

In Data We Trust: Proving Market Manipulation on the Tehran Stock Exchange

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Received: December 20, 2021

Accepted: February 17, 2022

Online Published: March 2, 2022

doi:10.5539/ijbm.v17n4p1

URL: <https://doi.org/10.5539/ijbm.v17n4p1>

Abstract

The Iranian financial markets play an essential role in the country's economic development. In 2019 and 2020, ordinary traders were encouraged by the political authorities to invest in state-owned enterprises. Citizens who invested in Tehran Stock Exchange (TSE) indices routinely complain that the volatile market performance has wiped out their capital and savings. In this study, the reliability of intraday transaction data for 341 stocks listed on the TSE was examined. Our critical objective is to identify fraud on the TSE. The authors applied Benford's first and second digit laws to detect irregularities in financial data based on three goodness of fit tests. The authors found overwhelming evidence of the presence of market manipulation on the TSE. We found that 46 percent of the companies listed on the TSE did not adhere to the law of the first digit. A thorough analysis of compliance with the second digit revealed a similar pattern. Given the severe impact of trade restrictions imposed by the 2018 US sanctions and the substantial increase in Iran's public debt burden, the TSE has become a major source for offsetting the government's deficit by conducting IPOs of state-owned companies. Market manipulation in Iran appears to be motivated by the government's urgent need for fresh capital and its waste. It would be a common misconception to trust the TSE's data.

Keywords: Market Manipulation, Benford's Law, Forensic Analysis, Financial Markets, Data Science

1. Introduction

Financial markets are a captivating example of complexity in action: a complex, multi-layered system that evolves around decisions made by a multitude of individual traders who ceaselessly try to win in a global game. Middle Eastern traders are no exception. Every day, millions of transactions are executed in the region, helping both ordinary and institutional investors to succeed.

1.1 Financial Market Manipulation

It is generally agreed that financial markets facilitate efficient allocation of funds, maturity transformation, risk transfer, fair pricing, and selling of financial instruments. Investors seek to both maximize returns and minimize risks (Markowitz, 1952). Eugene Fama was the first who introduced the concept of "efficient markets" in his groundbreaking work, according to which information determines the price of assets (Fama, 1963, 1965a, 1965b, 1970). When investors buy (demand) and sell (supply) stocks, asset prices are generally set. The prevailing notion of efficient markets is founded on trust. As securities are claims on future distributions, investors participate in buy-side and sell-side transactions to the extent that they enjoy access to reliable data and are confident in future trades. Trust is the most important prerequisite for participation in trades.

Market manipulation is nothing new. It is "*the unwarranted interference in the operation of ordinary market forces of supply and demand*" (Lomnicka, 2010). It can take many forms: Dissemination of misinformation about assets, insider trading, or simulation of prices, rates, or trades to falsely imply higher demand for securities (see U.S. SEC 2020). With the advent of digital transformation and the emergence of online financial markets, it is now easier to disseminate and place fake orders to increase or depress securities prices (Finnerty, 2005).

According to Nasdaq (2021), spoofing typically involves placing large orders to feign high market demand, which may influence investors' behaviors. Another form of fraud is insider trading is front-running transactions that give investors early access to undisclosed and confidential information (Thomson Reuters, 2020). Conspiracy to deceive is a further type of market manipulation. It occurs whenever a fraudulent image of active trading is

circulated. It is intrinsically motivated by the intent to maintain and maximize the market price at a predetermined level (Hauzen, 2021).

Fraud in the trading of stocks and financial products and other forms of market manipulation undermine the integrity of markets and can cause significant harm to investors. Lomnicka (2001) examined the ability of criminals to manipulate the financial markets in the United Kingdom. The author pointed to specific examples of financial market manipulation, such as misleading information to influence investment values or erroneous transaction volumes. There have been other attempts in the past literature to detect fraudulent financial data using statistical analyses (Luna, Palshikar, Apte, & Bhattacharya, 2018; Stack, 2015; Beneish, 1999; Aggraval and Dhimi, 2020; Karavardar, 2014; MacCarthy, 2017).

Karavardar (2014) studied the Istanbul Stock Exchange, applied Benford's law, and showed the compliance of the indices with the expected logarithmic law for the first and second digits and the first two first digits. A deviation from the logarithmic law does not always indicate fraud. Shengmin and Wenchao (2010) confirmed that the main indexes of the Shanghai Stock Exchange Composite Component Index followed the law. However, they provided empirical evidence of the influence of Chinese culture on trading patterns as observed by the abnormal absence of the number "4" in the Hong Kong stock market. In Chinese culture, the number four is widely viewed as a symbol of misfortune and bad luck. Non-compliance is also evident during periods of economic turmoil. While a study of S&P 500 stock prices confirmed overall compliance, it also showed that market volatility or crash events resulted in non-compliance with the law (Corazza, Ellero, & Zorzi, 2010).

1.2 Tehran Stock Exchange

The Tehran Stock Exchange (TSE) offers more than 350 financial instruments in primary and secondary sub-markets. It plays a crucial role in Iran's economic development and enables state-owned enterprises to raise capital for future investments (Yazdani, 2008). Established in 1967, the market is a fast-moving market offering commodities, securities, corporate certificates, and bonds that can be traded immediately for cash (TSE History, 2020). The secondary submarket of the TSE includes financial securities issued by small and medium-sized enterprises (SMEs). Figure 1 provides an overview of the historical development of the TSE.

Economists have demonstrated that the decline in Iran's GDP and its weakening currency are attributable to the several sets of sanctions imposed on Iran (see Carswell, 1981), which came into effect in 1979. Since the sanctions have been in place, it has become a major political impediment to economic growth and development. Today, sanctions permeate all financial facets of Iran and take various forms, including trade bans, freezing Iranian assets, travel restrictions, and blocking all types of investment in commercial markets.

Furthermore, sanctions lead to market volatility and currency depreciation (Goudarzi 2014). Since the United States withdrew from the 2015 nuclear agreement on November 4, 2018, Iran's national currency IRR has depreciated significantly. For this reason, Iranian investors probably sought shelter to secure their weakening currency. Thus, they invested in TSE securities from 36 industries, such as hydrocarbons, automotive, agriculture, telecommunications, and services, especially financial services. According to a survey conducted by a pro-government student organization, the Iranian Student Polling Agency (ISPA), 20 percent of the Iranian population has somehow invested in TSE indices over the past two years. According to the same report, more than seventy-seven percent of investors faced considerable loss, eight per percent made some profit, and 15 percent broke even. In April 2017, the index was at less than 100,000 points. Despite the severe impact of the U.S. sanctions and the related economic meltdown due to the COVID-19 outbreak, the index rose to 500,000 points by April 2018. The highly volatile market has recently exceeded the one-million-point threshold, representing an average annual growth rate of 1,040 percent in 2017 (Iran International News, 2021).

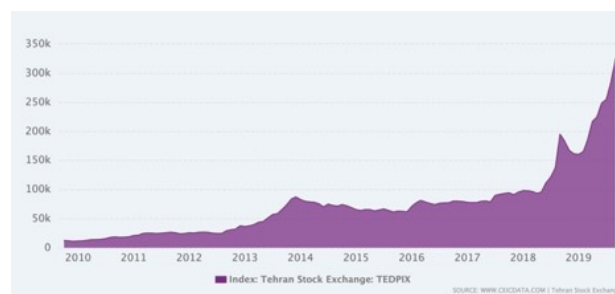


Figure 1. Tehran Stock Exchange (TSE)

Source: CEICDATA.com, last accessed: 15/9/2021

It is noteworthy that the political leadership in Iran has repeatedly encouraged households to invest in the primary stock market (see for example <https://www.leader.ir/en/content/24901/The-Leader%E2%80%99s-message-on-the-occasion-of-Nowruz>, last accessed: 19/9/2021). Simultaneously, the Iranian government contributed to the millionaire boom by flooding the TSE with an influx of taxpayers' money. The government poured 1% of the state fund (National Development Fund) into the index, followed by an additional tranche of 25 trillion rials, approximately \$595.2 million (Williams 2021). In the fall of 2020, the index exceeded two million points when the government began to sell its assets in the stock market and encouraged households to engage in investments. The higher the market rose, the more people saw the TSE as a common way to make money. However, the market soon fell by approximately half its value. After recouping some of its losses, it stands at around 1.3 million points (Iran International News, 2021). The 13-fold increase over the four years did not mean that people made much profit, as many entered the market too late. Figure 1 shows the TSE trend between 2010 and 2021 (TSE, 2021b). It is noteworthy that the number of millionaires in Iran has skyrocketed in recent years, contrary to general economic trends. In 2020, the total number of High-Net-Worth Individuals (or HNWI) grew by 21.6% in Iran, far above the global average of 6.3% (Khaasteh, 2021). In 2021 alone, the total wealth of these U.S. dollar millionaires increased by 24.3%.

The central question of this study is: Did the Iranian government fill its empty coffers by manipulating the financial market?

2. Methods

2.1 Benford's Law

It is common knowledge that natural numbers follow expected frequencies. The so-called logarithmic law, or Benford's law (BL), was first invented by the Canadian American mathematician Newcomb (1881). BL distinguishes natural from fictitious figures and provides empirical evidence of data manipulation if any, (Ravenda, Valencia-Silva, Argiles-Bosch & Garcia-Blandon, 2018). In this context, BL is instrumental in detecting anomalies and fraud (Nigrini, 2000) and was previously operationalized to identify fraudulent financial data.

Several studies have addressed market manipulation and have applied statistical techniques to detect such attempts. These studies unanimously used the numerical frequency law of first digits, also known as Benford's law (BL). In addition to the order of the first digit, other frequencies can also be determined for the second digit. The core idea refers to the frequencies of the first and second digits in naturally generated datasets according to Equations 1 and 2 (Newcomb, 1981; Benford, 1938):

$$P(d) = \log_{10} (1 + 1/d), \quad d \in \{1, 2, 3, \dots, 9\} \tag{1}$$

$$P(d) = \sum_{j=1}^9 \log_{10}[1 + 1/(10j + d)], \quad d \in \{0, 1, 2, 3, \dots, 9\} \tag{2}$$

Table 1: First and second digits' joint and marginal distributions

Second significant digit		0	1	2	3	4	5	6	7	8	9	≈ Σ
1	0.041	0.038	0.035	0.032	0.030	0.028	0.026	0.025	0.023	0.022		0.301
2	0.021	0.020	0.019	0.018	0.018	0.017	0.016	0.016	0.015	0.015		0.176
3	0.014	0.014	0.013	0.013	0.013	0.012	0.012	0.012	0.011	0.011		0.125
4	0.011	0.010	0.010	0.010	0.010	0.010	0.009	0.009	0.009	0.009		0.097
5	0.009	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.007	0.007		0.079
6	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.006	0.006	0.006		0.067
7	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.005		0.058
8	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005		0.051
9	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.004	0.004		0.046
≈ Σ	0.120	0.114	0.109	0.104	0.100	0.097	0.093	0.090	0.088	0.085		

Table 1 summarizes frequencies of the first and second digits. The first- and second-digit tests are high-level adequacy tests used in a complementary manner to assess whether the dataset is adequate. According to Benford's law for the first digit (1BL), the numbers one to nine follow a certain logarithmic distribution: 30.1% for one, 17.6% for two, 12.5% for three, 9.7% for four, 7.9% for five, 6.7% for six, 5.8% for seven, 5.1% for eight, and 4.6% for nine [20]; for Benford's law for two digits (2BL), the frequencies are distributed from zero to nine: 12% for zero,

11.4% for one, 10.9% for two, 10.4% for three, 10.0% for four, 9.7% for five, 9.3% for six, 9.0% for seven, 8.8% for eight, and 8.5% for nine (Nigrini, 1999, Newcomb, 1881).

The observed frequencies are likely to deviate from the BL distributions in an artificially generated dataset. Benfordness – compliance with the law – can be measured by applying financial data with a geometric trend and is characterized by the absence of minima and maxima. BL is a common practice and has been widely used in various disciplines, such as financial markets (Karavardar, 2014), epidemiology (Sambridge & Jackson, 2020; Farhadi, 2020; Farhadi & Lahooti, 2021a, 2021b), finance, and accounting (see Durtschi, Hillison, & Pacini, 2004), political science (Roukema, 2014), and compliance (Deleanu, 2017). The body of knowledge provides several tests to assess such agreement. Three standard techniques are well-known and widely used: the Kuiper test, chi-square test, and mean average deviation (MAD) (see Farhadi & Lahooti, 2021a).

The Kuiper statistic is a nonparametric test of discrete data. It is a modification of the Kolmogorov-Smirnov test. It quantifies the distance between the empirical distribution of samples of observations and the cumulative distribution of first-and second-digit frequencies [9]. The two summed parts are D_n^+ and D_n^- is calculated as $D_n^+ = \text{Max} [Fn(x) - F_0(x)]$ and $D_n^- = \text{Max} [F_0(x) - Fn(x)]$, where Fn is the cumulative observed distribution and F_0 is the cumulative Benford distribution. Nonparametric tests are distribution-free and more powerful when small sample size [25]. The Kuiper test is calculated as follows (see Equation 3):

$$K = (D_n^+ + D_n^-) \times [\sqrt{n} + 0.155 + 0.24/\sqrt{n}] \quad (3)$$

Another popular approach is Pearson's chi-square test (χ^2) with the confirmatory null hypothesis that the distribution of the first digit must match Benford's frequency curve [12]. The chi-square test is sensitive to the sample size and is not recommended for inference when the dataset exceeds 5,000 observations [22,26]. The chi-squared statistic uses the expected number of observations. If the sample size is too large, the null hypothesis is rejected even if there is no significant difference between the actual and expected subsets. The chi-squared test was calculated as follows (see Equation 4):

$$\chi^2 = \sum_{i=1}^9 (\tilde{p}_i - p_i)^2 / p_i \quad (4)$$

In this study, the mean absolute deviation (MAD) technique was used, less dependent on sample size. Equation 5 shows the MAD calculations for the observed and expected frequencies. k is the number of leading digit bins. O_i and E_i are the observed and expected frequencies, respectively. A $MAD > 0.015$ indicates a lack of agreement with the law (Nigrini, 2018).

$$MAD = 1/k \times \sum_{i=1}^k |O_i - E_i| \quad (5)$$

Furthermore, we operationalized all goodness-of-fit tests based on a significance level of 0.05. We tested all shares of listed companies in Iran for the following hypotheses.

H0: The frequency of the volume of J_i adheres to BL, where J_i stands for a specific security listed on the Tehran Stock Exchange.

2.2 Sampling of Data

We collected data on the number of intraday transactions published by the TSE from 21/3/2019 to 8/9/2021. The original datasets used in this study were obtained from the TSE website. The sample consisted of 176,618 integers (n or the sample size). Intermediaries, who disseminate information on financial instruments, can centrally control and theoretically change the number of intraday transactions. As mentioned earlier, changes in the number of transactions may signal higher demand and improve the attractiveness of traded securities. For each security, we compiled a sample of more than 100 observations, that is, the minimum number of intraday transactions, which can be considered an acceptable size for the application of Benford's law, even though the minimum threshold is not specified in the literature. Measuring compliance with the BL law is only helpful if the sample size is not too small. Small datasets may erroneously deviate from the expected logarithmic law and affect the reliability of the results. It was assumed that BL compliance increase as the sample size gets larger.

3. Results

3.1 Benfordness

To explore the BL agreement of data, six goodness-of-fit tests were conducted in this study: the Kuiper test, chi-square goodness-of-fit test, and MAD for the first and second digits of intraday transactions. Forty-one securities were included in the primary sample, with an average number of observations of $n = 536$, resulting in a subset of 330 stocks with over 100 records. This selection was necessary to perform reliable tests to assess the Benfordness. The MAD, Kuiper, and Chi-square tests quantified the distance between the reported and referenced Benford

distributions.

Table 2. Critical values of the empirical tests

Alpha level	Chi-Square		Kuiper		MAD	
	1st digit	2nd digit	1st digit	2nd digit	1st digit	2nd digit
0.01	13.36	14.68	1.62	1.62	0.006	0.008
0.05	15.51	16.92	1.75	1.75	0.012	0.010
0.1	20.09	21.67	2	2	0.015	0.012

The results are summarized in Tables 3-5, including list of financial products that did not conform to BL at an 0.1 alpha level. These assets are marked and highlighted in red. One hundred forty-eight assets did not meet the BL compliance requirements based on at least two goodness-of-fit tests for the first and second digits; thus, we reject the null hypothesis, suggesting market manipulation of the TSE. Looking at the Kuiper statistics for first- and second-digit compliance, nine assets with a total market capitalization of IRR 998,270,000 do not meet BL compliance requirements. A similar analysis of the MAD statistics resulted in a subset of 63 assets that did not meet the Benfordness thresholds. One hundred thirty-three securities did not pass the first-digit chi-squared test for adequacy. Figure 2 shows the frequency of the first leading digits of the most significant violations.

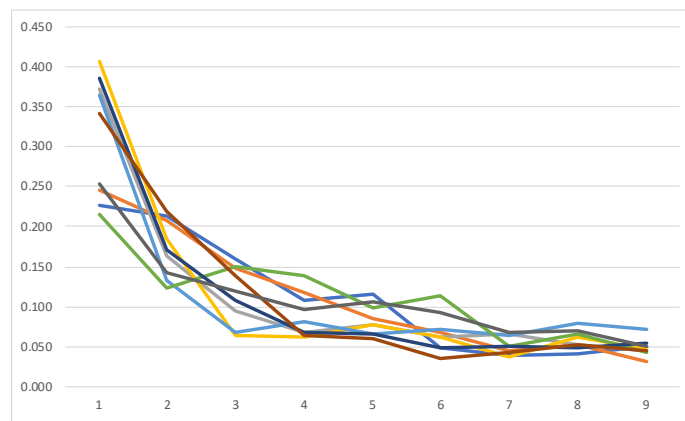


Figure 2: The most common violations of Benford's Law

Table 3: Results of the statistical and BL goodness of fit tests

Name	N	Volatility	Avg. Return	Kuiper 1D	Kuiper 2D	MAD 1D	MAD 2D	CHIS 1D	CHIS 2D
Abadan power generation	257	0.951	1.057	0.907	0.865	0.017	0.017	8.357	9.944
Abssal	562	0.179	1.003	2.689	0.973	0.020	0.008	25.895	4.816
Alborz Cable	558	0.173	1.005	4.262	1.053	0.032	0.013	58.067	10.681
Alborz Insurance	518	0.187	1.006	1.854	1.297	0.015	0.014	14.866	13.806
Alborz Investment (Holding	554	0.183	1.005	1.370	2.046	0.012	0.015	8.298	14.198
Alborz medicine	558	0.313	0.012	1.494	1.210	0.012	0.010	9.607	12.236
Aluminum Iran	558	0.172	1.004	1.605	1.053	0.013	0.009	11.851	5.388
Alumrad	513	0.191	1.006	1.882	0.909	0.015	0.011	14.187	8.368
Alvand Tile and Ceramic	557	0.201	1.004	2.554	1.232	0.020	0.011	21.133	6.816
Amin Capital	244	0.153	1.002	2.473	1.371	0.028	0.019	27.430	11.280
Arak Construction Machine	560	0.188	1.003	4.784	0.563	0.036	0.007	75.529	2.644
Asia Insurance	545	0.180	1.005	1.120	1.705	0.009	0.017	4.797	19.641
Automobile Engineering	518	0.182	1.007	3.388	2.207	0.028	0.016	35.630	12.888
Axis makers of Iran	560	0.190	1.004	2.137	0.830	0.016	0.009	17.763	6.561

Name	N	Volatility	Avg. Return	Kuiper 1D	Kuiper 2D	MAD 1D	MAD 2D	CHIS 1D	CHIS 2D
Azar Refractory Products	552	0.195	1.005	3.113	1.045	0.025	0.012	33.719	11.745
Bafgh Mines	532	0.180	1.004	2.362	0.854	0.018	0.013	18.929	9.812
Bandar Abbas oil refining	508	0.199	1.004	1.473	0.808	0.012	0.009	9.119	5.451
Bank Mellat Capital	322	0.371	1.011	0.900	0.900	0.010	0.011	5.041	6.415
Bank of Economics	549	0.180	1.003	1.540	1.071	0.015	0.011	13.668	8.085
Bank Saderat Iran	546	0.178	1.004	3.228	1.049	0.025	0.015	29.717	17.022
Bank Sina	555	0.184	1.004	1.541	1.453	0.013	0.012	12.426	11.323
Banks are entrepreneurs	533	0.163	1.004	1.667	0.911	0.013	0.008	11.540	5.882
Barakat Pharmaceutical Group	549	0.191	1.007	0.504	0.732	0.008	0.007	4.965	3.520
Barez Industrial Group	563	0.181	1.004	2.204	1.515	0.019	0.010	25.013	9.409
Behnoosh Iran	557	0.179	1.005	2.099	0.563	0.016	0.006	19.138	1.854
Behshahr Industrial Dev. Holding	572	0.176	1.004	2.246	0.686	0.017	0.008	22.322	3.175
Behshahr Industrial Group of Iran	570	0.173	1.004	0.980	1.650	0.010	0.011	11.406	9.850
Behshahr Industry	561	0.182	1.004	1.223	1.181	0.014	0.010	9.517	8.117
Bimeh Dana	562	0.182	1.004	1.427	0.818	0.011	0.007	7.231	5.133
Biscuit Georgia	494	0.185	1.004	0.971	1.444	0.011	0.012	7.567	13.846
Bootan Industrial Group	566	0.169	1.004	1.941	1.318	0.015	0.010	14.884	10.618
Brake pads	548	0.191	1.005	1.409	0.756	0.013	0.012	12.465	6.011
Calcium	558	0.177	1.004	2.112	1.155	0.016	0.009	18.175	6.640
Campus Investment	577	0.171	1.004	1.485	1.042	0.012	0.008	9.575	3.082
Capital of hope	562	0.171	1.004	1.570	0.890	0.012	0.007	9.928	5.895
Car axle production	521	0.175	1.005	2.606	0.627	0.021	0.008	25.061	4.042
Carbon Iran	567	0.177	1.004	4.006	0.668	0.030	0.010	42.749	7.925
Cartoon of Iran	513	0.181	1.003	3.089	1.546	0.024	0.014	27.989	18.910
Caspian Sea	556	0.188	1.005	2.293	0.795	0.018	0.007	20.303	4.698
Caspian Sea	545	0.169	1.005	0.738	0.929	0.013	0.009	14.548	6.999
Cement	561	0.175	1.005	1.422	1.972	0.015	0.016	18.963	22.290
Cement Arta Ardabil	557	0.175	1.004	1.233	1.778	0.012	0.016	8.333	11.203
Cement Industry Dev. Investment	572	0.168	1.004	2.819	0.913	0.021	0.013	23.403	14.858
Century Chemistry Phenomenon	345	0.250	0.008	1.469	0.568	0.014	0.009	10.284	4.023
Ceramics of Ardakan industry	532	0.188	1.005	4.038	0.799	0.031	0.008	69.862	3.465
Chemical Medicine	559	0.178	1.003	3.782	1.621	0.030	0.012	56.045	11.380
Chin-Chin culture and industry	516	0.174	1.005	0.904	1.287	0.015	0.013	16.173	15.683
Civilization and development of Persia	546	0.182	1.005	0.933	0.884	0.007	0.011	3.260	7.931
Coal Stone Tabas	558	0.176	1.004	4.805	0.846	0.037	0.008	77.891	5.292
Combine construction in Iran	562	0.174	1.004	2.175	1.198	0.017	0.011	18.592	9.731
Commercial Bank	530	0.181	1.004	0.999	0.992	0.009	0.010	5.151	9.119
Construction structure	486	0.161	1.005	0.865	0.629	0.012	0.005	8.255	2.995
Damavand Atieh Investment	567	0.176	1.004	2.907	1.493	0.022	0.012	28.944	10.909
Damavand Mining	477	0.372	0.028	1.381	1.721	0.011	0.014	6.577	12.350
Darookhsh	550	0.261	0.009	2.725	2.506	0.021	0.019	24.843	18.809
Dasht Morghab	423	0.415	0.035	1.112	0.934	0.010	0.014	8.693	11.093
Dashtestan Cement Industries	540	0.151	1.006	1.580	1.558	0.012	0.012	20.092	11.299
Data Processing Iran	569	0.176	0.004	3.110	0.987	0.023	0.009	25.724	6.779

Name	N	Volatility	Avg. Return	Kuiper 1D	Kuiper 2D	MAD 1D	MAD 2D	CHIS 1D	CHIS 2D
Desert tire	562	0.179	1.004	1.412	1.510	0.016	0.011	21.462	4.535
Detergent Industry Mgmt, Behshahr	575	0.173	1.003	2.122	1.145	0.016	0.010	18.419	5.305
Development and development of hope	234	0.239	1.004	1.870	1.032	0.022	0.019	13.901	9.589
Development of Iranian surface mines	567	0.180	1.004	1.066	0.970	0.008	0.008	6.204	5.801
Development of mines and metals	518	0.171	1.004	1.088	0.515	0.009	0.007	4.640	2.551
Development system	532	0.181	1.003	1.557	0.941	0.012	0.008	10.334	5.239
Driving Force	544	0.261	1.007	2.258	1.054	0.017	0.008	22.202	6.033
Drugs	537	0.452	0.046	1.349	0.864	0.012	0.010	13.913	6.328
Dudeh Industrial Pars	567	0.227	0.005	4.207	0.987	0.031	0.009	59.193	4.445
East Cement	567	0.182	1.004	2.694	0.831	0.023	0.007	28.843	3.269
Easy to pay Persian	573	0.171	1.002	1.769	1.474	0.015	0.011	17.623	9.619
Electric car east	571	0.212	0.998	3.425	1.168	0.026	0.009	38.543	6.451
Electric car east	569	0.183	1.004	3.425	1.168	0.026	0.009	38.543	6.451
Energy 31	213	3.545	1.862	2.636	0.742	0.034	0.014	27.955	5.726
Energy Capital Investment	502	0.191	1.003	0.938	1.346	0.009	0.013	6.929	8.396
Expansion of Iran Khodro Investment	545	0.239	1.007	1.819	0.800	0.014	0.009	15.309	6.751
Expansion of Persian oil and gas	574	0.170	1.004	1.780	2.155	0.013	0.015	14.845	15.103
Extension Industries Serv. Agriculture	554	0.179	1.005	1.931	0.808	0.015	0.008	12.921	5.130
Factories Razi glass	522	0.181	1.005	1.587	1.047	0.015	0.013	12.308	11.962
Factories of drug distribution	564	0.186	0.005	1.567	0.933	0.012	0.008	14.248	3.901
Faiber Iran	552	0.262	0.007	1.360	0.783	0.011	0.006	8.579	1.774
Fajr Energy Persian Gulf	563	0.165	1.003	2.602	0.855	0.020	0.009	28.909	6.662
Fans I	548	0.197	1.004	2.136	1.291	0.016	0.015	24.401	10.213
Fans II	543	0.268	0.009	1.936	1.470	0.015	0.011	20.071	9.013
Fars and Khuzestan Cement	566	0.188	1.005	2.585	1.601	0.019	0.016	23.662	12.277
February Investment	568	0.181	1.005	1.517	1.273	0.012	0.009	9.485	7.929
Ferro Silica Iran	532	0.175	0.004	0.790	0.752	0.009	0.007	5.666	4.725
Food control	536	0.177	1.001	2.407	1.213	0.019	0.012	22.738	8.380
Fund investment Retirement	574	0.166	1.004	1.520	1.281	0.011	0.011	10.442	6.822
Ghadir Investment (Holding)	578	0.174	1.004	2.903	0.674	0.022	0.008	34.073	5.037
Ghologhozan	535	0.460	0.050	1.254	1.167	0.013	0.013	11.351	9.257
Gholtash	572	0.173	1.003	2.678	1.224	0.021	0.011	24.089	8.384
Glass & Gas	564	0.178	1.004	3.074	1.787	0.023	0.015	42.696	15.679
Group of Crafts in the city of Iran	474	0.181	1.005	2.014	1.857	0.016	0.016	11.475	15.576
Healing Pharma investment	567	0.173	1.004	1.275	1.384	0.010	0.013	6.098	12.730
Housing investment	572	0.179	1.004	2.209	1.297	0.017	0.013	17.403	14.307
Industrial Group	549	0.190	1.005	1.440	1.261	0.011	0.011	7.253	7.768
Industrial pasta	250	1.566	1.156	2.270	1.047	0.026	0.019	19.331	12.076
Industries of Azar	446	0.185	1.006	3.051	0.767	0.026	0.009	30.011	5.243
Industries of paper making	533	0.183	1.005	2.497	0.826	0.019	0.010	31.317	10.372
Industries of welding	540	0.168	1.008	1.491	1.536	0.012	0.011	12.136	9.753
Industry Ama	563	0.173	1.004	0.913	0.852	0.007	0.013	6.844	12.695
Industry & Trade Dev. Investment	573	0.179	1.004	1.307	1.191	0.010	0.012	9.542	8.698
Informatics Services	558	0.167	1.002	1.369	1.010	0.010	0.007	5.879	4.127

Name	N	Volatility	Avg. Return	Kuiper 1D	Kuiper 2D	MAD 1D	MAD 2D	CHIS 1D	CHIS 2D
International Dev. of Construction	560	0.182	1.003	1.611	1.275	0.012	0.010	10.865	9.400
International Products of Persia	556	0.183	1.004	1.995	1.430	0.019	0.014	25.648	15.432
Investment Capital	564	0.177	1.004	1.650	1.183	0.014	0.012	10.603	10.345
Investment Development	577	0.166	1.004	1.073	1.320	0.008	0.009	6.893	6.714
Investment in Petrochemical Industries	571	0.181	1.004	4.515	0.675	0.034	0.008	55.642	6.991
Investment Dev. of Azerbaijan	542	0.187	1.006	0.519	1.315	0.007	0.011	4.899	11.593
Investment in the Insurance Industry	562	0.171	1.002	3.123	1.057	0.024	0.011	32.363	11.344
Investment in the Oil Industry	575	0.176	1.003	1.438	0.908	0.011	0.006	7.551	3.527
Investment in Tocafulad	548	0.180	1.005	3.830	1.095	0.030	0.009	51.213	6.154
Investment of Parsh Tosheh	546	0.174	1.004	2.226	1.287	0.017	0.012	15.292	5.757
Investment of Sepah	565	0.166	1.004	1.172	1.115	0.012	0.012	11.280	8.502
Investment in Construction, Iran	533	0.191	1.006	1.672	1.488	0.013	0.011	11.593	7.589
Iran Tire	542	0.184	1.006	3.123	1.894	0.024	0.013	28.294	14.593
Iran Alloy Steel	546	0.328	0.016	1.261	1.477	0.016	0.010	16.539	10.278
Iran Commodity Exchange	520	0.189	1.006	1.863	1.452	0.015	0.010	19.388	5.527
Iran Credit Investment	574	0.173	1.002	0.978	1.017	0.009	0.010	7.128	7.095
Iran Industrial Development Group	563	0.178	1.004	0.920	0.993	0.007	0.009	4.876	8.319
Iran Khodro	526	0.236	1.006	1.502	1.117	0.017	0.012	18.330	9.182
Iran Kish credit card	552	0.173	1.004	1.351	1.105	0.015	0.011	12.393	11.075
Iran Manganese Mine	566	0.177	1.005	3.827	2.410	0.029	0.018	48.829	25.694
Iran Mineral Processing	546	0.437	0.041	2.907	1.144	0.024	0.014	27.257	18.004
Iran Mobile Communications Co.	557	0.162	1.003	2.395	0.683	0.018	0.009	20.254	7.020
Iran Numbers	554	0.181	1.003	2.672	1.307	0.020	0.011	28.130	4.565
Iran Pharma	552	0.193	1.006	1.557	0.787	0.017	0.009	13.923	8.534
Iran Pipe and Machine Development	515	0.182	1.003	2.965	0.855	0.023	0.012	30.726	11.281
Iran Pump	557	0.176	1.004	1.513	1.523	0.011	0.011	7.954	8.897
Iran Telecommunication	531	0.204	1.004	1.920	0.968	0.016	0.008	19.389	4.946
Iran Transfo	530	0.185	1.003	0.842	1.413	0.009	0.010	3.955	7.801
Iran, Yasatiro Rabar	544	0.180	1.004	2.164	0.887	0.017	0.006	15.361	4.114
Iranian crying industry	544	0.188	1.004	2.376	1.108	0.018	0.009	17.450	8.095
Iranian glass wool	542	0.173	1.005	1.414	1.191	0.011	0.015	6.832	11.109
Iranian injection products	567	0.168	0.003	1.656	0.463	0.014	0.006	12.509	3.074
Iranian Leasing	542	0.179	1.005	1.799	0.530	0.014	0.007	12.621	2.577
Iranian National Capital Investment	555	0.165	1.005	1.195	1.005	0.011	0.011	7.213	9.764
Iranian refractory products	549	0.189	1.003	3.004	1.186	0.023	0.009	25.738	6.793
Iranian Soil Industry	557	0.161	1.005	2.360	1.199	0.018	0.010	25.037	5.764
Irka Part Industry	539	0.193	1.005	4.520	0.650	0.035	0.007	71.789	6.316
Isfahan Mobarakeh Steel	560	0.297	0.011	1.234	1.749	0.011	0.012	7.060	13.618
Isfahan Oil Refining	544	0.180	1.004	3.179	1.701	0.024	0.013	31.805	12.570
Kamal	555	0.202	1.005	2.956	0.835	0.024	0.011	29.311	8.828
Kaveh Steel South Kish	560	0.178	1.004	1.287	1.393	0.012	0.009	9.065	5.729
Kermanshah Petrochemical Industries	576	0.163	1.004	0.767	1.061	0.008	0.011	5.189	7.920
Keshavarzi	548	0.183	1.004	2.904	0.652	0.022	0.008	26.038	4.454
Kharazmi Investment	548	0.194	1.005	3.650	1.764	0.028	0.013	41.206	13.673

Name	N	Volatility	Avg. Return	Kuiper 1D	Kuiper 2D	MAD 1D	MAD 2D	CHIS 1D	CHIS 2D
Khorasan Petrochemical	562	0.160	1.004	1.412	1.009	0.017	0.011	16.616	9.983
Khorasan Steel	565	0.251	0.006	1.328	1.279	0.015	0.011	17.851	11.339
Khuzestan Cement	563	0.180	1.005	2.127	0.926	0.016	0.008	21.451	5.190
Kowsar Agricultural Investment	345	0.808	1.037	1.459	1.187	0.014	0.012	13.163	8.734
Laairan	549	0.189	1.005	1.827	0.627	0.016	0.005	20.233	3.104
Lamiran Cooperation	520	0.171	1.004	0.707	0.825	0.008	0.011	3.654	8.010
Leasing Iran	470	0.185	1.004	3.236	1.415	0.027	0.015	31.119	13.075
Leasing is self-sufficient	553	0.178	1.005	1.491	1.147	0.012	0.011	17.619	6.602
Leasing of industry and mining	557	0.181	1.004	1.429	1.423	0.012	0.011	9.866	4.638
Lebanese Calber	526	0.185	1.005	3.520	1.341	0.027	0.012	43.583	8.902
Loghman Pharmaceutical	530	0.413	0.035	2.281	1.820	0.018	0.013	27.869	15.830
Lotus Parsian Capital	566	0.166	1.004	1.418	0.962	0.013	0.009	9.456	5.757
Margarine	548	0.185	1.004	2.292	1.253	0.020	0.014	24.321	12.483
Masa Shahid Bahonar	549	0.180	1.005	3.036	0.347	0.023	0.004	26.529	1.418
Mashhad construction ring	565	0.180	1.006	3.623	1.531	0.027	0.014	45.910	15.913
Medicine: Mystery	563	0.170	0.004	1.364	1.049	0.011	0.011	11.698	10.159
Mehrka Parsa	563	0.182	1.004	2.786	1.348	0.021	0.014	29.844	9.894
Melat Bank	455	0.196	1.004	2.451	0.649	0.020	0.008	22.362	4.372
Middle East Bank	569	0.160	1.004	1.595	1.746	0.013	0.012	10.449	8.732
Middle East Confirmation	558	0.181	1.005	1.763	0.893	0.013	0.007	10.598	3.537
Minerals of Iranian salts	553	0.164	1.004	1.120	1.209	0.008	0.012	5.575	11.601
Mining, Industry, Tent	564	0.171	1.005	1.545	0.894	0.013	0.007	10.243	4.880
Motogen	561	0.173	1.004	0.995	0.890	0.010	0.011	8.056	8.870
Motor manufacturers of tractors in Iran	555	0.183	1.003	3.323	1.640	0.025	0.014	36.031	8.953
Nation Insurance	525	0.178	1.004	1.036	0.667	0.010	0.006	7.138	2.654
National Deve. Group Investment	569	0.171	1.004	2.533	1.490	0.019	0.015	20.971	17.121
National Guard of Iran	572	0.183	1.005	1.806	0.865	0.013	0.009	12.505	6.989
National Industrial Union of Iran	563	0.171	1.004	1.413	0.976	0.011	0.008	10.874	3.400
National Industrial Group	543	0.186	0.005	0.959	1.543	0.009	0.013	4.818	5.632
New capital supply	554	0.170	1.004	1.659	1.423	0.013	0.011	9.532	8.143
New Fars Cement	555	0.172	1.004	2.120	1.251	0.018	0.010	18.333	3.862
Nirookoler	549	0.180	1.004	2.344	1.159	0.018	0.010	17.028	11.960
Nishaboor Sugar	560	0.282	0.010	1.400	1.300	0.011	0.010	9.655	5.521
Noori Petrochemical	486	1.171	1.068	2.239	2.141	0.019	0.016	15.986	13.079
Noosh Mazandaran	424	0.180	1.010	1.796	1.643	0.019	0.020	18.822	11.167
North Cement	560	0.174	1.004	1.570	0.847	0.013	0.006	10.819	4.160
North Drilling	538	0.188	1.004	2.919	1.156	0.022	0.012	25.222	11.536
Northeast Housing Investment	550	0.171	1.004	3.690	0.603	0.028	0.008	41.606	3.971
Offset	558	0.177	1.003	3.216	0.996	0.026	0.011	38.601	10.790
Ofoogh Kourosh chain stores	556	0.161	1.004	3.028	1.536	0.023	0.013	29.064	9.822
Omid Investment Management Group	539	0.155	1.005	2.085	0.943	0.016	0.009	13.137	3.624
Our Insurance	566	0.166	1.005	2.570	1.499	0.023	0.012	31.366	9.488
Paksan	581	0.172	1.002	2.368	1.332	0.018	0.012	18.084	9.440
Pars Daroo	557	0.165	1.004	1.998	0.894	0.015	0.010	18.943	8.793

Name	N	Volatility	Avg. Return	Kuiper 1D	Kuiper 2D	MAD 1D	MAD 2D	CHIS 1D	CHIS 2D
Pars Electric	547	0.194	1.006	2.274	1.478	0.023	0.011	31.342	8.540
Pars Tile and Ceramic	530	0.180	1.007	0.620	1.627	0.010	0.012	5.947	6.759
Pars Khodro	531	0.189	1.004	2.970	1.264	0.024	0.012	28.188	10.617
Pars Minoo	542	0.208	1.005	2.105	1.538	0.016	0.012	18.531	12.361
Pars National Agro-industry	553	0.177	1.006	0.767	1.375	0.007	0.012	2.490	8.135
Pars Oil	500	0.181	1.005	1.120	0.586	0.010	0.007	5.675	3.184
Pars Paper Industries Group	247	0.853	1.043	2.872	1.147	0.032	0.016	28.623	6.496
Pars Petrochemical	564	0.155	1.004	1.619	1.183	0.013	0.013	10.831	9.864
Pars Saram	520	0.182	1.004	0.795	0.741	0.007	0.007	4.929	3.883
Pars Switsch	522	0.198	1.006	1.808	1.210	0.014	0.014	14.923	12.029
Parsian Bank	533	0.192	1.006	1.291	1.256	0.012	0.012	8.824	8.697
Parsian e-commerce	562	0.176	0.003	1.095	0.852	0.012	0.010	7.890	8.025
Parsian Insurance	565	0.175	1.005	1.517	1.395	0.011	0.009	9.244	6.061
Parsian Leasing	270	0.368	1.011	2.564	0.783	0.033	0.011	28.366	4.891
Pasargad Bank	556	0.165	1.005	3.451	1.252	0.026	0.014	37.280	10.792
Pasteur Milk Khorasan	518	0.184	1.005	2.237	2.161	0.018	0.017	18.439	20.298
Pasteurized Milk Isfahan Pegah	550	0.169	1.004	1.405	1.201	0.011	0.017	7.949	18.033
Pegah of West Azerbaijan	550	0.177	1.003	2.491	1.268	0.020	0.013	21.220	6.527
Persian Gulf Energy Mobin	556	0.159	1.003	0.985	1.138	0.014	0.011	12.858	9.786
Persian Gulf International Transport	535	0.195	1.002	2.808	0.751	0.023	0.009	28.619	5.477
Persian Gulf Petrochemical Industries	557	0.168	1.004	1.487	0.867	0.012	0.009	11.077	4.863
Persian refractory products	469	0.188	1.006	1.188	0.874	0.013	0.011	9.429	9.520
Petrochemical Bu Ali Sina	174	1.751	1.236	1.705	1.173	0.023	0.020	10.629	11.692
Petrochemical Campus	579	0.164	1.005	2.689	1.004	0.020	0.011	26.254	10.342
Petrochemical Group S. Iranians	515	0.236	1.006	1.590	0.788	0.014	0.009	11.564	5.893
Petrochemical Jam	538	0.159	1.004	0.606	1.250	0.007	0.010	8.633	8.970
Petrochemical Kharkiv	534	0.162	1.003	1.994	1.034	0.016	0.009	21.219	3.754
Petrochemical Shiraz	573	0.162	1.005	2.448	1.217	0.019	0.010	24.075	8.388
Petrochemical Technologists	552	0.161	1.005	1.981	0.840	0.017	0.012	13.763	7.945
Petrochemical Transportation & Log.	518	0.179	1.005	3.542	2.773	0.028	0.022	46.576	24.020
Pharma Laboratory Dr. Abidie	561	0.161	1.002	3.719	1.423	0.028	0.011	40.554	10.381
Pharmaceutical poisoning	551	0.296	0.009	2.616	0.563	0.022	0.007	33.476	3.122
Pharmacist (Holding)	568	0.221	0.007	1.202	0.775	0.010	0.008	6.773	4.188
Pharmacy Abu Rihanna	561	0.175	0.004	1.509	1.370	0.011	0.012	9.257	9.597
Pharmacy Day of Medicine	563	0.163	1.004	2.579	1.315	0.019	0.009	30.360	4.967
Pharmacy Elixir	572	0.167	0.005	1.540	0.894	0.012	0.011	10.104	5.777
Pharmacy Farabi	552	0.261	0.008	4.517	0.871	0.035	0.010	58.095	7.994
Pharmacy Jabrabana Hayyana	551	0.258	0.008	2.031	1.047	0.016	0.015	16.841	16.315
Pharmacy Kowsar	542	0.343	0.017	2.393	0.700	0.023	0.008	33.556	5.619
Phoenix	524	0.426	1.011	2.411	1.159	0.019	0.011	27.456	7.155
Piazer culture and industry	546	0.183	1.005	2.118	1.235	0.016	0.013	18.455	6.774
Plaskokar	573	0.171	1.004	2.786	1.026	0.022	0.009	32.303	7.452
Polypropylene Jam - Jam Pollen	521	0.971	1.045	1.921	0.761	0.016	0.008	17.565	6.080
Post Bank of Iran	567	0.183	1.005	2.593	0.729	0.021	0.008	24.940	3.755

Name	N	Volatility	Avg. Return	Kuiper 1D	Kuiper 2D	MAD 1D	MAD 2D	CHIS 1D	CHIS 2D
Power trans	523	0.174	1.005	1.642	2.356	0.013	0.017	12.215	16.329
Produced by Mehram	532	0.174	1.004	0.857	0.982	0.012	0.012	10.708	5.703
Produced by Taksim	538	0.190	1.004	1.776	1.776	0.014	0.017	13.513	17.542
Production of cast iron makers	537	0.184	1.005	0.568	0.648	0.007	0.009	3.611	6.440
Production of raw materials	569	0.182	1.005	2.692	1.144	0.020	0.011	21.194	6.941
Products of food and sugarcane	541	0.147	1.004	1.333	0.993	0.013	0.007	9.147	6.371
Qazvin sugar factories	548	0.184	1.003	3.220	0.933	0.025	0.010	29.795	6.276
Radiator Iran	552	0.201	1.007	0.937	0.928	0.013	0.006	8.532	3.486
Ramina	558	0.180	1.004	1.268	0.695	0.012	0.009	9.170	5.581
Rena Investment (Holding)	569	0.182	1.004	1.921	0.904	0.015	0.009	17.821	5.282
Renovation Construction Tehran	552	0.184	1.005	3.573	0.455	0.027	0.006	42.155	3.211
Retirement of bank employees	566	0.165	1.004	1.889	1.056	0.019	0.008	21.317	7.120
Rolled aluminum	563	0.176	1.004	1.188	1.436	0.013	0.012	10.059	13.472
Rollers of Sepahan	471	0.600	0.035	1.225	1.257	0.010	0.013	7.872	13.761
Rolling and Steel Parts	564	0.159	1.006	1.493	0.944	0.012	0.008	9.911	5.549
Rotary	556	0.177	1.004	1.783	0.755	0.013	0.008	8.901	2.636
Industrial Chemicals	551	0.180	1.005	1.290	0.792	0.010	0.009	12.025	6.405
Sabanour Mining and Industrial Dev.	554	0.170	1.006	3.231	0.773	0.024	0.010	34.689	5.762
Sadi Tile and Ceramic	537	0.191	1.004	2.212	1.493	0.017	0.013	16.828	11.033
Sadr Tamin Investment	546	0.241	1.007	2.629	0.828	0.020	0.009	20.916	7.164
Sahand Rubber Industry	568	0.175	1.004	2.928	2.046	0.022	0.014	29.514	15.706
Saipa	527	0.235	1.005	2.538	0.713	0.020	0.009	26.900	5.284
Saipa Azin	568	0.182	1.002	3.609	0.652	0.027	0.008	38.139	5.182
Saipa Computer Leasing	564	0.176	1.002	1.622	0.998	0.012	0.010	8.099	8.192
Saipa Investment	563	0.179	1.004	1.788	1.089	0.018	0.011	24.721	9.949
Salamin	555	0.191	1.004	1.792	1.556	0.015	0.011	14.158	7.451
Saman Kish electronic payment	566	0.167	1.003	0.766	1.464	0.007	0.012	4.237	7.751
Sarma Afarin	559	0.177	1.005	2.862	1.269	0.022	0.011	25.395	8.316
Securing Cement Investment	274	0.944	1.055	2.888	2.056	0.033	0.022	28.575	15.881
Sepahan Industrial Group	566	0.179	1.005	1.098	1.012	0.010	0.009	7.207	6.333
Sepanta Communication	571	0.158	1.005	0.926	1.288	0.007	0.012	4.324	6.973
Shahd	538	0.154	1.002	2.529	2.066	0.019	0.022	23.231	30.142
Shahd Iran	543	0.187	1.003	1.274	1.052	0.010	0.007	7.764	5.781
Shahid Ghandi Production Factories	518	0.193	1.006	1.252	1.181	0.013	0.011	10.126	8.437
Shazand Petrochemical	577	0.170	1.004	1.437	1.485	0.012	0.011	11.328	8.107
Shipping of the Islamic Republic of Iran	549	0.184	1.003	0.352	0.724	0.006	0.007	2.131	4.019
Siman Behbahan	553	0.184	1.004	1.157	0.785	0.011	0.009	11.813	6.384
Siman Bojnourd	565	0.179	1.003	1.491	0.755	0.015	0.008	19.474	4.171
Siman Darb	569	0.174	1.005	2.786	0.590	0.021	0.008	27.377	4.895
Siman Dorood	558	0.194	1.004	2.545	1.654	0.019	0.014	32.969	15.476
Siman Fars	503	0.187	1.005	0.756	2.518	0.006	0.020	2.950	9.250
Siman Ghaen	560	0.172	1.004	1.520	1.296	0.011	0.013	10.033	12.948
Siman Heghmatan	548	0.174	1.005	0.850	1.617	0.007	0.015	3.250	16.181
Siman Hormozghan	532	0.157	1.004	2.249	0.674	0.017	0.009	15.106	5.775

Name	N	Volatility	Avg. Return	Kuiper 1D	Kuiper 2D	MAD 1D	MAD 2D	CHIS 1D	CHIS 2D
Siman Ilam	543	0.196	1.004	1.901	0.614	0.017	0.009	20.115	6.501
Siman Isfahan	530	0.191	1.007	0.968	1.425	0.010	0.013	6.823	10.908
Siman Kerman	566	0.168	1.003	3.147	1.560	0.024	0.012	32.434	10.204
Siman Kordestan	558	0.179	1.004	2.440	1.354	0.018	0.011	28.304	13.129
Siman Mazandaran	573	0.177	1.004	2.718	0.552	0.020	0.008	21.800	4.556
Siman Sepahan	574	0.176	1.004	1.691	0.936	0.013	0.010	11.364	6.017
Siman Shahrood	565	0.173	1.005	1.320	0.633	0.010	0.008	9.530	5.726
Siman Soofian	558	0.239	1.006	1.475	0.698	0.012	0.012	11.212	9.055
Siman Urumich	564	0.181	1.005	2.962	0.705	0.022	0.008	36.948	4.593
Sina Pharmacy	566	0.254	0.005	1.846	0.960	0.014	0.007	10.548	4.647
Sinai Chemical Industry	539	0.184	1.007	2.211	1.023	0.017	0.010	16.254	7.638
Sinai Tile and Ceramic Industry	519	0.179	1.006	3.108	1.210	0.024	0.012	31.307	12.887
Sobhan Daru	553	0.261	0.008	3.189	1.013	0.024	0.008	33.441	5.775
Sobhan Pharmaceutical Group	561	0.169	0.004	2.724	1.023	0.021	0.013	28.884	10.050
Steel of Khuzestan	569	0.168	0.004	2.575	1.016	0.019	0.011	21.987	7.266
Sugar Hekmatan	546	0.180	1.003	1.799	1.172	0.015	0.014	14.985	10.537
Sugar Isfahan	570	0.236	0.006	1.505	0.887	0.013	0.012	10.324	7.948
Sugar Lorestan	528	0.169	0.003	4.173	0.700	0.032	0.009	60.935	5.118
Sugar Mardoosht	533	0.184	0.005	1.002	1.645	0.011	0.012	6.856	10.853
Sugar Shahrood	548	0.182	1.005	2.773	0.946	0.021	0.009	35.235	4.426
Supply of spilled sand	503	0.188	1.004	1.440	0.866	0.012	0.012	13.759	9.445
System Partners	541	0.158	1.004	0.475	1.094	0.007	0.012	4.669	9.823
Tabahsar	246	0.287	1.006	2.063	0.812	0.029	0.011	23.549	5.906
Tabriz Oil Refinery	559	0.177	1.004	0.715	1.000	0.010	0.012	6.768	12.395
Tamin Oil, Gas and Petrochemical	544	0.174	1.004	1.453	1.533	0.013	0.014	10.106	13.541
Tamin Pharmaceutical Investment	557	0.226	0.007	1.809	1.448	0.016	0.013	21.633	6.893
Tehran Oil Refinery	544	0.184	1.004	3.664	0.846	0.028	0.008	44.181	3.275
Tehran Siman	544	0.191	1.004	3.135	1.228	0.024	0.010	41.540	8.903
Teknotar	546	0.182	1.004	4.638	1.715	0.035	0.012	82.489	9.925
The cement is white	546	0.172	1.005	1.573	2.073	0.012	0.014	9.078	13.373
Iranian Tractor Manufacturer	551	0.179	1.005	1.852	1.714	0.014	0.012	17.347	13.626
The dairy is clean	534	0.229	1.005	3.277	1.022	0.025	0.012	42.914	13.508
The food of the Persian dam	533	0.174	1.005	0.888	0.879	0.007	0.009	3.846	6.779
The glass of Hamedan	569	0.177	1.004	1.705	0.642	0.013	0.006	10.038	3.615
The lamp of the Persian Meteor	540	0.175	1.006	2.502	1.545	0.020	0.011	20.354	9.130
The Medicine Cup	516	0.170	1.004	1.311	0.783	0.012	0.008	11.899	4.849
Sugar Khorasan	452	0.200	1.007	1.388	0.816	0.014	0.010	11.601	4.815
Tile and Ceramic Memory	532	0.196	1.006	2.262	0.782	0.018	0.006	23.216	2.203
To pay the nation	562	0.163	1.003	2.808	1.011	0.021	0.008	23.865	2.791
Tourism and Welfare of Abadgaran Iran	545	0.166	1.006	2.410	1.900	0.018	0.013	21.527	13.017
Traktorsazi Iran	558	0.172	1.005	0.754	0.684	0.007	0.012	6.393	12.721
Transportation Toka	557	0.190	1.005	4.217	0.686	0.032	0.009	73.389	6.161
Urban Development	553	0.173	1.005	4.571	0.971	0.035	0.008	64.377	5.747
Vaspari Mellat	567	0.183	1.004	0.961	1.340	0.007	0.011	5.124	9.782

Name	N	Volatility	Avg. Return	Kuiper 1D	Kuiper 2D	MAD 1D	MAD 2D	CHIS 1D	CHIS 2D
Web-based data spreaders	495	0.182	1.003	2.542	0.788	0.020	0.008	28.802	3.752
West Siman	561	0.167	1.004	1.987	1.191	0.015	0.013	17.523	10.980
White Farab Kavir Steel Production	430	0.505	1.018	2.885	1.311	0.025	0.013	26.813	9.850
With the help of technology	557	0.184	1.005	1.952	0.598	0.016	0.009	17.321	5.849
Witness investment	564	0.179	1.005	0.707	1.458	0.006	0.012	3.417	11.339
Zagros Pharmacy Pars Pharmacy	559	0.180	0.004	3.126	0.802	0.024	0.010	35.278	8.311
Zamyad	530	0.184	1.005	2.809	1.545	0.022	0.017	25.818	19.148

Notes. MAD: Median Average Deviation; CHIS: Chi-Square; 1D = First-Digit; 2D = Second-Digit.

Table 4. Results of the empirical tests

Conformity	Chi-Square		Kuiper		MAD	
	1st digit	2nd digit	1st digit	2nd digit	1st digit	2nd digit
Yes	149	17	190	116	134	4
No	192	324	151	225	207	337

4. Discussion

A thorough evaluation of intraday demand for public shares listed on the TSE revealed significant noncompliance with Benford's Law. There is overwhelming evidence that shares listed on the TSE are most likely to be affected by attempts to manipulate the market, most likely by a falsified number of intraday trades reported by the Iranian Financial Market Regulatory Authorities. The most common BL violations in this study were observed in various industries. Companies across the mining, financial services, banking, construction, pharmaceutical, energy, and manufacturing sectors were equally identified among the most frequent BL violators.

As mentioned, Iran's supreme leader, Ali Khamenei, repeatedly encouraged citizens and called for proactive engagement in investing in the country's primary and secondary equity markets. Analysts claim that these attempts were primarily associated with the desolate Iranian economy. Moreover, the persistent mismanagement, continuous incompetence, bribery in public administration, and international political and economic pressures on Iran have left deep scars on the Iranian economy (Bertelsmann Stiftung, 2020).

Iran is indeed a developing country that can barely sustain its economy on its own.

State-owned enterprises (SOEs) account for approximately 80% of the country's economic activity. According to the International Monetary Fund (IMF), as of December 2020, public sector debt exceeded IRR 500 trillion. More than 89% was held by the theocratic government and less than 11% by state-owned enterprises (IMF, 2020). Iran's national debt has increased by 41% annually over the past ten years. In terms of the soundness of its banking system, Iran ranks 131 out of 140 worldwide. These facts can explain Iran's political leadership motivation to encourage capital inflow through people's engagement in the TSE transactions. Figure 3 highlights Iran's national debt as forecasted by International Monetary Fund (IMF) until 2025.

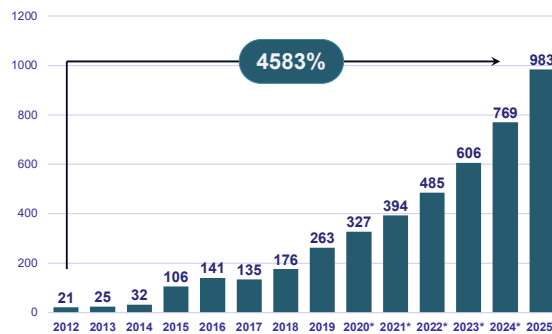


Figure 3. IMF forecasts for Iranian national debt until 2025

To plug budget holes, the clerical regime has repeatedly raised (latent) taxes, leading to widespread public unrest

and scrutiny. With Initial Public Offerings (IPO) throughout semi-functioning equity markets, the Islamic regime was able to access the people's savings and capital that had less engagement in Iran's equity markets. The deficit is indeed an additional motive for the interventions of the government across the TSE. It can be a driver behind the questionable development of the securities. Despite the impact of the U.S. sanctions on the Iranian crude oil exports, the country is a paragon of profligacy. For example, the Islamic government's annual budget for 2020/21 included a substantial \$40 million for the domestic travel expenses of the supreme leader, Ali Khamenei (Iran Budget, 2021). Comparing this amount to the \$14 million travelling costs of the former U.S. President Barack Obama (Delikic, 2020) shows how wasteful and inefficient the government in Iran is. Accordingly, Khamenei received three times more taxpayer money for his national trips than the former U.S. president for his international presence. This is quite surprising, as the chief cleric has already banned "too many foreign trips" by Iranian officials to save foreign currency in 2018 (Radio Farda, 2018).

Like budgeting and planning practices in Iran, the TSE is opaque. The lack of data integrity in Iran is nothing new. One can assume that the efficient market hypothesis cannot function in Iran due to the low quality of data. Existing investors in Iran shall exercise extreme caution when trading on TSEs. Given the empirical evidence found in this study, it is imperative to perform due diligence on all securities listed on TSE, including financial statements, the number of intraday transactions, representing transaction value and volume. This way, Iranian investors would be better able to navigate through the inherent risks of untransparent transactions on TSE. Nonetheless, novice investors should refrain from making any new transactions on the TSE until the market data is proven to be conclusive and reliable.

4.1 Limitations

This study is based mainly on the Tehran State Stock Exchange data. Former studies on the financial market in Iran do not exist. The literature driven by Iranian scientists appears to be inconclusive and compliant with the political will of the Iranian government. Given the lack of prior knowledge in the literature in this context, we took due care to avoid cognitive biases such as naïve realism, confirmation, and authority biases while studying the literature and collecting data.

4.2 Future Research

In view of our results, we suggest that the actual returns and risks of the best-performing stocks should be examined based on the portfolio selection theory. Although we recognize the overall issues with financial data in Iran, in a hypothetical investment scenario, one should determine the efficient frontier portfolio. This would greatly enhance the present understanding of the TSE indices as a multi-layered and diversified financial market and provide some guidance to investors who are quite inexperienced with the advanced techniques of portfolio management.

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