. It is notable that 22.7% (17 firms) of 75 oversubscribed issues that attracted a large number of investors presents a negative market adjusted return of 2.3%, despite their high mean subscription level reaching nearly 6 times. Their average return of -2.3%, however, is relatively larger than -11.4% of the undersubscribed issues. Also most of the undersubscribed issues display negative returns except 2 IPOs which started to trade above the offer price.

Table 4. Subscription Levels and Market Adjusted Returns

A. Number of IPOs by the Extent of Market Adjusted Returns on the First Trading Day			
Subscription	AR1		Total
	Negative	Positive	
Undersubscription	12	2	14
Oversubscription	17	58	75
Total	29	60	89
B. Mean Subscription Times by Negative/Positive AR1			
Undersubscription	.35	.17	.33
Oversubscription	5.86	20.52	17.20
Total	3.58	19.84	14.54
C. Mean Market Adjust Returns on First Day by Under/Over-Subscription			
Undersubscription	-.114	.081	-.09
Oversubscription	-0.23	.148	.109
Total	-.061	.146	.078

Note: AR1 = market-adjusted abnormal return on the first trading day.

Finally, we will explore whether the uninformed investors could earn returns from the investment of IPOs covering the riskless rate of return. As presented in Table 2, the average market adjusted returns without weighting the probability of receiving an allocation exhibits around 8.0% across all IPOs issued by an offer for sale. However, the probability of receiving an allocation for 89 sample IPOs is 0.38. The probabilities of obtaining an allocation of overpriced issues and underpriced issues are 0.67 and 0.24, respectively.

As can be seen in Table 2, the extent of the market-adjusted returns weighted by the probability of obtaining an allocation (WAR1) is greatly reducing compared with unweighed

returns (AAR1). In particular, the weighted average returns for all sample IPOs show -0.5% and this implies that the uninformed investors would experience losses with buying new issues. This does not support Rock's argument that weighting the returns by the probability of receiving an allocation should leave uninformed investors earning the risk free rate of return. On the other hand, the informed could earn a positive return from their IPO investment because the weighted return for underpriced issues shows positive return of 2.0%.

5. Conclusions

In this paper, we explored the explanation of underpricing of initial public offerings from the viewpoint of adverse selection model of Rock (1986) in which the uninformed investors would usually face bias in allocation of new issues. Using IPOs data of 89 UK firms going public by an offer for sale, we investigated the implication of Rock's adverse selection model which new issues are underpriced in order to entice the uninformed investors to the IPOs market. We found that initial excess return is positively related to the degree of subscription to new issues. That is, the subscription times for undersubscribed IPOs is 19.84 times and this is 5.5 times higher than the subscription level of 3.58 times for overpriced IPOs. This evidence confirms the presence of winner's curse which the uninformed investors would face in the investment of new shares in the IPOs market.

In addition, we confirmed the adverse selection problem in the IPOs market through examining whether the new issues were oversubscribed (the excess demand) or undersubscribed (oversupply) and analysing the excess return according to the degree of demand for new issues. The oversubscribed IPOs show average abnormal return of 10.9% and they might be heavily rationed. But the undersubscribed new issues exhibit negative mean return of 0.9% and they might be allocated fully to the uninformed investors. This makes the uninformed investors face winner's curse.

On the other hand, the weighted return of uninformed investors, who would apply randomly for any issues without accurate information, shows negative returns. And furthermore, this is not consistent with Rock's major empirical implication, in which the uninformed investors's returns should cover the risk-free rate of return. In the UK IPOs market, uninformed investors experience losses.

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