



## Risk and return in the Tehran stock exchange

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### ARTICLE INFO

#### Article history:

Received 26 January 2011

Received in revised form 18 April 2013

Accepted 19 May 2013

Available online 31 May 2013

#### JEL classification:

C22

C32

G12

G15

#### Keywords:

Conditional correlation and skewness

Efficiency

Emerging and frontier markets

ICAPM

Integration and segmentation

### ABSTRACT

This paper analyzes market index returns in the Tehran stock exchange (TSE) within the context of three variants of the Capital Asset Pricing Model: the static international; the constant-parameter intertemporal; and a Markov-switching intertemporal CAPM, which allows for time-varying degree of integration with regional and international equity markets. We find that TSE returns are CAPM-efficient at monthly frequency with respect to several international market indices. Moreover, we find evidence in support of international integration of the TSE with respect to international markets. In addition, we conduct an extensive investigation for the direction of causality between TSE returns, international market index returns, and those in neighboring countries.

Published by Elsevier B.V. on behalf of The Board of Trustees of the University of Illinois.

## 1. Introduction

Since the early 1990s, there has been growing interest in emerging and frontier financial markets among both financial scholars and practitioners. One of the least studied frontier markets is the Tehran stock exchange (TSE) of the Islamic Republic of Iran. Very little is known about the features of this market. In our study, we address some basic questions about risk and index returns behavior in this under-studied stock exchange.

In this paper, we analyze Tehran stock exchange index excess returns to test for efficiency of this market, via three variants of Sharpe (1964) and Lintner (1965) capital asset pricing theory (CAPM). One of the basic questions in our investigation is the degree of integration of the TSE with the international financial system. We first test for the static international CAPM, following Lintner (1965). The objective is to measure the ability of this classical vari-

ant of CAPM to explain the behavior of excess returns in the TSE. We find that at the monthly frequency, TSE excess returns are CAPM-efficient and that this result is robust to our proxy for the world market and to inclusion of macroeconomic or financial factors. This model assumes full integration of the TSE in the global system.

Second, following the seminal work of Merton (1973) and the voluminous literature that it generated, we test for constant-parameter intertemporal CAPM model in TSE returns. We find that using conventional measures for risk–return trade-off provides statistically mixed support for a positive market price of risk in TSE excess returns. Intertemporal CAPM assumes full isolation of the market under investigation from the rest of the world.

Third, based on the ground breaking work of Bekaert and Harvey (1995), we study the level of integration of the Tehran stock exchange with international financial markets. The proposed Markov-switching intertemporal CAPM allows for a time-varying degree of integration with international equity markets. Our empirical findings, surprisingly, support a considerable degree of market integration for the Tehran stock exchange. Cheng, Jahan-Parvar, and Rothman (2010) find evidence of international integration for Bahrain, Israel, and Turkey, but not other MENA markets. Thus, based on our empirical evidence, the Iranian market behaves more

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like the three arguably more open markets than other neighbors in the MENA region.

Finally, we investigate the direction of information flow from international and neighboring country indices to the TSE. We consider Granger (1969) causality in conditional returns, as well as “variance causality” following Hafner and Herwartz (2006) methodology. We finally study contemporaneous flow of information through a study of conditional correlations between TSE returns and international and MENA market returns.

A study of the TSE would naturally contribute to the literature on emerging and frontier markets finance in general, and Middle East and North Africa (MENA) financial markets in particular. While emerging and frontier markets have attracted considerable attention in the finance literature since the early 1990s, the MENA region is relatively understudied. The most comprehensive recent study is Cheng et al. (2010). We follow Cheng et al.’s methodology closely.

If investment in a frontier market such as Tehran stock exchange is an objective for investors seeking to diversify their portfolios, then some knowledge of the basic properties studied in this paper is necessary. It is important to bear in mind that this market is open to both small and large foreign investors. Portfolio investment in Iranian companies is illegal in the US, as it violates Iran-Libya Sanctions Act (ILSA) of 1996, among other laws and acts of the Congress. But international investors can, and in fact do, invest in the TSE. According to a report by the Financial Times, between 2 and 5% of market capitalization of the TSE was held by foreign investors in 2009. We are aware of at least one investment boutique, Turquoise Partners in London, that up to 2009 offered the opportunity to invest in TSE through two funds.

We believe that finance research community would find some of our findings, such as the level of efficiency at monthly frequency for a market populated by investors who are far less sophisticated than their developed market counterparts and prone to insider information trading, to be pleasantly surprising. Hence, we believe that a rigorous empirical study of this virtually unknown market is interesting and informative. In addition, our findings shed light on the puzzling positive performance of the TSE in 2011–2012, where in the face of increasing international pressure on the Iranian economy, TSE sustained significant positive growth.

Among the very few studies that look at the Iranian equity market, Foster and Kharazi (2008) examine the issues of efficiency and profitability of momentum strategies in TSE returns for the 1997–2002 period. They find evidence in support of efficiency at the weekly frequency, but not at the daily frequency. Our findings are inline with their conclusion regarding efficiency at low sampling frequencies.

Errunza (2001) focuses on the liberalization and integration of financial markets in Egypt, Israel, Jordan, Morocco, and Turkey. Ghysels and Cherkaoui (2003) study trading costs in Morocco. Lagoarde-Segot and Lucey (2008) study information efficiency in seven MENA markets and find heterogeneous levels of efficiency. Billmeier and Massa (2009) study the role of oil reserves, remittances, and institutions besides the traditional factors, and find that they appear to play a role in the determination of market capitalization in the MENA and Central Asian financial markets. Alsubaie and Najand (2009) investigate the informational role of trading volume in predicting the direction of short-term returns for the Saudi Stock Exchange. Billmeier and Massa (2008) and Jahan-Parvar and Waters (2010) study formation of financial bubbles in the MENA region. None of these studies investigate the TSE.

The rest of the paper proceeds as follows. We discuss the data used in this study in Section 2. In Section 3, we study the efficiency of TSE in an international CAPM and international factor model setting. Risk–return trade off and dynamics of market returns volatility

are the subject of Section 4. We test whether TSE is integrated or segmented from the international financial system and report our findings in Section 5. In Sections 6 and 7, we study information flows and causality between TSE, broad market indices, and MENA country market indices, respectively. Section 8 concludes.

## 2. Data

We use monthly returns data from the TSE and MSCI Inc. (formerly, Morgan Stanley Capital International) in this research. The binding constraint in our study is the availability of online historical data. We downloaded daily data from the Central Bank of Iran web site for December 27, 1998 to November 29, 2012 period. We use the TEPIX (TSE All-Share Price Index) market index. Since Iran follows the Persian calendar which differs substantially from the Gregorian calendar, we matched the trading day data from the TSE to MSCI ACWI index data. We construct the monthly data by matching the corresponding TSE data to the last trading day in the Gregorian calendar.

We use ten different international and regional index returns in our study. This is an exhaustive choice of index returns and our goal is to conduct an extensive investigation of CAPM efficiency, such that the majority of concerns about geographic, trade links, and relative market size are addressed. Formal definitions and construction methodologies for these indices are freely available from MSCI Inc. website.<sup>2</sup> MSCI indices are based on equity prices in US Dollar.

As a proxy for the world equity market, we use the MSCI All Country World Index (ACWI). This is a free float-adjusted market capitalization weighted index, designed to measure the equity market performance in 24 developed and 21 emerging markets. MSCI EM index measures equity market performance in 21 emerging markets spanning Africa, Asia, Europe, Middle East and North Africa, and Latin America. MSCI FM index is a free float-adjusted market capitalization weighted index, designed to measure the equity market performance in 25 frontier markets from Africa, Asia, Europe, Middle East and North Africa, and Latin America. MSCI EFM index measures the performance of 21 emerging markets in MSCI EM and the 25 frontier markets in MSCI FM index together. MSCI “Next 11 ex Iran” index is a GDP-weighted index based on equity market performance of 11 countries including Turkey, Mexico, Pakistan, and Korea. Some of these countries are Iran’s trading partners and some are neighbors. MSCI EAFEEM index contains data from 22 developed markets from Europe, Australia, and Far East, plus 21 emerging markets in MSCI EM index. Canada and US are not part of this index’s construction. MSCI GCC index represents the universe of companies in six (Persian) Gulf Co-operation Council countries of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates. MSCI FM ex GCC index excludes Bahrain, Kuwait, Oman, Qatar, and UAE from frontier market data. Notice that Saudi Arabia is not part of MSCI FM index. MSCI Arabian Markets index adds data from Jordan, Egypt, Lebanon, Morocco, and Tunisia to MSCI GCC index. MSCI Arabian Markets and Africa index adds data from Kenya, Nigeria, Mauritius, and South Africa to MSCI Arabian Markets index.

TSE data are Iranian Rial (IR) denominated, while the available international data are in US Dollars. We transform the IR-denominated returns to USD-denominated returns, using IR-USD exchange rate data from the Central Bank of Iran. Officially, the IR-USD exchange rate was fixed at 1750 IR per 1 USD until

<sup>2</sup> <http://www.msci.com/products/indices/tools/index.html>.

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