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IPO valuation in an emerging market – a study in Iran

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Abstract

Purpose

This study aims to highlight the accuracy, performance and selection of the IPO valuation methods in the Islamic Republic of Iran's emerging market.

Design/methodology/approach

We performed accurate ex-ante evaluations based on a pre-IPO dataset obtained from valuation institutions. We considered valuation methods through correlations, Mann-Whitney U tests and regression analysis, using a sample of 83 IPOs from January 2017 to March 2021.

Findings

We found that the Dividend Discount Model (DDM) was the most popular in Iran. Even after controlling firm characteristics and market circumstances, the IPO price was highly correlated to pre-IPO reports' estimates. The results showed that firms' age, size and profitability affected the selection of valuation methods. The valuers did not apply forward P/E in a volatile market. Firm size affected the weights assigned to Free Cash Flow to the Firm (FCFF), and the valuers considered the Asset-in-Place (AIP) intensity to determine the weights of DDM, P/E and Net Asset Value (NAV), and they mainly employed the P/E to value old firms. Finally, this study estimated the accuracy of the pre-IPO report at 61% and found the highest accuracy to be associated with DDM.

Originality/Value

IPO pricing in emerging markets constitutes a more significant dilemma than in developed markets. This paper provides empirical evidence of IPO pricing focusing on valuation methods used in the context of an emerging market – the Islamic Republic of Iran.

Keywords: Valuation report, IPO, valuation method, emerging Islamic market, pre-IPO report, valuers.

JEL Classification: G00; G24; G30

1. Introduction

The lack of a market price before IPOs and the brief or no operating history of numerous issuing firms have turned IPO pricing into a global challenge. On the one hand, an underpriced IPO causes the issuer to be dissatisfied with the capital raised. On the other hand, an overpriced IPO causes purchasers' unwillingness to participate due to the low return. This process of extensive application of book building to IPO pricing has involved investment banks underwriting and estimating the equity value using different approaches. According to Rasheed *et al.* (2018)and Roosenboom (2007), the most widely used valuation approaches comprise the dividend discount model (DDM), the discounted cash flow (DCF), including Free Cash Flow to Firm (FCFF) and free cash flow to equity (FCFE), and their combinations. Other approaches, such as the economic value-added (EVA) method, are not very common. As underwriters, investment banks play a crucial role in attracting participants by offering discounts on the IPO price(Abdulai, 2015; Roosenboom, 2012). According to Roosenboom (2007), underwriters select the valuation methods based on firm-specific factors and market circumstances.

Due to higher information asymmetries, IPO pricing in emerging markets constitutes a more significant dilemma than in developed markets (Mehmood, Rashid, and Tajuddin, 2021; Ong, Mohd-Rashid, and Taufil-Mohd, 2020). The present study focuses on Iran's emerging market that its extremely high returns on the latest IPOs have caused stock allocations, rushed investors into purchasing IPOs and diminished underwriters' pledges to buy unsold shares in the IPO process.

Book building, commonly used in Iran since 2017, requires issuers to disclose many details and delegate a valuer to evaluate IPOs for potential investors. However, these valuation institutions do not necessarily serve as underwriters, and their incentives in over/undervaluation can differ from those cited in the literature (Cassia, Paleari, and Vismara, 2004; Kim and Ritter, 1999).

IPO pricing has rarely been addressed in the literature, especially in the context of valuation methods used in emerging markets. The extant literature shows that few researchers have studied the role of IPO valuation reports in emerging markets.

The present research was performed to fill this gap by answering three main questions: **1)** What is the impact of pre-IPO estimates on the pricing process? **2)** How do valuation institutions present their IPOs estimates? This question itself embodies the following sub-queries: a) Which methods are often used? b) Does it affect whether investment banks or other licensed investment advisors do the valuation? c) What factors affect valuation model selection? d) How do the valuers combine the outcomes of different valuation methods to reasonably estimate the equity value? **3)** How are the performance and accuracy of valuation models appraised?

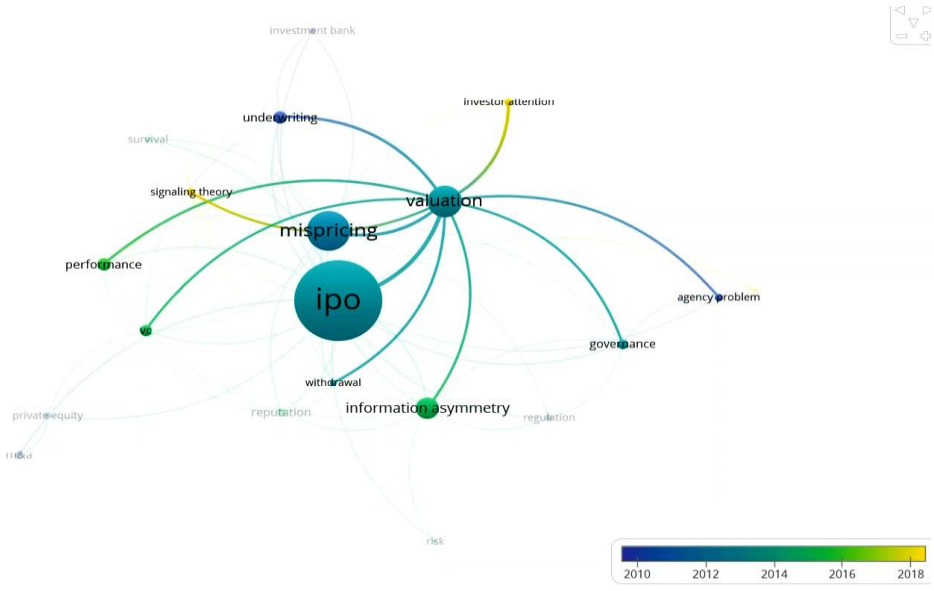
The contribution of this article is fourfold. **1)** Empirically detailing valuation given the lack of studies on IPO valuation methods in Iran. **2)** Performing accurate ex-ante evaluations based on a pre-IPO dataset from valuation institutions. Deloof *et al.* (2009) interpreted these evaluations as "real-world" estimates, which is inconsistent with the ex-post estimations performed in studies undertaken by Berkman, Bradbury, and Ferguson (2000) and Kim and Ritter (1999). **3)** Presenting empirical evidence for Iranian's emerging and developing market **4)** Comprehensively investigating factors affecting the selection of an IPO valuation model comprised of firm-specific factors and stock market circumstances.

The remainder of this article is structured thus: Section 2 investigates the IPO valuation models' selection, accuracy and performance reflected in the literature. Section 3 briefly explains the context of the present study - the IPO process in Iran. Section 4 discusses the sample, descriptive statistics and the methodology employed. Sections 5 and 6 present the results and conclusions.

2. Review of the literature

IPO has intense literature among researchers worldwide. At a glance, we can find about 20,000 papers around this area studying different related aspects (as we have just seen 19,398 in the Science Direct database). The valuation literature also sounds like an even more exciting and vast topic (more than 131,000 papers). In this study, we have aimed at the IPO valuation scope. The review of extant literature reveals that the joint topic (i.e., IPO and valuation together) has rarely been addressed in the literature. We have visually analyzed the most relevant literature through the VOS viewer 1.6.18 to depict it more appropriate. Figure 1 visualizes 60 papers' analytical results extracted from Science direct database. As shown, the valuation has 11 links to other issues in the IPO context: most relationship belongs to mispricing, information asymmetry, performance and underwriting. They mainly have focused on IPO mispricing (Boulanouar and Alqahtani, 2016; Cotten, 2008; Gregory, Guermat, and Al-Shawawreh, 2010; Mehmood, Mohd-Rashid, Tajuddin, & Saleem, 2021; Rathnayake, Louembé, Kassi, Sun, and Ning, 2019; Soongswang, 2017; Tutuncu, 2021; Tzang, Chang, Ochirbal, Sukhbaatar, and Tsai, 2021). According to our survey, only a few studies highlight the valuation methods used in evaluating initial offerings and their accuracy.

Figure 1- IPO valuation literature review



Kim and Ritter(1999) pioneered the investigation of 190 IPO valuations in the US using multiple peer groups, recorded accounting data and predicted earnings. They focused on multiple methods and found the P/E approach to dominate all the other multiples in terms of accuracy. Cassia *et al.* (2004), investigating different methods in 83 Italian IPOs, found IPO prices to be mainly driven by conventional P/E and P/BV, with P/E being considered more applicable. They found that the valuation estimates are highly correlated to offer prices. They argued that valuers could select comparables that make their valuations look conservative and have the incentive to build a reputation via accurately valuing IPOs. They calculated the accuracy of IPO valuation as the natural logarithm of the ratio of the estimated value to the actual price.

Deloof et al. (2002) studied 33 Belgian pre-IPO valuation reports compared to the price in the first-month post IPO in 1993-2000. They found that the most popular method was DCF. Furthermore, the pre-IPO reports were mainly driven by DDM. However, it underestimated the value, while DCF suggested more unbiased values. They showed that underwriters intentionally underpriced the IPO. They also found that forward p/e led to more accurate valuations than multiples using the IPO-year extent. Their results indicated that the pre-IPO estimates were closer to the IPO price than individual valuation estimates.

Roosenboom (2007) performed an ex-ante investigation of 228 IPOs in France using a pre-IPO valuation dataset to determine the effects of firm characteristics and market circumstances on the valuation method. Ordinary least squares and logistic regression showed that underwriters employ multiples and DDM to value profitable and rapidly-developing companies and old firms with a hefty dividend payout ratio, respectively. The DCF and EVA were applied to volatile markets and high market returns. In addition, the DCF, DDM and multiples were more common. Furthermore, underwriters selected the method based on firm characteristics and market circumstances.

Deloof *et al.* (2009) investigated valuation methods, presented evidence for accuracy, interviewed seven investment banks and interpreted the quantitative results. They found

DCF to be the most popular method in Belgium and produced unbiased estimates for 49 IPOs, whereas DDM yielded underpriced IPOs.

Cucculelli et al. (2021) investigated the impact of ongoing relationships between underwriters and institutional investors on IPO pricing. They proposed a model of pricing that depends on the intensity of interactions of market players in the years pre-IPO. Using a stochastic frontier approach on a sample of 1,677 US IPOs between 2000 and 2016 showed that the more market players regularly worked together, the more accuracy in pricing.

Except for the few subsequent studies investigating IPO valuation regarding used methods in emerging markets, all the studies cited obtained empirical results in developed countries. Abdulai (2015) suggested that firm characteristics insignificantly affected methods selection in 30 IPOs in Ghana. He also expressed that IPOs were underpriced, and a P/V ratio significantly predicted their first-day return. Moreover, investment banks selected a valuation method they were familiar with without considering firm characteristics and market factors.

Rasheed *et al.* (2018) showed that underwriters mainly employed DDM to value firms with dividends payout in Pakistan. They also used the DCF to value young firms with great AIP and those with negative sales growth and positive pre-IPO market returns. However, they used comparable multiples for firms with less-AIP and old ones. Furthermore, the DCF and P/B have the lowest and highest predictive accuracy, respectively.

Ong et al. (2021) studied 467 Malaysian IPO valuations from 2000 to 2017. Using OLS regression, they concluded that P/E, P/B, and P/S were positively related to the median P/E, P/B and P/S multiples of five comparable firms matched by industry and revenues. They announced P/S as the most effective valuation method. They believed that book-built IPOs result in higher returns because of their fair valuations.

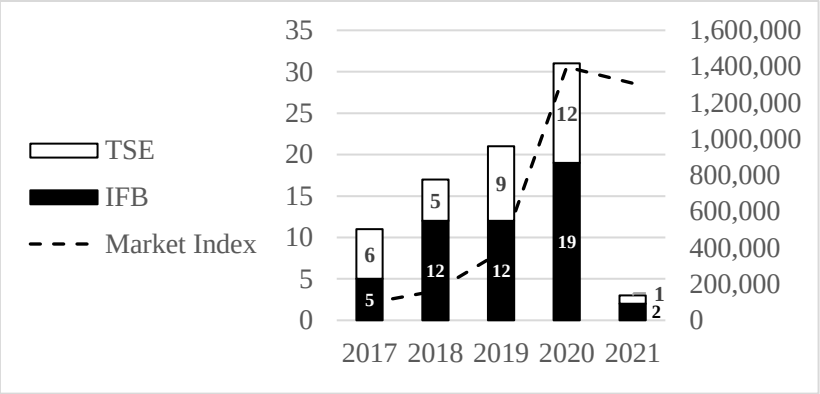
Buslot & Olieslagers (2021) found that multiples, DCF, and DDM were the most commonly used, and the multiple methods were the most reliable method, followed by the DCF. The DDM and EVA seem to be unsuitable for most firms willing to make an IPO. In another study, using correlation, regression and ANOVA test, Manu et al. (2020) found that about 70 percent of 26 Indian IPOs were underpriced, and the firm characteristics did not influence the pricing in the first month after IPO. This research aims to fill the literature gap on IPO valuation in emerging markets by presenting empirical evidence for the capital market in Iran.

3. IPO in Iran

The securities exchanges in Iran in charge of listing firms are the Tehran Stock Exchange (TSE) and Iran Fara Bourse (IFB). The TSE was established as the main equity market in February 1967. Although it only listed six companies shortly after its establishment, it is now the leading Iranian market, with over 440 listed companies from 42 industries and estimated at 47,000 trillion IRR (the Iranian Rial) in March 2021. In November 2008, IFB was established as a gateway for companies willing to enter the capital market and defined more straightforward listing requirements. Figure 2 shows a recent tremendous increase in the number of IPOs and the market index growth in TSE and IFB from January 2017 to March 2021[4].

Figure 2: Increasing number of IPOs and the market index
from January 2017 to March 2021

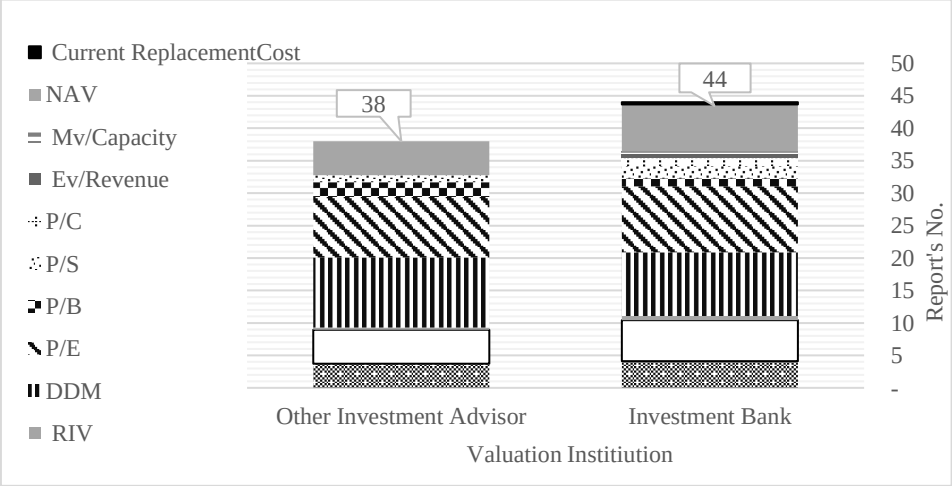
[4] The data for 2021 comprise only January to March.



Source: www.tse.ir and www.ifb.ir

Since 2017 issuers should use book building in Iran and publish a pre-IPO estimate reported by an investment bank or licensed investment advisors. Figure 3 shows the valuation methods used in IPOs since 2017.

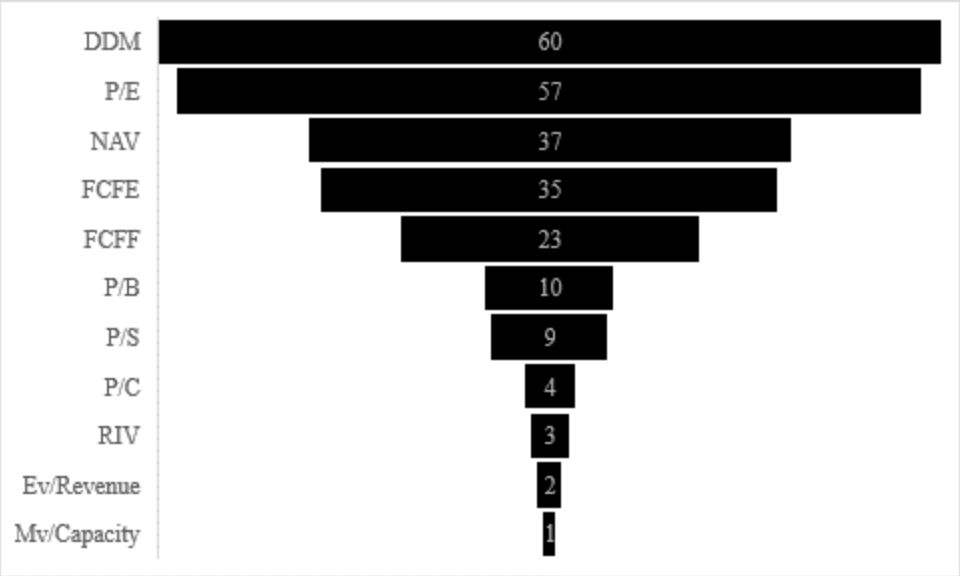
Figure 3: The number of methods valuers used
from January 2017 to March 2021



Source: Research findings

According to Figure 4, valuers' most popular methods used in Iran are DDM, PE, NAV, FCFF, and FCFE.

Figure 4: The number of valuation methods used in Iran
from January 2017 to March 2021



Source: Research findings

Figure 5 shows the average weights used by valuers to present a final price in their valuation reports, suggesting their reliance mainly on the NAV, which is consistent with the high inflation in Iran.

Figure 5: Average weights of the methods used by valuers

Source: Research findings

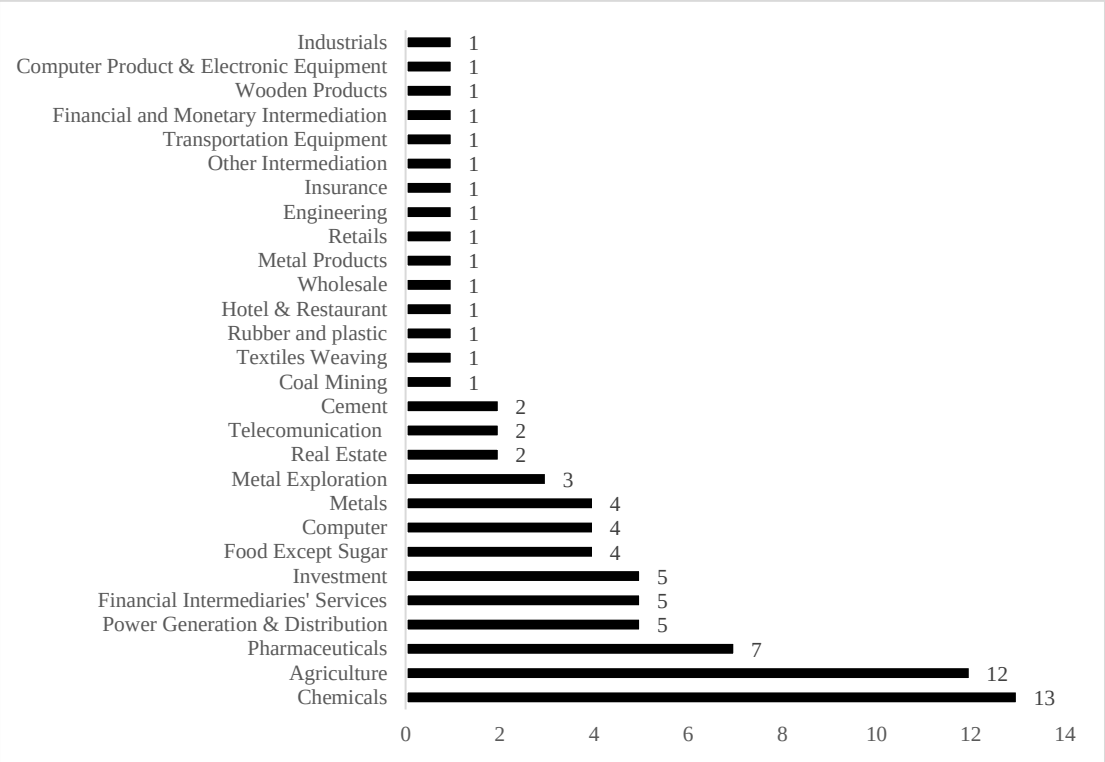
4. Research Design

a. Sample

Since the pre-IPO reports must be published on the exchanges' websites in Iran, we have downloaded them and, following Cassia et al. (2004), developed a dataset of the estimates of different valuation methods applied. Then, a sample of 33 TSE-listed firms

and 50 IFB-listed firms was selected between January 2017 and March 2021. Figure 6 shows the industry variation of our sample.

Figure 6: The sample industry variation



Source: Research's findings

b. Variable definitions

Table 1 present the definitions of the study variables. Note that we have extracted the estimates of each method from the pre-IPO reports to scrutiny "real-world" valuation methods.

Table 1: Variable definitions

Variable	Description
Age	The interval in the year between establishing the firm and issuing the IPO
Size	Total assets in millions IRR of the latest fiscal year
Asset in place (AIP)	The fixed asset ratio of the latest fiscal year
Sales growth	Sales growth associated with the current year
Profitability (PROF)	The current year ratio of forecasted earnings before interest and taxes (EBIT) to forecasted sales in the prospectus

Variable	Description
Future dividend payout ratio (DIV)	The ratio of dividends to the net income, as disclosed in the prospectus
IPO percentage	The ratio of the offered shares to the total issued shares on the IPO day
TSE	This dummy variable equals one if TSE is the target listing market; otherwise, it equals zero.
MRT	The market return index during the offering month
SD	The standard deviation of the daily market return index during the offering month.
FCFF	The Free Cash Flow to Firm model estimates the value of the firm as the present value of future FCFF discounted at the weighted average cost of capital (WACC): $$Firm\ Value = \sum_{t=1}^{\infty} \frac{FCFF_t}{(1+WACC)^t}$$
FCFE	The FCFE model estimates the value of equity can be found by discounting FCFE at the required rate of return on equity: $$Equity\ value = \sum_{t=1}^{\infty} \frac{FCFE_t}{(1+r)^t}$$
DDM	The DDM is expressed as follows: $$Firm\ Value = \sum_{t=1}^{\infty} \frac{Dividend_t}{(1+WACC)^t}$$
P/E	The trailing P/E Model uses EPS over the previous 12 months to calculate the price-earnings ratio. In contrast, Forward PE uses the forecasted EPS over the next 12 months in the calculation. The expression for this model is: $Firm\ Value_0 =$ Benchmark value of trailing (or forward) $\mathrm{P/E} \times \mathrm{EPS}_1$
NAV	Net asset value is defined as the value of a firm's assets minus the value of its liabilities.
FCFFW	The weights are assigned by valuers to the FCFF method in pre-IPO reports
FCFEW	The weights are assigned by valuers to the FCFE method in pre-IPO reports
DDMW	The weights are assigned by valuers to the DDM method in pre-IPO reports
P/EW	The weights are assigned by valuers to the P/E method in pre-IPO reports
NAVW	The weights are assigned by valuers to the NAV method in pre-IPO reports
Average estimate	The outcome of assigning different weights to the estimate of each method used in pre-IPO reports
VSD	The standard deviation of the estimates obtained from different methods
IPO Price	The closing price on the IPO day. The other examined prices included the average price of the first month after IPO (Avg.+30 P) and closing prices on the 10^{th}, 20^{th} and 30^{th} days of the IPO day

c. Methodology

According to our main questions, we have defined five hypotheses to test. The first hypothesis is that pre-IPO estimates significantly correlate to the IPO price. So, we have initially examined the correlations of the IPO price with pre-IPO estimates (the estimates

of the five valuation methods and the average estimate) to determine the reflection of these estimates in market prices.

In the next step, regarding our second hypothesis, we have checked whether this correlation is affected by different valuation methods. So we have regressed the IPO price (dependent variable) on the value estimates of the valuation methods individually (independent variables) obtained from pre-IPO reports and, as previously mentioned, focused on Iran's commonly used valuation methods: FCFF, FCFE, DDM, P/E and NAV. We also have fitted an OLS regression for the average value estimates computed among the different valuation methods of each pre-IPO report. Furthermore, We have controlled the effects of nine variables related to firm characteristics(Age, Size, AIP, Sales growth, PROF, DIV, IPO percentage) and market circumstances (MRT, SD) in these six OLS regressions to determine the robustness of the relationships. The corresponding model of each method are as follows:

Model1: $\text{IPO price} = \beta_0 \text{FCFF} + \beta_1 \text{Age} + \beta_2 \text{Size} + \beta_3 \text{AIP} + \beta_4 \text{Sales growth} + \beta_5 \text{PROF} + \beta_6 \text{DIV} + \beta_7 \text{IPO percentage} + \beta_8 \text{MRT} + \beta_9 \text{SD}$

Model2: $\text{IPO price} = \beta_0 \text{FCFE} + \beta_1 \text{Age} + \beta_2 \text{Size} + \beta_3 \text{AIP} + \beta_4 \text{Sales growth} + \beta_5 \text{PROF} + \beta_6 \text{DIV} + \beta_7 \text{IPO percentage} + \beta_8 \text{MRT} + \beta_9 \text{SD}$

Model3: $\text{IPO price} = \beta_0 \text{DDM} + \beta_1 \text{Age} + \beta_2 \text{Size} + \beta_3 \text{AIP} + \beta_4 \text{Sales growth} + \beta_5 \text{PROF} + \beta_6 \text{DIV} + \beta_7 \text{IPO percentage} + \beta_8 \text{MRT} + \beta_9 \text{SD}$

Model4: $\text{IPO price} = \beta_0 \frac{\text{P}}{\text{E}} + \beta_1 \text{Age} + \beta_2 \text{Size} + \beta_3 \text{AIP} + \beta_4 \text{Sales growth} + \beta_5 \text{PROF} + \beta_6 \text{DIV} + \beta_7 \text{IPO percentage} + \beta_8 \text{MRT} + \beta_9 \text{SD}$

Model5: $\text{IPO price} = \beta_0 \text{NAV} + \beta_1 \text{Age} + \beta_2 \text{Size} + \beta_3 \text{AIP} + \beta_4 \text{Sales growth} + \beta_5 \text{PROF} + \beta_6 \text{DIV} + \beta_7 \text{IPO percentage} + \beta_8 \text{MRT} + \beta_9 \text{SD}$

Model6: $\text{IPO price} = \beta_0 \text{Avg. estimate} + \beta_1 \text{Age} + \beta_2 \text{Size} + \beta_3 \text{AIP} + \beta_4 \text{Sales growth} + \beta_5 \text{PROF} + \beta_6 \text{DIV} + \beta_7 \text{IPO percentage} + \beta_8 \text{MRT} + \beta_9 \text{SD}$

According to Deloof *et al.* (2009), different factors affect the selection of a valuation method. Thus, in the third step, we hypothesized that firm characteristics and market

circumstances had influenced valuers' choices. The Mann-Whitney U test was individually applied to the five valuation methods to determine the potential effects of firm characteristics and market circumstances on the selection.

We expected investment banks to have a more accurate estimate than other advisors. A dummy variable was defined as one if the investment banks developed the pre-IPO report; otherwise, it equaled 0 to Understand the impact of the valuer's type in selecting the methods. Following Deloof *et al.*(2009), we examined the sample using the Mann-Whitney U test, a famous nonparametric test to compare outcomes between two independent groups.

Testing our fourth hypothesis, we investigated how valuation institutions combine the outcomes of different methods and assign weights to them. Similar to Roosenboom (2007), we have regressed the value estimate's weight of the pre-IPO report (as the dependent variables) on firm characteristics (Age, Size, AIP, Sales growth, PROF, DIV, IPO percentage) and market circumstances (MRT, SD) as the independent variables. The corresponding model of each method are as follows:

Model7: $\text{FCFFW} = \beta_0 + \beta_1 \text{Age} + \beta_2 \text{Size} + \beta_3 \text{ AIP} + \beta_4 \text{ Sales growth} + \beta_5 \text{ PROF} + \beta_6 \text{ DIV} + \beta_7 \text{ IPO percentage} + \beta_8 \text{ MRT} + \beta_9 \text{ SD}$

Model8: $\text{FCFEW} = \beta_0 + \beta_1 \text{Age} + \beta_2 \text{Size} + \beta_3 \text{ AIP} + \beta_4 \text{ Sales growth} + \beta_5 \text{ PROF} + \beta_6 \text{ DIV} + \beta_7 \text{ IPO percentage} + \beta_8 \text{ MRT} + \beta_9 \text{ SD}$

Model9: $\text{DDMW} = \beta_0 + \beta_1 \text{Age} + \beta_2 \text{Size} + \beta_3 \text{ AIP} + \beta_4 \text{ Sales growth} + \beta_5 \text{ PROF} + \beta_6 \text{ DIV} + \beta_7 \text{ IPO percentage} + \beta_8 \text{ MRT} + \beta_9 \text{ SD}$

Model10: $\frac{\text{P}}{\text{E}} W = \beta_0 + \beta_1 \text{Age} + \beta_2 \text{Size} + \beta_3 \text{ AIP} + \beta_4 \text{ Sales growth} + \beta_5 \text{ PROF} + \beta_6 \text{ DIV} + \beta_7 \text{ IPO percentage} + \beta_8 \text{ MRT} + \beta_9 \text{ SD}$

Model11: $\text{NAVW} = \beta_0 + \beta_1 \text{Age} + \beta_2 \text{Size} + \beta_3 \text{ AIP} + \beta_4 \text{ Sales growth} + \beta_5 \text{ PROF} + \beta_6 \text{ DIV} + \beta_7 \text{ IPO percentage} + \beta_8 \text{ MRT} + \beta_9 \text{ SD}$

Finally, according to previous studies (Abdulai, 2015; Cassia *et al.*, 2004; Deloof *et al.*, 2009; Kim and Ritter, 1999), the accuracy was evaluated by examining the distribution of valuation errors, expressed as the natural logarithm of the estimate relative to the IPO price. Therefore, the central tendency of the IPO price to the estimates was obtained as the percentage of differences within 15%, and then the mean absolute errors (MAE) were calculated. The valuation accuracy was measured as the percentage of valuation absolute errors within 15% and the mean absolute error, suggesting the dispersion of the valuation errors. We also accounted for the mean absolute percentage error (MAPE) following Ticknor (2013). All the calculations were repeated for 10, 20 and 30 days after IPO and the first month's average price.

Model 12: $MAE = \frac{1}{n}\sum|Estimate\ Value - IPO\ Price|$

Model 13: $MAPE = \frac{1}{n}\sum\frac{|Estimate\ Value - IPO\ Price|}{IPO\ Price}$

5. Results

Descriptive statistics

Table 2 presents the study variables' descriptive statistics in three categories: panels A-C. Panel A comprised firm characteristics and market circumstances, panel B showed the different value estimates methods, and panel C consisted of the prices.

Table 2- Descriptive statistics

Panel A	Age (year)	Size (million IRR)	AIP %	Sales growth %	PROF %	DIV %	IPO Percentage %	MRT %	SD %
N	83	83	83	83	83	83	83	83	83
Std. Deviation	11	31,540,000	23%	125%	37%	27%	5%	15%	1%
Minimum	6	945	0%	-94%	3%	0%	1%	-20%	0%
25th percentile	14	1,330,000	2%	13%	17%	47%	10%	-2%	1%
Mean	21	16,200,000	21%	71%	42%	69%	12%	7%	1%
75th percentile	26	14,900,000	29%	80%	55%	90%	15%	14%	2%
Maximum	66	200,000,000	92%	684%	232%	100%	28%	51%	3%
Median	19	5,040,000	14%	44%	31%	79%	10%	5%	1%

Panel B	FCF (IRR)	FCFW %	FCFE (IRR)	FCFEW %	DDM (IRR)	DDMW %	P/E (IRR)	P/EW %	NAV (IRR)	NAVW %	Avg. estimate (IRR)	VSD (IRR)
N	23	23	35	35	60	60	57	57	37	37	83	83
Std. Deviation	11,390	11%	14,850	16%	11,970	16%	19,690	12%	7,886	37%	12,784	6,486
Minimum	288	20%	8	0%	6	0%	11	0%	1,595	5%	1,217	0
25th percentile	3,237	30%	1,958	25%	2,238	25%	2,364	20%	3,749	23%	2,836	91
Mean	11,400	35%	11,400	35%	9,949	35%	14,200	28%	9,427	52%	11,904	888
75th percentile	17,600	40%	20,300	40%	16,000	35%	22,800	33%	13,000	100%	18,031	2,380
Maximum	41,397	80%	66,447	100%	63,686	85%	97,380	65%	30,205	100%	65,119	40,222
Median	6,427	33%	3,518	33%	4,680	33%	5,454	30%	5,749	33%	6,380	888

Panel C	IPO Price(IRR)	P+10 (IRR)	P+20 (IRR)	P+30 (IRR)	Avg. P+30(IRR)
N	83	83	83	83	83
Std. Deviation	11,980	10,864	13,550	15,459	12,507
Minimum	1,200	319	380	393	360
25th percentile	2,700	1,716	1,893	1,962	1,756
Mean	10,900	9,132	11,536	12,689	10,615
75th percentile	16,000	14,821	17,920	15,005	14,990
Maximum	65,119	50,400	61,400	79,700	55,700
Median	5,700	4,068	5,736	5,817	5,281

Notes*:* This table presents the descriptive statistics of 83 IPOs between January 2017 and March 2021. We categorized the variables into three panels: A to C. Panel A comprised firm characteristics and market circumstances, panel B showed the different methods' value estimates, and panel C consisted of the prices.

Panel A) Age is the interval in the year between the foundation and IPO. The firm's **Size** was calculated as the total assets of the most recent fiscal year. **AIP** equaled fixed assets divided by the total assets. **Sales growth** was the forecasted sales growth during the current year reported in the prospectus, **PROF** the ratio of the current year's forecasted EBIT to sales, **DIV** the future dividend payout ratio, **IPO Percentage,** the ratio of offered shares on the IPO day, and **MRT** and **SD** respectively represented the market return and standard deviation of the offering month pre-IPO.

Panel B) FCFF, FCFE, DDM, P/E and NAV represented the estimates obtained from each method, as reflected in the pre-IPO report. **FCFFW, FCFEW, DDMW, P/EW and NAVW** were the weights assigned by valuers to each method in the pre-IPO report. **Avg. Estimate** was the firm's weighted average presented by the valuers in the pre-IPO report. **VSD** represented the standard deviation of the different methods' value estimates.

Panel C) IPO Price was the closing price on the IPO day. Prices on the 10th, 20th and 30th days of IPO and the average price of the first month after IPO were respectively represented as **P+10, P+20, P+30 and Avg.+30**.

i. Role of pre-IPO valuation estimates and methods in pricing

Table 3 represents the correlation test between the IPO price and the estimates of each method indicated in the valuation report. It reveals that all estimates correlate highly with the IPO prices regardless of the method used. The highest correlation (about 99%) belongs to the average estimate, and then we have FCFF as the greatest (98.5%).

Table 3- Correlation test between the IPO price and value estimate

		Avg. estimate	FCFF	FCFE	DDM	P/E	NAV
IPO Price	Pearson Correlation	0.986***	0.985***	0.880***	0.906***	0.784***	0.791***
	Sig.	0.000	0.000	0.000	0.000	0.000	0.000
	N	83	23	35	60	57	37

Source: Research findings

Note:

The value estimates were obtained from a sample of 83 pre-IPO reports offered in Iran from January 2017 to March 2021. ∗, ∗∗ and ∗∗∗ denote significant differences based on the Pearson correlation test at significance levels of 10%, 5% and 1%, respectively.

Table 4 shows the results of the six OLS regressions (Models 1 to 6) in terms of the robustness of these relationships after controlling firm characteristics and market circumstances as per Table 3. According to Deloof *et al.* (2009) and Roosenboom(2007), we have used several regression models, one for each valuation method. We have specifically examined whether the estimates significantly explained the IPO price after controlling the effects of firm-based and market-based variables.

Table 4: The role of valuation method in IPO pricing – results of OLS regression (Models 1 to 6)

Dependent variable	Independent Variable	Non-standardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
		B	Std. Error	Beta			Tolerance	VIF
IPO price	Constant	-2096.41**	912.877		-2.296	0.033		
	FCFF	0.912***	0.03	0.983	30.58	0.000	0.999	1.001
	SD	162922.3***	57036.26	0.092	2.856	0.01	0.999	1.001
	R Square	0.979	Adjusted R Square		0.977	Durbin-Watson		1.965
	Constant	-9031.67**	3707.92		-2.436	0.021		
	DIV	6708.959*	3901.722	0.123	1.719	0.095	0.933	1.072
	SD	631941.3***	166398.5	0.275	3.798	0.001	0.912	1.097
	FCFE	0.791***	0.076	0.771	10.343	0.000	0.857	1.167
	R Square	0.852	Adjusted R Square		0.838	Durbin-Watson		1.502
	Constant	-6149.7***	1801.157		-3.414	0.001		
	DIV	5445.135***	2015.251	0.122	2.702	0.009	0.973	1.028
	MRT	-8395.12**	4088.847	-0.093	-2.053	0.045	0.974	1.027
	SD	402352.6***	79606.8	0.229	5.054	0.000	0.963	1.038
	DDM	0.884***	0.048	0.859	18.611	0.000	0.93	1.076
	R Square	0.891	Adjusted R Square		0.883	Durbin-Watson		1.855
	Constant	-21372.2*	11529.79		-1.854	0.069		
	Ln Size	1722.776**	759.313	0.183	2.269	0.027	0.995	1.005
	PE	0.527***	0.055	0.772	9.551	0.000	0.995	1.005
	R Square	0.649	Adjusted R Square		0.636	Durbin-Watson		1.94
	Constant	1217.429	1234.595		0.986	0.331		
	NAV	0.773***	0.101	0.791	7.651	0.000	1	1
	R Square	0.626	Adjusted R Square		0.615	Durbin-Watson		1.58
	Constant	-403.098	536.092		-0.752	0.454		
	PROF	-1039.85*	603.052	-0.032	-1.724	0.089	0.994	1.006
	SD	60973.39*	32456.83	0.037	1.879	0.064	0.882	1.134
	Avg. estimate	0.911***	0.018	0.973	49.789	0.000	0.885	1.13
	R Square	0.973	Adjusted R Square		0.972	Durbin-Watson		1.762

Source: Research finding

Note: This table shows the results obtained from the final step of the six backward OLS regressions of the IPO price using different methods (the five methods are FCFF, FCFE, DDM, P/E and NAV) and the average estimate of 83 IPOs between January 2017 and March 2021. They were controlled by applying firm characteristics, i.e., Age, Size, AIP, Sales growth, PROF, DIV and IPO percentage, and market circumstances, MRT and SD, defined in Table 1. ∗ . ∗, ∗∗ and ∗∗∗ denote significant differences based on the t-test at significance levels of 10%, 5% and 1%, respectively.

Table 4 shows that all the value estimates coefficients are significant after controlling the firm characteristics and market circumstances, and the highest coefficient belongs to FCFF (0.912).

ii) Selecting the valuation model

The mean values were compared to determine the potential effects of firm characteristics (Age, Size, AIP, Sales growth, PROF, DIV, IPO percentage)and market circumstances (MRT, SD) on the method selected by valuers. The results of the Mann-Whitney U test performed on the five valuation methods as per Table 5 are presented below:

- ✓ The significant extent of the Mann-Whitney U test shows that AIP, PROF and DIV are influential in selecting the FCFF method. The valuers mostly used the FCFF method for the firms with higher AIP (50.41 vs. 38.78), less PROF(%) (32.13 vs. 45.78) and less DIV (32.78 vs. 45.53).
- ✓ In selecting the FCFE method, AIP, PROF and TSE seem important. The valuers mainly rely on FCFE for firms with higher AIP (49.39 vs. 36.61), less PROF(%) (34.69 vs. 47.33) and not listed in TSE (36.17 vs. 46.25). They use the DDM method for firms with smaller Sizes (36.43 vs. 56.52), greater AIP (47.46 vs. 27.76) and lower PROF(%) (37.72 vs. 53.15).
- ✓ The P/E method is chosen when the firm is older (45.72 vs. 33.85) and has less PROF(%) (37.92 vs. 50.94). We have examined the forward P/E method, too. It is used when the market is less volatile or has a lower SD(%)(25.17 vs. 40.75)
- ✓ The NAV method is usually used for firms with higher PROF(%) (49.81 vs. 35.72) and higher DIV (%) (48.16 vs. 37.04).

Table 5: Effects of firm characteristics and market circumstances on valuation method selection

	FCFF						FCFE						DDM					
Method	Yes	No	Mann-Whitney U	Wilcoxon W	Z	Sig.	Yes	No	Mann-Whitney U	Wilcoxon W	Z	.Sig	Yes	No	Mann-Whitney U	Wilcoxon W	Z	Sig.
Age (year)	46.41	40.31	588.5	2418	-1.03	0.30	43.67	40.78	781.5	1,958	-0.54	0.59	41.78	42.57	677	2,507.0	-0.13	0.90
Size (million IRR)	36.52	44.10	564	840	-1.28	0.20	40.11	43.38	774	1,404	-0.61	0.54	36.43***	56.52	356	2,186.0	-3.40	0.00
AIP (%)	50.41**	38.78	496.5	2326	-1.97	0.05	49.39**	36.61	581.5	1,758	-2.39	0.02	47.46***	27.76	362.5	638.5	-3.34	0.00
PROF (%)	32.13**	45.78	463	739	-2.31	0.02	34.69**	47.33	584	1,214	-2.36	0.02	37.72**	53.15	433.5	2,264.0	-2.61	0.01
Sales growth (%)	38.28	43.42	604.5	880.5	-0.87	0.38	37.49	45.29	682	1,312	-1.46	0.15	41.31	43.80	648.5	2,478.5	-0.42	0.67
DIV (%)	32.78**	45.53	478	754	-2.16	0.03	44.59	40.11	749.5	1,926	-0.84	0.40	40.53	45.83	602	2,432.0	-0.90	0.37
MRT (%)	43.93	42.46	645.5	2476	-0.45	0.65	43.5	40.91	787.5	1,964	-0.49	0.63	41.93	42.17	686	2,516.0	-0.04	0.97
SD (%)	40.80	42.46	662.5	938.5	-0.28	0.78	42.53	41.61	821.5	1,998	-0.17	0.86	42.27	41.30	674	950.0	-0.16	0.87
TSE	41.74	42.10	684	960	-0.07	0.94	36.17**	46.25	636	1,266	-2.22	0.03	39.33*	48.96	530	2,360.0	-1.92	0.06
N	23	60					35	48					60	23				
	P/E						Forward P/E						NAV					
Method	Yes	No	Mann-Whitney U	Wilcoxon W	Z	Sig.	Yes	No	Mann-Whitney U	Wilcoxon W	Z	.Sig	Yes	No	Mann-Whitney U	Wilcoxon W	Z	Sig.
Age(year)	45.72**	33.85	529	880	-2.09	0.04	29.50	27.46	279.5	384.5	-0.40	0.69	43.54	40.76	794.0	1875	-0.52	0.60
Size (million IRR)	39.23	48.08	583	2,236	-1.55	0.12	28.12	31.71	263.0	1209.0	-0.70	0.48	45.14	39.48	735.0	1816	-1.06	0.29
AIP (%)	44.86	35.73	578	929	-1.60	0.11	29.01	28.96	300.5	405.5	-0.01	0.99	38.78	44.59	732.0	1435	-1.09	0.28
PROF (%)	37.92**	50.94	508.5	2,162	-2.28	0.02	27.49	33.64	236.0	1182.0	-1.21	0.23	49.81***	35.72	562.0	1643	-2.65	0.01
Sales growth (%)	41.75	42.54	727	2,380	-0.14	0.89	27.45	33.75	234.5	1180.5	-1.23	0.22	40.88	42.90	809.5	1513	-0.38	0.70
DIV (%)	42.59	40.71	707.5	1,058	-0.33	0.74	28.13	31.68	263.5	1210.0	-0.70	0.49	48.16**	37.04	623.0	1704	-2.09	0.04
MRT (%)	41.25	43.65	698	2,351	-0.42	0.67	29.22	28.32	291.5	396.5	-0.18	0.86	40.72	43.03	803.5	1506	-0.44	0.66
SD (%)	43.86	37.92	635	986	-1.04	0.30	25.17***	40.75	136.5	1082.0	-3.06	0.00	42.88	41.29	818.5	1900	-0.30	0.77
TSE	42.25	41.46	727	1,078	-0.16	0.87	28.77	29.71	291.0	1237.0	-0.22	0.83	38.96	44.45	738.5	1442	-1.22	0.22
N	57	26					43	14					37	46				

Source: Research findings

Note: This table compares the mean values of the firm characteristics and market circumstances in different methods used to value 83 IPOs on the TSE/IFB between January 2017 and March 2021. **Age** was the number of years from the foundation to the IPO year, **size** was defined as the total assets of the most recent fiscal year, **AIP** equaled the fixed assets divided by the total assets, and **Sales growth** was the forecasted sales growth during the current year as reported in prospectuses, **PROF** was explained as the current year ratio of the forecasted EBIT to sales, **DIV** was the future dividend payout ratio, **IPO percentage** was the ratio of offered shares on the IPO day, and **MRT** and **SD** were the market return and standard deviation of the offering month pre-IPO, respectively. *, ** and *** respectively denote significant differences at significance levels of 10%, 5% and 1% based on the Mann-Whitney U test.

The valuers were categorized into investment banks and other investment advisors to determine specific methods on which they rely. Table 6 presents the results of the Mann-Whitney U test, suggesting that the valuers' type had no impact on the selecting methods. Comparing VSD between the two groups also showed that the value deviation did not correspond to the valuers' type.

Table 6: Effects of valuers' type on selecting methods

		Investment Bank					
		Yes	No	Mann-Whitney U	Wilcoxon W	Z	Sig.
FCFF	Mean Rank	11.69	12.40	61	152	-0.248	0.804
	N	13	10				
FCFE	Mean Rank	17.1	19.20	132	342	-0.6	0.549
	N	20	15				
DDM	Mean Rank	28.03	33.14	373	869	-1.132	0.258
	N	31	29				
PE	Mean Rank	26.19	32.6	310	838	-1.447	0.148
	N	32	25				
NAV	Mean Rank	20.83	16	119	224	-1.315	0.188
	N	23	14				
Avg. estimate	Mean Rank	44.32	39.38	756	1536	-0.931	0.352
	N	44	39				
VSD	Mean Rank	45.61	37.92	699	1,479	-1.459	0.144
	N	44	39				

Source: Research findings

Note:

This table presents the influence of valuers' types on selecting different methods among 83 IPO firms offered from January 2017 to March 2021. Investment banks were compared with licensed investment advisors to develop pre-IPO reports. The standard deviation of the estimate associated with the methods used was also obtained. ∗, ∗∗ and ∗∗∗ denote significant differences based on the Mann-Whitney U test at significance levels of 10%, 5% and 1%, respectively.

According to Roosenboom (2007), we have fitted five OLS regressions (Models 7 to 11) to investigate the firm-based (Age, Size, AIP, Sales growth, PROF, DIV, IPO percentage) and market-based (MRT, SD) determinants of weights assigned to each method arriving at a final value estimate.

Table **7** summarizes the final step results of these five backward regressions. Our findings showed that size affected the weights assigned to the FCFF. In addition, AIP impacted the weights of DDM, P/E and NAV. Age significantly and positively (negatively) affected the P/E (NAV) weights. In other words, the valuers mainly used the P/E (NAV) to value old (young) firms. Moreover, the IPO percentage significantly affected the weight of the P/E.

Table 7: Determinants of the weights assigned to the valuation methods estimates using backward OLS regression (Models 7 to 11)

Dependent variable	Independent variable	Non-standardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
		B	Std. Error	Beta			Tolerance	VIF
FCFFW	Constant	-0.732**	0.259		-2.832	0.010		
	Ln (Size)	0.067***	0.015	0.821	4.369	0.000	0.715	1.399
	IPO percentage	0.742*	0.429	0.325	1.728	0.099	0.715	1.399
	R Square	0.495	Adjusted R Square		0.444		Durbin-Watson	2.072
FCFEW	Constant	0.348***	0.027		13.016	0.000		
	R Square	0	Adjusted R Square		0			
DDMW	Constant	0.391***	0.029		13.597	0.000		
	AIP	-0.186**	0.086	-0.272	-2.152	0.036	1	1
	R Square	0.074	Adjusted R Square		0.058		Durbin-Watson	2.31
P/EW	Constant	-0.017	0.099		-0.17	0.865		
	AIP	-0.115*	0.061	-0.218	-1.885	0.065	0.985	1.015
	Ln (Age)	0.064**	0.03	0.247	2.153	0.036	0.999	1.001
	IPO percentage	1.085***	0.305	0.411	3.563	0.001	0.985	1.016
	R Square	0.304	Adjusted R Square		0.265		Durbin-Watson	1.915
NAVW	Constant	0.231	0.559		0.413	0.682		
	AIP	-0.575**	0.169	-0.428	-3.405	0.002	0.767	1.304
	PROF	0.291**	0.126	0.35	2.318	0.027	0.531	1.882
	Ln (Size)	0.057*	0.032	0.256	1.77	0.086	0.579	1.727
	Ln (Age)	-0.205**	0.09	-0.273	-2.29	0.029	0.855	1.17
	R Square	0.612	Adjusted R Square		0.564		Durbin-Watson	2.025

Source: Research findings

Note:

This table shows the results of five backward OLS regressions of the method weights based on firm-based (Age, Size, AIP, Sales growth, PROF, DIV, IPO percentage) and market-based (MRT, SD) variables (Table 1) among 83 IPOs in Iran from January 2017 to March 2021. ⁎, ⁎⁎ and ⁎⁎⁎ respectively denote significant differences based on the t-test at significance levels of 10%, 5% and 1%, respectively.

iii. Accuracy and performance of valuation models

Table 8 presents the accuracy test results on the IPO price (Models 12 and 13), the average price of the first month after the IPO and the 10^{th}, 20^{th} and 30^{th} days of the IPO. The accuracy of the average pre-IPO estimate was the highest (about 61%) on the IPO day. The DDM and NAV were also found to be the most (50%) and least (19%) accurate methods.

Table 8: Pre-IPO estimates and price: Comparing different valuation methods

		FCF	FCFE	DDM	PE	NAV	Avg. estimate
IPO time	Median	7%	-9%	-3%	16%	26%	7%
	Mean	-7%	-18%	-22%	19%	21%	9%
	SD	53%	50%	64%	28%	43%	18%
	Interquartile range	30%	39%	40%	31%	34%	19%
	Accuracy	48%	43%	50%	40%	19%	61%
	MAE	31%	33%	37%	24%	38%	15%
	MAPE	25%	26%	25%	31%	46%	16%
+10 P	Median	19%	19%	14%	43%	34%	24%
	Mean	23%	35%	18%	54%	46%	43%
	SD	80%	91%	97%	66%	70%	59%
	Interquartile range	88%	122%	97%	76%	65%	78%
	Accuracy	17%	23%	18%	28%	22%	36%
	MAE	61%	74%	71%	61%	60%	49%
	MAPE	88%	126%	102%	129%	123%	94%
+20 p	Median	-17%	0%	-8%	21%	16%	0%
	Mean	-4%	15%	-4%	32%	26%	21%
	SD	83%	89%	99%	71%	76%	63%
	Interquartile range	116%	136%	132%	85%	68%	88%
	Accuracy	13%	11%	12%	19%	22%	23%
	MAE	65%	72%	75%	58%	55%	50%
	MAPE	74%	101%	86%	104%	101%	78%
+30 P	Median	-26%	1%	-21%	-1%	3%	-5%
	Mean	-20%	9%	-16%	22%	19%	12%
	SD	86%	92%	103%	77%	82%	69%
	Interquartile range	139%	128%	144%	109%	83%	102%
	Accuracy	13%	14%	10%	19%	31%	22%
	MAE	74%	74%	81%	61%	57%	54%
	MAPE	75%	98%	86%	101%	100%	79%
Avg. P+30	Median	-9%	8%	-7%	25%	23%	8%
	Mean	4%	23%	3%	39%	33%	29%
	SD	81%	89%	98%	69%	75%	62%
	Interquartile range	105%	132%	118%	95%	64%	85%
	Accuracy	26%	20%	10%	18%	25%	27%
	MAE	61%	72%	73%	58%	57%	49%
	MAPE	75%	109%	91%	110%	109%	83%

Source: Research findings

Note:
This table compares the accuracy of the methods used to value 83 IPOs in Iran from January 2017 to March 2021. The valuation errors were calculated as the natural logarithm of the ratio of the estimate to the IPO price (+10, +20, 30 and first-month average price). The mean absolute error and percentage of errors within 15% were used as the measures of valuation accuracy. The number of IPOs using a method determined the number of observations.

1. Conclusion

This study was designed based on ex-ante estimations of 83 IPOs in Iran's capital market from January 2017 to March 2021 to expand the literature and fill the gap. The three main empirically discussed topics were the roles of valuation reports and used methods in IPO pricing, the firm-based and market-based factors affecting the selection of models, and their performance and accuracy. The findings are summarized as follows:

The DDM was found to be the most popular method in Iran. This finding is consistent with previous studies done in both developed and emerging markets (Abdulai, 2015; Deloof, De Maeseneire, and Inghelbrecht, 2009; Mehmood, Mohd-Rashid, Tajuddin, and Saleem, 2021; Rasheed, Khalid Sohail, Din, and Ijaz, 2018; Roosenboom, 2007). It sounds reasonable regarding Iran's volatile market since the valuers are unwilling to rely on methods involving more judgment based on market risk; so, putting themselves on the safe side, they have usually tried to consider the firms' historical trends, such as dividend payout in their value estimate. It is similar to Cassia et al. (2004), who believed valuers make their valuations look conservative.

Like Cassia et al. (2004), we have found that the valuers' estimates are highly-correlated to the offer prices. The correlation test results revealed significant correlations (about 99%) between the forecast and IPO pricing. Firm characteristics and market circumstances did not affect these findings. Among the different valuation methods, IPO pricing was mainly correlated to the FCFF. As Deloof(2002) mentioned, DCF suggested more fair values.

The selection of models was investigated from different dimensions, comprising: a) the effects of firm characteristics and market circumstances on selecting methods, b) the determinants of the weights assigned to each method arriving at a final value estimate, and c) the effects of valuers' type on selecting methods.

Like Rasheed *et al.* (2018), we found that valuers applied the P/E method in evaluating old firms and DDM in the valuation of small firms, which is inconsistent with Roosenboom's (2007) report. The TSE comparison results emphasize similar findings as firms listed on TSE must comply with size requirements and are usually older. The higher the amount of AIP, the higher the likelihood of selecting direct methods, i.e., FCFF, FCFE and DDM.

In contrast to Deloof *et al.* (2009), higher profitability percentages favored selecting the NAV rather than the DCF. The valuers indicate a more conservative pre-IPO value, so they prefer not to use the DCF method in these cases. A high percentage of expected dividend payout did not affect the selection of DDM, as it was a proxy in selecting the NAV or FCFF. This result can be explained by the fact that valuation reports are published before announcing the dividend payout commitment in prospectuses and that companies fail to adhere to their primary dividend commitment.

Regarding market circumstances, forward P/E is not applied to volatile markets as per risk assessments. Valuers seem to ignore market return and sales growth while selecting the valuation model. We also examined the valuer type's impact on selecting different valuation methods. As a result, we showed no difference in an IPO valuation performed by an investment bank or any other investment advisor.

In terms of the impact of firms' characteristics on selecting valuation methods, we found that firm size affected the weights assigned to the FCFF. Valuation institutions also incorporated the percentage of AIP to DDM, P/E and NAV weight calculation and relied more on the P/E (NAV) in valuing old (young) firms. The IPO percentage was also found to affect only the weight of the P/E significantly.

In line with the literature (Abdulai, 2015; Cassia *et al.*, 2004; Deloof, De Maeseneire, and Inghelbrecht, 2009; Kim and Ritter, 1999), the accuracy was determined as the MAE within 15% and MAPE, which showed the dispersion of valuation errors. According to the present findings, the accuracy of the average pre-IPO estimate was about 61% on the IPO day, and DDM and NAV were respectively the most and least accurate methods, which is inconsistent with the findings by Deloof *et al.* (2009), who reported multiples as the most accurate model based on post-IPO forecasted earnings and cash flows. The present study has policy implications and discusses that much more empirical data is needed on the accuracy of different methods for Security Exchange Organizations (SEO) in their monitoring duty. In other words, the results suggest the accuracy of each method so that SEO could oblige and emphasize the most accurate methods to the valuers in practice. Also, this paper bridges the gap between theory and practice by pointing out the special attention of the valuers to firms' characteristics and market circumstances in assigning weights to their estimates. Finally, this paper prepares clear evidence of the role of a valuation report on IPO pricing and suggests that investors make decisions regarding the pre-IPO valuation reports.

The limitation of this paper is that market bubbles or crashes, and firm industry variation could affect the value estimates and the method selections. However, we have not controlled them in our model. Also, we limited our study to the five most popular valuation methods (FCFF, FCFE, DDM, P/E and NAV), that we had sufficient observations and couldn't investigate all of them.

It is recommended that further studies be conducted at the level of industries on the performance and accuracy of IPO valuation and its selection methods in emerging markets. The effects of market bubbles or crashes on selecting an IPO valuation method can also be investigated. Moreover, a more profound insight can be acquired into the present findings through their qualitative re-evaluation and interpretation from the valuers' perspective. We also recommend controlling the potential effect of the valuers' reputation in the model for future studies.

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