The Underperformance of Initial Public Offerings (IPOs): The Sensitivity of the Choice of Empirical Method.

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Abstract

This paper investigates the performance of Jordanian IPO's using data from Amman Stock Exchange (ASE) over the period 1981-2002. We studied the sensitivity of the model used to estimate the cumulative average abnormal returns. In doing that, we employed three different models and used two approaches to test the result: Standard event-time analysis and the calendar-time approach. The three models used to estimate the cumulative average abnormal returns produce significant negative abnormal returns when we employ event-time analysis. However, the calendar-time approach concludes that the long-term performance of Jordanian IPO's is not different than that of the overall market.

JEL classification: G14

Keywords: Initial public offerings (IPOs); long-run returns; emerging markets.

Introduction

Previous research has concluded that investing in recent initial public offerings (IPOs) is a poor investment strategy (e.g. Ritter, 1991; Loughran & Ritter, 1995; and Levis, 1993, amongst others) since IPOs underperform a market index. However, Bravo and Compers (1997) and Espenlaub et al. (2000) find that the underperformance of IPOs is sensitive to the approach used to estimate abnormal performance.

Up to date, no published paper exists that investigates the performance of IPOs using data from Amman Stock Exchange (ASE). Thus, the aim of this paper is to investigate the performance of the IPOs using data from ASE over the period 1981-2002. In particular, this paper seeks to investigate the sensitivity of the models used to estimate abnormal returns.

We employ three different models to estimate abnormal returns. These are: the capital asset pricing model (CAPM), the Fama and French (1993) three-factor model and a Fama-French type model (hereafter, the multi-factor model) extended for leverage effect, liquidity effect, stock return volatility, and loser-winner effect. Furthermore, we apply two different approaches to test the sensitivity of the above three models: event-time analysis in which abnormal returns are calculated for up to 60 months after the IPO and calendar-time analysis in which equally weighted 12-month portfolios are constructed to include any firm which has an IPO during the previous 12-month period. The latter approach has advantage over the former in which it controls for cross-correlation in returns (e.g. Loughran and Ritter, 1995 & Espenlaub et al, 2000), thus, it yields to well-specified test statistics (e.g. Lyon et al., 1999).

Using event-time analysis, the results indicate that there is no significant underperformance in the first 18 (14) months after the issuance of IPOs for the CAPM (Fama-French model). After that the two benchmarks indicate a significant underperformance up to 60 months. The multi-factor model yields slightly to different results. The t-statistics are positive (but not significant) in most cases in the first 27 months, but negatively significant after that up to 60 months. Overall, we conclude that the extent of the underperformance of IPOs is sensitive to the model adopted.

Using the calendar-time analysis method or model to control for cross-correlation in returns, the results provide less evidence of underperformance. This result is consistent with Espenlaub et al. (2000). Therefore, this paper concludes that, among the models used to estimate abnormal returns, the multi-factor model seems to be the best approach that describes the patterns of abnormal returns, and that the calendar-time analysis is more appropriate in reflecting this pattern.

Literature Review

The problem of underperformance has been expansively researched. Financial economists in recent years have closely examined and intensely debated the performance of Initial Public Offerings (IPO's) .

Ibbotson (1975) discovered a saucer shaped pattern upon study of a random selected security from each month in the sixties whereby the offering initially yielded positive returns; below market returns ensued, while the fourth year returns tended towards normal. The initial 48 months exhibited below normal performance. As most returns were negative with a few very high, the distribution of the returns was evidently very skewed. This points to individually risky investments. This underperformance was not statistically significant due to the small size of the sample and the high standard deviations.

Ritter (1991) focused on the 1975 to 1984 time period wherein the returns from a control sample of 1,526 initial public offerings from firms similar in industry and size were analyzed. The three-year return was 34.47%; the control sample returned 61.86% over the same three years.

Loughran (1993) examination of the returns from 3,556 IPO's during 1967-1987 uncovered an average six year total return of 17.29% in contrast with 76.23% for the NASDAQ index during the same time span. These results are considerably worse than those of Ritter's during his three year tests. Comparatively, firms matched in size on both the New York Stock exchange and on NASDAQ yielded results which showed a much stronger performance. Despite control of the exchange and the book to market ratio, a regression equation for July 1973- December 1988 had a statistically significant negative coefficient for having had an IPO within six years.

Later, Loughran & Ritter (1995) examined initial public offerings from1970-1990. Their examination uncovered a 5% average rate of return

per year for the five years after issuance. This is compared to firms of similar size which yielded a 12% average rate of return. A more significant underperformance was found in the initial public offerings of median firms; here, after five years, their IPO's averaged a negative return of 39%; in significant contrast, similar sized firms yielded a positive return of 16% for the five years. The authors calculate that the forgone return was $39 billion dollars, making the underperformance of economic significance.

Servaes & Rajan (1997) examined initial public offerings from 1975-1987. They uncovered a five year raw return of 24%. In comparison with the NYSE/AMEX index, this represents a 47% underperformance; with the smallest decile from the NYSE/AMEX, a 17% underperformance; and with firms similar in size and industry, a 41% underperformance.

Other researchers (Bravo & Gompers 1997; Gompers & Lerner, 1999) examined a slightly different set of years and similarly uncovered high level underperformance effects, with the underperformance greater for non-venture capital-backed companies. Teo, Welch, and Wong(1998) used firms going public between 1975 and 1984 also found underperformance; their study also shows that underpeformance was greater in firms which used more aggressive accounting. Aggarwal & Rivoli (1990) found that 1598 IPO's offered between 1977 to 1987 underperformed the US market by 13.73% over the first 250 trading days.

Forbes magazine (Stern & Bernstein, 1985, as cited in Ritter, 1991) found, after analyzing 1,922 IPO's priced over $1.00 issued from January 1975 to June 1985, that "from its date as going public to last month, the average new issue was down 22% relative to the broad Standard & Poors 500 stock index" .

It is important to point out that these studies of US IPO's overlap in time periods as well as IPO's. The results are hence reliable because differing methodologies which use varying statistical methods ((including controlling for a range of other variables) have yielded similar conclusions. Two US studies which examined earlier time periods also found underperformance: Simon (1989) found that IPO's offered from 1926 to 1933 listed on regional exchanges showed substantial underperformance over 60 months while. Stoll & Curley (1970) found underperformance for 205 small issues in the fifties and sixties.

This underperformance is not limited to the United States. Levis (1993), in examining the three year performance of 712 UK IPO's issued between 1980 and 1988, and depending on the chosen benchmark, uncovered underperformance that varied between 8.3% and 23.0%. Uhlir (1988) also uncovered an underperformance of 7.4% after one year for German issues 1977-1987. Finn & Higham's (1988) examined 93 Australian IPO's for 1966-1978. They found that buying at the end of the listing month and holding to the end of the first year earned 6.52% below the indices, but that this loss was not quite statistically significant. Kunz & Aggarwal (1994) found that 42 Swiss IPO's between 1983 and 1989 experienced an underperformance of 6.1%. Keloharju (1993) found that the average Finnish IPO lost 22.4% from the first market trading to three years later, versus 1.6% average decline for the market index. Therefore, it seems that the US pattern of underperformance extends to other countries.

Studies of emerging markets also revealed a similar underpeformance effect to that exhibited by developed countries. Aggarwal, Leal, & Hernandez (1993) uncovered an underperformanceof 47% after three years Brazilian IPO's. Chileean IPOs also yielded underperformance after three years which averaged 23.7%, while for Mexico the underperformance after one year was 19.6%.

In studies of Asian markets, Dawson (1987) found, upon examination of one year market adjusted returns for initial public offerings in Hong Kong, Singapore, and Malaysia during 1978-1984, that those for Hong Kong were down 9.3% and Singapore 2.7%. Noticeably, neither decline was statistically significant. Contrastingly, Malaysia yielded a positive, statistically significant overperformance of 18.2%. The author importantly points out that the Malaysian index used in the study was not a market wide one, but an industrial one and hence does not constitute a significant exception. The one significant exception to the pattern of underperformance in Asian markets is India where Shah (1995) finds (in a large data set with 2056 IPO's from 1991-1995), that after typically outperforming the market for the first 200 trading days, IPO's then decline where after 400 days they are approximately at the level of the first trading.

From the aforementioned studies, it appears that in most countries, IPO's underperform the market over periods of one to five years. These studies examine IPO's by comparing them to other stocks and do not typically adjust for risk as risk is difficult to measure when no trading history exists. However, IPO returns are much more variable than most stocks, with the mean return usually exceeding the median since the average can be raised by a few large winners. Thus, because of their high risk, one would expect IPO's to outperform the indices, especially for undiversified individual investors who cannot count on a portfolio with only a few securities including any of the big winners among the IPO's. Even on a systematic risk basis (beta), IPO's appear to be riskier than average .

Data and Research Methodology

The sample of this study consists of all IPOs issued by Jordanian companies over the period 1981-2002. The empirical analysis of this study uses monthly market information as well as annual accounting data. Thus, the dataset used in this paper consists of monthly stock returns[1], monthly 3-month Treasury bill rates as a proxy for risk-free returns, and monthly returns on the ASE value-weighted index as a proxy for market returns. Data on book-to-market of equity, market capitalization, trading volume, equity to total asset ratio are collected from ASE guidelines.

Cumulative Average Abnormal Returns (CAARs)

In order to analyze the long-term performance of IPOs, we apply the standard event-study methodology. To calculate long-term abnormal returns, three models are employed. These benchmarks are: the capital asset pricing model (CAPM), the Fama and French (1993) three-factor model (FF), and a Fama-French type model (hereafter, the multi-factor model; MF) extended for leverage effect, liquidity effect, stock return volatility, and loser-winner effect.

For each model, monthly abnormal returns are computed for up to 60 months after the IPO excluding the initial return period (the period between the offer date and the listing date). Following previous research in this area, we estimate the model parameters and the excess returns jointly and use in-sample estimates of abnormal returns. Then, abnormal returns, for each model, are cumulated over time up to period T after the IPO, thus:

$$AAR = \frac{1}{N}\sum_{i=1}^{N} Ab_{i,t}$$

$$CAAR_T = \sum_{t=1}^{T} CAR$$

Where AAR is the average abnormal returns, is the abnormal return, $Ab_{i,t}$ in month t after the IPO from company i, N is the number of firms in the sample.

We adopt t-test statistics that are generated based on Ritter (1991). Thus, the following t-test is used to test whether CAART differs from zero:

$$t(CAAR_T) = \frac{CAAR_T (n)^{1/2}}{(t.\text{var} + 2(t-1)\text{cov})^{1/2}}$$

Where n is the number of firms trading in each month t, is the event month, var is the average cross-sectional variance over 60 months, and cov is the first-order auto-covariance of the abnormal return series.

Three Models to Estimate Abnormal Returns

We employ three different models to estimate abnormal returns. Mainly, we use: (1) the capital asset pricing model (CAPM) as follows:

$$Ab_{i,t}^{CAPM} = R_{i,t} - [R_{f,t} + \beta_i^{CAPM}(R_{m,t} - R_{f,t})]$$

Where $R_{i,t}$ is the return on firm i in event month t, $R_{m,t}$ is the return for the market in event month t, $R_{f,t}$ is the risk-free rate in event time t measured by the return on the Treasury bills, β_i^{CAPM} is the CAPM beta of firm i, estimated by the ordinary least square (OLS) regression up to 60 months after the IPO. (2) the Fama and French (1993) three-factor model as follows:

$$Ab_{i,t}^{FF} = R_{i,t} - [R_{f,t} + \beta_i^{FF}(R_{m,t} - R_{f,t}) + s_i^{FF} SMB_t + h_i^{FF} HML_t]$$

SMB (small minus big) is the difference, each month, between the average of the returns on the three small-stock portfolios (S/L, S/M, and S/H) and the average of the returns on the three big-stock portfolios (B/L, B/M, and B/H). HML is the difference, each month, between the average of the returns of the two high-book-to-market portfolios (S/H and B/H) and the average of the returns on the two low-book-to-market portfolios (S/L and B/L). Following Fama and French (1993) the mimicking portfolios for the size (SMB) and book-to-market (HML) factors are constructed as follows. At the end of April[1] of each year t stocks are allocated to two groups (big and small) based on whether their market value is above or below the median of the market[2]. Moreover, stocks are allocated independently into three book-to-market groups (high, medium, and low) based on the breakpoints for the top 30 percent, middle 40 percent, and bottom 30 percent of the book-to-market values. We test whether the three-factor model explains the difference in returns between winners and losers by testing whether the intercept in each regression is equal to zero using conventional t-statistics.

(3) the multi-factor model.

In addition to the above two models, we employ a Fama-French type model extended for leverage effect (LMU), liquidity effect (LMI), stock return volatility (HMLSTD), and loser-winner effect (LMW) as follows:

$$Ab_{i,t}^{MF} = R_{i,t} - [R_{f,t} + \beta_i^{MF}(R_{m,t} - R_{f,t}) + s_i^{MF} SMB_t + h_i^{MF} HML_t + u_i^{MF} LMU_t + l_i^{MF} LMI_t + v_i^{MF} HMLSTD_t + w_i^{MF} LMW_t]$$

LMU is the difference, each month, between the average of the returns on the two high-leverage portfolios and the average of the returns on the two low-leverage portfolios. LMI[1] is the difference, each month, between the average of the returns on the two high-trading-volume portfolios and the average of the returns on the two low-trading-volume portfolios[2]. LMW is the return difference between portfolios of past losers and past winners based upon returns over the past 12 months. HSVMLSV[3] is the difference, each month, between the average of the returns on thetwo high-stock-volatility portfolios and the average of the returns on the two low-stock-volatility portfolios.

Event and Calendar time-analyses

For each model and for each IPO, we regress 60-month excess returns against the respective benchmarks. The average intercept value from these regressions will be a measure of average long-run abnormal returns following an IPO. Following Loughran and Ritter (1995), we also adopt a calendar-time analysis. This approach has an advantage over the event-time analysis in which it controls for cross-correlation in returns (Loughran and Ritter, 1995) and thus, it yields to well-specified test statistics (Lyon et al., 1999).

Therefore, for each calendar month we form equally weighted n month portfolios set up to include any firm which has an IPO during the previous n months, n= 12, 24, 36, 48, and 60. Then, portfolio returns are calculated by equal weighting of the 5 years' portfolio returns in calendar time. That is, we invest 20% in the first year, 20% in the second year, 20% in the third year, 20% in the fourth year, and 20% in the fifth year. Next, we examine the performance of the 5 years portfolio by running the following regressions:

The CAPM

$$Rp_t - R_{f,t} = \alpha_i + \beta_i(R_{m,t} - R_{f,t}) + e_{i,t}$$

$$Rp_t - R_{f,t} = \alpha_i + \beta_i(R_{m,t} - R_{f,t}) + s_i SMB_t + h_i HML_t + e_{i,t}$$

$$Rp_t - R_{f,t} = \alpha_i + \beta_i(R_{m,t} - R_{f,t}) + s_i SMB_t + h_i HML_t + u_i LMU_t + l_i LMI_t + v_i HMLSTD_t + w_i LMW_t + e_{i,t}$$

Where, $R_p - R_f$ is the excess return in month t on the 5 years portfolio of IPO. Other variables are defined above.

Empirical Results

Table 1 presents the cumulative average abnormal returns for the first month up to the 60th month after the IPOs of alternative models used in this study. The results confirm that the CAAR is not significant in the short and medium terms irrespective of the model employed. For example, the performance of the Jordanian IPOs is not statistically and economically different than zero in the first 17, 12, and 26 months, when we use the CAPM, FF, and MF model, respectively, to estimate the CAARs. However, the results also provide evidence of long-term IPO underperformance regardless of the model used to estimate the CAARs. For example, the three models (CAPM, FF, and MF) confirm the existence of statistically and economically significant long-term IPO underperformance. Overall, the above results confirm the significant underperformance of Jordanian IPOs in the long-term irrespective of the model used to estimate the CAARs. However, the magnitude of underperformance differs based on the model used. For instance, the CAAR over the 36 (48 and 60) months is -25% (-29% and -34%), -35% (-40% and -50%), and -14% (23% and -36%) for the CAPM, FF, and MF model, respectively.

The results from Table 1 are illustrated graphically in Figure 1. Comparing the CAARs across the three models used in this paper, we can observe that the multi-factor model (MF) produces less underperformance, whilst the Fama-French model (FF) produces high underperformance, and the capital asset pricing model (CAPM) lies in between.

Table 2 reports the cross-sectional averages of the event-time regression results for the alternative models used. Recall that for each IPO, we run a time series regression of the 60-month excess returns on the various models and then average the coefficients across the IPOs. Thus, α in the regression represents a measure of the average abnormal returns. If α is not significantly different than zero, the null hypothesis of no abnormal returns can be accepted. The results from Table 2 confirm the results from Figure 1. That is, the CAPM, FF, and MF models produce significantly negative intercepts which imply long-run underperformance[1].

However, there is a considerable body of studies which argues that the long-term tests are mis-specified and the there is significant over-rejection of the null hypothesis of no positive abnormal performance for the CAAR approach (e.g. Kothari and Warner; 1997 and Barber and Lyon; 1997). Moreover, Loughran and Ritter (1995) argue that the t-statistics assessing the significance of abnormal returns are likely to be overestimated due to the presence of cross-correlation in contemporaneous returns.

Lyon, Barber, and Tsai (1999) suggest a calendar-time approach instead of the event-time analysis as it controls for cross-correlation. Further, they show that the calendar-time approach yields well-specified test statistics. Therefore, we employ the calendar-time approach. Table 3 presents the calendar-time regressions of the CAPM, FF, and FF models, respectively. The results show that the intercept coefficients (α) are insignificantly positive, 0.14%, 0.09%, and 0.13% with t-statistics of 0.62, 0.37, and 0.46 for the CAPM, FF, and MF models respectively. These results suggest that the performance of Jordanian IPOs is positive, but not significant compared to the market performance. Furthermore, these results suggest that the underperformance result of Jordanian IPOs from the event-time analysis is biased. In addition to that, Table 3 shows that neither the size factor nor the book-to-market factor has an effect on the performance of the Jordanian IPOs. The only factor that loads significantly is the loser-winner factor (LMW).

Figure 2 shows and confirms the results illustrated in Table 3. The implication of the results in Table 3 and Figure 2 is that a long-term investment strategy based on holding Jordanian IPOs yields returns close to the market return.

Summary and Conclusions

Up to date no published paper exists that examines the performance of Jordanian IPOs. Therefore, the objective of this paper was to investigate the long-term returns of Jordanian IPOs, up to five years after the issuance. The sample consists of all IPOs over the 1981-2002 period.

We use three models to estimate the cumulative average abnormal returns. Namely, these are: the capital asset pricing model (CAPM), the Fama and French (1993) three-factor model (FF), and a multi-factor model (MF) that extends the Fama-French model to include the leverage effect, the liquidity effect, the stock return volatility, and the loser-winner effect. Further, we use two different approaches to test the results: standard event-time analysis and the calendar-time approach.

The three models used to estimate the cumulative average abnormal returns produce significant negative abnormal returns when we employ the event-time analysis. However, the calendar-time approach concludes that the long-term performance of Jordanian IPOs is not different than that of the overall market.

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Notes-:

[1] These returns are adjusted for stock dividends, stock split, and dividend yield.

[2] Note that the fiscal year-end for all companies listed on Amman Stock Exchange is the end of December. Thus, we permit for four-month gap to ensure that the data is available at the formation date.

[3] We use the median of the market since the number of the companies over the sample period is just 232.

[4] To construct such a factor, I do the following: At the end of April of each year t stocks are allocated to two groups (big and small) based on whether their market value is above or below the median of the market. Further, stocks are allocated in an independent sort to three trading-volume groups (high, medium, and low) based on the breakpoints for the top 30 percent, middle 40 percent, and bottom 30 percent of the trading-volume values. From the intersection of the two size groups (S and B) and the three trading-volume groups (L, M, H), six size-trading-volume portfolios are constructed

[5] Note that trading volume was scaled by market value of equity.

[6] HSVMLSV factor is constructed as follows: At the end of April of each year t stocks are allocated to two groups (big and small) based on whether their market value is above or below the median of the market. Further, stocks are allocated in an independent sort to three stock volatility groups (high, medium, and low) based on the breakpoints for the top 30 percent, middle 40 percent, and bottom 30 percent of the standard deviation of the past 12-month returns. From the intersection of the two size groups (S and B) and the three standard deviation groups (L, M, H), six size-volatility portfolios are constructed.

[7] Note that in the case of using MF model to estimate the CAARs, the intercept is marginally significant at 10% level

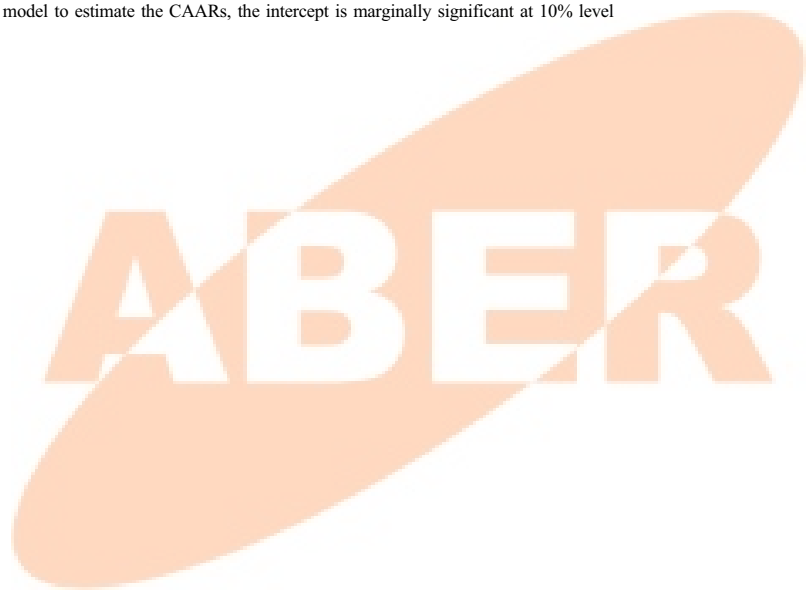

Table 1: Cumulative average abnormal returns for alternative models

	CAPM results					FF results					MF results				
Month	CAARt %	t-stat	month	CAARt %	t-stat	CAARt %	t-stat	month	CAARt %	t-stat	CAARt %	t-stat	month	CAARt %	t-stat
1	0.00	0.10	31	-0.24	-3.74	0.00	-0.06	31	-0.35	-5.26	0.04	1.51	31	-0.16	-2.24
2	-0.01	-0.37	32	-0.23	-3.59	-0.02	-0.66	32	-0.34	-5.03	0.04	0.95	32	-0.14	-1.88
3	-0.02	-0.63	33	-0.24	-3.69	-0.03	-0.73	33	-0.34	-5.03	0.03	0.89	33	-0.14	-1.88
4	-0.03	-0.84	34	-0.25	-3.80	-0.04	-1.12	34	-0.35	-5.07	0.01	0.27	34	-0.14	-1.88
5	-0.01	-0.38	35	-0.25	-3.68	-0.02	-0.59	35	-0.35	-4.91	0.03	0.77	35	-0.13	-1.68
6	-0.04	-1.04	36	-0.25	-3.55	-0.05	-1.24	36	-0.35	-4.78	0.01	0.16	36	-0.14	-1.74
7	-0.04	-1.13	37	-0.25	-3.56	-0.05	-1.26	37	-0.34	-4.72	0.01	0.18	37	-0.14	-1.75
8	-0.05	-1.32	38	-0.25	-3.50	-0.06	-1.53	38	-0.35	-4.65	0.00	-0.01	38	-0.15	-1.81
9	-0.04	-1.01	39	-0.27	-3.73	-0.06	-1.32	39	-0.37	-4.94	0.02	0.36	39	-0.17	-2.10
10	-0.04	-0.99	40	-0.27	-3.64	-0.06	-1.44	40	-0.37	-4.89	0.03	0.74	40	-0.17	-2.07
11	-0.03	-0.75	41	-0.29	-3.93	-0.05	-1.21	41	-0.39	-5.10	0.05	1.09	41	-0.20	-2.42
12	-0.01	-0.36	42	-0.30	-4.03	-0.03	-0.84	42	-0.41	-5.30	0.07	1.55	42	-0.22	-2.64
13	-0.03	-0.66	43	-0.30	-3.94	-0.06	-1.34	43	-0.41	-5.18	0.05	1.12	43	-0.21	-2.50
14	-0.05	-1.08	44	-0.30	-3.91	-0.08	-1.86	44	-0.41	-5.16	0.03	0.69	44	-0.22	-2.57
15	-0.05	-1.21	45	-0.29	-3.79	-0.09	-2.07	45	-0.40	-4.93	0.04	0.84	45	-0.21	-2.38
16	-0.04	-0.89	46	-0.29	-3.75	-0.08	-1.81	46	-0.40	-4.94	0.05	1.08	46	-0.22	-2.47
17	-0.06	-1.38	47	-0.29	-3.68	-0.11	-2.37	47	-0.40	-4.86	0.04	0.71	47	-0.23	-2.53
18	-0.09	-1.82	48	-0.29	-3.55	-0.14	-2.87	48	-0.40	-4.82	0.02	0.46	48	-0.23	-2.53
19	-0.08	-1.63	49	-0.29	-3.54	-0.14	-2.85	49	-0.41	-4.84	0.03	0.52	49	-0.25	-2.68
20	-0.06	-1.20	50	-0.30	-3.54	-0.13	-2.48	50	-0.42	-4.81	0.04	0.78	50	-0.24	-2.57
21	-0.08	-1.62	51	-0.30	-3.59	-0.15	-2.90	51	-0.43	-4.87	0.02	0.28	51	-0.25	-2.61
22	-0.09	-1.83	52	-0.30	-3.57	-0.17	-3.23	52	-0.43	-4.86	0.00	0.03	52	-0.25	-2.64
23	-0.12	-2.34	53	-0.32	-3.68	-0.20	-3.71	53	-0.44	-4.89	-0.04	-0.63	53	-0.25	-2.62
24	-0.17	-3.13	54	-0.34	-3.94	-0.25	-4.33	54	-0.46	-5.15	-0.07	-1.11	54	-0.28	-2.86
25	-0.18	-3.20	55	-0.34	-3.89	-0.26	-4.51	55	-0.46	-5.06	-0.08	-1.20	55	-0.28	-2.83
26	-0.20	-3.42	56	-0.33	-3.75	-0.28	-4.63	56	-0.46	-5.00	-0.09	-1.41	56	-0.29	-2.85
27	-0.21	-3.43	57	-0.34	-3.81	-0.30	-4.74	57	-0.49	-5.22	-0.12	-1.71	57	-0.33	-3.22
28	-0.23	-3.74	58	-0.36	-3.93	-0.31	-4.92	58	-0.51	-5.47	-0.13	-1.86	58	-0.36	-3.53
29	-0.23	-3.75	59	-0.36	-3.81	-0.33	-5.07	59	-0.52	-5.32	-0.15	-2.08	59	-0.36	-3.39
30	-0.24	-3.85	60	-0.34	-3.58	-0.35	-5.30	60	-0.52	-5.19	-0.16	-2.27	60	-0.36	-3.31

Note: figures in Table 1 represent the cumulative average abnormal returns for the capital asset pricing model (CAPM), the Fama-French three factor model (FF), and a Fama-French type model extended to include leverage effect, liquidity effect, stock return volatility, and loser-winner effect. The t-statistics are computed based on the method of Brown and Warner (1980).

Table 2: Event-Time Regression Results for Alternative Models.

Coefficient	Panel A CAPM	Panel B FF	Panel C MF
α	-0.0089	-0.011	-0.035
t(α)	-3.34	-5.67	-1.59
β	0.18	0.17	0.18
t(β)	2.46	2.09	1.27
SMB	-	-0.0163	0.03
t(SMB)	-	-0.30	0.22
HML	-	-0.0434	-0.13
t(HML)	-	-1.39	-0.53
LMU	-	-	-0.59
t(LMU)	-	-	-0.96
LMI	-	-	-0.15
t(LMI)	-	-	-1.29
HMLSTD	-	-	-0.05
t(HMLSTD)	-	-	-0.94
LMW	-	-	-0.39
t(LMW)	-	-	-1.33

Note that the following regressions were run in event time for each IPO, then the coefficient values were averaged over all IPOs.

$$Rp_t - R_{f,t} = \alpha_i + \beta_i (R_{m,t} - R_{f,t}) + e_{i,t} \quad \text{(Panel A)}$$

$$Rp_t - R_{f,t} = \alpha_i + \beta_i (R_{m,t} - R_{f,t}) + s_i SMB_t + h_i HML_t + e_{i,t} \quad \text{(Panel B)}$$

$$Rp_t - R_{f,t} = \alpha_i + \beta_i (R_{m,t} - R_{f,t}) + s_i SMB_t + h_i HML_t + u_i LMU_t + l_i LMI_t + v_i HMLSTD_t + w_i LMW_t + e_{i,t} \quad \text{(Panel C)}$$

Where, $R_p - R_f$ is the excess return in month t on the 5 years portfolio of IPO. $R_{m,t}$ is the return for the market in event month t, $R_{f,t}$ is the risk-free rate in event time t as measured by the return on the Treasury bills. *SMB* (small minus big) is the difference, each month, between the average of the returns on the three small-stock portfolios (S/L, S/M, and S/H) and the average of the returns on the three big-stock portfolios (B/L, B/M, and B/H). HML is the difference, each month, between the average of the returns of the two high-book-to-market portfolios (S/H and B/H) and the average of the returns on the two low-book-to-market portfolios (S/L and B/L). LMU is the difference, each month, between the average of the returns on the two high-leverage portfolios and the average of the returns on the two low-leverage portfolios. LMI is the difference, each month, between the average of the returns on the two high-trading-volume portfolios and the average of the returns on the two low-trading-volume portfolios. LMW is the return difference between portfolios of past losers and past winners based upon returns over the past 12 months. HSVMLSV is the difference, each month, between the average of the returns on the two high-stock-volatility portfolios and the average of the returns on the two low-stock-volatility portfolios. T-statistics are calculated with standard errors using White (1980).

Table 3: Calendar-Time Regression Results for Alternative Models.

Coefficient	Panel A CAPM	Panel B FF	Panel C MF
α	0.0014	0.0009	0.0013
t(α)	0.62	0.37	0.46
β	0.41	0.28	0.26
t(β)	5.41	2.53	1.91
SMB	-	0.0227	0.0003
t(SMB)	-	0.75	0.007
HML	-	0.0249	0.0056
t(HML)	-	0.90	0.15
LMU	-	-	-0.017
t(LMU)	-	-	-0.49
LMI	-	-	0.0347
t(LMI)	-	-	0.84
HMLSTD	-	-	-0.0189
t(HMLSTD)	-	-	-0.50
LMW	-	-	0.339
t(LMW)	-	-	1.90

Note that the following regressions are estimated using 252 monthly observations:

$$Rp_t - R_{f,t} = \alpha_i + \beta_i(R_{m,t} - R_{f,t}) + e_{i,t} \quad \text{(Panel A)}$$

$$Rp_t - R_{f,t} = \alpha_i + \beta_i(R_{m,t} - R_{f,t}) + s_i SMB_t + h_i HML_t + e_{i,t} \quad \text{(Panel B)}$$

$$Rp_t - R_{f,t} = \alpha_i + \beta_i(R_{m,t} - R_{f,t}) + s_i SMB_t + h_i HML_t + u_i LMU_t + l_i LMI_t + v_i HMLSTD_t + w_i LMW_t + e_{i,t} \quad \text{(Panel C)}$$

Where, $R_p - R_f$ is the excess return in month t on the 5 years portfolio of IPO. $R_{m,t}$ is the return for the market in event month t, $R_{f,t}$ is the risk-free rate in event time t as measured by the return on the Treasury bills. *SMB* (small minus big) is the difference, each month, between the average of the returns on the three small-stock portfolios (S/L, S/M, and S/H) and the average of the returns on the three big-stock portfolios (B/L, B/M, and B/H). HML is the difference, each month, between the average of the returns of the two high-book-to-market portfolios (S/H and B/H) and the average of the returns on the two low-book-to-market portfolios (S/L and B/L). LMU is the difference, each month, between the average of the returns on the two high-leverage portfolios and the average of the returns on the two low-leverage portfolios. LMI is the difference, each month, between the average of the returns on the two high-trading-volume portfolios and the average of the returns on the two low-trading-volume portfolios. LMW is the return difference between portfolios of past losers and past winners based upon returns over the past 12 months. HSVMLSV is the difference, each month, between the average of the returns on the two high-stock-volatility portfolios and the average of the returns on the two low-stock-volatility portfolios. T-statistics are calculated with standard errors using White (1980).

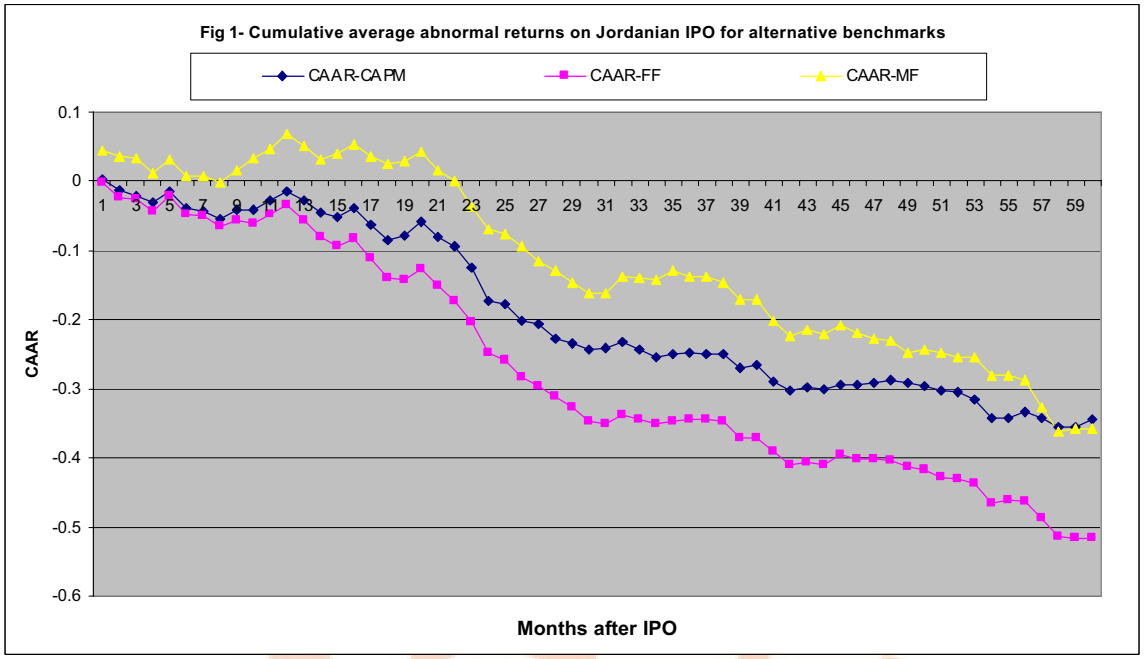
Fig 1- Cumulative average abnormal returns on Jordanian IPO for alternative benchmarks
CAAR-CAPM
CAAR-FF
CAAR-MF
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
CAAR
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57 59
Months after IPO

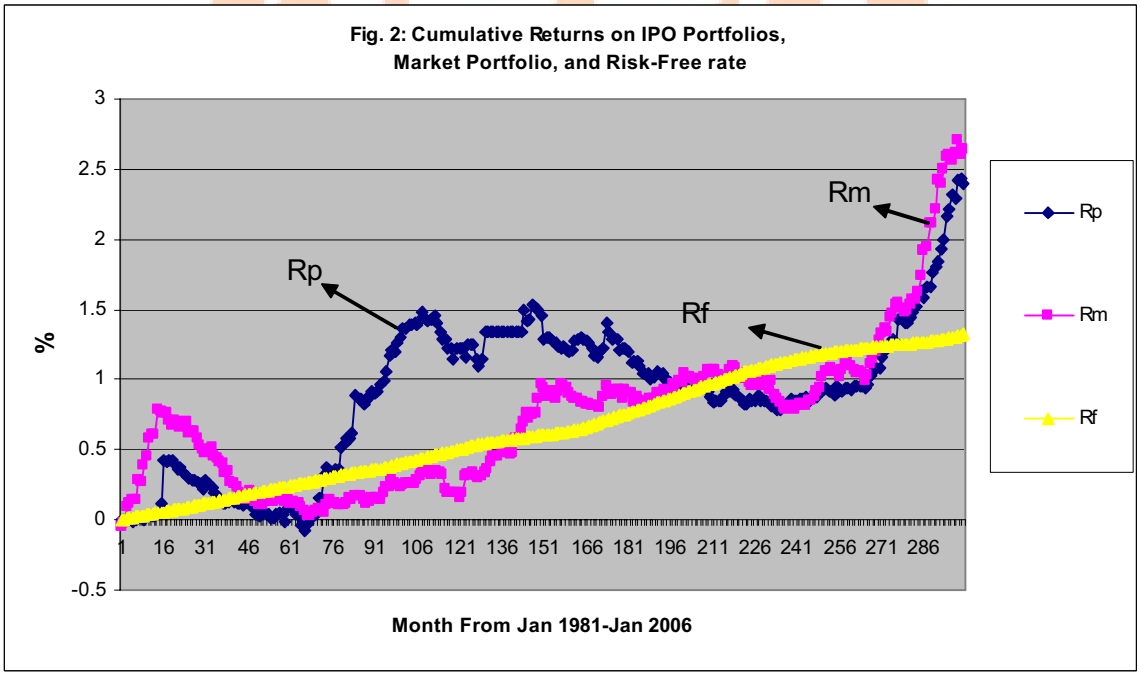
Fig. 2: Cumulative Returns on IPO Portfolios,
Market Portfolio, and Risk-Free rate
3
2.5
2
1.5
1
0.5
0
-0.5
%
Rm
Rp
Rf
1 16 31 46 61 76 91 106 121 136 151 166 181 196 211 226 241 256 271 286
Month From Jan 1981-Jan 2006
Rp
Rm
Rf