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ARAŞTIRMA MAKALESİ / RESEARCH ARTICLE

# MEASURING IPO PERFORMANCE THROUGH INDUSTRY-ADJUSTED MODELS

# SEKTÖRE UYARLANMIŞ MODELLERLE HALKA ARZ PERFORMANSININ ÖLÇÜLMESI

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**Abstract**

We investigate operating performance of Turkish IPOs between January 2010 and December 2017 through well-specified industry – and performance-adjusted models advocated by Barber and Lyon (1996). We find that issuers underperform matched peers in the long-run regardless of the choice of model. Any improvement in performance is either temporary or precedes the issue. We conclude that performance improvements observed around the issue do not extend to long-term, because better profitability could point to earnings management which leads to earnings reversal, while improvements in leverage and liquidity end when proceeds are exhausted.

**Keywords:** Initial public offerings, financial performance, operating performance.

**JEL Code:** G14, G30, L25

**Öz**

Bu çalışmada Ocak 2010 ve Aralık 2017 arasında Türkiye'deki halka arzların faaliyet performansı Barber ve Lyon (1996) tarafından onerilen sektöre ve performansa uyarlanmiş modellerle incelenmektedir. Sonuçlar ihraççı firmaların model seciminden bagımsız olarak uzun vadede eşleştirilmiş benzer firmalardan düşük performans gösterdiğini ortaya koymaktadır. Performansta gerçekleşen iyileşmeler ya geçici ya da ihraçtan öncedir. İhraç senesi etrafında gözlenen iyileşmelerin uzun vadeye uzanmamasının sebebi olarak halka arz gelirlerinin kısa vadede tüketilmesi ile kaldıraç ve likiditedeki iyileşmenin durması ve karlılıktaki iyileşmenin kar manipulasyonu kaynaklı olabileceği sonucuna varılmıştır.

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**Anahtar Kelimeler:** İlk halka arz, finansal performans, faaliyet performansı.

**JEL Kodu:** G14, G30, L25

## Introduction

The performance aspect of initial public offerings (IPO) is investigated by numerous studies, many of which document abnormal performance in the form of positive initial returns and long-run underperformance. Ibbotson (1975), Ritter (1984; 1991), Loughran et al. (1994) and Loughran and Ritter (2002) examine financial performance of IPOs, Jain and Kini (1994) and Mikkelson et al. (1997) investigate operating performance, while Ritter and Welch (2002) review the theory and evidence for IPO pricing. Theorists argue that initial underpricing of IPOs is caused by information asymmetries between going public firm and prospective investors, since firms in their private form do not disclose as much information as public firms. Firms preparing to go public are typically required to disclose specific information about ownership, business dealings and financial statements to be approved by the regulatory authority in the prospectuses, which are published subsequent to regulatory approval. However, investors may feel that information in the prospectuses may not be sufficient to convince them. Signalling theory introduced by Allen and Faulhaber (1989) propose that going public firms need to signal their quality and potential through underpricing the offering. Indeed, Roosenboom (2012) finds that underwriters deliberately offer discounts on the estimated value of IPOs to attract investors. The estimated values are, however, tend to be positively biased. The long run performance is a widely controversial topic and various studies indicate that pricing of IPO is linked to post-issue performance. Miller (1977) argues that only optimistic investors buy shares in an IPO and performance declines when initially pessimistic investors also buy shares over time and performance approaches to mean valuation. Jain and Kini (1994) find that investors expect better performance and higher earnings growth, consequently they are surprised by the performance decline. They document that IPOs are valued at a premium to their industry peers and investors value IPOs based on their expectation that high pre-issue performance will extend to post-issue period. Expiry of lockup provisions also allows insiders to sell their shares, increasing the trading volume and diversifying investor base. Field and Hanka (2001) and Brav and Gompers (2003) show that lockup expiration is accompanied by negative returns. Studies also suggest that market timing is an important element of pricing, firms tend to go public when market is hot (Ritter, 1984). Firms decide to go public when they can obtain higher prices for their shares, and market timing can explain long-run underperformance (Schultz, 2003; Benninga et al., 2005). Attempts by managers to window-dress earnings can also affect future performance. Teoh et al. (1998) argue that earnings management can result in poor future performance for IPOs.

In this study, we investigate financial and operating performance of Turkish IPOs between January 2010 and December 2017. As documented by Jain and Kini (1994), poor financial performance in the post-issue period can be accompanied by poor operating performance. Unlike prior studies in Turkey, we consider peer-adjusted and matched performance. These dimensions are important because measuring operating performance raw or relative to pre-issue period ignores industry-specific factors. Ritter and Welch (2002) report that market-adjusted returns are considerably more negative

compared to raw returns, although there is no consensus among researchers on which measure of the return provides more appropriate results. Barber and Lyon (1996) discuss the measurement of abnormal operating performance and find that the model is well-specified only when firms are matched on control firms with similar pre-event performance if the sample includes performance bias. Since the IPO event characteristically involves factors related to insider wealth and ownership, the performance bias is likely to be present around the event. For example, if managers adjust earnings upwards to facilitate the IPO (e.g., Teoh et al., 1998), the profits are likely to be lower after the IPO due to mean reversion. Industry – and performance-matched controls account for this bias. We find that issuers underperform matched peers in the long-run regardless of the methodology used. Any improvement in performance is either temporary or belongs to the pre-issue period.

The rest of the study is organised as follows. Section 1 provides a brief review of the literature. Section 2 describes data, methodology and descriptive statistics. Section 3 presents the results and next section concludes.

## 1. Literature review

Performance is one of the most widely studies aspects of IPOs. Based on the type and timing of the analysis, we can divide performance studies into initial performance, long run performance, financial performance and operating performance categories. Ritter (1991) finds that investors are overoptimistic about the future potential of IPOs, which significantly underperform matched firms in the period of 3 years. Jain and Kini (1994) study operating performance of IPOs and find that performance measured as return on assets and operating cash flow-to-assets decline subsequent to going public. Their results suggest that the changes in performance are not related to initial returns. Mikkelson et al. (1997) examine insider ownership and operating performance and find that managerial ownership and post-issue performance are not related. Chi and Padgett (2006) investigate performance of Chinese IPOs and find that post-IPO period is characterised by declines in profitability and efficiency, as well as lower leverage. Similar to Jain and Kini (1994), they find an insignificant relation between initial returns and performance changes. Kiymaz (2000) studies initial and immediate returns of Turkish IPOs. Durukan (2002) finds that long term returns are negatively associated with initial returns and infers that underwriters deliberately underprice the offering to reward informed investors. Kurtaran and Er (2008) study operating performance of Turkish IPOs and find that performance measured by market-to-book and price-to-earnings ratios declines relative to pre-offering period. Bildik and Yilmaz (2008) examine initial returns and long run financial performance of Turkish IPOs. Celik (2016) documents that median profitability of Turkish IPOs declines after going public.

The inferences of Turkish studies above are based on raw operating performance, measured as change from pre-to-post issue ratios. This allows the reader to obtain an understanding of firm performance in time, however, does not allow observation of performance relative to its peers and environment. This study aims to fill this gap in the present research.

## 2. Data and methodology

We obtain the list of IPOs between 2010 and 2016 from SPK and supplement data with information collected from prospectuses, valuation reports and annual reports obtained from KAP. IPO share prices are directly obtained from Borsa Istanbul (BIST) Data Store. The sample covers last seven years, excluding 2017, because SPK data do not extend prior to 2010. Sample is terminated at 2016 to allow measurement of operating performance for at least one year following IPO. 111 firms undertake IPO during this period, out of them we are able to collect share price data for 110 firms to examine financial performance. Then we exclude 8 financial firms and 13 real estate investment trust (REIT) firms since their financial statements differ from mainstream industries. Of the remaining 89 IPOs, we could not access financial statements for 7 firms. The final sample used to measure operating performance contains 82 IPOs. Market performance is measured using 110 IPOs. In the analysis, the number of firms may change from year to year since a firm may delist from stock exchange, reducing the sample size in the following years. In addition, we hand-collect accounting data of all listed firms, excluding financial industries, to construct matched control samples, a necessity to examine peer-adjusted operating performance. The data collection procedure and sources of data are summarised in Table 1 below.

**Table 1.** Sample selection

| Step | Source of identification | N |
|---|---|---|
| Population of IPOs between 2010-2016 | SPK | 111 |
| Remaining: Market performance sample | BIST Data Store | 110 |
| Less: Financial IPOs | Prospectus | 8 |
| Less: REIT IPOs | Prospectus | 13 |
| Remaining IPOs | | 89 |
| Less: Missing annual reports | KAP | 7 |
| Remaining: Operating performance sample | | 82 |

### 2.1. Measuring market performance

We calculate cumulative abnormal returns (CAR) and buy-and-hold raw (BHR) and abnormal returns (BHAR) up to 36 months after IPO using the standard event study procedure. Monthly raw returns are calculated as the change from the first to the last day of month, where an event month is defined as 21 trading days. BIST Composite Index is used as market benchmark. The alpha and beta of the model are set to 0 and 1 respectively as in Ritter (1991) and MacKinlay (1997). Monthly abnormal returns (AR) for firm i in the event month t can be defined as:

$$AR_{i,t} = r_{i,t} - (\alpha_{i,t} + \beta_i m_{i,t}), \quad (1)$$

where $r_{i,t}$ and $m_{i,t}$ are firm and market returns. CARs are calculated as follows:

$$CAR_T = \sum_{t=0}^{12,24,36} \left[ \frac{\sum_{i=1}^{N} (r_{i,t} - m_{i,t})}{N} \right], \quad (2)$$

BHR and BHAR are calculated as below:

$$BHR_T = \frac{\sum_{i=1}^{N} \prod_{t=0}^{12,24,36} (1 + r_{i,t})}{N}, \quad (3)$$

$$BHAR_T = \frac{\sum_{i=1}^{N} \left[ \prod_{t=0}^{12,24,36} (1 + r_{i,t}) - \prod_{t=0}^{12,24,36} (1 + m_{i,t}) \right]}{N} \quad (4)$$

Long horizon event studies are known to suffer several biases. Lyon et al. (1999) show that survivor bias and rebalancing bias result in poorly specified tests of long run performance. To address these issues, we use monthly rebalancing, computing performance of the firms for the period they survive, if the firms do not survive the 36-month test period. This procedure requires termination of benchmark performance at the month the IPO firm is delisted from stock exchange.

#### 2.2. Measuring operating performance

Barber and Lyon (1996) investigate specification of operating performance models. They classify performance models into level and change models, where level models are measured as performance at a point in time and change models are measured as performance change at a point in time. In total, they summarise and test 9 different models. Their results show that change models are more powerful than levels and model is only well-specified when firms are matched on pre-event performance. Following them, we measure operating performance using several models, including change and performance-matched models. In the first model, changes in time are measured relative to pre-issue median (lagged firm performance). This corresponds to model 9 in Barber and Lyon (1996) and can be formulated as:

$$OP_{i,t} = P_{i,t} - P_{i,t-1}, \quad (5)$$

where $OP_{i,t}$ represents operating performance, $P_{i,t}$ post-IPO performance and $P_{i,t-1}$ lagged performance. Although this measure of performance is widely used and gives insights into performance through time, a disadvantage is that it ignores peer performance. Therefore, our second model examines IPO performance relative to industry firms. This model corresponds to model 1 in Barber and Lyon (1996).

$$OP_{i,t} = P_{j,t}, \quad (6)$$

where $OP_{i,t}$ is IPO performance in year t and $P_{j,t}$ is median industry performance in year t. Despite considering industry peers in the analysis, this model ignores changes through time. In the third model, we simultaneously consider industry performance and changes in time, by measuring post-IPO performance as change in IPO performance minus change in industry benchmark performance. Also known as first-differencing, this measure of performance corresponds to model 5 in Barber and Lyon (1996). We can write it down as follows:

$$OP_{i,t} = (P_{i,t} - P_{i,t-1}) - (P_{j,t} - P_{j,t-1}), \quad (7)$$

where $P_{j,t}$ and $P_{j,t-1}$ represent performance of industry control firms. The fourth model measures performance through time relative to an industry peer performance matched sample. Barber and Lyon (1996) show that only pre-event performance matched samples are well specified when firms are expected to perform unusually well or poorly. Performance-matching accounts for the mean-reversion in accounting data. This allows the researcher to avoid the misleading conclusion that firms perform poorly when in fact accounting performance reverts to its median. We adopt model 4 and 8 from Barber and Lyon (1996). The former merely adjusts for the level of industry performance while the latter also accounts for the changes through time. The performance-matched model can be stated as below:

$$OP_{i,t} = (P_{i,t} - P_{i,t-1}) - (P_{j,t} - P_{j,t-1}), \quad (8)$$

where $P_{j,t}$ and $P_{j,t-1}$ represent performance of pre-event performance matched industry control firms. The IPOs are matched on control firms by lagged return on assets (ROA). The matching procedure is as follows: We first attempt to match on 110%-90% of firm i's ROA in the year before IPO. If multiple firms are matched, we use median performance of matched industry control firms. If a single firm is matched, we use that firm j's performance. If no match is found in 110%-90% interval, we use performance of firm with the closest ROA. We utilise return on assets (ROA) and return on equity (ROE) for profitability, current ratio (CR) for liquidity, asset turnover (AT) for efficiency, and leverage (LEV) calculated as total liabilities divided by assets.

### 2.3. Defining control firms

A major issue with measuring operating performance is industry classifications. Studies in the US and UK commonly rely on 2-digit or 4-digit standard industry classification (SIC) to construct control firms with similar characteristics, whereas industry classification codes are not presently available in Turkey. This presents a significant challenge. To overcome this issue we adopt classifications from primary sector indices. BIST incorporates 17 non-financial primary indices, amongst them Industrials and Services indices, and their subsectors. Since digitised SIC does not apply to Turkey, we collect components of these indices from investing.com and match IPO firms with non-IPO control firms in these indices. In cases where a firm is present in multiple indices, we use one index only. Three different scenarios apply in this matching procedure: In the first scenario a firm is a component of Industrials & Services and one of their sub-indices, in this case we use the sub-index as a control sample. In the second scenario, a firm is present in Industrials & Services,

however not in sub-indices. In this case we use Industrials & Services as control sample. In the third scenario, a firm is a component of Information Technologies and Technology indices simultaneously. In this case we use Technology index as a control sample. These two indices have only one different share component. In the fourth scenario, we find no match for the IPO firm in primary indices. In this case, we use medians of entire control sample (267 firms) to measure performance. 5 IPOs are matched in this way. Table 2 shows the primary industries and number of firms in each category.

**Table 2.** Sample and control firms industry distribution

| | N (IPOs) | N (Controls) |
|---|---|---|
| Industrials | 25 | 135 |
| Services | 18 | 35 |
| Basic Metals | 4 | 15 |
| Information Technologies | 2 | 12 |
| Electric | 4 | 9 |
| Food & Beverages | 11 | 21 |
| Holdings | 5 | 26 |
| Chemicals, Oils & Plastics | 10 | 22 |
| Metals & Machinery | 5 | 26 |
| Non-metal Minerals | 4 | 25 |
| Wood, Paper & Print | 4 | 15 |
| Textile & Leather | 9 | 21 |
| Technology | 2 | 13 |
| Tourism | 2 | 8 |
| Transport | 3 | 4 |
| Wholesale, Retail &Trade | 12 | 12 |
| Other | 5 | 14 |
| Total | 82 | 267 |

Summary statistics for the 111 IPOs in our sample are presented in Table 3. On average, 29.4% of the firms become public, shareholders increase capital by 33.3%, and existing shareholders sell 7.6% of the pre-issue equity in the IPO, meanwhile more than half of the firms do not sell secondary equity. It appears than companies tend to obtain fresh financing through IPO rather than selling their existing shares to the benefit of incumbent shareholders, as demonstrated by a capital increase ratio more than four times that of participation ratio. Likewise, insiders continue to hold more than 70% ownership following the IPO. The average IPO firm is 16.6 years old and 27% (30 IPOs) of the firms use the price range method of offering. The average first day returns is 6.83% and median first day return is 1.6%, which is considerably lower than prior studies (Kıymaz, 2000; Durukan, 2002 et al.). Lastly, the average (median) IPO firm is valued at $176 ($42) million based on the first day price.

**Table 3.** Descriptive statistics

| | Mean | Median | 1st Quartile | 3rd Quartile | Min | Max | N |
|---|---|---|---|---|---|---|---|
| Public ratio (%) | 29.4 | 29.4 | 24 | 35.7 | 5.3 | 70.3 | 111 |
| Capital increase ratio (%) | 33.8 | 33.3 | 15 | 44 | 0 | 200 | 111 |
| Participation ratio (%) | 7.6 | 0 | 0 | 14.5 | 0 | 40.5 | 111 |
| Ownership ratio (%) | 70.5 | 70 | 64.3 | 76 | 29.7 | 94.6 | 111 |
| Age | 16.6 | 15 | 7 | 23 | 0 | 57 | 111 |
| Bookbuilding | 0.27 | 0 | 0 | 1 | 0 | 1 | 111 |
| First day return (%) | 6.83*** | 1.6*** | -0.8 | 11.06 | -17.3 | 108 | 111 |
| Market cap. (mil$) | 176.05 | 42.2 | 16.8 | 116.36 | 4.39 | 3187.92 | 111 |

Public ratio is obtained from post-issue filings and includes overallotment. Participation ratio shows the percentage shares sold by incumbent shareholders relative to the pre-issue equity. Ownership ratio shows the post-issue ownership of the incumbent shareholders. Age is calculated as IPO year minus incorporation year. Bookbuilding is a dummy variable equal to 1 if the offering price is determined as a price range, 0 otherwise. First day return is computed as first day close price minus offer price, divided by offer price. Market capitalisation is first day close price multiplied by outstanding shares, converted to US Dollars using the first trading day bid exchange rate. Significance is tested for a t-test for means and Wilcoxon test for medians. *** shows significance at 1% level.

## 3. Financial and operating performance

### 3.1. Financial performance

This study covers 111 firms that went public between 2010 and 2016; however, financial performance is investigated through 110 firms due to lack of data for one firm. The long-term performance indicators cumulative abnormal returns (CAR), buy-and-hold abnormal returns (BHAR) are presented in Table 4. Returns are presented separately for 12-month, 24-month and 36-monht windows following the IPO.

All returns in the table show a consistently declining pattern in the long-term. Median cumulative returns declines by 11.5% by the end of first year, while this decline deteriorates to 27.5% in the last year of observation. Buy-and-hold returns show a similar decline. Given the fact that offer price is taken as 1 in the calculation of buy-and-hold returns, median BHR provides – 19% return in the first year and – 44% return at the end of third year. These figures are unadjusted for market return in the samle period. When market return is taken into consideration, median BHAR drops further to – 25.1% in the first year, and – 63.4% in the third year, which means that financial performance of IPOs are well below market returns in the first three years. Wealth relative demonstrate this situation even more clearly. WR is first use by Ritter (1991), and obtained by scaling buy-and-hold return plus one by the corresponding market return plus one. If investor holds the market portfolio or obtains market return, wealth relative equals 1. Values larger than 1 indicate better and values lower than 1 indicate worse performance relative to the market index. The last three rows show that wealth relatives are below 1 in all years observed, indicating that IPOs underperform the market. Overall, results of Table 4 suggest that buy-and-hold investors are likely to get negative returns on their IPO investment. To add insult to injury, the 3rd Quartile abnormal returns are negative, implying that less than

one fourth of all IPOs outperform the market index in the long-term. The long-term IPO investors should therefore be prepared to absorb the potential loss from their investment.

**Table 4. Financial performance of IPOs**

| | Mean | Median | 1st Quartile | 3rd Quartile | Min | Max | N |
|---|---|---|---|---|---|---|---|
| 1-Year CAR | 0.051 | -0.115 | -0.453 | 0.269 | -1.287 | 8.075 | 109 |
| 2-Year CAR | 0.054 | -0.237 | -0.625 | 0.238 | -1.443 | 8.816 | 85 |
| 3-Year CAR | 0.326 | -0.275 | -0.898 | 0.485 | -1.626 | 22.966 | 61 |
| 1-Year BHR | 1.005 | 0.812 | 0.589 | 1.236 | 0 | 4.481 | 110 |
| 2-Year BHR | 0.868 | 0.607 | 0.426 | 1.074 | 0.076 | 6.485 | 88 |
| 3-Year BHR | 0.753 | 0.561 | 0.332 | 0.993 | 0.167 | 2.808 | 64 |
| 1-Year BHAR | -0.073 | -0.251 | -0.477 | 0.173 | -1.119 | 3.303 | 110 |
| 2-Year BHAR | -0.277 | -0.477 | -0.684 | -0.131 | -1.145 | 5.570 | 88 |
| 3-Year BHAR | -0.482 | -0.634 | -0.903 | -0.207 | -1.255 | 1.765 | 64 |
| 1-Year WR | 0.949 | 0.773 | 0.556 | 1.203 | 0 | 3.806 | 110 |
| 2-Year WR | 0.781 | 0.587 | 0.388 | 0.888 | 0.062 | 7.087 | 88 |
| 3-Year WR | 0.640 | 0.442 | 0.264 | 0.854 | 0.156 | 2.694 | 64 |

CAR: Cumulative abnormal return; BHR: Buy-and-hold return; BHAR: Buy-and-hold abnormal return; WR: Wealth relative. Number of observations may vary across samples due to delisting or lack of share price. Two outliers are excluded from the calculation of 2nd and 3rd year CARs.

### 3.2. Operating performance

Subsequently, we investigate operating performance through widely used ratios of accounting. Because we also need pre-event ratios to use Barber ve Lyon (1996) performance models, used ratios are carefully selected to be able to calculate them for the pre-issue period. In other words, ratios such as price-to-earnings, market-to-book are not used because it is not possible to compute them when the firm is not public. In fact, the offer price is often estimated using these ratios for public peers because issuing firm multiples do not exist. The models can be grouped in three as pre-event adjusted, industry-adjusted and performance-adjusted performance. The raw performance indicators (e.g. ratios without adjustment) are not presented because they do not inform the reader about the state of the firm relative to the industry and trends. Issuers cannot be examined in isolation and meaningful comparisons through time and across market are necessary. The results for the (-3, +3) event window are presented in Table 5 through Table 8. The number of observations vary for each year because of missing data, delistings and because issuers do not have to disclose financial statements for the Year – 3. Only two years of disclosure is mandatory in the prospectus. The sample covers 82 IPOs at the largest window. The first row shows means and the second row shows medians. t – and z-values are not reported for brevity.

Table 5 presents ratios adjusted by pre-event performance. The abnormal performance indicators are calculated using Eq. 5, where we substitute pre-issue median ratio for the lagged performance. This model allows us to interpret and compare the change in performance after the IPO relative to

the pre-issue private firm. In the three post-issue years, we observe significant drops in profitability in the region of 2% and decline in efficiency as measured by asset turnover. The liquidity, measured by current ratio, shows improvement and there is evidenceof deleveraging in the first two years after the IPO, both of which are positive performance signals. These improvements can be attributed to the IPO proceeds, which could be used towards payments of short – and long-term debt, hence resulting in better liquidity and lower leverage. In the third year, these improvements are reversed and firms go back to their old leverage ratios, implying that IPO provides a temporary respite and after proceeds are exhausted, reliance on debt financing continues. Meanwhile, their profitability remains low and does not bounce back to pre-issue levels, partly explaining the increase in leverage and reliance on debt financing. The evidence so far suggests declining levels of profitability and efficiency, coupled with a temporary improvement in leverage and liquidity compared to pre-IPO period. To better understand the characteristics of these performance changes, we provide industry-adjusted ratios in Table 6.

**Table 5.** Pre-event adjusted performance

| | T0 | T1 | T2 | T3 |
|---|---|---|---|---|
| ROA | -0.008 | -0.029*** | -0.087** | -0.016 |
| | -0.002 | -0.009** | -0.028*** | -0.019** |
| ROE | -0.105** | -0.127*** | -0.218*** | -0.178** |
| | -0.049*** | -0.047*** | -0.085*** | -0.082*** |
| CR | 2*** | 1.21*** | 0.88 | 0.59 |
| | 0.54*** | 0.36*** | 0.2*** | 0.16** |
| AT | -0.21** | -0.24*** | -0.17* | -0.21 |
| | -0.17*** | -0.19*** | -0.18*** | -0.20*** |
| LEV | -0.09*** | -0.05*** | -0.02 | -0.00 |
| | -0.07*** | -0.03*** | -0.03* | -0.03 |

Means are in the first row, medians are in the second row. Significance is tested for a t-test for means and Wilcoxon test for medians. *** significant at 0.01 level, ** significant at 0.05 level, * significant at 0.10 level.

Median ratios in Table 6 show that firms outperform industry peers in profitability prior to IPO and underperform them starting from second year following the IPO. Liquidty is consistently in a better state than industry peers in the first two years, potentially due to the incoming proceeds from the issue. Liquidity; however, returns to the pre-issue levels in the third year. As expected, leverage ratio is the lowest relative to peers in the IPO year. The results of Table 6 indicate a temporary improvement in leverage and liquidity, while IPO firms underperform peers in terms of profitability. The profitability measures are particularly important in the sense that they could indicate earnings management practices to artificially prop up the profits before the IPO (Teoh et al., 1998), and due to mean reversion in time profits may deteriorate following the issue. The results in general are consistent with the evidence that IPOs underperform in the long-run. (Ritter, 1991; Jain and Kini, 1994).

**Table 6.** Industry-adjusted operating performance

| | T-3 | T-2 | T-1 | T0 | T1 | T2 | T3 |
|---|---|---|---|---|---|---|---|
| ROA | 0.000 | 0.025** | 0.036*** | 0.012 | -0.007 | -0.074* | -0.006 |
| | -0.005 | 0.003** | 0.011** | -0.000 | -0.008 | -0.025*** | -0.017 |
| ROE | 0.034 | 0.118*** | 0.126** | 0.002 | -0.02 | -0.129** | -0.086 |
| | 0.034 | 0.063*** | 0.049*** | -0.011 | -0.021*** | -0.045** | -0.043** |
| CR | 0.57 | 0.019 | 1.12* | 2.22*** | 1.48*** | 1.11** | 0.76 |
| | -0.17 | -0.27** | -0.05 | 0.63*** | 0.36*** | 0.03* | 0.08 |
| AT | 0.38*** | 0.28*** | 0.35*** | 0.17 | 0.13 | 0.21* | 0.14 |
| | 0.15** | 0.09** | 0.12** | -0.09 | -0.04 | -0.02 | -0.06 |
| LEV | -0.19*** | -0.18*** | -0.21*** | -0.25*** | -0.21*** | -0.18*** | -0.17*** |
| | -0.22*** | -0.22*** | -0.25*** | -0.29*** | -0.23*** | -0.21*** | -0.20*** |
| N | 57 | 81 | 82 | 82 | 82 | 81 | 75 |

Barber ve Lyon (1996) argue that in the presence of important corporate events, performance models are best specified when industry-adjustment is carried out with performance-matched control firms. The performance matching is done prior to the event. The procedure is explained previously in Section 3.2, and its results are presented in Table 7.

**Table 7.** Performance-matched operating performance

| | T-3 | T-2 | T-1 | T0 | T1 | T2 | T3 |
|---|---|---|---|---|---|---|---|
| ROA | -0.004 | 0.015 | 0.015** | 0.019 | -0.004 | -0.083** | -0.008 |
| | -0.004 | 0.001 | 0.001** | 0.002 | -0.012 | -0.027*** | -0.007 |
| ROE | 0.089 | -0.257 | 0.086** | -0.076 | -0.063 | -0.141*** | -0.005 |
| | 0.026 | 0.012 | 0.019*** | -0.001 | -0.028 | -0.063** | -0.016 |
| CR | -0.52 | -0.9** | -1.44** | 1.67** | 0.91 | 0.29 | 0.16 |
| | 0.04 | -0.27*** | -0.19 | 0.55*** | 0.14** | 0.05 | 0.07 |
| AT | 0.6*** | -1.34 | -1.25 | 0.12 | 0.09 | 0.20 | 0.10 |
| | 0.33*** | 0.15*** | 0.15* | -0.07 | -0.08 | 0.02 | -0.06 |
| LEV | -0.08** | -0.12*** | -0.18*** | -0.24*** | -0.20*** | -0.13*** | -0.14*** |
| | -0.04 | -0.09*** | -0.19*** | -0.22*** | -0.23*** | -0.13*** | -0.13*** |
| N | 57 | 81 | 82 | 82 | 82 | 81 | 75 |

Because we match on ROA, the abnormal ROA before the issue in Table 7 is smaller than industry – and pre-event adjusted profitability; however, it maintains superior performance compared to matched peers. The lagged event year is especially critical with significant profitability ratios. This suggests that issuers deviate more from industry peers more on the eve of the IPO, while the second and third years before the IPO as well as the first two years after the IPO do not show significant deviations in terms of profitability. Only in the third IPO year (T2), the performance is significantly lower. The liquidity and leverage ratios follow a similar pattern we observed previously, with a temporary improvement and deleveraging due to IPO proceeds and reversion to pre-issue levels of debt after T2. Overall, the results point to short-term improvements around the IPO year in terms of profitability, liquidity and leverage.

**Table 8.** Difference-in-differences

| | T0 | T1 | T2 | T3 |
|---|---|---|---|---|
| ROA | -0.008 | -0.026** | -0.093** | -0.026 |
| | -0.006 | -0.011** | -0.038*** | -0.026*** |
| ROE | -0.102** | -0.124*** | -0.232*** | -0.183** |
| | -0.041*** | -0.063*** | -0.119*** | -0.099*** |
| CR | 2.01*** | 1.27*** | 0.89 | 0.31 |
| | 0.49*** | 0.49*** | 0.26** | 0.11** |
| AT | -0.15* | -0.19*** | -0.11 | -0.20 |
| | -0.13*** | -0.16*** | -0.14*** | -0.15*** |
| LEV | -0.05*** | -0.01 | 0.02 | 0.04 |
| | -0.04*** | 0.01 | -0.01 | 0.02 |

The last model implements a two-dimensional performance measurement by investigating industry-adjusted performance through time. Called difference-in-differences, this model analyses performance of IPOs by comparing the post-issue industry-adjusted performance (1st difference) and pre-event adjusted performance (2nd difference). Although different uses exist in the literature, we use median pre-issue ratios to calculate changes in time and to illustrate trends. The results presented in Table 8 have a pattern observed in prior models. Specifically, industry-adjusted profitability considerably and significantly deteriorates relative to the pre-issue profitability in all post-IPO years, including the event year which underperforms in terms of ROE. Liquidity and leverage show temporary improvement limited to first two post-issue years at maximum, while efficiency is worse overall. The results are consistent with the scenario where IPO proceeds are used towards paying down debt for a short-term deleveraging and better liquidity, while issuers tend to underperform consistently in terms of profitability regardless of the way performance is measured, insinuating an artificially propped up profitability before the event to facilitate the success of the IPO. Although we do not formally test for earnings management, we suspect that managers engage in this practice to appear profitable and promising in a market where profit margins are low. If practiced, earnings manipulation would lead to deterioration in post-IPO performance due to mean reversion. Oue results are in parallel with the long-run underperformance anomaly (Ritter, 1991; Jain and Kini, 1994), and support the findings of the existing research on Turkish market (Durukan, 2002; Bildik and Yilmaz, 2008; Celik, 2016).

## Conclusion

We investigated long-term financial and operating performance of going public firms in Turkey in the spirit of prior research of Ritter (1991), Jain and Kini (1994) and Barber and Lyon (1994). Going public is a difficult and critical decision for private companies due to changing ownership structure, disclosure regulations and exposure to trading on the stock exchange. Most private companies are owned by families, who value privacy of their business absent mandatory disclosure which creates an information asymmetry between insiders and investors. Although firms usually have to meet several criteria to prove their conformity to the stock exchange and to be eligible to go public, prior

research has consistently shown worldwide that conformity to regulations does not prevent them from underperforming the market index and peers. This study makes a marginal contribution to research on Turkish IPOs through an investigation of performance through industry-adjusted, performance-matched, and difference-in-differences methodology. Previous studies in Turkey lack these dimensions and we believe this study complements existing research that analyzes performance across time. Replicating this methodology requires consistent industry codes, which Turkish companies lack. Therefore, we rely on industry indices and prospectuses to define industries for IPOs and control firms. Although we are able to execute the industry-adjusted and matched performance analysis in this manner, the reader should be aware that SIC codes do not exist and the peer-matching process could yield different results from studies in other markets (e.g. Jain and Kini, 1994). Despite this limitation, the results support the long-term underperformance anomaly in terms of financial and operating performance. We show that profitability peaks immediately before the event year and drops after the IPO, while there are temporary improvements in leverage and liquidity. The results suggest that companies adjust or manage their earnings before the IPO, likely to ensure conformity to regulations and increase the chances of a successful IPO. Investors should be aware that improvements around the IPO event do not last and disappear after the second post-event year at the maximum. Further research can examine the determinants of performance changes, whether earnings management is practiced, and investor allocations in under – and out-performing IPOs. The future research on this arena is; however, likely to suffer from limitations such as low number of observations and insufficient information disclosure in the IPO filings.

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