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Aydin Yüksel
Faculty of Business Administration, Bilkent University

Asli Yüksel
Department of Management, Ã‡ankaya University

The Link Between IPO Underpricing and Trading Volume: Evidence from the Istanbul Stock Exchange

Aydin Yüksel[*]
Faculty of Business Administration, Bilkent University

and

Asli Yüksel[**]
Department of Management, Çankaya University

Recent evidence from U.S. markets shows that IPO underpricing is associated with high liquidity for issuing firms. One explanation given for this link is that IPO firms simultaneously decide on share retention and underpricing to maximize aftermarket liquidity. We use data from the Istanbul Stock Exchange (ISE) to provide international evidence. Our results do not support the argument that IPO firms use underpricing as a tool to make up the reduction in liquidity caused by higher share retention. We report that there is an asymmetric relationship between underpricing and trading volume in the short run. However, the positive link between short term volume and long term volume, which is shown to exist in U.S. markets, is missing in the ISE. Based on the explanations in prior research, we argue that the lack of persistency in initial broad ownership and/or investor interest may be the reason for the missing link.

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[*] Aydin Yüksel was born in 1965 in Istanbul. He had his B.S. in Electrical Engineering and M.A. in Business Administration from Bogaziçi University. He received his Ph.D. in Finance at Michigan State University in 2000. He joined Bilkent University in 2000. Currently, he is an assistant professor of finance at Bilkent University. His research interests are investment and market microstructure.

[**] Asli Yüksel was born in 1973 in Ankara. She had her B.S. in management from Middle East Technical University and M.S. in Business Administration from Bilkent University. She received her Ph.D. in Finance at Bilkent University in 2002. She was a research assistant in Bilkent University between 1996 and 2001. She joined Cankaya University in 2001. Currently, she is an assistant professor of finance at Cankaya University. Her research interests are investment and market microstructure.

Many papers examining IPO allocations focus on the distinction between institutional and individual investors. Booth and Chua (1996), Mello and Parsons (1998), and Stoughton and Zechner (1998) all emphasize that underpricing leads to oversubscription to the issue and thus gives issuers and underwriters discretion with regard to whom to allocate shares. Giving priority to either investor type has its own benefits on the value of IPO firm and hence on the wealth of pre-IPO shareholders. The latter two papers argue that share allocation will be biased towards institutional investors for the purpose of establishing block ownership. Booth and Chua (1996), on the other hand, defend the opposite view. They argue that issuers like the increased liquidity associated with permanently higher aftermarket trading caused by broad ownership.

The early work on IPO underpricing has noted a link between underpricing and trading volume long ago while examining other aspects of IPOs. In most cases, however, the evidence is for the first week after the IPO. Regarding the trading activity, the first few weeks after an IPO are atypical. For example, a temporarily high trading activity is observed during this period for all IPOs regardless if they are underpriced or overpriced. Analogously, the observed positive relationship between underpricing and trading volume may also be a temporary phenomenon. But unless the higher trading volume associated with higher underpricing is persistent as it is assumed in Booth and Chua (1996), it is not clear how the issuing firm benefits from underpricing.

Two recent papers focus on the relationship between underpricing and both short-term and long-term trading volume. In Zheng et al. (2005), underpricing is used by the issuing firm as a tool, similar to that in Booth and Chua (1996), to maximize the aftermarket liquidity of its stock through broad ownership. In Reese (2003), the way underwriters make their price and share allocation decisions leads to underpricing if there is high initial investor interest for the IPO. Their common dependence on investor interest results in a positive relation between underpricing and trading volume. Although they explain it differently, both papers find a significant positive relationship between underpricing and liquidity associated with permanently higher trading in U.S. markets.

The purpose of our paper is to provide international evidence on the question whether underpricing provides a more liquid aftermarket for IPOs by using data from an emerging market, the Istanbul Stock Exchange (ISE). Specifically, the following two hypotheses are tested: (1) Share retention is positively related to IPO underpricing. (2) Underpricing is associated with higher trading volume in both the short-run and the long-run. As Bekaert and Harvey (2002) discuss, a major contribution of emerging market research is its provision of different institutional, legal and regulatory environments to challenge existing models.

We report that there is no significant relation between share retention and underpricing. It appears that Turkish IPO firms do not use underpricing as a tool to make up the reduction in liquidity caused by higher share retention. Moreover, we do not find a statistically significant relation between initial return and volume, if we assume a symmetric relation. Once we allow for an asymmetric relationship, however, we observe that overpricing is negatively related to trading volume in the short-run. The magnitude of initial return is not related to trading volume once underpricing is positive. The initial return-trading volume relationship disappears in the long-run.

The remainder of the paper is organized as follows. The next section reviews the related literature. The third section introduces the ISE and presents the data. The fourth section analyzes the relationship between share retention rate, IPO underpricing and trading volume. The last section provides the concluding remarks.

I. Literature Review

Several empirical papers in the IPO literature have noted a positive relationship between initial volume and underpricing. For instance, Miller and Reilly (1987) link underpricing to ex ante uncertainty. They observe a positive underpricing-volume relation over the first five days of trading which is consistent with explaining underpricing by uncertainty. If the underpriced issues tend to be those with the greatest uncertainty, then they should display greater trading volume, assuming that volume is a proxy for the extent to which investors disagree about the value of a security. Furthermore, Schultz and Zaman (1994) examine quotes and transactions during the first three days of trading to find evidence regarding underwriter support to IPOs in the aftermarket. Although trading volume measured over 10-minute intervals on the first day of trading is heavy for both underpriced and overpriced IPOs, it is consistently higher for the former group. They attribute the difference in trading volume to the selling of short-term traders.

Hanley (1993) and Krigman et al. (1999) make similar observations. Hanley (1993) examines the relation between offer price revisions and both revisions in the number of shares issued and the extent of underpricing. He reports that turnover on the first day of trading is higher for issues whose offer prices exceed the offer range than that for issues whose final offer prices are within/below the offer range. Furthermore, this relation holds for up to two years into the future. Although this observation implies that more underpricing is associated with permanently higher level of liquidity, no explanation is given in the paper. Krigman et al. (1999) examine whether the extent of flipping on the first day is related to long-term (1-year) performance of an IPO. By sorting sample IPOs into four groups based on initial returns, they report that turnover is positively related to underpricing on all days during the first week of trading.

There are three popular explanations for the relationship between underpricing and short- and/or long-term trading volume. First, underpricing is used by underwriters as a tool to achieve high short-term trading volume. Underwriters have an incentive to underprice since high trading activity leads to higher trading profits for them in the aftermarket. Second, underpricing is a tool used by underwriters not to achieve high short-term trading volume but to reward regular investors for truthfully revealing their information. Underwriters' price and allocation decisions lead to a positive relationship between underpricing and trading volume. Finally, underpricing is a tool used by the issuing firm to achieve higher long-term trading volume (permanent liquidity).

Based on the first explanation, underwriters have incentive to use underpricing and discretion on the allocation of shares as a tool to achieve high initial aftermarket trading volume. Boehmer and Fishe (2001) argue that an active aftermarket benefits underwriters through increased brokerage commissions and trading profits. Underpricing causes trading, since shares are sold in the aftermarket to those who have higher valuations, but were rationed during the primary allocation.[1] They develop a model in which underwriters face a tradeoff between underwriting fees, which increase with the offer price, and aftermarket trading profits, which decrease with the offer price. Their empirical analysis shows a significant positive relationship between the underwriters's trading revenues and both initial returns and the fraction of shares flipped. Ellis et al. (2000) examine trading activity of lead underwriter in the

[1] In addition, Boehmer and Fishe (2001) assume that underwriters also increase trading by placing some shares with investors, who will subsequently sell (flip) these in the aftermarket.

IPO aftermarket. Consistent with Boehmer and Fishe (2001), they find a significant link between underwriter's trading profits and IPO underpricing.

Based on the second explanation, higher liquidity is not a goal but a by-product as it is argued by Reese (2003). The reasoning relies on the book-building model of Benveniste and Spindt (1989). In their model, underwriters of initial public offerings use pricing and allocation rules to give regular investors incentive to truthfully reveal their demand. When the revealed demand is higher than expected, the underwriter partially adjusts the offer price upward. Moreover, truth-telling investors are given priority in share allocation. This way, offer price is revised in the right direction without decreasing the total reward for truth-telling. In the model, underpricing will occur when demand exceeds the issue size leading to oversubscription. Thus, underpricing is directly related to the level of interest in the premarket.

Reese (2003) argues that initial trading volume is directly related to the level of interest in the premarket. This common dependence results in a positive relationship between underpricing and initial trading volume. Reese (2003) assumes that high initial interest, high underpricing, and high initial trading volume together leads to both the generation of additional information, through increased analyst following, and reduced transactions costs. All of these result in high long-term trading volume.

Based on the third explanation, issuing firms have incentive to use underpricing as a tool to achieve a permanently higher level of liquidity. Booth and Chua (1996) assume that underpricing, providing compensation for investor-borne information costs, leads to oversubscription to an IPO. In this case, the issuer uses its discretion in allocating shares to create a broad initial ownership. Ownership dispersion increases secondary market liquidity, which in turn reduces the required return to investors and leads to a higher firm value. The empirical evidence in Booth and Chua (1996) indicates that underpricing is a positive function of proxies for information costs. This finding gives indirect support to the hypothesis that the demand for ownership dispersion affects IPO underpricing.

A second paper that uses a similar line of reasoning is Zheng et al. (2005). It assumes that when preparing for an IPO firms simultaneously and optimally decide on the extent of underpricing, share retention and the inclusion of a lockup provision to maximize the liquidity of the stock. In effect, the paper considers the resulting tradeoff once the Booth and Chua (1996) model is combined with the Leland and Pyle (1977) signaling model. Zheng et al. (2005) points out two channels through which share retention has a negative impact on liquidity. First, as pre-IPO owners retain more shares, fewer shares will be floating in the aftermarket. This leads to a lower trading volume, ceteris paribus. Second, when more shares are retained, outside investors are more likely to trade with pre-IPO owners, who usually have an informational advantage over them. This reduces outside investors' trading interest and leads to lower liquidity.

In Zheng et al. (2005), pre-IPO owners use underpricing to increase liquidity through broad ownership as in Booth and Chua (1996). They discuss two reasons for why higher share retention is associated with more use of underpricing. First, as more shares are retained underpricing becomes less costly. The reason is that, keeping percentage underpricing constant, the total dollar amount left on the table gets smaller with share retention. Second, with more shares retained, the future price of the shares in the aftermarket becomes more important for the pre-IPO owners and therefore higher liquidity becomes more valuable.

II. Data

Reestablished in December 1985, the ISE is the only stock exchange in Turkey. It is a rapidly growing market, as evinced by the number of companies traded, which grew from 80 in 1986 to 288 in 2002, the last year in our sample. Over the same period, the total market capitalization of traded firms increased from $938 million to $34,402 million, while annual total trading volume leaped from $13 million to $70,756 million.

An IPO offering requires approvals from both the Capital Market Board (CMB) and the ISE. The requirements include that IPO firms should have positive profits during the two years prior to the IPO, they should comply with disclosure requirements, and the offer rate should exceed a lower limit dictated by the CMB rules. The lower limit is a negative step function of firm's market capitalization.[2]

Our sample period covers 13 years, from January 1, 1990 (the earliest year for which IPO characteristics data are available) through December 31, 2002 (thereby permitting at least three years of post-IPO trading for all stocks in the sample). Price and volume data are collected from Datastream, and IPO characteristics are obtained from the web page of the ISE. Issues that have considerable missing values in Datastream are excluded. This was the case for several stocks. For many IPOs, volume data in the first few weeks are missing in Datastream. Missing values in these cases are filled using weekly bulletins of the ISE. During the sample period there were 298 IPOs in the Istanbul Stock Exchange. The final sample in this paper consists of 181 IPOs for which we have complete data.

Table I shows IPO activity over the sample period with some selected characteristics. One can make several observations from the table. One observation is that IPO activity shows considerable time variation. Based on the number of IPOs and total proceeds, 2000 is the most active year. The sharp decline in IPO activity after the most active year reflects the economic crisis that began in February 2001 and became one of the largest crises since modern Turkey was established in 1923.[3] Another observation is that some of the IPOs in the initial years were those of state owned enterprises (privatizations). The table also indicates that during the initial years most of the IPOs were the sale of existing shares (secondary) by pre-IPO shareholders. Over time, the fraction of IPOs in which primary shares are offered has increased. Finally, time variation in average underpricing is evident. 1990 and 1995 are years with the largest underpricing, and the post-crisis year, 2002, is the only year when average underpricing is negative. The negative underpricing in 2002 probably reflects the effect of low demand (Benveniste and Spindt (1989)) after the start of the crisis.[4]

In our analysis, we examine the relation between share retention, initial return, and trading volume. Share retention is the difference between number of shares outstanding after the IPO and number of shares offered scaled by number of shares outstanding after the IPO. Initial return is defined as the relative price change from the offering price to the market price at the end of the first day of trading adjusted by the market return on the first day. Trading

[2] At the end of 2002, the step function rule was as follows: For firms with a market capitalization up to TL 750 billion, the minimum limit is 15%, between TL 750 billion and TL1,500 billion, the minimum limit is 10%, more than TL1,500 billion, the minimum limit is 5%.

[3] The combined effect of high real interest rates, a large devaluation, the huge fiscal cost of bank restructuring and deep recession caused the stock of public debt to rise significantly from 58 percent of GNP at the end of 2000 to 95 percent of GNP by the end of 2001.

[4] We repeated our analyses by excluding post-crisis IPOs from the sample. The reported findings are robust to the shortening of the sample period.

activity is measured by turnover, which is defined as daily trading volume scaled by the number of shares outstanding.

Our regressions include several control variables, which others have found to be significant explainers of IPO initial returns. Beatty and Ritter (1986), Ritter (1984), and Rock (1986) explain underpricing based on information asymmetry among traders. Underpricing is greatest for those issues that are subject to the greatest ex ante uncertainty. We use firm size, gross proceeds from the offering, and age of the firm as proxies for ex ante uncertainty. Since large firms have less uncertainty than smaller firms, we expect a negative relationship between underpricing and firm size (Ritter (1991)). *Size* is measured as the natural logarithm of the dollar value of total market capitalization at offer price. Furthermore, since larger issues are generally easier to value, we expect that the relationship between underpricing and gross proceeds from the offering is negative (Booth and Chua (1996)). *Proceeds* is the natural logarithm of the dollar value of gross proceeds. Finally, investors have more information about older firms than younger ones. Since uncertainty for older firms is lower, a lower level of underpricing is expected for older firms. *Age* is the difference between the year of the IPO and the year of foundation.

In addition to the three measures of ex ante uncertainty, the following control variables are used in the analysis. These are market return (*Mret*) and market volatility (*Mvol*) before the IPO date, and three IPO characteristics, namely the offering of shares by state owned enterprises (*Privat*), the sale of newly issued shares (*Primary*), and the existence of information asymmetry between the issuing firm and its underwriter (*Selfoff*).[5] Hanley (1993) finds a positive relation between initial return and market index return before the initial public offering. *Mret* is defined as the percentage change in Datastream's Turkish Market daily index over the 40-day period preceding the initial trading day.

When the stock market return is volatile, the firm may increase underpricing to reduce the probability of unsuccessful offer (Paudyal, Saaddouni and Briston (1998)). *Mvol* is calculated as the standard deviation of daily returns of Datastream's Turkish stock market index over the 40-day period preceding the initial trading day.

During the first few years in the sample period several state owned enterprises used IPOs as first step in their privatization. Assuming that these firms will be managed more efficiently once they become public, this may imply less underpricing for them (Kiymaz (2000)). *Privat* is a dummy variable taking a value of one if the IPO is a privatization, and zero otherwise.

An IPO can be the offering of newly issued (primary) shares, the sale of shares (secondary) by pre-IPO shareholders or a combination of these (Zheng et al. (2005)). *Primary* is a dummy variable taking a value of one if the IPO includes the sale of primary shares, and zero otherwise.

It is possible that there is information asymmetry between the firm and its underwriter regarding the demand for the IPO shares (Baron (1982) and Aktas et al. (2003)). This is likely to affect the level of underpricing. However, if the issuing firm and its underwriter belong to the same group or family the information asymmetry will disappear. *Selfoff* is a dummy variable taking a value of one if this is the case, and zero otherwise.

Table II shows descriptive statistics for the variables used in this study. Mean (median) value of market adjusted initial return is 12.4% (7.5%). Minimum and maximum values are -

[5] We also used sector dummies as control variables. Firms are classified into three groups based on their sector. These are industrials, financial, and others.

29.7% and 230%, respectively. Mean (median) value of share retention rate equals 76.4% (83.3%). Most of the listed Turkish firms are controlled by families, as in Italy and some other countries. Their unwillingness to share control of these companies is likely a reason for the relatively high share retention. Rows 3-6 report the distribution of time-series averages of daily turnover measured over different time intervals. Consistent with U.S. findings, turnover is remarkably high during the first few weeks; thereafter it quickly falls to equilibrium levels. Mean and median values for firm size (gross proceeds) are $217 million ($28 million) and $48 million ($8 million), respectively. There is a huge difference between the maximum and minimum values for both firm size and gross proceeds. Both measures of central tendency are positive for market return during the 40-day period prior the IPO date. Finally, for the average firm in the sample it took 17 years after its foundation to get the listing at the exchange.

Table III shows the correlation matrix for the explanatory variables. Firm size is highly correlated with both share retention (0.54) and gross proceeds (0.92). As firm size grows a smaller fraction of the firm is offered in the IPO. Recall that the rules of the CMB dictate a lower limit for the offer rate, which is a negative function of firm size. The negative sample correlation between firm size and offer rate may just be a reflection of this rule. As Table II shows, the variability of firm size is much higher than that of share retention (coefficients of variation are 5.90 and 0.24, respectively). Since gross proceeds is defined as the product of firm size and shares offered, most of the variability of gross proceeds comes from that of firm size.

III. Empirical Analysis

Our first hypothesis is that share retention is positively related to IPO underpricing. It is informative to examine the bivariate relationship first. For that purpose, IPOs are classified into five groups based on their share retention. Since the distribution of share retention is not uniform, these groups contain unequal number of stocks. The group with the lowest share retention, group 1 contains 22 IPOs, while groups 2-5 contain 34, 41, 56, and 28 IPOs, respectively.

Figure 1 shows mean and median initial return for each share retention group. A u-shaped relation is observed between share retention and underpricing. Moreover, underpricing is larger for firms with the lowest retention rate than those with the highest share retention. This is inconsistent with the reasoning in Zheng et al. (2005), which argues that issuers use underpricing to neutralize the negative effect of share retention on aftermarket liquidity.

To formally test this hypothesis we estimate:

$$IR_i = \alpha_0 + \alpha_1 Retention_i + Z_i'\theta + \varepsilon_i \,, \qquad (1)$$

where the dependent variable is the market-adjusted initial return. *Retention* is fraction of shares retained, and Z refers to a vector of control variables affecting initial return.

The regression results using White (1980) heteroskedasticity-consistent t-statistics are presented in Table IV. In model 1, the coefficient of share retention is not significant and supports the bivariate relation shown in Figure 1.[6] This means that Zheng et al. (2005) explanation that higher the share retention calls for more underpricing to maximize liquidity is not supported by the Turkish data.

[6] Over the sample period 1990-1996, Kiymaz (2000) also reports no significant relation between share retention and underpricing.

As expected, several control variables have significant coefficient estimates. In model 1, size and prior market return are both significant and have the predicted sign. Models 2 and 3 use different combinations of explanatory variables. In addition to prior market return, size, gross proceeds, and privatization are statistically significant in at least one model. Both size and gross proceeds are proxies for ex ante uncertainty and their coefficients have the predicted negative sign. Moreover, a rising market increases the extent of underpricing consistent with the finding in Hanley (1993). The negative coefficient on the privatization dummy indicates that less underpricing is observed for firms that sell shares to public as a first step in privatization. Overall, these results are consistent with prior research on IPO underpricing in the ISE (Kiymaz (2000) and Aktas et al. (2003)).

The lack of support for the first hypothesis only indicates that the assumption in Zheng et al. (2005) that issuers simultaneously decide on share retention and underpricing is not true for the Turkish IPOs. It does not imply the absence of a relationship between underpricing and trading volume. Neither Booth and Chua (1996) nor Reese (2003) assigns a role to share retention in explaining the link between underpricing and liquidity.

Before testing the second hypothesis, it may be informative to examine the time-series behavior of trading volume. Since trading volume is a relatively volatile measure, weekly averages of daily turnover are formed for each firm. Sample IPOs are divided into two groups based on the sign of initial returns. Figure 2 presents the time-series behavior of weekly averages of daily turnover for these two groups over a period of 156 weeks. Consistent with prior research, turnover is very high for both groups during the initial weeks. Until about week 40, underpriced group has notably higher turnover than the overpriced group. Thereafter, the difference becomes very small although the underpriced group continues to display a higher turnover.

To formally test the second hypothesis that underpricing is associated with higher trading volume in both the short-run and the long-run, we estimate:

$$TO_i = \alpha_0 + \alpha_1 IR + \alpha_2 Retention_i + Z_i'\theta + \varepsilon_i \ , \qquad (2)$$

where the dependent variable is average daily turnover calculated over four different time periods: 1) The five-week period after the IPO, 2) The remaining 47 weeks during the first year, 3) the second year after the IPO, 4) the third year after the IPO. *IR* is the market-adjusted initial return, *Retention* is fraction of shares retained, and Z is a vector of control variables affecting initial return.

As in the regression to explain market-adjusted initial return, we use different combinations of explanatory variables. Because of multicollinearity (see Table III) we avoid using *size* and *retention* (gross proceeds) in the same model. However, it is clear that in a cross-sectional regression we need to control for the negative effect of share retention on volume. As a compromise, we define a second measure of turnover as the ratio of trading volume to the number of shares offered. We use the first measure of turnover whenever share retention is one of the explanatory variables and use the second measure otherwise.

The results (not reported) indicate no significant relation between underpricing and turnover. This is rather unexpected given the difference in turnover, especially during the first year, between underpriced and overpriced IPOs as shown in Figure 2. To explore this, we reexamined the time-series behavior of trading volume this time by classifying IPOs into three groups as overpriced, mildly underpriced, and heavily underpriced. The resulting graph (not

reported) indicates that the turnover of the overpriced group quickly falls to its equilibrium level by the end of third week. For the other two groups, it takes most of the initial year for turnover to settle down to its equilibrium level. Moreover, the mildly and heavily underpriced groups display a remarkably similar pattern. This behavior suggests that the relation between underpricing and trading volume may be asymmetric.

The second hypothesis is tested again using the following empirical model that allows for asymmetry:

$$TO_i = \alpha_0 + \alpha_1 |IR|_i + \alpha_2 |IR|_i \cdot D_{neg} + \alpha_3 Retention_i + Z_i'\theta + \varepsilon_i \ , \qquad (3)$$

where all the variables are same as those in equation (2) with one exception. Instead of using initial return as an explanatory variable, we use two terms that depend on it. $|IR|$ is absolute value of initial return; and D_{neg} is a dummy variable that takes the value of one when initial return is negative, and zero otherwise. This specification allows the underpricing-turnover relation to be different for positive and nonpositive initial returns. α_1 shows the coefficient on initial return for underpriced issues, while the sum of α_1 and α_2 indicates the coefficient on initial return for overpriced issues.

To examine the relation between underpricing and short term turnover we estimate the empirical model twice: (1) using average daily turnover calculated over the first five weeks after the IPO as the dependent variable, and (2) using average daily turnover over the rest of the first year.[7] Table V presents the results. Considering first five weeks, all the models indicate that overpricing is negatively related to trading volume in the short run. The magnitude of initial return has no relation to trading volume once underpricing is positive. In model 1, where the initial definition of turnover is used, share retention has significantly negative coefficient. In model 2 (3), where the second measure of turnover is used, there is a significant negative relation between firm size (gross proceeds) and turnover. All three models show that those IPOs in which primary shares are sold have significantly higher turnover. Finally, IPOs that were made under the privatization plan have significantly lower turnover.

When average daily turnover over the rest of the first year is used, the strength of the asymmetric relation becomes weaker. Overpricing is negatively related to trading volume, only in model 1. When we repeat the analysis by using the average daily turnover calculated over the entire first year (results not reported) the asymmetric relation holds in all the three models. To sum up, the evidence in Table V indicates that there is an unusual positive relationship between initial return and short-term turnover.

We now test if the observed asymmetric relation also holds for long-term turnover. Table VI presents the results when average daily turnover over the second (third) year is used as the dependent variable in the same empirical model. For both periods, initial return is not significant in any of the three specifications. This means that the asymmetric relation that exists during the first year disappears in the long run. The same set of control variables that were significant in the short run regressions, namely share retention, size, gross proceeds, and the primary dummy, are also significant and have the same sign in the long run regressions.

It is interesting to interpret the significant coefficients on control variables in turnover regressions. Size and, whenever it is absent, gross proceeds almost always have significant negative coefficients both in the short term and long term. It is reasonable to expect that the

[7] Because the initial few weeks after IPO usually are atypical, we treat the first five weeks separately.

visibility of a firm increases with its size. Based on Merton (1987), which argues that investors only trade in securities they have heard about, we would expect a positive relationship. Since these are proxies for uncertainty, this finding indicates the higher uncertainty the higher is turnover. Assuming that proceeds from the issuance of new shares is used in financing real investments, uncertainty about these new investments is likely to increase uncertainty about the firm value. The significant positive coefficient on PRIMARY dummy indicates again that the higher uncertainty the higher is turnover. To sum up, it appears that uncertainty is associated with higher trading volume both in the short term and in the long term.

IV. Conclusions

Our examination of the relationship between initial return, share retention and trading volume using data on the Turkish IPOs reveals the following: First, there is no significant relation between share retention and underpricing. Firms do not use underpricing as a tool to make up the reduction in liquidity caused by higher share retention. Thus, our data do not support the explanation given in Zheng et al. (2005).

Second, we find a significant positive relationship between underpricing and trading volume in the short-term. However, unlike the U.S. evidence, this relationship is an asymmetric one. We show that for overpriced issues the magnitude of initial return is negatively related to trading volume. For underpriced issues, on the other hand, there is no significant relation between the magnitude of initial return and trading volume. It appears that investors react negatively to overpriced issues, affecting trading volume for at least a year.

Third, we report that a positive link between short-term volume and long-term volume is missing in the Turkish market. In other words, underpricing and trading volume are not related in the long-term. Based on the reasoning by Booth and Chua (1996) and Reese (2003), which explains why there should be such a link, one may argue that the lack of persistency in initial broad ownership and/or investor interest may be the reason for the missing link.

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Table I
IPO Activity and Selected Sample Characteristics

Year	Number of IPO	*Initial Return*	*Total Proceeds*	*Primary Shares*	*Privatization*	*Selfoffer*
1990	20	30.03%	966,263,680	2	3	8
1991	12	4.59%	126,844,920	2	6	3
1992	8	4.35%	72,804,736	2	0	1
1993	11	12.33%	121,493,691	2	2	3
1994	15	9.13%	183,274,155	5	0	4
1995	19	27.17%	158,596,002	13	0	4
1996	20	11.69%	131,678,540	11	0	8
1997	19	3.82%	348,614,888	14	0	8
1998	17	8.43%	354,954,509	16	0	8
1999	9	15.05%	89,398,467	6	0	6
2000	27	7.65%	2,540,963,277	22	0	7
2001	1	0.72%	237,367	0	0	1
2002	3	-7.24%	53,350,533	1	0	1

Initial Return is the average of market adjusted initial returns. *Total Proceeds* shows the total dollar value of gross proceeds. *Primary* Shares gives the frequency of IPOs which includes the sale of newly issued shares. *Privatization* is the frequency of IPOs in which shares of state owned enterprises are offered, and *Selfoffer* indicates the frequency of IPOs in which the issuing firm and its underwriter belong to the same group or family

Table II
Descriptive Statistics

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
IR	0.124	0.075	2.305	-0.297	0.257	4.555	34.353
Retention	0.764	0.833	0.975	0.040	0.180	-2.159	7.871
Turnover Weeks 1-5	28.597	10.417	687.849	0.051	67.653	6.350	54.672
Turnover Weeks 6-52	16.126	9.929	485.007	0.037	37.537	10.921	136.119
Turnover Year 2	14.734	9.397	97.821	0.047	16.619	2.081	7.962
Turnover Year 3	14.073	7.518	113.411	0.069	17.821	2.870	13.390
Size ($ 1,000s)	217,000	47,745	16,900,000	242	1,280,000	12.437	162.296
Proceeds ($ 1,000s)	28,445	7,635	1,770,000	148	135,000	12.016	154.443
Age	17.622	16.000	73.000	0.000	13.950	0.875	3.698
Mret	0.133	0.047	1.467	-0.425	0.310	1.879	7.937
Mvol	0.028	0.027	0.059	0.012	0.009	0.793	3.943

IR is market adjusted initial return. *Retention* refers to the fraction of shares retained. *Turnover Weeks* i-j refers to the average daily volume between weeks i and j multiplied by 1,000 and scaled by the number of shares outstanding. *Turnover Year i* shows the average daily volume during year i multiplied by 1,000 and scaled by the number of shares outstanding. *Size* is measured as the dollar value of total market capitalization at offer price. *Proceeds* is defined as the dollar value of gross proceeds. *Age* is the difference between the year of the IPO and the year of foundation. *Mret* is defined as the percentage change in Datastream's Turkish Market daily index over the 40-day period prior to the initial trading day. *Mvol* is calculated as the standard deviation of daily returns of Datastream's Turkish stock market index over the 40-day period preceding the initial trading day.

Table III
Correlation Matrix

	IR	*Retention*	*Size*	*Proceeds*	*Age*	*Mret*	*Mvol*	*Primary*	*Privat*
IR									
Retention	-0.063								
Size	-0.179	0.544							
Proceeds	-0.179	0.221	0.923						
Age	-0.012	0.378	0.292	0.183					
Mret	0.440	-0.046	-0.098	-0.085	-0.066				
Mvol	-0.001	0.042	0.013	0.013	-0.011	-0.032			
Primary	-0.114	-0.047	-0.043	-0.004	-0.160	0.002	0.114		
Privat	-0.102	0.048	0.163	0.124	0.215	-0.084	-0.086	-0.270	
Selfoff	0.082	-0.202	-0.025	0.037	-0.084	0.007	0.120	-0.181	-0.136

IR is market adjusted initial return. *Retention* refers to the fraction of shares retained. *Size* is measured as the natural logarithm of the dollar value of total market capitalization at offer price. *Proceeds* is the natural logarithm of the dollar value of gross proceeds. *Age* is the difference between the year of the IPO and the year of foundation. *Mret* is defined as the percentage change in Datastream's Turkish Market daily index over the 40-day period prior to the initial trading day. *Mvol* is calculated as the standard deviation of daily returns of Datastream's Turkish stock market index over the 40-day period prior to the initial trading day. *Primary* is a dummy variable taking a value of one if the IPO includes the sale of primary shares, and zero otherwise. *Privat* is a dummy variable taking a value of one if the IPO is a privatization, and zero otherwise. *Selfoff* is a dummy variable taking a value of one if the IPO is a self-offered IPO, and zero otherwise.

Table IV
Relation between Share Retention and Underpricing

	Model1	Model2	Model3
Intercept	0.536	0.505	0.518
	(2.24) [b]	(2.38) [b]	(2.24) [b]
Retention	-0.060		
	(0.44)		
Size		-0.024	
		(2.32) [b]	
Proceeds	-0.026		-0.026
	(1.94) [a]		(2.05) [b]
Age	0.000		0.001
	(0.35)		(0.50)
Mret	0.358	0.355	0.354
	(2.64) [c]	(2.60) [b]	(2.61) [c]
Mvol	0.805	0.854	0.555
	(0.58)	(0.60)	(0.37)
Primary	-0.054	-0.056	-0.064
	(1.46)	(1.58)	(1.65)
Privat			-0.097
			(1.97) [a]
Selfoff	0.055	0.055	0.049
	(1.28)	(1.31)	(1.16)
Dfin	-0.053	-0.062	-0.058
	(0.86)	(1.07)	(1.01)
Dind	-0.006	-0.009	-0.019
	(0.13)	(0.22)	(0.46)
R-sq.	0.237	0.234	0.243
Adj. R-sq.	0.197	0.203	0.203
F-statistic	5.875	7.534	6.055
p-value	0.000	0.000	0.000

The dependent variable is market adjusted initial return (*IR)*. *Retention* refers to fraction of shares retained. *Size* is measured as the natural logarithm of the dollar value of total market capitalization at offer price. Proceeds is the natural logarithm of the dollar value of gross proceeds. *Age* is the difference between the year of the IPO and the year of foundation. *Mret* is defined as the percentage change in Datastream's Turkish Market daily index over the 40-day period prior to the initial trading day. *Mvol* is calculated as the standard deviation of daily returns of Datastream's Turkish stock market index over the 40-day period prior to the initial trading day. *Primary* is a dummy variable taking a value of one if the IPO includes the sale of primary shares, and zero otherwise. *Privat* is a dummy variable taking a value of one if the IPO is a privatization, and zero otherwise. *Selfoff* is a dummy variable taking a value of one if the IPO is a self-offered IPO and zero otherwise. *Dfin* is a dummy variable which is equal to one if the offering is made by a financial firm, and zero otherwise. *Dind* is a dummy variable taking the value of one if the offering is made by an industrial firm, and zero otherwise. In parentheses are the t-statistics using White (1980) heteroskedasticity-consistent standard errors. a,b,c show statistical significance at 10%, 5% and 1% level, respectively.

Table V
Relation between Underpricing and Short-term Turnover

	Turnover Weeks 1-5			*Turnover Weeks 6-52*		
	Model1	Model2	Model3	Model1	Model2	Model3
Intercept	0.200	-0.385	-0.134	0.042	-0.591	-0.140
	(0.13)	(0.29)	(0.09)	(0.03)	(0.51)	(0.11)
$\|IR\|$	0.249	0.341	0.272	-0.498	-0.356	-0.438
	(0.43)	(0.57)	(0.46)	(1.10)	(0.70)	(0.90)
$\|IR\| D_{Neg}$	-7.468	-6.489	-6.402	-3.652	-2.189	-2.610
	(2.97) [c]	(2.87) [c]	(2.94) [c]	(1.84) [a]	(1.19)	(1.46)
Retention	-3.330			-2.817		
	(5.16) [c]			(3.98) [c]		
Size		-0.145			-0.167	
		(2.20) [b]			(2.64) [c]	
Proceeds	-0.138		-0.161	-0.187		-0.206
	(1.65)		(2.04) [b]	(2.37) [b]		(2.85) [c]
Age	-0.003		0.000	-0.008		-0.004
	(0.34)		(0.01)	(0.87)		(0.54)
Mret	0.265	0.241	0.229	0.380	0.355	0.358
	(0.81)	(0.77)	(0.71)	(1.20)	(1.17)	(1.17)
Mvol	12.587	10.000	8.619	9.467	7.708	7.207
	(0.90)	(0.72)	(0.62)	(0.81)	(0.72)	(0.66)
Primary	1.265	1.178	1.108	1.081	1.004	0.980
	(5.33) [c]	(5.26) [c]	(4.50) [c]	(5.14) [c]	(4.95) [c]	(4.46) [c]
Privat			-0.704			-0.184
			(1.76) [a]			(0.41)
Selfoff	0.292	0.262	0.233	0.149	0.106	0.117
	(1.34)	(1.31)	(1.12)	(0.75)	(0.55)	(0.61)
Dfin	-1.726	-1.576	-1.656	-0.983	-0.916	-0.906
	(4.74) [c]	(4.89) [c]	(5.26) [c]	(3.05) [c]	(3.23) [c]	(3.40) [c]
Dind	-1.368	-1.302	-1.414	-0.439	-0.417	-0.411
	(3.72) [c]	(4.45) [c]	(4.59) [c]	(1.43)	(1.78) [a]	(1.57)
R-sq.	0.355	0.243	0.250	0.340	0.220	0.230
Adj. R-sq.	0.313	0.203	0.201	0.296	0.179	0.180
F-statistic	8.409	6.083	5.089	7.854	5.370	4.565
p-value	0.000	0.000	0.000	0.000	0.000	0.000
Negative	7.677	6.784	7.270	4.031	1.728	2.658
p-value	0.006	0.010	0.008	0.046	0.190	0.105

Table V
Notes

In Model 1 the dependent variable is the average daily volume between week i and j scaled by the number of shares outstanding. In Model 2 and Model 3, the dependent variable is the average daily volume between week i and j scaled by the number of shares offered in the IPO. I*IR*I is the absolute value of market adjusted initial return. D_{Neg} is a dummy variable which is equal to one if *IR* is negative, and zero otherwise. *Retention* refers to the fraction of shares retained. *Size* is measured as the natural logarithm of the dollar value of total market capitalization at offer price. *Proceeds* is defined as the natural logarithm of the dollar value of gross proceeds. *Age* is the difference between the year of the IPO and the year of foundation. *Mret* is defined as the percentage change in Datastream's Turkish Market daily index over the 40-day period preceding the initial trading day. *Mvol* is calculated as the standard deviation of daily returns of Datastream's Turkish stock market index over the 40-day period prior to the initial trading day. *Primary* is a dummy variable taking a value of one if the IPO includes the sale of primary shares, and zero otherwise. *Privat* is a dummy variable taking a value of one if the IPO is a privatization, and zero otherwise. *Selfoff* is a dummy variable taking a value of one if the IPO is a self-offered IPO, and zero otherwise. *Dfin* is a dummy variable which is equal to one if the offering is made by a financial firm, and zero otherwise. *Dind* is a dummy variable taking the value of one if the offering is made by an industrial firm, and zero otherwise. In parentheses are the t-statistics using White (1980) heteroskedasticity-consistent standard errors. Negative gives the F statistic for the test that overpricing is significantly related to turnover. a,b,c show statistical significance at 10%, 5% and 1% level, respectively.

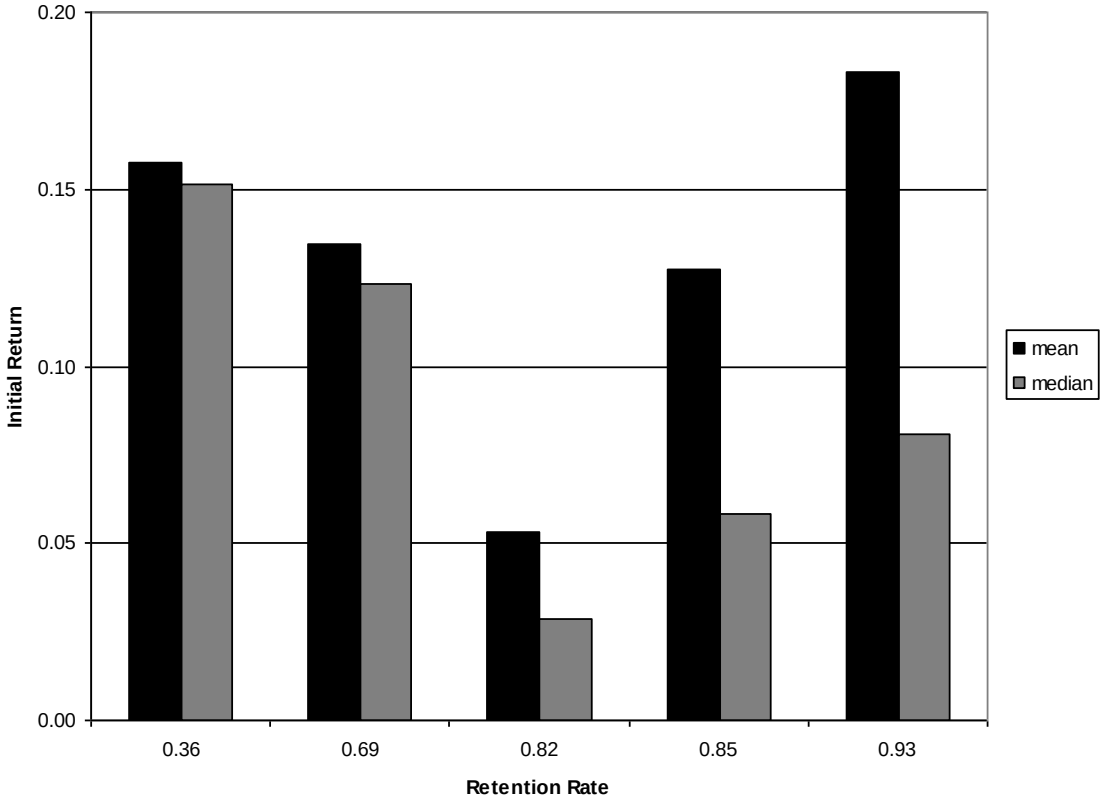
Table VI
Relation between Underpricing and Long-term Turnover

	Turnover Year 2			*Turnover Year 3*		
	Model1	Model2	Model3	Model1	Model2	Model3
Intercept	-1.510	-2.405	-1.478	-0.458	-1.408	-0.297
	(1.07)	(1.87) [a]	(1.09)	(0.32)	(1.11)	(0.21)
$\|IR\|$	-0.368	-0.204	-0.315	-0.774	-0.582	-0.709
	(0.64)	(0.31)	(0.52)	(1.27)	(0.85)	(1.10)
$\|IR\| D_{Neg}$	-0.688	0.753	1.064	-1.285	0.790	0.674
	(0.27)	(0.35)	(0.51)	(0.53)	(0.39)	(0.34)
Retention	-2.298			-1.928		
	(3.46) [c]			(2.97) [c]		
Size		-0.093			-0.114	
		(1.38)			(1.72) [a]	
Proceeds	-0.149		-0.154	-0.185		-0.184
	(1.79) [a]		(1.96) [a]	(2.07) [b]		(2.28) [b]
Age	-0.003		0.003	-0.009		-0.002
	(0.32)		(0.43)	(1.14)		(0.32)
Mret	0.471	0.442	0.453	0.187	0.183	0.177
	(1.35)	(1.17)	(1.20)	(0.57)	(0.48)	(0.47)
Mvol	13.639	13.218	11.913	-0.477	-0.784	-1.334
	(1.04)	(1.04)	(0.93)	(0.04)	(0.07)	(0.11)
Primary	1.005	0.895	0.847	0.720	0.619	0.567
	(4.88) [c]	(4.51) [c]	(3.90) [c]	(3.58) [c]	(3.22) [c]	(2.69) [c]
Privat			-0.526			-0.415
			-1.086			-0.995
Selfoff	-0.137	-0.180	-0.186	-0.399	-0.453	-0.443
	(0.62)	(0.81)	(0.84)	(1.90) [a]	(2.02) [b]	(1.99) [b]
Dfin	-0.272	-0.253	-0.305	-0.062	-0.038	-0.125
	(0.77)	(0.76)	(0.94)	(0.19)	(0.11)	(0.39)
Dind	-0.068	0.016	-0.075	-0.097	-0.019	-0.084
	(0.22)	(0.06)	(0.27)	(0.33)	(0.07)	(0.31)
R-sq.	0.279	0.175	0.196	0.260	0.134	0.164
Adj. R-sq.	0.231	0.132	0.143	0.212	0.089	0.109
F-statistic	5.897	4.033	3.713	5.370	2.948	2.992
p-value	0.000	0.000	0.000	0.000	0.003	0.001
Negative	0.163	0.059	0.117	0.678	0.009	0.000
p-value	0.687	0.808	0.733	0.411	0.923	0.987

Table VI
Notes

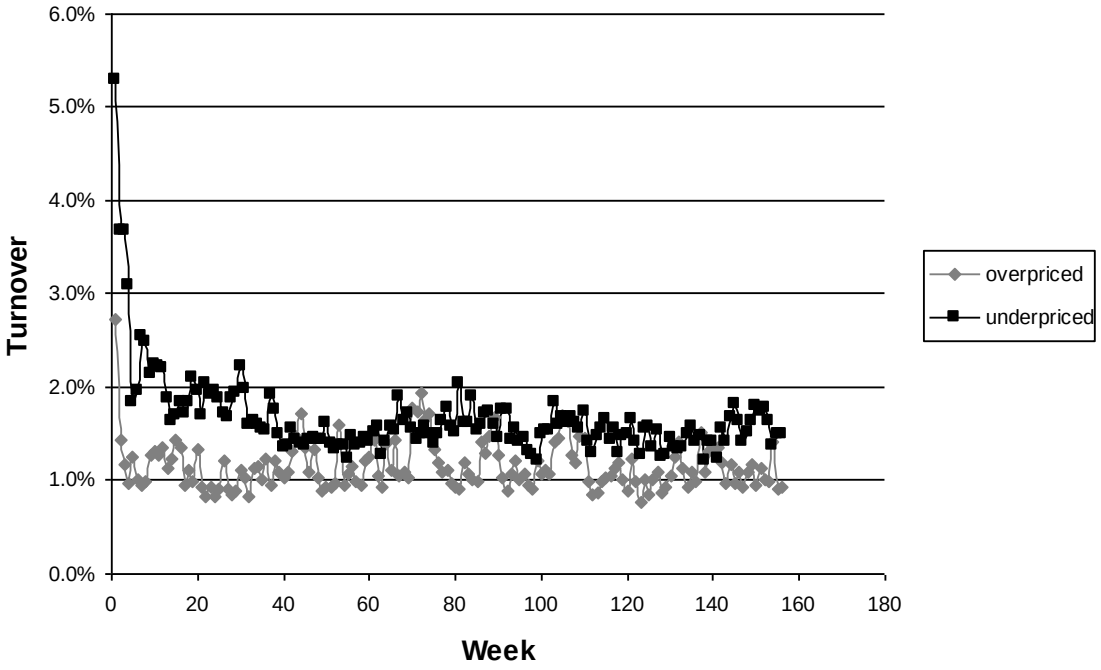
In Model 1, the dependent variable is the average daily volume during year i scaled by the number of shares outstanding. In Model 2 and Model 3, the dependent variable is average daily volume during year i scaled by the number of shares offered in the IPO. I*IR*I is the absolute value of market adjusted initial return. D_{Neg} is a dummy variable which is equal to one if *IR* is negative, and zero otherwise. *Retention* refers to fraction of shares retained. *Size* is measured as the natural logarithm of the dollar value of total market capitalization at offer price. *Proceeds* is defined as the natural logarithm of the dollar value of gross proceeds. *Age* is the difference between the year of the IPO and the year of foundation. *Mret* is defined as the percentage change in Datastream's Turkish Market daily index over the 40-day period preceding the initial trading day. *Mvol* is calculated as the standard deviation of daily returns of Datastream's Turkish stock market index over the 40-day period prior to the initial trading day. *Primary* is a dummy variable taking a value of one if the IPO includes the sale of primary shares, and zero otherwise. *Privat* is a dummy variable taking a value of one if the IPO is a privatization, and zero otherwise. *Selfoff* is a dummy variable taking a value of one if the IPO is a self-offered IPO and zero otherwise. *Dfin* is a dummy variable which is equal to one if the offering is made by a financial firm, and zero otherwise. *Dind* is a dummy variable taking the value of one if the offering is made by an industrial firm, and zero otherwise. In parentheses are the t-statistics using White (1980) heteroskedasticity-consistent standard errors. Negative gives the F statistic for the test that overpricing is significantly related to turnover.
a,b,c show statistical significance at 10%, 5% and 1% level, respectively.

Figure 1
Relation between Share retention and Initial return



IPOs are classified into five groups based on their share retention. The cutoff levels of share retention for those five groups are 0.55, 0.80, 0.84, and 0.88, respectively. These five groups contain 22, 34, 41, 56, and 28 IPOs, respectively.

Figure 2
Weekly Averages of Daily Turnover



IPOs are classified into two groups based on their initial return. The overpriced group contains 43 IPOs, while the underpriced group includes the remaining 138 IPOs.