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IPO Discount and Competition

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A B S T R A C T

Lacking examples of IPO mechanisms that are open to the public and priced competitively, previous studies could not determine what size discount, if any, is efficient. We test and reject the hypothesis that underpricing is efficient or consistent with competition by comparing two consecutive pricing mechanisms on the Tel Aviv Stock Exchange: A standard investor-driven auction constrained by pre-announced maximum and minimum prices, replaced by a uniquely competitive auction in which a maximum price is banned. The switch from fixed pricing to unconstrained auction pricing leads to important changes: Rationing and herding disappear along with the binding maximum price, improving the access of uninformed investors to strong issues while decreasing their exposure to the winner's curse attached to weak issues; the quality of pricing increases by the elimination of the underpricing bias and increased pricing accuracy beyond that bias, and by increased price sensitivity to individual IPO factors. There is evidence that the underwriter fees moderately increase, apparently in compensation for a higher risk, while services performed for those fees remain unchanged. Consistently, early trading reveals no evidence of deterioration in the IPO's efficiency as a screen for weak issues. Jointly, these changes demonstrate that the price discount dominating the fixed pricing mechanism is neither competitive nor efficient. The introduction of competitive pricing increases the efficiency of IPOs by improving the quality of pricing and by removing an implied tax on companies going public.

IPO Discount and Competition

1. Introduction

Shares issued by companies going public are commonly offered below their market clearing price, rewarding winning bidders with a handsome return that can be measured by the difference between the offer price and the higher price observed in early trading. Due to the price discount, share allocation must rely on rationing among winning bidders whose combined demand at the offer price is often a large multiple of the number of shares issued. The price discount varies over time and across IPO mechanisms, but remains economically significant everywhere. Spanning four decades and 38 countries, Ritter's (2003) survey of international studies reports a mean first-day return (commonly equated with the offer price discount, or underpricing) ranging from 5.4% (Denmark) to 257% (China) with a median return of 20.7%. A US mean return of 18.4% during 1960-2001 is estimated by Ibbotson, Sindelar, and Ritter [tabulated in Ritter (2003)] based on a sample of nearly 15,000 IPOs. Initial return, measured as of the end of the first day of trading, is almost fully reflected in the *opening* market price as well. When multiplied by the issue size, the amount implied by the initial return represents a portion of the IPO proceeds foregone by the issuing company.[1]

Previous writers devote significant resources to explaining *why* the issuing company must surrender to initial investors a large portion of the proceeds. With few recent exceptions,[2] those studies assume, often implicitly, that IPOs are generally priced competitively and proceed to justify the price discount as an *efficient* payment for valuable services the issuing company acquires from its underwriter or primary buy-side investors – services other than those explicitly charged for by the underwriter. Lacking data on IPO mechanisms that are open to the public *and* priced competitively, those studies gauge efficiency from observable mechanisms by selectively testing for benefits generated by hypothesized services. This approach does not capture the

complexity of efficiency engendered by competition and cannot be relied upon to determine whether an observed discount price is competitive, or how much initial return, if any, is efficient.

This study *empirically tests and rejects the hypothesis that the price discount and consequent rationing are consistent with competition and efficiency*. The opportunity to study this phenomenon presented itself with the adoption of a uniquely competitive IPO regime on the Tel Aviv Stock Exchange (TASE), a regime based on an investor-driven Dutch auction that is open to the public and ends with an offer at the clearing price (hereafter auction pricing or AP). We compare this regime, which is constrained only by a minimum price, to its predecessor, a similar auction subject to pre-announced minimum *and* maximum prices (hereafter fixed pricing or FP).[3] The switch from FP to AP was initiated in January 1994 by the Israel Securities Authority and the Exchange in reaction to frequent herding of bids at the binding maximum price and consequent severe rationing and uncertain share allocations, a phenomenon that reached its peak during the hot market of 1993.

Here are the main findings:

- The switch to AP lowers the mean return in early trading to an insignificant modest figure whose precise level and sign depend on the relative rates and weights of issues offered above and below the minimum price. Issues priced competitively above the minimum yield a significant positive return of 4.6%, which is offset by the negative return of overpriced issues offered at the minimum price. The elimination of the price discount in offers priced above the minimum increases the proceeds garnered by issuers and their risk.
- The elimination of the price discount increases the fees (gross spread) charged by the underwriter, apparently in compensation for the higher risk of supporting under-subscribed offers made at the minimum price.
- Under FP, there is causality between offers made at the maximum price and gains garnered by informed investors. Symmetrically, uninformed investors play a key role in causing and absorbing negative returns in offers priced at the minimum. Free of rationing, competitive pricing under AP decreases the return of informed investors

and increases that of uninformed ones. The former trade price/quantity market risks for the quantity risk under FP; the latter gain better access to strong issues, which offered above the minimum price and appear to be *less* exposed to the winner's curse arising from weak issues priced at the minimum.

- Free of a binding maximum price, AP increases the *quality* of pricing beyond the elimination of the discount price bias, a change that benefits both sides of the market. There is evidence of increased *pricing accuracy* and *price sensitivity* to individual IPO factors. There is no evidence that a price discount promotes better screening of weak issues.

Viewed in total, our results indicate that the price discount associated with FP is neither competitive nor efficient. The introduction of competition increases the efficiency of IPOs by improving the quality of pricing and by removing an implied tax on companies going public.

The remaining sections are as follows. Section 2 examines the related literature to define our contribution; Section 3 discusses the institutional and theoretical background of our hypotheses; Section 4 describes our data and testing methodology; Section 5 analyzes the empirical results; and Section 6 offers a summary of our results and conclusions.

2. Literature

Prevailing hypotheses describe the price discount as competitive, or rely on the implicit assumption that its efficiency is consistent with competition. Rock (1986) focuses on the distinction between informed investors who are able to discern (underpriced) strong issues from (overpriced) weak ones, and uninformed investors who are unable to do so. He argues that without a price discount, uninformed investors would earn a negative mean return: strong issues face a greater demand by all investors and entail rationing and smaller allocations; overpriced weak issues, shunned by informed investors, are allocated among the uninformed. An issuer seeking to attract the uninformed would discount the offer price to mitigate their losses even as it awards informed investors with a windfall gain. Consistent with first economic principles, our results show that underpricing causes rationing that punishes rather than rewards uninformed

investors by selectively hindering their access to profitable issues. In contrast, the AP regime on the TASE is free of a binding maximum price and concomitant price discount, offering uninformed investors rationing-free access to fairly priced issues and an opportunity to mitigate negative returns of overpriced issues.

Recent studies of foreign markets explore the relationship between the IPO mechanism, underpricing, and efficiency.[4] Pettway and Takashi (1996) extended by Pettway (1999) compare first-day returns of Japanese IPOs under an investor-driven FP mechanism modified in stages to incorporate market effects. A fall of returns from 70% to 12% during 1/1981 - 9/1996 following such modifications leads them to conclude that increased competition diminishes underpricing. Despite remaining restrictions on competition, they view the lower return of 12% -- a rate common to Japan and the US during 4/1989 - 9/1996, as an inherent minimum price discount consistent with competition. Our empirical findings suggest that the least restrictive Japanese mechanism, like bookbuilding in the US, falls short of market competition, and 12% mean return is not a legitimate benchmark of competitive underpricing.

Biais, Bossaerts, and Rochet (2002) study the investor-driven French FP mechanism *Offre à Prix Minimal* (OPM) in which a "reasonable" discount price is set under official supervision following a public auction. Citing evidence that investment banks possess market power and collude with institutional investors, they hypothesize a benevolent collusion that benefits the issuer by maximizing proceeds and shielding uninformed investors from the winner's curse. The 15% mean return during 1983-1996 is viewed as a competitive price charged for inside information provided by the colluding parties. The authors do not offer evidence for the transfer of valuable information and do not explain why such information in not purchased indirectly, how the underwriter collects its share, or how free-riding winning bidders are excuded.

Derien and Womack (2003) revisit French IPOs to compare the performance of OPM to that of two other FP mechanisms used side-by-side during 1992-1998. Unlike OPM, under the investor-driven *Offre à Prix Ferme* (OPF), the fixed price is set privately and announced before the auction; the *Placement Garanti* (PG) is an underwriter-driven US-style bookbuilding. According to the authors' estimates, the OPM has a mean return of 9.7% with 12.3% standard

deviation, compared with 8.9% and 11% under OPF and 16.9% and 24.5% under PG, respectively. Focusing on OPM and PG, they interpret the lower return and dispersion under the former as evidence that OPM is a more competitive mechanism.[5] We observe that these results, like those of predecessors, do not demonstrate that the more competitive mechanism is in itself competitive. The possibility remains that OPM's 9.7% return overstates the price discount consistent with unobstructed competition.

3. Institutional Setup

Table 1 summarizes the main IPO features on the TASE before and after the regime change, abstracting from taxes and underwriter commission and fees. Under both regimes, underwriters have no discretion over share allocation. Shares are offered at the same price to wholesale and retail investors, while the underwriter is barred from any form of promotion, early release of information to investors, or the solicitation of investors' commitment to buy shares. All bids are submitted on the same day and the allocation of shares is non-discriminatory within two categories: Accredited institutional investors can bid and expect preferential allocation on up to 40% of the issued shares, while retail investors and unaccredited institutions share the remainder at the same price. Price stabilization after registration for trade is forbidden. Under FP, the auction is constrained by maximum and minimum prices. The price barriers and the size of the offer are negotiated between the issuer and underwriter and announced in the prospectus ahead of the auction. In case of an insufficient demand at the minimum price (under-subscription), the issuer may withdraw the offering or rely on the underwriter's "firm commitment" to purchase unsold shares at that price. These rules suggest that the minimum price must be set high enough to prevent dilution of equity held by owners-entrepreneurs. On its part, the underwriter has an incentive to lower the price minimum toward the issuer's reservation price to minimize its own expected cost of having to purchase the unsold overpriced shares. In the relevant range, the issuer would increase its proceeds by raising that price.

--- Insert Table 1 ---

The described features render some popular explanations of the price discount irrelevant for the TASE. Baron (1982) argues that the issuer discounts the offer price to lower its cost of monitoring the underwriter's marketing efforts. As noted, underwriters on the TASE are barred from any form of promotion or solicitation of commitment to buy shares. Hanley, Kumar, and Seguin (1993), Ruud (1993), and Schultz and Zaman (1994) claim that underpricing is an illusion created by underwriters' post-IPO price support. Price stabilization is not permitted on the TASE. Logue (1973), Tinic (1988), and Hughes and Thakor (1992) explain that issuers discount their offerings to reduce potential legal liability should original investors sustain losses in the after market. Experience shows that the probability of such litigations on the TASE is negligible. Referring to US-style bookbuilding, Benveniste and Spindt (1989), Benveniste and Wilhelm (1990), and Spatt and Srivastava (1991) argue that institutional investors have superior information about the market demand for new issues, which they convey to the underwriter by tentative bids during the road show, and for which they are paid by allocations of underpriced shares. An alternative explanation is provided by Loughran and Ritter (2002a) who claim that corrupt underwriters in the US stand to gain from the price discount by establishing tie-in arrangements with institutional investors selected for preferential treatment in share allocations. Unlike bookbuilding, the investor-driven IPO regimes on the TASE give the underwriter no discretion over share allocation. Moreover, the underwriter could purchase market information directly and be reimbursed by raising fees.

4. Data and Testing Methodology

4.1 Basic Statistics

Our sample consists of 94 common-stock IPOs, all offerings in this category during 1992-1996. This period is delineated by institutional events: It is preceded by a decade of infrequent FP offerings of security bundles consisting of warrants and bonds in addition to common stocks;[6] it is followed by an extended period of regulatory uncertainty during which the rule on the use of a maximum price is reversed twice before becoming law. Our data comprise the offer price, the daily closing price of each of the first 10 trading days, the TASE stock price index, the minimum

and maximum prices specified by the prospectus, the number of shares offered, the number of shares demanded at or above the offer price, the subscription rate (number of shares demanded at or above the offer price divided by the total number of shares offered), the market index closing value in each of the first 10 trading days, the financial leverage (book ratio of long-term liabilities divided by total assets), Tobin's Q-ratio (a proxy for growth opportunities; the combined value of equity according to market and long-term debt according to books divided by the book value of assets), the rate of underwriter fees (the sum of commissions and fees reported in the prospectus divided by the amount of equity raised), and an underwriter reputation proxy (a dummy variable assigned the value 1 or 0 for reputation above or below average, respectively).[7] In the absence of data on underwriting activity, reputation is based on official scoring used in awarding IPO permits.[8]

--- Insert Table 2 ---

Table 2 contains basic sample statistics. Of the 94 IPOs studied, 41 are under FP in the hot market of 1992-1993, and 53 under AP in a market that changed its temperature from hot to cold and back to warm during 1994-1996. The 41 IPOs under FP include 10 issued at the minimum price and 31 at the maximum price – none offered between the price barriers. The 53 IPOs under AP include 40 issued at the minimum price and 13 priced competitively above the minimum. We note the following features. The regime change brings about a dramatic decrease in gross initial returns earned by winning bidders, generating parallel benefits for issuers. Under FP, returns average 10.74% and 22.78% in the first day and first 10 days, respectively; under AP, the respective returns are both negative, -5.26% and -10.77%, a peculiar result that needs further examination. This decrease in returns is accompanied by a sharp decrease in the average subscription rate, from 123.2 to 1.6, both changes pointing to the critical role played by the binding maximum price.[9] The drop in subscription rate is also accompanied by a sharp fall in the proportion of IPOs offered above the minimum price, from 3/4 to 1/4, a change that suggests an increase in the underwriter risk of having to support under-subscribed issues offered at the minimum price. The underwriter's elevated risk is also suggested by a significant increase in the

average rate of underwriter fees (gross spread) from 10.86% to 13.98% of the gross amount of equity raised.[10]

4.2 Testing Methodology

Initial returns net of market movement are estimated using the market model[11]

(1) $$R_{it} = R_{mt} + \varepsilon_{it}$$

where R_{it} is the gross rate of return of stock i on trading day t, R_{mt} is the concurrent rate of return of the TASE stock index, and ε_{it} is the excess rate of return, or "return" of stock i on that day. To examine the average difference between the offer price and closing market prices on subsequent trading days across N stocks, we calculate for each sample the mean return (AR) on any day t and mean cumulative return (CAR) on any day T

(2) $$AR_t = \frac{1}{N}\sum_{i=1}^{N}\varepsilon_{it}$$

(3) $$CAR_T = \frac{1}{N}\sum_{i=1}^{N}\left[\prod_{t=1}^{T}(1+\varepsilon_{it})-1\right]$$

The following tests are employed to gauge mispricing. We compare the average return under the two pricing regimes (Table 2 and 3), the effects of the two price barriers on the average returns earned by informed versus uninformed investors (Table 4), and the IPO screening quality under the two regimes (Table 5); we examine causes for the appearance and disappearance of systematic negative returns under AP (Tables 6 and Figure 1); conduct a regression analysis of IPO-specific factors affecting returns (Table 7); and reexamine the regressions for pricing accuracy and selectivity.

5. Results

5.1 Pricing Regime

In the first test, we compare initial returns under FP and AP before and after the removal of the maximum price. Table 3 reports mean daily return and cumulative return in the first 5 and 10 trading days calculated based on equations (1)-(3). Under FP, a mean market-adjusted 1-day return of 10.4% increases to 21.1% cumulative return over 10 days with over 70% of the IPOs generating positive returns; under AP, a negative 1-day return of -4.4% decreases to –0.6% cumulative return over 10 days with about 60% of the IPOs yielding negative returns. The switch from FP to AP eliminates the 21% of positive return then some. This evidence supports our hypothesis attributing the systematic positive return under FP to the binding maximum price. The emergence of systematic negative returns requires further examination.

--- Insert Table 3 ---

5.2 Returns and Price Barriers: A Closer Look

For additional comparison of initial returns under the two regimes, we hypothesize more specifically that (a) the large mean positive return under FP arises from issues offered at the binding maximum price, and (b) the disappearance of positive return under AP is caused by competitive pricing in the absence of a maximum price. We begin by separating the issues under both regimes into those facing a strong demand, which are well subscribed to and offered *above* the minimum price, versus those facing a weak demand, which are poorly subscribed to and offered *at* the minimum price. As reported in Table 2, three-fourths of the issues under FP are offered above the minimum price, all of those at the maximum price;[12] under AP, one-fourth of the issues are priced competitively above the minimum price.

Two features stand out among the results reported in Table 4. First, we note that issues offered above the minimum price display a positive 1-day return that is substantially larger (18.3%), more dispersed (16.5% SD), and more significant under FP than under AP (4.6%, 10.1% SD). Under FP, the polarity between offers made at the maximum and minimum prices results in herding and rationing at both ends, more severely at the maximum price.[13] This phenomenon is consistent with Welch's (1992) cascade hypothesis by which investor

expectations and actions converge through imitation, a phenomenon which is anticipated by the underwriter in setting the maximum price. Intuitively, an issue offered at the maximum price is over-subscribed by higher bids and lower ones that are raised to capture the underpricing gain. Rock (1986) argues that such an issue is dominated by *informed* investors. Upon publication of the auction results, over-subscription signals underpriceing, prompting a price increase which benefits better-informed winning bidders in early trading. In contrast, under AP, an offer above the minimum barrier is priced competitively; free of rationing, such an offer generates no pressure for a price increase and no systematic gain (or loss) in early trading. The last conclusion appears to be contradicted by evidence reported in Table 4 that such issues generate a moderately positive if significant initial return of 4.6%. We offer two complementary explanations for this finding. With an eye to disparity among investors, this figure may be viewed as the infra-marginal return of informed investors, those able to avoid weak issues offered at the minimum price. Since strong issues under AP are accessible to uninformed investors, theirs is the marginal return combining the same positive return with the negative return of weak issues, -7.3%, offered at the minimum price. The second explanation contrasts the demand for shares before and after the auction. The positive return of 4.6% is viewed as compensation for the special costs that must be borne by bidders mainly due to temporary uncertainty about the offer price, share allocation, and market-untested value (e.g., shares may be offered at the minimum price with a prospect of a negative return). The impact of those costs would lower the demand and clearing price in the auction, but would evaporate once the auction is over, allowing the demand and market-clearing price to rise in early trading. Under FP, this competitive mechanism would be turned off by the forced price discount.

Another prominent feature of Table 4 is the significant negative return under both regimes of issues offered at the minimum price, causing a greater loss to investors under FP, -13.9%, than under AP, -7.3. Shunned by informed investors, an offer priced at the minimum is often subject to under-subscription and, unless retracted by the issuer, forces the underwriter to purchase unsold, overpriced shares at the minimum price and hold them for a while (see Table 1). Under-subscription at the minimum price will signal to uninformed, successful bidders that the

issue is overpriced, prompting them to unload shares at a loss by depressing the price in early trading.[14] The more substantial negative return of such offers under FP does not support claims by Rock (1986) and Biais, Bossaerts, and Rochet (2002) that the price discount alleviates the winner's curse of uninformed investors. Rather, the absence of underpricing and rationing under AP affords uninformed investors a greater opportunity for gain and a better protection against loss.[15] Since informed investors may affect the choice of IPO regime, it is worth noting that the switch to AP is likely to lower the expected return of winning bidders *and* change the nature of their risk. The significant quantity (allocation) risk of bidding with herding at the maximum price is replaced by the quantity/price risk inherent to competitive pricing.[16]

Our hypotheses comparing the effects of the price constraints under the two regimes receive further support from the time-chart of 1-day returns displayed in Figure 1. With the exception of a short transition period between January and April 1994, the removal of the binding maximum price is followed by a substantial decrease in the average size and dispersion of positive returns. Consistent with the continued presence of a binding minimum price, there is no change in the pattern of negative returns. Consistent with Tables 2 and 4, the chart reveals that the fall in the unconditional mean return is caused by a fall in the conditional mean of positive-return issues and a rise in the relative frequency of negative-return issues.

--- Insert Table 4 and Figure 1 ---

5.3 Screening Poor Issues

The rise in the relative frequency of negative-return issues begs the question whether a diminished price discount under AP interferes with the selection process of companies going public, or deprives qualified companies of essential services [Biais, Bossaerts, and Rochet (2002)]. One symptom of such a failure would be an increase in the absolute value of negative returns, which are closely associated with weaker issues priced at the minimum barrier. According to Table 5, the 1-day mean of negative returns under AP, -11.23%, is smaller in absolute value than that under FP, -14.67%, although the difference in favor of AP is insignificant.[17] This piece of evidence does not support the claim that underpricing finances

unique, valuable services for the issuer, while the decrease in the mean positive return from 19.65% to 5.24% confirms the substantial cost saving of AP for strong issues.[18]

--- Insert Table 5 ---

5.4 Do Negative Returns Persist?

Next, we explore the conjecture that, unlike the FP environment, uninformed investors under AP learn to avoid the winner's curse of systematic negative returns. We propose the explanation that the average negative return under AP during 1/1994-12/1996, reported in Tables 2-3 and Figure 1, is caused by an abrupt change in the market temperature in late February 1994 from a sustained hot market to a cold one, followed by a gradual adjustment of investors to a market that warms up again. To examine these effects, we divide the 3-year AP period containing 53 IPOs into three periods: We begin by creating two nearly equal periods, 17 months with 39 IPOs followed by 19 months with 14 IPOs, and then divide the first period into two sub-periods, 3 months with 11 IPOs followed by 14 months with 28 IPOs. Of the resulting three periods, the first is the tail end of a three-year hot market and the beginning of a cold market, the second is a cold market, and the third is a warming market.

According to Table 6, the mean 1-day (10-day) return during 1/94-3/94, the initial AP period straddling a hot and cold market, is positive at 1.3% (2.7%), but insignificantly different from zero.[19] Figure 1 reveals that this transition period is marked by moderation in the absolute size of both positive and negative returns. Averaging positive and negative observations, our low positive mean is consistent with the absence of a maximum price. During the following period, 4/94-3/95, the mean return becomes significantly negative at -7.5% (-10.9%). This low rate is explained by two unrelated developments: (1) A diminishing magnitude of positive returns due to the removal of the binding maximum price, along with (2) large negative returns of IPOs following the market collapse in late February 1994. Finally, Table 6 reports that the mean return remains negative during the warming market of 4/95-12/96, but rises to -1.4% (-3.2%), a rate which is insignificantly different from zero. Consistently, Figure 1 shows that negative returns begin to decrease in absolute value and frequency at the end of 1994, eventually disappearing at the end of 1995.

Gradually diminishing negative returns under AP may be explained by a learning process of uninformed investors who were accustomed to bid indiscriminately under FP, but have a better access to strong issues under AP and a better opportunity to be selective.[20] An alternative explanation could be based on evidence provided below of a general rise in the quality of issue-specific market information as expressed by pricing selectivity and accuracy (subsections 5.6 and 5.7). Our interpretation notwithstanding, diminishing negative returns under AP and improved access of uninformed investors due to the elimination of rationing are both inconsistent with claims made by Rock (1986) and Biais, Bossaerts, and Rochet (2002) that the price discount under FP is designed to offset the systematic loss sustained by uninformed investors.

--- Insert Table 6 ---

5.5 The Cost of Going Public

We next use estimated initial returns to determine the effect of regime change on issuance cost as viewed by the company going public. Our conservative definition of cost saving under AP includes proceeds foregone under FP by the price discount, net of changes in underwriter fees, but ignores any positive effect of competition on pricing quality as measured below by increased pricing accuracy and selectivity. We begin with the entire sample, including issues offered under either regime at the minimum price and issues offered above the minimum price, under FP only at the maximum price. According to Table 6, the switch to AP causes the 1-day return to decrease by 10.4%-(-4.4%)=14.8%. After accounting for the increased rate of underwriter fees, 13.98%-10.86%=3.12% (Table 2), apparently in response to the higher frequency of issues offered at the minimum price, the estimated net cost saving is 14.8%-3.12%=11.68% (24.48%). For the latest sampling period under AP, 4/1995-12/1996, which allows a more complete market adjustment to the new regime, the 1-day net cost saving is smaller, standing at 8.68% (21.08%). (Results in parentheses are based on 10-day returns.)

To examine the change in the cost of going public in issues offered *above* the minimum price, where the price discount applies in the first place, we turn to Table 4. The switch to AP decreases the 1-day return by 18.3%-4.6%=13.7% (22.2%), or by 13.7%-3.12%=10.58% (19.08%) after netting out the increase in underwriter fees reported in Table 2. Under FP, the

gross return, 13.7% (22.2%), falls in the hands of informed investors, and up to 40% of the amount involved is collected by accredited institutional investors at their discretion. The remainder of this section examines additional benefits from the switch to AP.

5.6 Price Selectivity

We now turn to test the hypothesis that the replacement of FP by AP entices investors to seek more information before the auction and turns the offer price into an unbiased and otherwise more informative signal in subsequent trading. The counter-hypothesis by Biais, Bossaerts, and Rochet (2002) claims a benevolent collusion between the underwriter and wholesale investors aimed at using the price discount under FP to purchase valuable market information. If the latter hypothesis were correct, the switch to AP would result in less accurate and selective pricing of IPO-specific factors. The literature reports several factors that cause systematic differences between the offer price and subsequent trading price, including the firm's growth opportunities, issue size, financial leverage, and underwriter reputation and fees. Calculating a separate regression for each pricing regime, we test the effect on return of these variables alongside a dummy variable identifying under both regimes issues offered at or above the minimum price.

The results reported in Table 7 reveal under AP a 10-day return that is significantly related to four variables – inversely to the rates of underwriter fees and financial leverage, and directly to the Q-ratio and the minimum-price dummy variable, which assumes the values 0 or 1 for issues priced at or above the minimum, respectively. Under both regimes, we interpret a positive coefficient of the last variable as evidence that issues are more profitable when offered above the minimum price (under FP, at the maximum price) and dominated by informed investors. The importance of this variable is evident from its superior explanatory power, 21.0% under FP and 20.34% under AP. On the flip side, these results like those reported in Table 4 confirm the hypothesized causality running from the minimum price to negative returns prompted by the behavior of uninformed investors.

Further examination of Table 7 reveals that, compared with FP, initial returns under AP are more sensitive to our IPO-specific factors, especially the firm's growth opportunities as

measured by the Q-ratio. Only under AP this variable is significantly correlated with initial returns, explaining 10.6% of the CAR variance, consistent with the argument that competition would attach a return premium to projected growth due to greater information symmetry between insiders and outsiders. These results offer tentative evidence that the binding maximum price under FP interferes with price selectivity.

--- Insert Table 7 ---

5.7 Pricing Accuracy

Price selectivity is related to pricing errors. As the removal of the binding maximum price raises the quality of the price signal by eliminating the discount and increasing price selectivity, it should also lead to smaller idiosyncratic pricing errors as measured by unexplained, cross-sectional dispersion of initial returns. A comparison of the two pricing regimes in Figure 1 and Tables 4 and 6 confirms this by showing that AP generates a substantially smaller standard deviation of returns. Since a formal statistical comparison is prevented by the modest sample size, we offer these heuristic observations. First, the scatter diagram in Figure 1 shows that the removal of the maximum price in early 1994 is followed by a large decrease in the dispersion of *positive* returns, on top of a decrease in their average size. Second, the same diagram shows that large and widely-spread *negative* returns occur during 4/1994-2/1995, four months after the switch to AP, apparently due to an increasingly binding minimum price in the cold market that follows the crash in late February 1994 (subsection 5.4). Third, Table 4 shows that the standard deviation of 10-day returns under FP is nearly twice as large as that under AP whether issues are priced at or above the minimum. Together with the evidence reported in Table 7, these findings confirm that *both* price barriers increase price dispersion, but the effect of the maximum price is stronger, institutionally supported, and avoidable. The additional evidence that the dispersion generated by the minimum price is greater under FP suggests a synergetic adverse effect of the of two price constraints under that regime.

6. Summary and Concluding Remarks

With few recent exceptions, previous studies of the IPO price discount do not challenge the prevailing assumption of its consistency with competition. Lacking data on IPO regimes that are competitive in access and pricing, those studies cannot tell whether observed price discounts are efficient. We test and reject this hypothesis by comparing the performance of two investor-driven pricing regimes based on an auction open to the public – the first with a binding maximum price and the second without it. Our empirical analysis reveals a significantly improved performance. There is an increase in proceeds of issues priced competitively above the minimum price as measured by a significant decrease in initial returns. Investor herding and share rationing disappear with the binding maximum price that causes the price discount. The absence of a price discount and related herding causes a modest increase in underwriter risk and fees, but no apparent decrease in underwriter services.

The pricing regime change increases pricing quality in a number of ways. The elimination of the underpricing bias and attached rationing is accompanied by increased pricing accuracy and price sensitivity to individual IPO factors. This finding is inconsistent with the claim by Biais, Bossaerts, and Rochet (2002) that the price discount is a result of a benevolent collusion between the underwriter and wholesale investors aimed to promote efficiency by providing the former with valuable information.

Auction pricing on the TASE, which is free of a binding maximum price and concomitant price discount, offers uninformed investors rationing-free access to strong issues, while decreasing the absolute value of negative returns generated by weak issues. This finding is inconsistent with Rock's (1986) claim that the price discount is aimed to attract uninformed investors. Our evidence suggests that the price discount and resulting rationing largely *cause* the limited access of uninformed investors to strong issues rather than alleviate its consequences.

Loughran and Ritter (2002a) explain the price discount typical of underwriter-driven US IPOs by pitting a rational underwriter shielded from market competition against an irrational issuer. Citing prospect theory [Kahanman and Tversky (1979) and Shefrin and Statman (1984)] and issuer polling, they claim that the typical issuer of US IPOs is happy with the discount price in

view of its low expectations encouraged by the underwriter. Our evidence suggests that a rational issuer subjected to fixed pricing would be satisfied with the best price it can negotiate if that price exceeds its reservation price; but the same issuer would be happier with the higher, full price of an unconstrained auction, a price for which it need not negotiate. Overall, our evidence is inconsistent with the claim that the IPO discount common to fixed pricing everywhere is competitive or efficient. Our results beg the question how IPO regimes elsewhere remain immune from competition.

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Figure 1

Rate of Return on the First Trading Day

Individual IPOs' rate of return net of market movement, ε_{it} , is measured between the offer price and the closing price of the first trading day, $\varepsilon_{it} = R_{it} - R_{mt}$, where R_{it} is the gross rate of return of stock i on trading day t =1 and R_{mt} is the concurrent rate of return of the TASE stock index. Note that for the individual IPO there is no necessary relationship between pricing at the minimum barrier and a zero return.

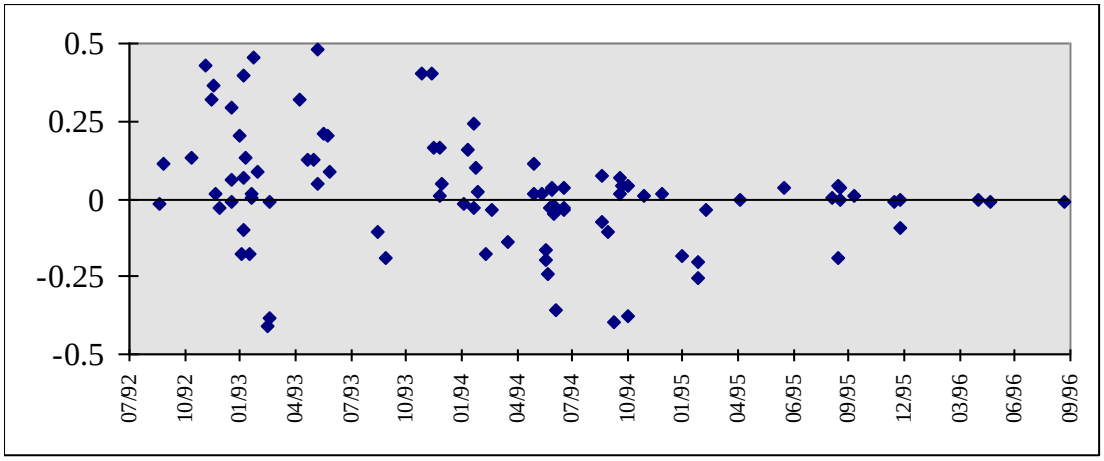

Table 1

IPO Definitions and Features on the TASE Before and after the Regime Change

Capital Requirement	The net capital requirement is 1.2 million NIS (about 3.75 NIS per US dollar) indexed to inflation.
Underwriter's Liability	The underwriter indorses the prospectus and is liable for any damage to those purchasing or selling the securities on the exchange if caused by a reasonably avoidable error or omission in the prospectus.*
Due Diligence	The underwriter's intervention is limited. Due diligence is performed by the Securities Commission and the Exchange before or concurrently with the submission of the prospectus to the ISA for approval.
Marketing	After the prospectus is approved, the security is registered for trade on the exchange. An issuer/underwriter may not solicit tentative price commitments before approval. Marketing of the issue is limited to the prospectus distribution period during the 5 days immediately following its approval.
Pricing	A nondiscriminatory price is determined by an open public tender. Until 12/1993 the issuer/underwriter stated the offer's minimum and maximum prices in the prospectus. In practice, all IPOs were priced at the maximum or minimum. Beginning in 1/1994 a maximum price was temporarily disallowed.
Public Allocation	The allocation of securities by a tender follows Exchange dispersal directives. All bids above the offer price are filled at that price. The allocation of remaining shares among bids at the offer price is prorated according to relative order size. Any set-aside for accredited institutional investors is limited to 40% of the issue and may be subject to a reduced commission. Securities left unsold at the minimum price are not destroyed but purchased by the underwriter at that price. Consummation of the IPO requires that a minimum fraction of the issued shares be purchased by bidders and dispersed among a minimum number of bidders.
Price Stabilization	Price stabilization after registration for trade is prohibited.
Beginning of Trade	Trading on the Exchange begins on the first day following the auction and security allocation.

*We ignore the risk of a legal action due to the scarcity of lawsuits charging issuers with an incomplete or misleading prospectus.

Table 2

Sample Descriptive Statistics

Notations $GR_{0,1}$, and $CGR_{0,10}$ are mean gross and cumulative gross rates of return (pricing errors), the percentage difference between a stock's offer price and the market price at the closing of the first and tenth trading days, respectively. Underwriter fee ratio is commissions and fees as reported in the prospectus divided by the amount of equity raised. The Q-ratio is the sum of equity market value and book value of long-term debt divided by book assets. The subscription rate is the aggregate demand at or above the auction price divided by the number of shares offered. The t-value pertains to the null hypothesis that the means of the two periods are insignificantly different from each other.

	Fixed Pricing	Auction Pricing	t-value
Observations	41	53	
IPOs issued at the Min Price	10	40	
Mean gross return, $GR_{0,1}$	.1074	-.0526	4.32
Mean cumulative gross return, $CGR_{0,10}$	.2278	-.1077	6.09
Mean Underwriter Fee Rate	.1086	.1398	4.56
Mean Q-ratio	2.24	2.00	.34
Mean Issue Size ($US millions)	2.99	3.84	1.35
Mean Subscription Rate	123.2	1.60	9.81

Table 3

Return and Cumulative Return Over the First 10 Trading Days

Defining $AR_t = \frac{1}{N}\sum_{i=1}^{N}\varepsilon_{it}$ and $CAR_T = \frac{1}{N}\sum_{i=1}^{N}\left[\prod_{t=1}^{T}(1+\varepsilon_{it})-1\right]$ where $\varepsilon_{it} = R_{it} - R_{mt}$ is the return on stock i (i=1, 2,...,N) net of market, R_{it} is the return on that stock, and R_{mt} is the return on the TASE stock index, and AR and CAR are the average return and average cumulative return, respectively – all through the end of trading day *t*.

Days Past Issue Date	*AR*	t-value of *AR*	*CAR*	Ratio of Positive-*CAR* IPOs
		Panel A: Fixed Pricing (N=41)		
1	.104	3.14	.104	.73
2	.006	.91	.111	.73
3	.016	2.72	.130	.71
4	.024	3.41	.160	.71
5	.015	2.17	.184	.66
10	.036	1.09	.211	.71
		Panel B: Auction Pricing (N=53)		
1	-.044	-2.52	-.044	.42
2	-.014	-2.24	-.055	.43
3	-.001	-1.29	-.063	.40
4	.003	.50	-.059	.45
5	-.003	-.55	-.062	.45
10	-.006	-.51	-.066	.34

Table 4

Average Return at or above the Minimum Price, by Pricing Regime

Mean and median AR and CAR of 1-day and 10-day trading, respectively. We test the hypothesis that the mean and median are insignificantly different from zero. An asterisk denotes rejection of this hypothesis at the 5% level. p-values of mean and median differences are based on a one-way analysis of variance and a Kruskal-Wallis test, respectively.

	Cleared at the Minimum Price				Cleared above the Minimum Price			
	N	Mean	Median	S.D.	N	Mean	Median	S.D.
				Panel A: $AR_{0,1}$				
Fixed Pricing	10	-.139*	-.104*	.153	31	.183*	.132*	.165
Auction Pricing	40	-.073*	-.026*	.122	13	.046	.036*	.101
p-value of the Difference		.144	.139			.008	.006	
				Panel B: $CAR_{0,10}$				
Fixed Pricing	10	-.051	-.135*	.309	31	.295*	.283*	.290
Auction Pricing	40	-.111*	-.085*	.160	13	.073	.046	.160
p-value of the Difference		.391	.808			.013	.007	

Table 5

Mean 1-Day Return by Sign and Pricing Regime

Testing the hypothesis that cross-regime differences in 1-day mean AR of the same sign are insignificant. p-values of mean differences are based on a one-way analysis of variance test.

	$AR_{0,1}$		
Regime	Negative	Positive	P-value
Fixed Pricing			
N	11	30	
Mean	-0.1467	0.1965	0.000
Standard Deviation	0.1416	0.1514	
Auction Pricing			
N	31	22	
Mean	-0.1123	0.0524	0.000
Standard Deviation	0.1187	0.0570	
P-value testing the Mean Difference between Fixed and Auction Pricing	0.493	0.000	

Table 6

Mean 1-Day and 10-Day Return of Selected Sampling Periods

Testing the hypothesis that overpriced auction bids resulting in investor losses were affected by the adjustment period. The 3-year period of AP is divided into three sub-periods as follows. It is first divided into two nearly equal sub-periods of 17 months and 19 months. The 17-month sub-period is further divided into two sub-periods of 3 months and 14 months. Of the three sub-periods, the first is the tail end of a three-year hot market and the beginning of a cold market, the second is a cold market, and the third is a warm market.

		$AR_{0,1}$		$CAR_{0,10}$	
	N	Mean	S.D.	Mean	S.D.
Fixed Pricing (1992-1993)	41	.104	.213	.210	.327
Auction Pricing (1994-1996)	53	-.044	.127	-.066	.177
1/94 - 3/94	11	.013	.134	.027	.188
4/94 - 3/95	28	-.075	.141	-.109	.184
4/95 - 12/96	14	-.014	.065	-.032	.127

Table 7

Effects of Pricing Regime and Firm-Specific Factors on Return: A Regression Analysis

Stepwise regression relating the 10-day *CAR* to the underwriter fee ratio, issue size, financial leverage, underwriter reputation, Q-ratio, and the minimum-price dummy variable assuming the values 0 or 1 if the issue is priced at or above the minimum, respectively. The signs "**" and "*" denote a coefficient's significant difference from zero at the 1% and 5% levels, respectively.

	Regression Analysis						
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Panel A: Fixed Pricing (N=41)						
Constant	.255	.094	.193**	.274**	.212**	.295**	.232
1- Underwriter Fee Ratio	-.410						2.458
2- Issue Size		.008					-.002
3- Financial Leverage			.131				-.057
4- Underwriter Reputation				-.111			-.169
5- Q-ratio					.003		.021
6- Min Price Dummy						.345**	.438
R^2	.001	.000	.010	.030	.000	.210	.309
	Panel B: Auction Pricing (N=53)						
Constant	.119	-1.363	.038	-.063*	-.162**	.073	.970
1- Underwriter Fee Ratio	-1.319*						-.548
2- Issue Size		.086					-.051
3- Financial Leverage			-.245*				-.100
4- Underwriter Reputation				-.004			-.059
5- Q-ratio					.047*		.001
6- Min Price Dummy						.184**	.173**
R^2	.086	.019	.079	.000	.106	.203	.252

Endnotes

[1] This amount is commonly reffered to as "money left on the table." We follow the convention of using the synonims price discount, underpricing, and initial or early return. Possible differences are discussed below.

[2] Loughran and Ritter (2002a, b) and Ritter (2003) describe noncompetitive practices limited to the US market during the 1990s. For a comprehensive survey of IPO theories, including explanations of the IPO discount, see Ritter and Welch (2002).

[3] Investor-driven FP mechanisms, which include a public auction with minimum and maximum prices, have originated outside the US and were most popular until the late 1990s. Generally, their offer price may be set before or after a public auction.

[4] Kandel, Sarig, and Wohl (1999) examine the relationship between initial returns and the auction's demand elasticity of TASE IPOs that combine stocks with other securities during the first three months of the AP regime. Although their hypotheses and data do not overlap our own, we cite their relevant results below.

[5] For lack of space, we do not contrast OPM with OPF, except for noting that the lower pricing quality of the former is suggested by the authors' regression analysis. The first-day return under OPM is less sensitive to market and firm-specific factors than under either OPF or PG. Biais and Faugeron (2002) claim that the most competitive French mechanism is bookbuilding (PG), not OPM, a view shared by Ljungqvist, Jenkinson, and Wilhelm (2003).

[6] To avoid ambiguity and unknown bias, we exclude offerings combining stock with other securities. Amihud, Hauser, and Kirsh (2003) find that the underpricing of such IPOs is more modest than that of pure stock offerings. See also Shultz (1993), Jain (1994), and Hauser and Levy (1996).

[7] See Carter and Manaster (1990) and Carter and Dark (1992).

[8] The ISA and TASE retain experts to rank all active underwriters on a scale of 1 to 4, where 1 stands for best reputation. Underwriters with an average score of 2 or less are assigned the dummy variable value 1. Scoring is based on a few parameters, including the number of issues for which the underwriter served as leader and the quality of work as reflected in prospectus preparations and interviews with the Securities Commission in charge of granting IPO permits. Scores assigned by the two experts are highly correlated.

[9] At the height of the bull market of 1993, allocations under FP averaged less then 1% of the order size. Some subscriptions priced at the maximum were over 300 times larger than the number of shares offered. Over-subscription at the maximum price was exceserbated by the rule that shares be rationed among bids *at* the offer price according to relative order size. Due to imperfect price divisibility, an auction under AP often results in over-subscription of bids submitted *at* the clearing price.

[10] Note that IPOs on the TASE are on a smaller scale than those in the US, for example, where the lower fee ratio during the same period is 7%.

[11] The assumption of beta=1 in this simplified model is commonly used in calculating initial IPO returns because of its negligible effect on the results.

[12] Rare offers were made between the maximum and minimum price barriers during a decade of infrequent FP offerings of security bundles preceding our study period.

[13] Announced before the auction, the minimum price attracts no bids at a lower price, but the combined bids may axceed the quantity of shares offered.

[14] Institutional constraints prevent informed investors from generating a systematic gain from overpriced shares offered at the minimum price.

[15] The connection between offers at the minimum price and uninformed investors, which are slow to adjust their expectations, is confirmed by additional evidence (not tabulated here) that such offers are preceded by detectable inferior growth opportunities that would selectively discourage informed bidders – a mean Q-ratio of 1.7 that is significantly lower (1% level) than the parallel ratio of 2.6 for IPOs offered above the minimum price.

[16] As an exception to the rule, accredited institutional investors on the TASE can only lose by the switch to AP since their guaranteed share allocation necessarily means a lower expected return ander AP.

[17] These results resemble Table 4 because of a high correlation between negative returns and offers pricing at the minimum barrier.

[18] Our comparison of CAR between the closing prices of trading day-10 and day-180 shows a similar negative mean return: –11.60% under FP and –12.44% under AP with an insignificant difference between the two figures (0.957 p-value).

[19] Kandel, Sarig, and Wohl (1999) estimate a higher and significant mean return of 4.7% during 12/93-2/94, a short transition period between the two pricing regimes. Their sample avoids the cold market of March 1994 and relys on data of security bundles rather than stocks (see fn. 4).

[20] Additional evidence on the connection between uninformed investors and offers that yield negative initial returns is reported in subsection 5.6 and Table 7. A detailed analysis of this issue is offered by Amihud, Hauser, and Kirsh (2003).