ALLOCATIONS, ADVERSE SELECTION AND CASCADES IN IPOs: EVIDENCE FROM THE TEL AVIV STOCK EXCHANGE

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Evidence from the Tel Aviv Stock Exchange

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Abstract

We examine theories of IPO underpricing using unique data from Israel where the allocation to subscribers is by equal proration. This enables us to simulate the return earned by uninformed investors. Consistent with Rock’s (1986) theory of adverse selection, allocations were negatively related to underpricing. But uninformed investors earned a negative allocation-weighted initial return, although the average initial return was 12%. They could break even, however, by using publicly available information. The data also supports Welch’s (1992) theory of information cascades: demand is either extremely high or there is undersubscription, with very few cases in between.
1. **Introduction**

Stocks issued in IPOs appear to be underpriced: they earn an average positive return immediately following the IPO. This phenomenon has been documented in many countries.\(^1\) This paper presents tests of some theories of underpricing in IPOs using data from the Tel Aviv Stock Exchange (TASE), which make these tests feasible. These data also enable us to study the excess demand for new issues, its determinants and its relationship to underpricing.

Rock (1986) proposed that the high positive returns that are observed in IPOs cannot be earned in practice because of adverse selection. Uninformed investors are allocated greater quantities in overpriced IPOs and smaller quantities in underpriced IPOs. This is because investors who are informed about the issuing company’s value select to invest in underpriced IPOs. Underpricing is then needed to attract uninformed investors. In equilibrium, "weighting the returns by the probabilities of obtaining an allocation should leave the uninformed investor earning the riskless rate" (Rock (1986), p. 205). Indeed, uninformed strategy should yield zero profit in a frictionless market with rational investors.

We test the hypothesis that uninformed IPO investors earn zero profit using data from the TASE that enable to calculate the return to these investors. The data are the allocation to investors relative to their subscriptions, which is used to calculate the allocation-weighted returns. In the TASE, in case of oversubscribed IPOs, securities were allocated mechanically by equal proration to all subscribers, each receiving an equal fraction of his or her subscription. The allocation rate was publicly announced at the end of the IPO day. This enables us to simulate the initial return that would be earned
by uninformed investors and to examine whether allocations are related to underpricing.

In contrast, in the U.S., the allocation rate to subscribers in IPOs is at the discretion of underwriters and brokers and varies across subscribers. Therefore, these tests cannot be done in the U.S.

Using the data on the rate of allocation to subscribers, we test Rock’s (1986) theory in two ways:

(i) We test for adverse selection by examining whether the allocation rate to subscribers was greater in overpriced IPOs.

(ii) We simulate the initial return that would be earned by uninformed investors by calculating the allocation-weighted initial return that would be earned by an investor who participated equally in all IPOs (or randomly in some IPOs).

Consistent with Rock (1986), we find evidence of adverse selection in IPOs. However, uninformed investors earned a small negative excess initial return, even though the average IPO excess initial return was 12%. This means that IPOs were slightly overpriced for uninformed investors, or that the demand of these investors for IPOs was on average too high. Still, “minimal information conditioning” investors could do better and earn zero initial return. These investors, while being uninformed about the issuing firm, could condition their participation in IPOs on publicly available information about the recent market performance or other investors’ participation.

The second theory that we examine is that of information cascades or herding in IPOs, due to Welch (1992). If investors learn about the value of the issued company by observing the behavior of other investors, issuers will underprice their stock to create a cascade or herding of buyers. We find that investors either subscribed overwhelmingly to

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new issues, which resulted in very small allocations, or largely abstained so that the issue was undersubscribed and subscribers received full allocation, with very few cases in between. This is consistent with herding.

The rules of the TASE exclude two explanations of underpricing that have been proposed in the U.S. One explanation of underpricing is that price stabilization or price support by underwriters after the IPO curtails the negative returns (Hanley et al. (1993), Ruud (1993), Schultz and Zaman (1994)). This explanation does not apply in our case since price support by underwriters is not allowed on the TASE. Loughran and Ritter (2001) proposed an agency explanation. Since underwriters have complete discretion to allocate shares, they have an incentive to lower the offering price to provide gains to preferred buy-side clients and then benefit from the quid pro quos received from them. However, in the TASE underwriters had no discretion to allocate shares since it was done pro-rata.

In the U.S., Rock’s (1986) winner’s curse theory was tested indirectly under the assumption that institutional investors are better informed. Michaely and Shaw (1994) showed that in IPOs with small participation of institutional investors, underpricing is smaller since then investors know that they do not have to compete with informed investors. Aggrawal, Prabhala and Puri (2001) used data on the proportion of the issue that is allocated to institutional investors and retail investors. They found that institutional investors received larger proportion of new issues in IPOs that were more underpriced, and that they earned more than retail investors, avoiding “lemons” in the IPO market. However, in the U.S. there are no data on the allocation rate to subscribers relative to
their subscriptions.\(^2\) Therefore, it is impossible to test Rock’s (1986) proposition that although IPOs are underpriced, uninformed investors earn zero initial return.

Rock’s (1986) theory was examined in countries where there were data on allocation to subscribers (Koh and Walter (1989), Levis (1990), Keloharju (1993)),\(^3\) but the results are not conclusive. The results were inconsistent among these studies: in two studies the initial return was decreasing in order size (in one, the relationship was non-monotonic), while in one study return was increasing in size. In addition, there were some problems with the allocation procedure in IPOs in these countries that were absent in Israel.

Koh and Walter (1989) studied 66 IPOs in Singapore during 1973-1987. There, allocation to subscribers was done by “combinations of full allocation, pro-rata allocation and balloting” (p. 268) with the selection of an allocation basis done by the issuer after the IPO. The probability of allocation was a non-monotonic decreasing function of the order size. They found that the IPO return, adjusted for allocation, was positive but insignificantly different from zero. It was higher for small orders and lower for larger ones, with the return-order size relationship being non-monotonic, having a saw-teeth pattern that reflected the allocation method. Levis (1990) analyzed 123 IPOs during 1985-1989 in the UK, where issuers had discretion as to the method of allocation as a function of the order size, involving ballot or rationing or both. Rationing “may involve any form or pattern that suits the particular circumstances” (p. 78). Then, “the probability

\(^2\) Our allocation data are different from those in Aggrawal et al (2001). Our allocation is the proportion of each subscriber’s order that is filled in the IPO. Their allocation is the proportion of each issue that is allocated to a type of investor (institutional or retail). The same data were also used by Ljungqvist and Wilhelm (2001) who found, using 3SLS estimation, that underpricing is negatively related to the allocation to institutional investors, since by their model there is substitution between the amount that these investors receive and the extent of underpricing on this amount.

\(^3\) See a survey in Ljungqvist and Wilhelm (2001) on allocation methods around the world.
that an investor obtains a specified number of shares, ... is proportional but not always linear to the size of the application” (p. 78). The average return, adjusted for allocation, was positive and statistically significant. The return was increasing in the order size and then decreasing for larger orders, being insignificant for the largest orders above 2 million pounds. (This was calculated using estimates on the probability of obtaining certain number of shares at a specific level of application.) Keloharju (1993) studied 80 cases of IPOs in Finland during 1984-1989, where the allocation was a function of the order size with the formula of allocation being set ex post. He found that the allocation-weighted initial return was a declining function of the order size, being positive for small orders and negative for large orders.

In these studies, the uninformed investors’ returns were affected by their order placement strategy since the allocation was a function of the order size and its method (balloting or rationing or a combination of both) was sometimes determined ex post. This makes it difficult to simulate the strategy for uninformed investors. In addition, in Finland, investors could be effectively excluded from participating in IPOs that garnered high demand: the acceptance of new orders could be stopped at any time before the IPO day by the management of the issue, after learning that the issue has been fully subscribed. (Indeed, subscriptions to IPOs were often discontinued before the closing day of the offering.) And, payment was done one or two months after the first day of issue, which raised the effective return due to the time value of money. Finally, the reliability of rationing data in Finland was varying.
In contrast, in the TASE the rate of allocation to subscribers was quite mechanistic -- simply proportional to their order size\(^4\) -- and every investor who wished to participate at the IPO could subscribe at any time during the IPO day. This enables us to simulate the returns earned by uninformed investors and test Rock's (1986) propositions on the return-allocation relationship.

In what follows, section 2 describes the data and the main variables -- initial return and allocation -- and their determinants. Section 3 presents two tests of Rock's (1986) theory: section 3.1 provides a test of the existence of adverse selection in IPOs, and section 3.2 provides evidence on the initial return earned by uninformed investors. Section 4 analyzes the performance of uninformed investors who can condition their participation on publicly-available information. The theory that relates underpricing to ownership dispersion is tested in Section 5. Section 6 presents the conclusions.

2. Data, underpricing and allocation

The study includes 284 IPOs in the Tel Aviv Stock Exchange between 11/1989 and 11/1993, after which time the IPO method has changed.\(^5\) Table 1 includes information about our sample. Most IPOs -- 84.6% -- were of units, a bundle of stocks and warrants or bonds (mostly convertible) or both, which were sold together but were separable right after the IPO.

\(^4\) Except in four cases during the period 11/1989-11/1993, 1.4% of the sample, in which allocations was a decreasing function of the quantity ordered by investors.

\(^5\) In 12/1993, it was mandated that all IPOs be auctioned with no maximum prices; see Kandel, Sarig and Wohl (1999).
INSERT TABLE 1

Issues were sold either at a fixed predetermined price or at a price that was
determined in a sealed-bid, uniform-price auction with specified minimum and maximum
prices. Auction was by far the preferred method: it was used in 86% of the IPOs. In
auctions, investors submitted sealed bids specifying a quantity and a price within the
given range (including the upper and lower bounds). Most auctioned IPOs were
effectively fixed-price IPOs: 77% of auctioned IPOs closed at the maximum price, which
ended up being the issue price, and the allocation among subscribers was done by equal
proration to all. When the equilibrium price was below the maximum, subscribers at the
maximum price received the full quantity they had ordered and paid the equilibrium
auction price.

The unit price or the auction minimum and maximum prices were stated in the
prospectus, which was published one week (five business days) before the IPO day. The
offer price could not be revised between then and the IPO day. There were neither road
shows nor a bookbuilding process. On the IPO day, subscriptions were received by
brokers from morning till noon and passed on to the underwriter. The results were
announced immediately thereafter. To guarantee the integrity of the orders, a subscriber
had to deposit with her broker the full amount of her subscription on the day of the IPO.

The scenario seems to bear close resemblance to that assumed in Rock’s (1986)
model. Our simulation of an uninformed investor assumes subscribing for a fixed
amount in each and every IPO. The subscription price was either the fixed issue price or,
in case of an auction, the auction’s maximum price. This would guarantee the investor to
be apportioned some units in all IPOs. Bidding below the maximum price would have
excluded the investor from about three quarters of auctioned IPOs that closed at the maximum price.

2.1 Underpricing

Trading in the stock commenced on the day after the IPO day, and trading in the other securities that were included in the unit usually commenced three days after the IPO. Securities issued in IPOs traded by a once-a-day auction, called Karam, that was used for small-cap securities. Under this trading method, securities prices were more noisy and adjusted more slowly to information than in a continuous trading market (see Amihud, Mendelson and Lauterbach (1997)). We therefore measure the initial IPO return six days after the issue day, which are two or three days after the warrants and bonds in the unit started trading. The six-day initial return on the IPO unit of securities of firm j, in excess of the market return, is

\[ IR_j = \frac{P_{j,6}}{P_0} - \frac{M_{j,6}}{M_{j,0}}. \]

\( P_{j,t} \) is the market price of unit j on day \( t \), day 0 being the IPO day, and \( P_0 \) is the unit’s offer price. The post-IPO unit price is the sum of the market prices of its components (of the securities that make up the unit).\(^6\) \( M_{j,t} \) is the closing price of the TASE Karam market index on day \( t \) relative to the IPO day of firm j. This index is the proper benchmark for IPO securities since it included securities with relatively small float, similar to the newly issued securities. Longer-term initial returns are calculated over 15 and 150 days\(^7\) after the IPO:

\(^6\) For example, if the unit of firm j included one share of stock and two warrants, \( P_{j,6} \) would be the share price plus twice the warrant price.

\(^7\) The time period after the IPO is limited to 150 days because later there were expirations of warrants and convertible bonds, which were included in most of the IPOs.
(2.1) \[ IR_{15j} = \frac{P_{j,15}}{P0_j} - \frac{M_{j,15}}{M_{j,0}}. \]

and

(2.2) \[ IR_{150j} = \frac{P_{j,150}}{P0_j} - \frac{M_{j,150}}{M_{j,0}}. \]

**INSERT TABLE 2**

**INSERT FIGURE 1**

Statistics on initial excess returns in IPOs, \( IR_j \), are presented in Table 2 and their distribution is depicted in Figure 1. The average \( IR_j \) is positive and significant: the mean is 11.99% with \( t = 7.20 \). Two third of the initial returns (66.6%) are positive; this proportion is significantly different from a chance result of 50% (\( t = 5.58 \)). The average 15-day and 150-day initial returns, \( IR_{15j} \) and \( IR_{150j} \), are slightly higher, 13.14% (\( t = 6.77 \)) and 15.00% (\( t = 4.16 \)), respectively. Notably, the mean initial return from day +6 to day +150 is not significantly different from zero (mean = 2.95%, \( t = 1.10 \)), which implies that there is no momentum effect in pricing. Nor does the initial return \( IR_j \) show evidence of overshooting that is subsequently reversed: the correlation between \( IR_j \) and the subsequent initial return over days +6 to +150 is very small, \(-0.028\), insignificantly different from zero. This evidence shows that the market priced the issued units efficiently immediately after the IPO, and that the initial return was not a result of fad or overreaction.

2.2. Allocation

Testing Rock’s (1986) theory requires data on “the probabilities of obtaining an allocation” (p. 205) in IPOs. These data, which are unavailable in the U.S., are available in Israel. There, the allocation was an equal proportion to all subscribers and it was
publicly announced at the end of the IPO day. The allocation rate to subscribers was quite mechanistic, simply the ratio of the number of units issued to the number of units subscribed by investors, so that each subscriber received the same proportion of his or her order. The allocation rate was naturally not greater than 1.0 when the issue was undersubscribed, in which case the underwriter absorbed the unsold quantity.\(^8\) \(ALLOC_j\) denotes the allocation rate in IPO \(j\), \(0 < ALLOC_j \leq 1\).

\textbf{INSERT TABLE 3}

\textbf{INSERT FIGURE 2}

Statistics for \(ALLOC_j\) are presented in Table 3, and the pattern of its distribution is shown in Figure 2. The distribution of \(ALLOC_j\) is an extreme U-shaped distribution that is skewed to the left. While the mean \(ALLOC_j\) is 0.360, the median is far lower, 0.048.

The allocation in most IPOs was extremely small due to overwhelming oversubscription, and in many cases there was undersubscription at the offer price or at the auction maximum price, resulting in \(ALLOC_j = 1.0\).

The distribution of \(ALLOC_j\) is consistent with the implications of Welch's (1992) model of information cascades. There, each investor has a prior belief about the true value of the IPO, which is revised after having observed the offer price and whether other investors subscribe or abstain. Based on that, the investor then decides on whether to subscribe to the IPO. Since one investor's decision is influenced by that of others, there is herding into subscribing or abstaining. As a result there is either overwhelming oversubscription or undersubscription. Figure 2 indeed shows evidence of very high demand or abstention, with only a few issues in between these extremes.

\(^8\) In the four IPOs where allocation was declining in order size, \(ALLOC_j\) is the ratio of issued units to the quantity subscribed. Excluding these four observations does not change the results in any meaningful way.
2.3. *The determinants of underpricing and allocation*

If underpricing is done just to the extent necessary to attract sufficient demand to accommodate some observed factors, there should be no relationship between *excess* demand and these factors. Our data on the rate of allocation, which measures excess demand, enables us to examine this issue. We find that excess demand was predictable by factors that were publicly known before the IPO, and that factors that led to greater underpricing also led to greater excess demand. This means that underpricing was done to a greater extent than was necessary to attract sufficient demand.

The following are the variables that are likely to affect the initial return and the demand for IPO units.

*(i)* *The market's past returns.* If underwriters fully adjust the offer price to market conditions, the market return before the offer price is set should not affect underpricing. However, Loughran and Ritter (2002) and Lowry and Schwert (2001) found that the initial return reflects partial adjustment to recent market return. In Israel, the pricing decision of the IPO was made by the time that the prospectus was submitted, five or six days before the issue day, with no revision thereafter.\(^9\) We therefore consider the market return before the offer price was set, the ten-day period \(-16\) to \(-6\),

\[
RM_{-16} = \frac{M_{-6}}{M_{-16}} - 1,
\]

where \(M_{ji}\) is the TASE Karam market index. We also consider the five-day market return between the price setting day and the IPO day, days \(-6\) to \(-1\) (day \(-1\) is the last full day with information about the market before investors entered their orders on day 0),

\(^9\) Issuers could withdraw the prospectus and cancel the IPO, but it was extremely rarely done.
(4) \[ RMI-6_j = M_{j-1}/M_{j-6} - 1. \]

\( RMI-6 \) should positively affect \( IR_j \) since this market return occurred after the setting of the issue price. But \( RM6-16 \) should have no effect on \( IR_j \) if this information about the market were fully incorporated in the pricing of the IPO.

(ii) \( PROCEEDS_j \) is the logarithm of the IPO proceeds or the issue size in monetary units (Israeli Shekels, in constant prices of December 1992). If the issued securities are uniquely unhedgeable,\(^{10}\) it would give rise to a declining demand function and then larger issues may need to be more underpriced in order to attract sufficient demand. On the other hand, if larger issue size means smaller uncertainty (Beatty and Ritter, (1986)), it should have a negative effect on underpricing (see next).

(iii) \( SDIR_j \) is the standard deviation of the daily initial return in the after-market, days -6 to +15. This proxy for the uncertainty about the value of the issued securities was proposed by Ritter (1984), who found that it has a positive effect on underpricing.

Theory predicts that underpricing is positively related to uncertainty. Rock (1986, p. 189) stated: “the greater the uncertainty about the true price of the new shares, the greater the advantage of the informed investors and the deeper the discount the firm must offer to entice uninformed investors into the market.” Beatty and Ritter (1986) proposed that greater uncertainty induces more investors to spend resources and become informed, which in turn increases the asymmetry in information and requires greater underpricing to attract uninformed investors. Welch (1992) proposed that underpricing is an increasing function of a mean-preserving increase in the spread of investors’ prior beliefs about the

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\(^{10}\) Short selling was extremely difficult and costly at the TASE during the sample period. Therefore, hedging was almost impossible.
IPO price. We also examine here the effect of uncertainty on excess demand, measured by the allocation rate.

(iv) \( AUCTION_j = 1 \) for IPOs sold by the auction method with upper and lower price limits, and 0 for IPOs sold at a fixed price. Because the auction had an upper price limit, it effectively became a fixed price method when that limit was binding, in which case rationing was necessary. This occurred in 77.1% of the auctions (see Table 1). Yet, in auctions an equilibrium price could be reached below the maximum price without a need for the underwriter to absorb the unsold quantity. Therefore, underwriters could set higher maximum prices than they would in fixed-price IPOs since their risk of undersubscription was lower.\(^{11}\) As a result, underpricing is expected to be smaller in IPOs by auction. While evidence shows that IPO underpricing is smaller in countries where auctions are used (Loughran, Ritter and Rydkvist (1994)), this is the first study that compares the effects of the two methods of IPOs within the same market.

(v) \( UNIT_j = 1 \) in an IPO where a unit of securities is issued, and \( UNIT_j = 0 \) in an IPO of stock alone. In our sample, unit IPOs included stock and warrants or bonds (mostly convertible) or both and constituted about 85% of the cases. The decision to issue a unit of securities instead of stock alone is affected by agency costs and incentive issues (Schultz (1993)), but it may also be affected by marketing considerations. In response to our inquiry, underwriters said that it was “easier” to sell units that included warrants and convertibles, meaning that they could issue the securities at higher prices.

The effects of these variables are examined in regression models where the initial excess return, \( IR_j \), and the allocation rate \( ALLOC_j \) are functions of the pre-IPO market
returns \( RM1-6_j \) and \( RM6-16_j \), the issue size \( PROCEEDS_j \), the method of sale \( AUCTION_j \),
the uncertainty \( SDIR_j \) and the composition of the issued unit \( UNIT_j \). In the allocation
model we use \( ALLOCT_j \), the logistic transformation of the allocation rate: \(^{12}\)
\[
(5) \quad ALLOCT = \log(ALLOC + a)/(1 + ALLOC + a),
\]
where \( a = \sqrt{2}/284 \), to accommodate the cases where \( ALLOC = 1 \) or is practically zero. The
estimation results of these models are presented in Table 4.

INSERT TABLE 4 HERE

The results show that the factors that led to greater underpricing also stimulated
higher demand and brought about smaller allocation: the signs of the coefficients in one
model are the opposite of their signs in the other model. This may suggest that
underpricing was greater than necessary to ensure a given level of (excess) demand. An
exception is the type of unit, \( UNIT_j \), whose effect is insignificant in the allocation
equation (therefore it is not included in the final estimation of the allocation model).

It is expected that \( RM1-6_j \) should affect both underpricing and excess demand
(allocation). Since the offer price was set by day -6, it was already stale by the IPO day.
Therefore, the change in market prices during the last six days before the IPO should
have affected the demand for the issue. However, the significant coefficients of \( RM6-16_j \)
in both equations imply that underwriters deliberately underpriced IPOs relative to
information they had before the IPO about market returns during days (-16, -6). This is
consistent with the results of Loughran and Ritter (2002) and Lowry and Schwert (2001).
Notably, underpricing was not affected significantly by the market return in the preceding

\(^{11}\) We examined the determinants of the selection of the issuing method (single price or auction) by a Probit
model, the explanatory variables being \( PROCEEDS_j \), \( SDIR_j \) and \( RM6-16_j \). These variables had no
significant effect.

\(^{12}\) This transformation is suggested by Cox (1970), p. 33. The term \( a = \sqrt{N} / N \), where \( N \) is the sample size.
10-day period, days (-26, -16), suggesting that this information about the market was fully incorporated into the offer price.

**INSERT TABLE 5 HERE**

We observe that IPOs were timed to take place after an unusual rise in market prices. The average daily return during days (-26, -16) was 2.36 times the return after the IPO, days (0, +10), and the return during days (-16, -6) was 56% greater than the return on days (0, +10). The return since the IPO price was announced in the prospectus, days (-6, -1), was practically the same as the return on days (0, 10). That is, issuers did not have any predictive power regarding the return between the prospectus day and the IPO day, but they timed the IPO after a period of an unusually high market price run-up.

Doing IPOs after a rise in market prices enabled issuers to raise their offer price and raise more money. The partial adjustment of the offer price to the recent market return \( RM_{6-16} \) is consistent with Loughran and Ritter’s (2002) proposition, based on prospect theory, that issuers do not mind “leaving money on the table” when the IPO brings them higher value than they have anticipated. While Loughran and Ritter’s (2002) analysis was in the context of the information about demand that is revealed in the pre-IPO bookbuilding process,\(^{13}\) we apply it here to information about the recent market return (in Israel, there is no bookbuilding process).

Underpricing was greater for IPOs that were larger and had greater uncertainty. Such IPOs also had greater excess demand, as measured by allocation. This means that

\(^{13}\) Loughran and Ritter’s (2001) proposition explains the phenomenon, documented by Hanley (1993), about underpricing being larger when the offer price is moved upward following the bookbuilding process. Benveniste and Spindt (1989) explained that underwriters do that to elicit truthful information from investors during that process.
new issues were underpriced by more than was necessary to offset the negative effects of large size and uncertainty. This indicates deliberate underpricing.

Auctioned IPOs were associated with smaller underpricing, which explains the popularity of this method (see Table 1). The smaller underpricing also reduced the excess demand in auction IPOs. Indeed, the Israeli Securities Authority mandated in December 1993 the auction method without setting an upper price limit. As expected, Kandel et al. (1999) found that underpricing in these auctions was much smaller. In their sample of 27 IPOs, the initial return was 0.045 and significant. A recent study by the Israeli Securities Authority finds that for all 14 IPOs during the period 4/95-12/96 the initial return was -0.014, insignificantly different from zero.

Finally, underpricing was smaller in IPOs of units of securities that included, in addition to stock, warrants or bonds or both. This is consistent with the underwriters' claim that unit IPOs are “easier” to sell.

Underpricing does not necessarily imply gains to uninformed investors. Rock (1986) suggested that greater initial returns are offset by smaller allocations of shares to subscribers and uninformed investor should earn zero excess gain. This is examined in the next section.

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14 Underpricing was not significantly affected by whether the additional securities in the unit were warrants or bonds or both.
3. **Two tests of Rock's theory**

3.1. **Test I: adverse selection**

Rock's (1986) hypothesis of adverse selection (or winner's curse) in IPOs implies a negative correlation between initial returns and allocations to investors. Since informed investors avoid overpriced IPOs, uninformed investors then receive larger allocations of shares on which they earn negative returns. In underpriced IPOs that earn positive returns, uninformed investors receive smaller allocation.

Consistent with Rock's (1986) proposition of adverse selection in IPOs, we obtain the following relation:

\[
(6) \quad IR_j = 0.093 - 0.028 ALLOC_T_j \\
(t \text{ statistic})^{15} = (6.62) \quad (9.07) \quad R^2 = 0.225
\]

To examine whether the results are affected by extremely high allocations, we excluded observations where \( ALLOC_j > 0.95 \) (25.7\% of all IPOs). For the remaining 211 IPOs, the results are:

\[
(6') \quad IR_j = 0.033 - 0.044 ALLOC_T_j \\
(t \text{ statistic}) = (1.56) \quad (6.74) \quad R^2 = 0.136
\]

The results thus strongly support the existence of adverse selection in IPOs.\(^{16}\)

Another examination of the adverse selection proposition is presented in Table 3, where the sample divided between overpriced and underpriced IPOs. In overpriced IPOs (where \( IR_j < 0 \)) the average allocation rate is 0.613 whereas it is much less than half, 0.232, in underpriced IPOs (where \( IR_j > 0 \)). The difference between the medians is much greater: allocation of 0.920 in overpriced IPOs vs 0.013 in underpriced ones. This strongly supports the proposition of adverse selection in IPOs.

\(^{15}\) The \( t \) statistics are calculated using White's (1980) robust standard errors.
While the results are consistent with Rock (1986), the negative relationship between initial returns and allocations can also be obtained under a simpler scenario. If underwriters set the offer price different from what investors believe it should be – say, due to error in estimating the market’s expectations -- we shall observe a negative relationship between initial returns and allocations. When the offer price is smaller than the market’s expectation of the company’s value there will be excess demand (low allocation) and high return, and the opposite will occur when the offer price is above the market’s expectation.

Another aspect of Rock’s (1986) theory is examined as follows. If informed investors participate in underpriced IPOs and avoid the overpriced ones, there should be a greater number of investors participating in underpriced IPOs. This is notably different than the same investors increasing their order size in response to IPO underpricing. We test this hypothesis as follows. Denote the number of orders accepted in the IPO by $ORDERS_j$. These are all the orders in fixed-price IPOs and those who bid at least the auction price in auctioned IPOs. $LORDERS_j = \log(ORDERS_j)$. Then,

$$
LORDERS_j = -3.650 + 1.595IR_j + 0.623PROCEEDS_j + 6.661RM1-16_j + 10.818SDIR_j
$$

(7) \hspace{2cm} (t \text{ statistic}) \quad (1.34) \quad (6.26) \quad (3.84) \quad (4.29)

$$
R^2 = 0.348
$$

The result support the hypothesis that underpricing attracts more investors to participate in the IPO. Since the participation of uninformed investors is unrelated to underpricing -- this is the very meaning of their being uninformed -- the increase in the number of orders

\textsuperscript{16} See Koh and Walter (1989), Levis (1990) and Brennan and Franks (1997) who found a positive relationship between oversubscription and underpricing.
in response to underpricing signifies the participation of informed investors joining the demand for the new issue.\footnote{These results are also consistent with the hypothesis of Booth and Chua (1996) and Brennan and Franks (1997) that underpricing increases the investor base and ownership dispersion. See, however, Field and Sheehan (2002) on the post-IPO blockholding in underpriced firms.}

3.2. *Test II: allocation-weighted initial returns*

Rock (1986) proposed that in equilibrium, the initial return should be zero to uninformed investors in IPOs who are subject to adverse selection. It is in fact expected that an uninformed strategy should not produce initial returns in a frictionless market with rational investors. To test this proposition, we assume that uninformed investors subscribe a fixed amount for each and every IPO (or subscribe randomly to some IPOs). Their allocation-weighted initial return is given by

\[
AWIR_j = ALLOC_j IR_j - \text{interest}.
\]

$IR_j$ is the initial return over days 0 to +6 (defined in (1)), $ALLOC_j$ is the allocation received in the IPO by equal proration to all subscribers, and $\text{interest}_j$ is the one-day interest rate\footnote{We use the interest rate for withdrawals from bank accounts (source: Bank of Israel report, various issues). The practice was that banks, which are by far the largest brokers in Israel, provided the funds for the one-day deposit.} that prevailed at the time of the IPO of company $j$. This is because investors subscribing to an IPO had to deposit for one day the entire amount of their order, to ensure that they can buy the number of units ordered at the specified price. In the period under study, the average one-day interest rate was 0.054%.

INSERT FIGURES 3 and 4

The distribution of $AWIR_j$, depicted in Figure 3, is negatively skewed, affected by the “lemons” where the return was negative and investors were allocated a larger
proportion of their order (sometimes -- the full amount of their order), which gives the negative returns greater weight. Figure 4 presents the relationship between $AWIR_j$ and the initial return $IR_j$. Because of investor herding that makes most allocations either close to zero or 1.0, most observations of $AWIR_j$ are either close to zero or equal to $IR_j$ -- in which case they are on the 45-degree line. Figure 4 presents two interesting observations. While high $IR_j$ is associated with very small allocation and $AWIR_j$ close to zero, we observe many cases where $IR_j < 0$ yet $AWIR_j$ is close to zero, meaning that these overpriced IPOs were greatly oversubscribed. And, when $IR_j < 0$, $AWIR_j$ is commonly along the 45-degrees line since then it is likely that $ALLOC_j = 1$. But there are quite a few observations on the 45-degree line with $IR_j > 0$, meaning that these were underpriced IPOs that were undersubscribed. These observations show the extent of errors of investors in subscribing to IPOs.

The statistics for $AWIR_j$ are presented in Table 2. The mean $AWIR_j$ is negative, $-1.18\%$, with $t = 1.77$, marginally significant,$^{19}$ and the median $AWIR_j$ is practically zero. The 15-day allocation-weighted initial return, $AWIR15$, has a mean of $-1.77\%$ with $t = 2.41$, statistically significant. The long-term allocation-weighted initial return for 150 days after the IPO, $AWIR150$, has a mean of $-2.43\%$ with $t = 1.52$.

The conclusion is that the allocation-weighted initial return at IPOs, earned by uninformed investors, is negative. This means that uninformed investors lose on average, which is inconsistent with Rock’s (1986) prediction. This loss may reflect the asymmetry in the effect of informed investors on the returns realized by uninformed investors. If the

$^{19}$ An alternative formulation of the allocation-weighted excess return is $AWIR_j^M = ALCLOC_j - IR_j - M_j$ which means that instead of borrowing the money for one day (shorting a bond), investors borrowed stock (shorted the market) for one day. The results are similar: the mean of $AWIR_j^M$ is $-1.17\%$ with $t = 1.75$. 

20
offering price paid by uninformed investors in the IPO was too high, informed investors
could not exploit that since it was impossible to short sell stocks in IPOs or thereafter.
Therefore overpayment in IPOs could not be reversed. On the other hand, if uninformed
investors were on average making money in IPOs, informed investors could reverse that
by participating in the offering and reducing the allocation to the uninformed investors.
This asymmetry in the effect of informed investors on the earnings realized by
uninformed investors may explain why we observe the negative allocation-weighted
initial return.

4. Conditioning IPO subscriptions

Investors who were uninformed about the values of the issuing firms were
assumed here to subscribe to all IPOs, or subscribe randomly to some of them. Such
investors realized a small loss, which seems inconsistent with the result of zero gain in
Rock's (1986) model that assumes rationality. Now, consider investors who are
uninformed about the issuing firms, but can easily observe market information. The
question is whether they could improve their performance by conditioning their
subscription on publicly available information that is unrelated to the firm’s value.
These may be called “minimal information conditioning” (MIC) investors. The
following examines two strategies available to such investors and their results.
4.1. Conditioning on pre-IPO market returns and volatility

Investors could use publicly available information about the market conditions prior to the IPO that includes market return and market volatility. We examine the effect of this information as follows. Over the fifteen-day period before the IPO we measure

(i) $RM_{1-16}$, the market return (using the Karam index), days -16 to -1, and

(ii) $SDRM_j$, the standard deviation of the market return, days -16 to -1.

We then estimate the effects of these variables on the allocation-weighted initial return by the following models:

\[
(9.1) \quad AWIR_j = -0.0248 + 0.432 \cdot RM_{1-16} \\
(t \text{ statistic}) \quad (2.87) \quad (3.33) \\
R^2 = 0.031,
\]

and

\[
(9.2) \quad AWIR_j = 0.0291 - 4.024 \cdot SDRM_j \\
(t \text{ statistic}) \quad (1.61) \quad (2.34) \\
R^2 = 0.025.
\]

The results suggest that MIC investors in IPOs could increase their allocation-weighted return by subscribing only to IPOs that were preceded by favorable market conditions: high market return or low market volatility. When both measures of market performance, $RM_{1-16}$ and $SDRM_j$, are included in the model, market return emerges as the one with the stronger effect (the correlation between the two measures is -0.45).

Doing further analysis, we divided the sample into two halves by the median of $RM_{1-16}$. The results were as follows:

- In IPOs preceded by $RM_{1-16} > \text{median}$: mean $AWIR_j = 0.0086 \ (t = 1.11)$.
- In IPOs preceded by $RM_{1-16} < \text{median}$: mean $AWIR_j = -0.0320 \ (t = 3.04)$. 

22
The difference between the two means is significant \((t = 3.10)\). It follows that zero initial return was earned only by investors who selectively participated in IPOs that were preceded by relatively high market return.

Conditioning subscription to IPOs on other variables did not improve investors' performance. We estimated a regression model similar to the one in Table 4, where

\(AWIR_j\) is a function of lagged market returns as well as of the variables \(PROCEEDS_j\), \(AUCTION_j\), \(SDIR_j\) and \(UNIT_j\). While these variables affect the initial return \(IR_j\), they also affect \(ALLOC_j\) in the opposite direction, and on balance they have no significant effect on the allocation-weighted initial return \(AWIR_j\). The absence of a significant effect of \(SDIR_j\) on \(AWIR_j\) means that investing in riskier IPOs did not yield a higher risk premium, as might be expected for risk averse investors.

It thus seems that Rock's (1986) equilibrium, in which uninformed investors earn zero initial return, applied to MIC investors. While being uninformed about the issuing firm, these investors could use pre-IPO information about the market, which is available costlessly, to improve their performance and erase the small loss that would be incurred if they subscribed indiscriminantly to all IPOs (or to some of them at random).

4.2. Conditioning on allocation

We now show that MIC 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 "cascades." Subscriptions to IPOs could be entered at any time on the IPO day from morning till noon and no information was available during the day on the accumulated
orders. However, many investors could obtain coarse information about it by talking to other investors and to their brokers who observed the order flow at their post.

The evidence shows that the information about the extent of the pre-IPO demand is valuable: \( Corr(AWIR_j, ALLOC_j) = -0.215 \), statistically significant. However, this relationship is driven by the cases of undersubscribed IPOs. There were 73 cases of \( ALLOC_j > 0.95 \), undersubscribed and almost-undersubscribed IPOs (25.7% of the sample). Excluding these IPOs, we obtain \( Corr(AWIR_j, ALLOC_j) = 0.122 \). While for the undersubscribed IPOs the mean \( AWIR_j = -0.0602 \) \( (t = 2.31) \), for the rest of the IPOs the mean \( AWIR_j = 0.0049 \) \( (t = 2.00) \), a small gain which is statistically significant.\(^{20}\) Thus, MIC investors could gain by avoiding IPOs with low investor interest if they had this information.

Since demand begets additional demand, the question is what prevents an unstoppable cascade of demand. Welch's (1992) model limits investors' purchase to no more than one share. Here, the cascade was bounded by the requirement that investors deposit the entire monetary value of their subscriptions for one day, which entails an interest cost, \( interest_j \) (see (8)). This cost offsets the gain in IPOs with very small allocation (high demand) and thus discourages subscribing to them. We estimate the relationship between investor gain and allocation for half the sample (142 IPOs) for which \( ALLOC_j < 0.0478 \) (the median):

\[
(10) \quad AWIR_j = 0.0065 + 0.0012 \cdot ALLOC_j \\
(t \text{ statistic}) (4.24) \quad (4.09) \quad R^2 = 0.174
\]

\(^{20}\) It was not important to know exactly the extent of subscription. For example, using \( ALLOC_j = 0.75 \) as the breaking point, 85 IPOs with higher allocation had mean \( AWIR_j = -0.0507 \) \( (t = 2.38) \), while 199 cases with smaller allocation had mean \( AWIR_j = 0.0048 \) \( (t = 2.39) \).
The results show that investors gained significantly less in IPOs with high demand and small allocation. Figure 5 depicts the relationship between the allocation and the respective $AWIR_j$ for IPOs with allocations below the median. And, given that the gain in the case of small allocation was practically nil, considering the fixed cost of time and effort involved in subscribing to an IPO means that investors who knew the extent of demand would have been better off avoiding the very hot IPOs altogether.

INSERT FIGURE 5 HERE

5. Conclusion and discussion

This paper examines major theories of underpricing in IPOs, using unique data from Israel on the rate of allocation to subscribers in IPOs, where each subscriber received an equal proportion of her or his order. Such data are unavailable in the U.S.

We first test Rock's (1986) theory of adverse selection by which informed investors choose to participate in underpriced IPOs and uninformed investors receive larger allocations of the overpriced IPOs. In equilibrium, uninformed investors should earn zero initial return. Our evidence is consistent with the existence of adverse selection: underpricing was negatively related to the rate of allocation to subscribers. However, the mean initial return earned by uninformed investors was negative. Investors who participated in all IPOs (or subscribed randomly to some) earned a return of -1.18% or -1.77% when measured over 6 days or 15 days after the IPO, respectively. This is inconsistent with Rock's (1986) prediction and suggests that IPOs were overpriced from the viewpoint of uninformed investors.
The negative returns earned by uninformed investors means that their demand for new issues was, on average, too high. While losing on undersubscribed offers, the allocations that they received in underpriced offers were too small and as a result their allocation-weighted return was negative. This may reflect the asymmetry in the effect of rational investors on the outcomes for uninformed investors in IPOs. In Rock’s (1986), as in reality, it is impossible to short sell securities in IPOs that are likely to decline afterwards. Therefore, if there are investors who participate indiscriminantly in IPOs and lose as a result, rational investors cannot trade against them and undo that. They can only exert their influence if uninformed investors underpay, in which case they too would participate in the IPO. We show that “minimal information conditioning” investors – those who were uninformed about the firm but conditioned their participation in IPOs on publicly available information about the market that could be obtained costlessly – were able to improve their performance. Subscribing only to IPOs that were preceded by high market return or lower volatility enabled them to break even, as proposed by Rock (1986).

Second, we examine Welch’s (1992) theory of information cascades by which investors set their own demand after having observed the demand of others, which leads to herding: demand is either very high or is very low. In which case the offering fails. Then, underpricing is a means to create a cascade of high demand that will ensure the success of the offering. We obtain that the distribution of allocations to IPO subscribers exhibits an extreme U-shaped pattern, indicating strong herding among investors: they either subscribed overwhelmingly to new issues or largely abstained, in which case the issue was undersubscribed. We again consider the return earned by MIC investors.
Those with information about the extent of demand could improve their performance by avoiding IPOs with low demand and joining those with high demand.

We find that IPOs were timed to take place after an unusual rise in market prices, and that the offer prices were not fully adjusted to this information. As a result, underpricing and excess demand are related to the pre-IPO market return. This is consistent with Loughran and Ritter’s (2002) proposition that issuers do not mind “leaving money on the table” when they raise more money than they have anticipated.

Our results that excess demand is affected by factors that are known before the IPO -- recent market return and issue characteristics -- may cast doubt on Rock’s (1986) reasoning for underpricing. Suppose that underpricing is done to attract some desired level of excess demand. Then, the issue can be priced just right, that is, with no underpricing, and then the offer price can be lowered by a constant. This would generate excess demand that is not related to any factor. However, we do find that the factors that affect underpricing also affect excess demand. This raises question on the motivation for underpricing by issuers and underwriters.
References


Table 1: Characteristics of the IPOs in this study

The last line gives the proportion of the number of IPOs at that category out of the total number of IPOs. The proportion in the last column is out of the 245 IPOs sold by the auction method.


<table>
<thead>
<tr>
<th>Year of issue</th>
<th>Total num.</th>
<th>Composition of unit issued</th>
<th>Method of IPO pricing</th>
<th>Fixed price</th>
<th>Auction Total</th>
<th>Closed at max*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Stock only</td>
<td>Stock + warrant</td>
<td>Stock + warrant + bonds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11/1989 -1990</td>
<td>10</td>
<td>0</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1991</td>
<td>16</td>
<td>3</td>
<td>11</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1992</td>
<td>87</td>
<td>13</td>
<td>57</td>
<td>13</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>1993</td>
<td>171</td>
<td>28</td>
<td>104</td>
<td>34</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>284</strong></td>
<td><strong>44</strong></td>
<td><strong>177</strong></td>
<td><strong>52</strong></td>
<td><strong>11</strong></td>
<td><strong>39</strong></td>
</tr>
<tr>
<td>Proportion</td>
<td>1.00</td>
<td>0.155</td>
<td>0.623</td>
<td>0.183</td>
<td>0.039</td>
<td>0.137</td>
</tr>
</tbody>
</table>

* "Closed at max" means that the demand at the auction's maximum price exceeded the issued quantity and rationing was necessary. (In auctions, underwriters specified maximum and minimum prices.)
Table 2: Initial returns in IPOs, with adjustment for allocation

The initial excess return is $IR_j = \frac{P_{t,0}}{P_{t,0}} - M_{t,0}/M_{t,0}$. $P_{t,0}$ is the price on the IPO unit of firm $j$ on day $t$, where day 0 is the IPO day and $M_{t,0}$ is the TASE Karam market index on day $t$ pertaining to the IPO of firm $j$. day 0 is the IPO day.

$IR_{15} = \frac{P_{t,15}}{P_{t,0}} - M_{t,15}/M_{t,0}$ is the 15 day initial return on the IPO unit.

$IR_{150} = \frac{P_{t,150}}{P_{t,0}} - M_{t,150}/M_{t,0}$ is the 150 day initial return on the IPO unit.

The allocation-weighted initial return is $AWIR_j = \frac{ALLOC_j \cdot IR_j - interest_j}{interest_j}$, where $ALLOC_j$ is the allocation to subscribers in the IPO of firm $j$, calculated as the ratio of issued units to the total demand, $0 < ALLOC \leq 1$, and $interest_j$ is the one-day interest cost.

$AWIR_{150}$ is the allocation-weighted initial return over 150 days after the IPO.


<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
<th>Skewness</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(underpricing)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 $IR$</td>
<td>0.1199</td>
<td>0.0660</td>
<td>1.264</td>
<td>-0.6581</td>
<td>1.7671</td>
</tr>
<tr>
<td>2 $IR_{15}$</td>
<td>0.1314</td>
<td>0.0563</td>
<td>1.603</td>
<td>-0.6775</td>
<td>2.1920</td>
</tr>
<tr>
<td>3 $IR_{150}$</td>
<td>0.1500</td>
<td>0.0563</td>
<td>1.728</td>
<td>-0.9450</td>
<td>3.7424</td>
</tr>
<tr>
<td></td>
<td>(6.77)</td>
<td>(4.16)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(7.20)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(4.67)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Allocation-weighted initial return:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
<th>Skewness</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 $AWIR$</td>
<td>-0.0118</td>
<td>0.0001</td>
<td>-0.736</td>
<td>-0.6587</td>
<td>0.5731</td>
</tr>
<tr>
<td>5 $AWIR_{15}$</td>
<td>-0.0177</td>
<td>0.0001</td>
<td>-0.440</td>
<td>-0.6781</td>
<td>0.5057</td>
</tr>
<tr>
<td>6 $AWIR_{150}$</td>
<td>-0.0243</td>
<td>-0.0002</td>
<td>0.706</td>
<td>-0.9457</td>
<td>1.1848</td>
</tr>
<tr>
<td></td>
<td>(1.77)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.41)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.52)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

($t$ statistics, testing that the mean is different from zero.)
Table 3: Allocations in IPOs

$ALLOC_j$ is the allocation to subscribers in the IPO of firm $j$, calculated as the ratio of issued units to the total demand, $0 < ALLOC \leq 1$.

The initial return is $IR_j = P_{j,t}/P_{j,0} - M_{j,6}/M_{j,0}$. $P_{j,t}$ is the price on the IPO unit of firm $j$ on day $t$, where day 0 is the IPO day and $M_{j,t}$ is the TASE Karam market index on day $t$ pertaining to the IPO of firm $j$. day 0 is the IPO day.


<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ALLOC$</td>
<td>0.3595</td>
<td>0.0478</td>
<td>0.0003</td>
<td>1.0000</td>
<td>284</td>
</tr>
</tbody>
</table>

Allocation classified by initial return (underpricing):

For $IR_j < 0$:

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ALLOC_j$</td>
<td>0.6134</td>
<td>0.9200</td>
<td>0.0015</td>
<td>1.000</td>
<td>95</td>
</tr>
</tbody>
</table>

For $IR_j > 0$:

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ALLOC_j$</td>
<td>0.2319</td>
<td>0.0127</td>
<td>0.0003</td>
<td>1.000</td>
<td>189</td>
</tr>
</tbody>
</table>
Table 4: The determinants of IPO allocations and initial returns

\[ IR_j = \alpha_0 + \alpha_1 RM1-6_j + \alpha_2 RM6-16_j + \alpha_3 PROCEEDS_j + \alpha_4 AUCTION_j + \gamma_5 SDIR_j + \gamma_6 UNIT_j + \nu_j \]

\[ ALLOCT_j = \beta_0 + \beta_1 RM1-6_j + \beta_2 RM6-16_j + \beta_3 PROCEEDS_j + \beta_4 AUCTION_j + \gamma_5 SDIR_j + \nu_j. \]

- \( IR_j \) = the initial return on the IPO unit of firm \( j \) over days \( (0, +6) \).
- \( ALLOCT_j = \log((ALLOC_j +a)/(1+ALLOC_j+a)) \) is the transformed \( ALLOC_j \), the proportional allocation rate to subscribers, \( 1 < ALLOC_j \leq 1 \), and \( a = \frac{\sqrt{2}}{284} \).
- \( RM1-6_j \) = market return from day -6 to day -1.
- \( RM6-16_j \) = market return from day -16 to day -6.
- \( PROCEEDS_j \) = logarithm of size of issue in Israeli Shekels (in December 1992 prices).
- \( SDIR_j \) = standard deviation of daily initial returns, days \((+6,+15)\).
- \( AUCTION_j \) = 1 for IPOs sold at the auction method (with an upper and lower bounds) and = 0 for IPOs sold at a fixed price.
- \( UNIT_j \) = 1 in IPOs of units that include other securities in addition to stock, = 0 in IPOs of stock alone.


<table>
<thead>
<tr>
<th>Regression results:</th>
<th>Statistics of variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable</td>
<td>Mean</td>
</tr>
<tr>
<td>( IR_j )</td>
<td>0.563</td>
</tr>
<tr>
<td>( ALLOCT_j )</td>
<td>1.388</td>
</tr>
<tr>
<td>( RM1-6_j )</td>
<td>2.343</td>
</tr>
<tr>
<td>( RM6-16_j )</td>
<td>0.043</td>
</tr>
<tr>
<td>( PROCEEDS_j )</td>
<td>4.500</td>
</tr>
<tr>
<td>( UNIT_j )</td>
<td>-0.128</td>
</tr>
</tbody>
</table>

\( t \) statistic in parentheses; standard errors use White’s (1980) robust estimation.)
Table 5: Market return around the IPO day

Average daily return on the market \textit{Karam} index before and after day 0, the IPO day.

<table>
<thead>
<tr>
<th></th>
<th>Days -26 to -16</th>
<th>Days -16 to -6</th>
<th>Days -6 to -1</th>
<th>Days 0 to +10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market return (%)</td>
<td>0.326</td>
<td>0.225</td>
<td>0.144</td>
<td>0.138</td>
</tr>
<tr>
<td>Ratio relative to return in (0, +10)</td>
<td>2.36</td>
<td>1.56</td>
<td>1.04</td>
<td>1.00</td>
</tr>
</tbody>
</table>
Figure 1: The distribution of initial return in IPOs

The initial return is $IR_j = P_{j,t}/P_{j,0} - M_{t,t}/M_{t,0}$. $P_{j,t}$ is the price on the IPO unit of firm $j$ on day $t$, where day 0 is the IPO day and $M_{t,t}$ is the TASE Karam market index on day $t$ pertaining to the IPO of firm $j$. 
Figure 2: The distribution of allocations to investors in IPOs

$ALLOC_j$ is the allocation of units of firm $j$ to subscribers, calculated as the ratio of issued units to the total demand for units at the IPO.
Figure 3: The distribution of allocation-weighted initial return in IPOs

The allocation-weighted initial return is \( AWIR_j = \frac{ALLOC_j \times IR_j - \text{interest}_j}{\text{MJO}} \), where \( IR_j = R_j - RM_j \), the initial return on the IPO unit over days \((0, +6)\), \( ALLOC_j \) is the proportional allocation to shareholders who participated in the IPO of firm \( j \) and \( \text{interest}_j \) is the one-day interest cost.
Figure 4: Initial return, $IR_j$, and allocation-weighted initial return, $AWIR_j$

$IR_j = \frac{P_{j,6}}{P_{j,0}} - \frac{M_{j,6}}{M_{j,0}}$. $P_{j,t}$ is the price on the IPO unit of firm $j$ on day $t$, where day 0 is the IPO day and $M_{j,t}$ is the TASE Karam market index on day $t$ pertaining to the IPO of firm $j$.

$AWIR_j = ALLOC_j \cdot IR_j - interest_j$, where $IR_j = R_j - RM$, the initial return on the IPO unit over days (0, +6), $ALLOC_j$ is the proportional allocation to shareholders who participated in the IPO of firm $j$ and $interest_j$ is the one-day interest cost.
Figure 5: The allocation-weighted initial return against Allocation

The allocation-weighted initial return is $AWIR_j = ALLOC_j \cdot IR_j - interest_j$, where $IR_j = R_j - RM_j$, the initial return on the IPO unit over days (0, +6), $ALLOC_j$ is the proportional allocation to shareholders who participated in the IPO of firm $j$ and $interest_j$ is the one-day interest cost. $ALLOC_j = (ALLOC_j + a)/(1 - ALLOC_j + a)$, where $a = \frac{1/2}{284}$. The data presented here is for half the sample (142 IPOs) for which $ALLOC_j$ below its median.