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DOCTORAL THESIS

Doctor of Philosophy (PhD)

FORECASTING THE EQUITY RISK PREMIUM WITH MACROECONOMIC AND TECHNICAL INDICATORS: INTERNATIONAL EVIDENCE

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DECLARATION

I hereby declare that this doctoral thesis titled as **"Forecasting the Equity Risk Premium with Macroeconomic and Technical Indicators: International Evidence"** has been written by myself without applying the help that can be contrary to academic rules and ethical conduct. I also declare that all materials benefited in this thesis consist of the mentioned resources in the reference list. I verify all these with my honor.

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Efe Çağlar ÇAĞLI

ABSTRACT

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Forecasting the Equity Risk Premium with Macroeconomic and Technical Indicators: International Evidence

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Graduate School of Social Sciences

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The main purpose of this study is to investigate the forecastability of equity risk premium which takes part in asset pricing and valuation models in finance and has a crucial importance in decision making processes.

We conduct an empirical application in order to examine the forecasting power of macroeconomic and technical indicators on the equity risk premiums of selected thirteen stock markets over the period 1988-2012. We use several macroeconomic indicators of selected stock markets as domestic factors and same macroeconomic indicators of three major stock markets as foreign factors. Our empirical analyses also include fourteen technical indicators based on moving-average, momentum, and volume-based rules.

We implement our estimations both in-sample and out-of-sample. In-sample analysis, the bi-variate regression estimation results suggest that foreign macroeconomic indicators perform as well as domestic indicators; and technical indicators perform better than all analyzed macroeconomic indicators. Incorporating information from all indicators provides in-sample fitting gains indicating that the macroeconomic and technical predictors essentially contain complementary information. Predictive performance of the models is closely related to the business cycle fluctuations, and they generally perform much better in recessions vis-à-vis expansions.

Out-of-sample forecasting results suggest poor performance for the forecasts generated by the individual indicators; however, the combined forecasts are found to be more successful in beating the stringent benchmark model than individual forecasters. Asset allocation exercise suggests good performance of the models in terms of Sharpe ratios, and certainty equivalent returns even after accounting for transaction costs; and investors following the forecasts generated by proposed models obtain positive returns over the buy-and-hold strategy.

Keywords: Equity Risk Premium Forecastability, Macroeconomic Indicators, Technical Indicators, Out-of-Sample Tests, Business Cycle, Asset Allocation, Transaction Costs.

ÖZET

Doktora Tezi

Makroekonomik ve Teknik Göstergeler ile Hisse Senedi Risk Primi Öngörümlemesi: Uluslararası Kanıt

Efe Çağlar ÇAĞLI

Dokuz Eylül Üniversitesi

Sosyal Bilimler Enstitüsü

İngilizce İşletme Anabilim Dalı

İngilizce İşletme Programı

Bu çalışmanın ana amacı, varlık fiyatlama ve değerleme modellerinde yer alan ve karar verme süreçlerinde önemli bir yeri olan hisse senedi risk priminin öngörümlenebilirliğini araştırmaktır.

Makroekonomik ve teknik göstergelerin seçilen on üç hisse senedi piyasasının risk primini öngörümleme gücünü değerlendirmek için 1988-2012 dönemini kapsayan bir uygulama yürütülmüştür. Seçilen hisse senedi piyasalarına ait birkaç makroekonomik gösterge yerel faktörler olarak, üç büyük hisse senedi piyasasına ait aynı makroekonomik göstergeler de dış faktörler olarak kullanılmıştır. Ampirik analiz hareketli ortalama, momentum ve hacim kurallarından oluşan on dört teknik göstergeyi de içermektedir.

Tahminlemeler, hem örneklem içi hem de örneklem dışı yapılmıştır. Örneklem içi analizde, iki-değişkenli regresyon sonuçlarına göre, dış makroekonomik faktörlerin yerel makroekonomik faktörler kadar iyi performans gösterdiği, teknik göstergelerin de makroekonomik göstergelerden daha iyi performans sergilediği görülmüştür. Makroekonomik ve teknik göstergelerden elde edilen bilgilerin birlikte değerlendirilmesi durumunda çok daha iyi örneklem içi performans elde edilmektedir ve bu makroekonomik ve teknik göstergelerin birbirini tamamlayıcı bilgiler içerdiğine işaret etmektedir. Modellerin tahminleme performansları konjonktür dalgalanmalarıyla yakın ilişkilidir ve söz konusu modeller iktisadi gerileme dönemlerinde daha iyi performans sergilemektedirler.

Örneklem dışı analiz sonuçları, tekil göstergelerden elde edilen öngörümlemelerin kötü performans sergilediklerini göstermektedir; ancak kombine öngörümlemelerin tekil öngörümleyicilere göre zorlu kıstas modelini yenme konusunda daha başarılı olduğu bulunmuştur. Varlık tahsis uygulaması, modellerin Sharpe oranına ve belirlilik eşitliği getirisine göre değerlendirildiğinde işlem maliyetleri göz önüne alınsa da iyi performans sergilediklerini göstermektedir ve sunulan modellerden elde edilen öngörümlemeleri izleyen yatırımcıların "al ve tut" stratejisi karşısında pozitif getiri elde ettiği görülmektedir.

Anahtar Kelimeler: Hisse Senedi Risk Primi Öngörümlemesi, Makroekonomik Göstergeler, Teknik Göstergeler, Örneklem Dışı Testler, Konjonktür, Varlık Tahsisi, İşlem Maliyetleri

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EMPIRICAL APPLICATION

ABBREVIATION

APT	Arbitrage Pricing Theory
ARCH	Autoregressive Conditional Heteroskedasticity
BEL	Belgium
BRA	Brazil
CAL	Capital Allocation Line
CAPM	Capital Asset Pricing Model
CCAPM	Consumption Capital Asset Pricing Model
CER	Certainty Equivalent Return
DY	Dividend Yield (log)
ECON	Macroeconomic Indicator
EMH	Efficient Market Hypothesis
GER	Germany
GRC	Greece
HKG	Hong Kong
IND	India
INF	Inflation
JPN	Japan
MA	Moving Average
MEX	Mexico
MOM	Momentum
MSFE	Mean Squared Forecast Error
MYS	Malaysia
OIL	U.S. Crude Oil Prices
OLS	Ordinary Least Squares
OS	Out-of-Sample
PC	Principal Component
PCA	Principal Component Analysis
PE	Price-Earnings Ratio
POR	Portugal
PRD	Industrial Production

RP	Risk premium
RUS	Russian Federation
RVOL	Equity Risk Premium Volatility
RWM	Random Walk Model
SPN	Spain
TBL	3-month Treasury Bill Rate
TECH	Technical Indicator
TUR	Turkey
TWN	Taiwan
USA	The United States of America
VOL	On-Balance Volume
ZAF	South Africa

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INTRODUCTION

Are financial asset prices forecastable? This is one of the earliest and most challenging questions in finance. The mathematical forecasting models of asset prices have a long and rich history which dates back to the early attempts to beat the market. The common idea of those models is discounting the stream of future cash flows provided by the assets in order to value the assets. Nevertheless, the riskiness and the timing of that stream of future cash flows put this task into a challenge. Determining the factors driving riskiness and timing of the stream of future cash flows plays an important role in asset pricing. In this way, asset pricing models can be developed once the determinants of those future cash flows are taken into account. Asset pricing models that incorporate accurate estimates of the future stream of cash flows provide to what extent investors can explain the existing prices as equilibrium compensations for risks. If the prices do not reflect their expected values identified by the asset pricing model, investors can find mispriced assets and make money by forecasting the future movements of the assets.

Along this line, understanding the behavior of asset prices is essential in evaluating investment decisions so that practitioners and academics have been investigating what assets are worth and whether asset prices are predictable. The issue of asset price predictability is the central paradigm of finance and has a long history. On one hand, investors seek to identify predictable patterns by examining past price behavior along with plethora of variables in order to obtain asset price forecasts for enhancing investments and using for asset-allocation exercises. On the other hand, academics do the same job for testing and measuring the market efficiency and producing more realistic asset pricing models that better explain the observed facts about the data.

Fama (1970) defines an efficient market as '*a market in which prices always "fully reflect" available information*' (Fama, 1970:383). His definition, in fact, implies that in an informationally efficient market with respect to information set of θ_t, prices incorporate expectations and fully reflect the all available information (θ_t) so that it is impossible to make 'economic' profits by using the information set of θ_t where the term economic profits imply risk-adjusted returns after accounting transaction costs. Moreover, Fama (1970) proposes joint-hypothesis problem in which we jointly test the market efficiency and the specification of the equilibrium model (Fama, 1991:1575). According to this statement, one can never test market efficiency unless appropriate equilibrium model is specified and risk-return is defined accurately. Despite the presence of joint hypothesis problem, empirical literature heavily tests the market efficiency since we observe several important facts that lead investors seeking price predictability even more. Historically, the average realized returns are found to be higher in stock markets than that of bond markets, put another way, equity risk premium is calculated very high. One of the reasons behind that fact is stocks are riskier than bonds. Moreover, equity risk premium is found to be time-varying and the variation in that variable increases in recession times. If the equity risk premium is time-varying then discounted dividends, stream of future cash flows, are time-varying. Stock returns are also found as closely correlated with the economic activity, namely consumption level and gross domestic product.

It is clear from the above facts that investing in assets involves risk, for this reason, evidence of price predictability does not necessarily mean malfunctioning of markets or market inefficiencies but instead means a compensation for time-varying aggregate risk. Furthermore, empirical evidences prove that we may expect time-varying expected returns and some level of predictability even in efficient markets since aggregate risks for consumption/investment levels are tightly linked to fluctuations in the real economic activity (Rapach and Zhou, 2013:2). The presence of stock return predictability due to changing business cycles implies time-varying risk premium demand for taking risk associated with the investment; and this is consistent with market efficiency. However, asset pricing models following rational investor theory are consistent with the market efficiency if only they do not exceed the certain theoretical bounds. In this way, we should expect limited stock return predictability evidence. When the theoretical imposed bounds are exceed by asset pricing models, we suspect for incorrect specification of the models or market inefficiencies due to irrational investor behavior, behavioral/psychological biases, and empirical regularities. The degree of stock return predictability is a statistical concept and totally an empirical issue.

The empirical studies on this issue mainly investigate the predictability of stock returns with a number of macroeconomic indicators, including financial ratios (e.g. dividend yield, price-earnings ratio), interest rates, term structure variables, macroeconomic quantity variables (e.g. economic output, industrial production), firm-specific variables and many others. Particularly, several studies test the predictive power of domestic macroeconomic indicators along with the global risk factors or with the foreign macroeconomic indicators of major economies. Using macroeconomic variables many studies provide in-sample evidences along with out-of-sample verifications for their proposed models. Other than macroeconomic indicators, technical indicators are rarely analyzed in the literature in terms of measuring their direct predictive power on the equity risk premium, despite the fact that technical trading strategies are applied heavily by the professional investors.

In the light of aforementioned issues, in this thesis, we conduct an empirical application on the equity premium forecastability concept. The main purpose of our study is to investigate the forecastability of equity risk premium which takes part in asset pricing and valuation models in finance and has a crucial importance in decision making processes, particularly allocation of wealth (i.e. consumption) across risky assets (Damodaran, 2009:290). Moreover, equity risk premium provides us to determine the price of a risk for different types of investments with the same expected value.

We consider both macroeconomic and technical indicators in order to predict the equity risk premiums of selected thirteen stock markets including Belgium, Greece, Malaysia, Mexico, Portugal, Spain, Taiwan, Turkey, Brazil, Hong-Kong, India, Russia, and South Africa. We consider macroeconomic indicators of those selected markets as *domestic factors* and macroeconomic indicators of the major stock markets, namely the US, Japan, and Germany, as *foreign factors*. We use the same domestic and foreign macroeconomic indicators, namely Dividend Yield (DY), 3-month Treasury Bill Rate (TBL), Price-Earnings Ratio (PE), Equity risk premium volatility (RVOL), Inflation (INF), and Industrial Production (PRD). Our empirical analyses include fourteen technical indicators based on well-known moving-average (MA), momentum (MOM), and volume-based (VOL) rules. By doing so, we both test the predictive/forecasting power of technical indicators on the equity risk premium and their performance compared to macroeconomic variables including both domestic and foreign factors. In fact, we combine the ideas of the studies by Rapach et al. (2013) and Neely et al. (2014), and attempt to contribute to the existing literature by examining predictive/forecasting power of the aforementioned indicators in an international context.

Our empirical analyses consider the statistical issues raised by the literature and proceed in several steps. First, we conduct our estimations in in-sample perspective. We estimate bi-variate predictive regressions where the equity risk premium is regressed on a constant and the lag of a macroeconomic variable or technical indicator. Second, we implement principal components analysis in order to incorporate information from many indicators. So that, we regress the equity risk premium on small number of principal components extracted from the entire set of macroeconomic variables and/or technical indicators. We also differentiate the performance of forecasting variables across business cycles and stress whether they perform better in expansion or recession times. The statistical significance of the coefficient estimates are assessed by the *p*-values obtained from wild bootstrapping procedures rather than conventional procedures. Moreover, parameter stability issue is addressed by statistical tests.

Second, we employ out-of-sample analysis where we compare the forecasts generated by individual macroeconomic and technical indicators to the forecasts generated by a very stringent benchmark model, historical average. Similarly, we also compare the average combination of forecasts by all forecasting variables as well as the principal component predictive regression forecasts to that of benchmark model. Furthermore, we conduct asset allocation exercise where we check whether forecasts generated by the forecasting models are able to generate incremental profits over the benchmark model before and after accounting transaction costs. The bottom line is that the empirical application provides insight to both professional investors and academics in terms of forecasting equity risk premium in selected stock markets.

According to our knowledge, this is the most comprehensive study trying to predict the equity risk premium of the stock markets of some selected countries including both the developed and developing ones by using a numerous macro-economic and technical indicators. In addition to the domestic macroeconomic indicators, we also consider the forecastability of the macroeconomic indicators of the major countries as a global factor. In this context, different from the existing studies, we examine the forecastability of Japan and Germany's macroeconomic indicators on equity risk premiums other than the US. Additionally, this study also provides a comprehensive empirical analysis by applying the most recent statistical techniques to provide more accurate and reliable forecasts for equity risk premiums.

Our findings are important especially for the international individual investors, portfolio managers and global institutional investors such as global investment banks and global mutual funds and etc. They can use our findings for their own investment decisions or as a portfolio manager and an investment advisor. Similarly, our findings are also important for the domestic investors for their asset allocation and security selection decisions. Domestic investors also need to consider the global factors in forecasting risk premiums in domestic stock markets. Examining the forecastability of both macro-economic and technical indicators is important for the policy makers and governmental agencies trying to canalize the savings to the stock markets in order to provide economic development and financial stability. Our study is also important for the academics studying on similar issues and trying to solve this big puzzle theoretically. As a result, this study provides a contribution in both practice and theory.

The remainder of this study is organized as follows. Chapter one reports theoretical background of the stock return predictability. Chapter two reviews the existing studies investigating the predictive power of technical trading rules and macroeconomic indicators on the stock returns. Finally, we present empirical evidence on the predictability issue using macroeconomic and technical indicators in an international context.

CHAPTER ONE
THEORETICAL BACKGROUND

> *"I suspect that even if the random walkers announced a perfect mathematic proof of randomness, I would go on believing that in the long run future earnings influence present value…"*
>
> *Smith, 1968, pp. 157-58*

This chapter discusses the theoretical background of the stock return predictability issue. In the first two sections, we review the theoretical approaches that attempt to explain the behavior of stock prices, namely efficient market hypothesis and the random walk hypothesis. Then, we discuss present-value relations among prices, dividends, and returns in the third section which presents theoretical framework for time-varying predictability consistent with the market efficiency. Section four documents the determinants of the stochastic discount factor based on two competing approaches, rational-investor theory and behavioral finance. After having provided theoretical background of two main streams in finance, we discuss stock return predictability and market efficiency, and shed light on some misconceptions. Finally, we review equity risk premium that is the key component of the whole predictability debate. We document the determinants of equity risk premium and briefly discuss the equity risk premium puzzle.

1.1. MARKET EFFICIENCY

Fama (1970) proposes the Efficient Market Hypothesis (EMH) by systematically summarizing the capital market ideas that can be traced back to the influential studies of Bachelier (1900), Cowles (1933), Mandelbrot (1963), and Samuelson (1965) which state that asset prices should follow sub-martingale process in well-functioning markets. In his groundbreaking paper, Fama (1970) defines an efficient market as '*a market in which prices always "fully reflect" available information*' (Fama, 1970:383). In this textbook definition, the term 'efficiency' simply indicates 'informational efficiency' which should not be confused with Pareto-efficiency. Jensen (1978), one of great contributors to the EMH, explains the definition in a more explicit way. Jensen (1978) states that in an informationally efficient market with respect to information set of θ_t, prices incorporate expectations and fully reflect the all available information (θ_t) so that it is impossible to make 'economic' profits by using the information set of θ_t where the term economic profits imply risk-adjusted returns after accounting transaction costs. Accordingly, in an efficient market where market participants can access available information at no cost, security prices are fairly priced and thus their expected returns equal their required returns. Moreover, only new information could change the stock price levels and upside or downside swings in the price levels do not necessarily indicate an irrational environment surrounding the markets, in fact this shows that stock prices reflect new information and indicate how efficient the markets are.

It is clear from the above definitions that the EMH is also empirically testable by observing, for instance, the market participants' profits earned by trading on an information set. However, it is not possible to observe the information set used in the market trading strategies directly. Following Roberts' (1967) suggestions, Fama (1970) proposes three information subsets relevant to the adjustments of security prices in the financial markets and subdivides the EMH based on these three information subsets:

- Weak form efficiency where the information set, θ_t, contains only historical prices or returns of the securities as of time *t*,
- Semi-strong form efficiency where the information set, θ_t, contains information (fundamental data) *publicly* available to all market participants in addition to the historical prices or returns as of time *t*,
- Strong form efficiency where the information set, θ_t, contains all information *private* and *public* information available to any market participant.

Accordingly, strong form efficiency defines extreme market conditions and covers all information subsets observed in the other forms of market efficiency. Moreover, the EMH asserts that any attempt to make profits by trading on the basis of currently available information is fruitless.

After the introduction of EMH, every form of it is tested heavily in the literature[1]. By considering theoretical and empirical contributions to the EMH, Fama (1991) modifies his types of EMH. Fama (1991) suggests new categorizations for the studies testing each form of market efficiency. Tests for *stock return predictability* is the new title for the tests for *weak-form* of efficiency and covers the studies on forecasting returns with macroeconomic variables such as price ratios and interest rates, as well as the studies testing cross-sectional predictability, in addition to the existing concept of testing the forecasting power of past returns. The titles for *semi strong form* tests and *strong form* tests are changed as *event studies* and *tests for private information*, respectively (Fama, 1991:1577). However, the coverage of those categories remains the same.

The empirical studies on the stock return predictability investigate the issue comprehensively and attempt to judge the efficiency of financial markets in mainly two aspects namely time horizon and forecasting variables. While the former includes the studies testing predictability in short (high frequency, e.g. day-by-day, even intraday) and long (low frequency, e.g. monthly, annually over longer time spans) horizons, the latter approaches the stock return predictability using past returns or other forecasting variables, such as dividend yield, interest rate, term spread.

1.2. RANDOM WALK

Random walk hypothesis is developed based on the *martingale* model which is one of the earliest models in asset pricing theory. A martingale is a stochastic process satisfying the following condition (Campbell et al. 1997: 30):

$$\mathrm{E}\left[P_{t+1} \mid P_t, P_{t-1}, \ldots\right] = P_t$$

$$E\left[P_{t+1} - P_t \mid P_t, P_{t-1}, \ldots\right] = 0 \tag{1}$$

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[1] We refer to Lim and Brooks' (2011) comprehensive survey which reports the empirical studies testing the efficient market hypothesis.

where P_t is the asset price at time t. The martingale model indicates that P_{t+1} is expected to be equal to Pt, given the asset's entire price history. In other words, the information containing past prices are fully reflected in today's asset prices, thus the current price of an asset is the best predictor of the price of an asset in the next period. Although, martingale model seems to be consistent with the *weak form* of efficiency it does not take the *risk* associated with the asset's return into account. However, when the asset returns are adjusted for risk, martingale property of returns hold and this eventually forms the basis for random walk hypothesis.

Random walk hypothesis states that price changes are random and unforecastable, thus using historical prices (technical analysis) to forecast the future prices is futile. Campbell et al. (1997) proposes three versions of random walk hypothesis and categorizes the tests for each version of random walk hypothesis.

First model is titled as *Random Walk Model (RWM) 1* and asset price dynamics via this model can be shown as follows:

$$P_t = \mu + P_{t+1} + \varepsilon_t, \qquad \varepsilon_t \sim \text{IID}\left(0, \sigma^2\right) \tag{2}$$

where P_t is the asset price at time t, μ is the expected price change, so called drift, and IID stands for independently and identically distributed increments. *RWM 1* assumes that error terms are IID with mean 0 and variance σ^2. In this model, independence of the increments implies that not only the increments are uncorrelated, but also any nonlinear functions of the increments are uncorrelated (Campbell et al., 1997:32). This version of random walk hypothesis can be tested via nonparametric and/or semiparametric tests, such as Sequences and Reversals, Runs tests. The reason behind using nonparametric tests is that IID random variables (prices) do not follow any particular parametric distributions.

Second version of the random walk hypothesis is titled as *RWM 2*. In this type of RWM the assumption of identical distribution of increments is relaxed, however, independency of the increments still holds. The relaxation of identical distribution is necessary for asset prices since there are many changes in the business conditions (booms/recessions) and we experience many economic, social technological developments over the time. The key feature of the *RWM2* is that it allows for unconditional heteroskedasticity in the ε_t's. This feature provides basis for the theory of autoregressive conditional heteroskedasticity (ARCH) model of Engle (1982). The *RWM 2* can be tested applying *Filter rules* and *Technical analysis*[2].

Third version of the random walk model, *RWM 3*, is the weakest form of the random walk hypothesis and relaxing the assumption of both independent and identically distributed increments. The increments in *RWM 3* follow dependent but *uncorrelated* process. It is a process for which $Cov\left[\varepsilon_t, \varepsilon_{t-k}\right]=0$ for all $k \neq 0$, but where $Cov\left[\varepsilon_t^2, \varepsilon_{t-k}^2\right] \neq 0$ for some $k \neq 0$ (Campbell et al., 1997:33). Put another way, we have uncorrelated but not independent increments since their squared (nonlinear) forms are correlated. *RWM 3* can be tested by calculating the autocorrelation statistics, implementing portmanteau tests (*Ljung-Box* (1978) *test statistics*), variance ratios etc. The presence of autocorrelations in the error terms indicates the rejection of the model *RWM 3*.

1.3. PRESENT-VALUE RELATIONS

The present-value model can be applied in order to estimate the current price of an asset by discounting its expected future cash flows to present at a discount rate in the absence of arbitrage opportunities. In this way, present-value model is also known as *discounted-cash flow* model. In this model, dividend payments and discount rates are included for every time point, that is to say, the persistent variations in those variables have a significant and larger effect than temporary variations do (Campbell et al., 1997:253). The key implication here is that long-run asset returns are closely related to asset prices and it might be useful to incorporate macroeconomic (fundamental) data and historical price data in order to test the stock return predictability in the long-horizon.

The discussion on present-value relation between prices, dividends, and returns is based on the definition of simple *holding period return* on a dividend paying stock between the period *t* and *t+1*, given by:

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[2] Please see Section 2.1 for detailed information about the studies on technical analysis.

$$R_{t+1} \equiv \frac{P_{t+1} - P_t}{P_t} + \frac{D_{t+1}}{P_t} \tag{3}$$

where R_{t+1} is the simple return of the stock at time t+1, Pt is the ex-dividend price of the stock at time t, and Dt+1 stands for the dividend payment at time t+1. While the first term on the right hand side of the equation is the capital gain yield, the second term is the dividend yield. Using R_{t+1} obtained in the identity (3), we can calculate continuously compounded (logarithmic) returns which is used for the mathematical approximations conducted in the subsequent sections[3]. We can calculate logarithmic return of a stock as follows:

$$r_{t+1} \equiv \log\left(1 + R_{t+1}\right) \tag{4}$$

Moreover, when we take the expectations of the identity (3) and rearrange it we can express the current stock price as an expected sum of next periods' stock price and dividends discounted at expected return:

$$P_t = \mathrm{E}_t\left[\frac{P_{t+1} + D_{t+1}}{1 + R_{t+1}}\right] \tag{5}$$

We discuss this present-value relation between prices, dividends, and returns under the assumption of constant expected returns. Then, we relax that assumption and consider the time-varying expected returns in the present-value relation.

1.3.1. Constant Expected Returns

In this subsection, we first assume that expected return is constant and equal to zero for a non-dividend paying stock, $\mathrm{E}_t\left[R_{t+1}\right] = 0$. Put another way, we assume that discount rate is (approximately) zero when time horizon is very short. Under that assumption, we get the following equation:

$$\mathrm{P}_t = \mathrm{E}\left[P_{t+1}\right] \tag{6}$$

---

[3] The advantage of using continuously compounding returns is their additive property over time. Put another way, continuously compounded multi-period return is the sum of continuously compounded single period returns, and this gives flexibility over, for example, the geometric average calculations (Campbell et al., 1997: 11).

The equation (6) suggests that the stock price follows the martingale process that we discuss in section 1.2. This indicates that future price movements are unpredictable. Then, if we assume constant expected return and greater than zero, $\mathrm{E}_t\left[R_{t+1}\right]=R>0$, we obtain the following model that follows a submartingale process:

$$(1+R)P_t = \mathrm{E}_t\left[P_{t+1}\right] \tag{7}$$

Finally, if we apply the assumption of $\mathrm{E}_t\left[R_{t+1}\right]=R>0$ for the dividend paying stock we get:

$$P_t = \mathrm{E}_t\left[\frac{P_{t+1}+D_{t+1}}{1+R}\right] \tag{8}$$

Using *Law of Iterated Expectations*, we solve P_t forward and obtain the following equation expressing the stock price as the expected present value of future dividends out to the finite future, and discounted at a constant rate, R (Campbell et al., 1997:256):

$$P_t = \mathrm{E}_t\left[\sum_{i=1}^{\infty}\left(\frac{1}{1+R}\right)^i D_{t+i}\right] \tag{9}$$

Campbell et al. (1997) also note that we ignore equity purchases which have a significant effect on the timing of dividends and that we ignore, so called, stock market bubbles implying the situation in which stock prices grow forever at faster rate than R. Moreover, we can obtain *Gordon (constant) growth model* when the dividends are expected to grow at a constant rate G:

$$P_t = \frac{(1+G)D_t}{R-G} \tag{10}$$

where G, dividend growth rate, should be less than R. The models and reveal the fact that any degree of predictability in future cash flows, dividends, directly indicates predictive components stock prices as well.

1.3.2. Time-Varying Expected Returns

In this section, we report present-value relation with time-varying expected returns through relaxing the assumption that expected stock returns are constant over time. Since financial time series grow exponentially and have unit root in their level forms, it is essential to relax that assumption. However, when we allow expected stock returns to change over time stock prices do not follow submartingale process anymore. In this way, nonlinear models like Campbell and Shiller's (1988b) model applying loglinear approximation is more appropriate than the previously examined linear models. The framework of the loglinear model of Campbell and Shiller (1988b) suggests that high prices must be followed by high future dividends, low future returns, or some combination of two. Furthermore, investors' expectations must follow the same pattern.

By incorporating the equation (5) and (4), Campbell and Shiller (1988b) loglinearize the return and the approximate nonlinear notation is derived as (Campbell et al., 1997:261):

$$r_{t+1} \approx k + \rho p_{t+1} + (1-\rho) d_{t+1} - p_t \tag{11}$$

where r, p, and d indicate the logarithmic forms of the expected returns (*R*), stock prices, (P_t), and dividends (D_t), respectively; ρ and k are parameters of linearization defined by $\rho \equiv 1/\left(1+\exp\overline{(d-p)}\right)$, where $\overline{(d-p)}$ is the average log dividend-price ratio, and $k \equiv -\log(\rho)-(1-\rho)\log(1/\rho-1)$. To allow the expected returns vary over time, we solve the equation (11) forward through imposing the terminal condition of $\lim_{j\to\infty}\rho^j p_{t+j} = 0$ and obtain (Campbell et al., 1997:262):

$$p_t = \frac{k}{1-\rho} + \sum_{j=0}^{\infty}\rho^j\left[(1-\rho)d_{t+1+j} - r_{t+1+j}\right] \tag{12}$$

which is a dynamic accounting identity and implies that if the stock prices is high today, then there must be some combination of high dividends and low stock returns in the future (Campbell et al.,1997:263). Campbell et al. (1997) also states that the equation (12) holds both ex-post and ex-ante. By taking the conditional expectations of the equation (12) we obtain:

$$p_t = \frac{k}{1-\rho} + \mathrm{E}_t\left[\sum_{j=0}^{\infty}\rho^j\left[(1-\rho)d_{t+1+j} - r_{t+1+j}\right]\right] \tag{13}$$

which is *dynamic Gordon growth* model also called as *dividend-ratio* model. This model implies that stock prices are high when dividends are expected to grow rapidly or when dividends are discounted at a low rate. However, this model, unlike the previous linear models, accounts how long the dividend growth rate is expected to be high or similarly how long the discount rate is expected to be low over time (Campbell et al. 1997:263).

The equation (13) can also be written as follows:

$$d_t - p_t = -\frac{k}{1-\rho} + \mathrm{E}_t\left[\sum_{j=0}^{\infty}\rho^j\left[-\Delta d_{t+1+j} + r_{t+1+j}\right]\right] \tag{14}$$

which states that left-hand side of the equation, log-dividend ratio, is calculated high when dividends are expected to grow only slowly, or when stock returns are expected to be high.

The loglinear model framework provides theoretical background for the empirical research studies on forecasting stock returns using forecasting variables like dividend-price ratio, interest rate variables along with the past returns. The literature review on this empirical research area is covered in the section 2.2.

1.4. THE THEORIES OF STOCHASTIC DISCOUNT FACTOR

We have basically two approaches on the determinants of stochastic discount factor: First approach explains the determinants of stochastic discount factor based on the assumption that investors are rational. Second is called as behavioral finance that considers psychological and behavioral biases of the investors.

1.4.1. Rational Investor Theory

Rational investor theory assumes that investors in the market are rational. They are utility maximizers seeking higher rate of expected return at a given level of risk or at a given level of expected return, minimizing their risk. We discuss static asset pricing models, namely capital asset pricing model (CAPM), arbitrage pricing theory (APT) model, and factor models. Moreover, we document methodological information about consumption-CAPM that establishes a linkage between the stochastic discount factor and marginal utilities of investors' consumption through providing a dynamic consumption-based theory.

1.4.1.1. CAPM, APT and Factor Models

Markowitz (1952) in his seminal work titled “Portfolio Selection” divides the process of selecting a portfolio into two stages: First one is starting with observation, experience and ending with beliefs about the future performances of available securities. Second one is choosing of a portfolio based on the relevant beliefs about future performances of securities. His main assumptions are that investors are *Von Neumann and Morgenstern* utility maximizers seeking higher rate of expected return at a given level of risk or at a given level of expected return, minimizing their risk. Tobin (1958) associates risk with the variance in the value of a portfolio. Tobin's most important contributions are based on a theory which describes how individual households and firms determine the composition of their assets. Tobin (1958) examines personal preferences (risk aversion) in allocating of the complete portfolio to risk-free assets versus the optimal risky portfolio which may be determined according to mean-variance framework of Markowitz through estimating a set of expected rates of return and a covariance matrix (input list) via specific optimization techniques. Thus, investing choices (among alternative investing tools) investigated by Tobin (1958) is called as “separation property” which deals with the selection of the desired point along the capital allocation line (*CAL*).

Sharpe (1964), Lintner (1965), and Mossin (1966) develop CAPM on the mean-variance framework of Markowitz (1952) and considering the Tobin’s separation theorem[4]. CAPM is a set of predictions concerning the equilibrium expected returns on risky assets under a number of assumptions (Bodie et al., 2011:281):

- There is a perfect competition assumption indicating that there are many investors with an endowment (wealth) that is small compared to the total endowment of all investors and investors cannot affect the whole trading security prices.
- All investors plan for one identical holding period

[4] Although William Sharpe is the first publisher of CAPM, Lintner and Mossin cover capital budgeting problem using CAPM and Sharpe’s lack of precision in the specification of equilibrium conditions, respectively.

- Only traded assets are considered. CAPM excludes a number of important assets like human capital, private enterprises.
- Investors may borrow or lend any amount at a fixed risk-free rate.
- There are no taxes and transaction costs.
- All investors are Markowitz mean-variance optimizers indicating that they all use Markowitz portfolio selection framework.
- All investors have homogenous beliefs. Given a set of security prices and the risk-free interest rate, all investors use the same expected returns and covariance matrix of security returns to generate the efficient frontier and the unique optimal risky portfolio.

CAPM can be expressed in the following specification:

$$E\left[R_i\right]=R_f+\beta_{im}\left(E\left[R_m\right]-R_f\right) \tag{15}$$

where $\beta_{im}=\mathbf{Cov}\left(R_i,R_M\right)/\mathbf{Var}\left[R_m\right]$, R_f is risk-free rate, E[R_i] is expected return of asset i, E[R_m] is expected return of market portfolio. As can be seen in the above equation, CAPM describes how investors determine expected returns, and thereby asset prices of risky assets, based upon their volatility relative to the market.

However, there are several questions governing the practicability and validity of the CAPM. The most popular criticism to the validity of the CAPM is Roll's (1977) critique. Roll (1977) states that there are two ways testing a model: normative and positive. According to Roll's critique CAPM does not pass normative tests since its assumptions are not realistic at all. If a model's underlying assumptions do not fit at real world conditions its predictions via positive tests are not free of errors. For instance, CAPM simply assumes that "market portfolio" is efficient and security market line exactly illustrates the risk-return relationship, meaning that alpha values are all zero. The main problem here is that market portfolio is unobservable. Specifications and estimation of the CAPM also leave a question mark over minds. This is important on the grounds that CAPM can be rejected even if it were perfectly valid.

Miller and Scholes (1972) firstly examined the statistical bias in the estimation of CAPM due to the fact that residuals are correlated (as is common for firms in the same industry) leading to the situation of that the standard beta estimates are not efficient. Moreover, CAPM as a static model considers only one holding period in time and therefore models based on the assumption that investors consume all their wealth after one holding period. Since the market participants consider many periods in their investing activities, this assumption is also unsatisfactory.

To simplify the assumptions of CAPM, Black (1972) proposes zero-beta model relaxing the assumption of that investors are able to borrow/lend at risk free rates, that is, the presence of restricted borrowing, Merton (1973) and Heaton and Lucas (2000) consider the multi-period CAPM (Intertemporal CAPM) model and the labor income/non-traded assets and multi-period CAPM (Intertemporal-CAPM, ICAPM) model, respectively. Furthermore, in the next subsection, we discuss *consumption*-CAPM (CCAPM) which has its origins from the ICAPM of Merton (1973) and forms the basis for the relationship between asset prices and consumption/saving decisions of investors.

Strict assumptions and shortcomings of CAPM as well as the fact that CAPM does not completely explain the variation in the cross-section expected asset returns leads to consideration of multifactor pricing models (Campbell et al., 1997:219). In this line, *factor models* are tools that allow us to describe and quantify the different factors (other than market portfolio) that affect the rate of return on a security during any time period (Bodie et al., 2011:319). Factor models are considering the sources of the systematic risk. Single factor model can be expressed as follows:

$$R_i = E\left[R_i\right] + \beta_i F + e_i \tag{16}$$

where $E\left[R_i\right]$ is the expected return on asset *i*; β_i is the sensitivity of firm to the specified factor, F, and e_{it} is the firm-specific disturbance. If there is any macroeconomic (i.e. systematic) shock, the return of asset *i* will be exactly equal to its expected return. It is also noteworthy that single factor model specification is similar to that of single-index model in which a common systematic factor is proxied by broad market index. However, in financial markets, each individual security do not have same relative sensitivity to the specified single factor which is used as a proxy for whole systematic risk arising from different sources (e.g. changes in interest rates, industrial production etc.). This might lead us to think that multifactor models can provide better descriptions of security returns. For instance, Fama and French (1992, 1993) develop another type of multifactor model, called three-factor model pointing out that firms with high ratios of book-to-market value are more likely to be in financial distress and that small stocks may be more sensitive to changes in business conditions. Thus, these variables may capture sensitivity to various risk factors.

Furthermore, Ross (1976) develops the APT based on the arbitrage arguments. This theory relaxes the following CAPM assumptions of normal distribution of security prices, the presence of a "market" portfolio, and lending/borrowing at risk free rate (Karan, 2001:259). Moreover, arbitrage pricing theory which relies on three key propositions (Bodie et al., 2011:323): (i) security returns can be described by a factor model; (ii) there are sufficient securities to diversify away idiosyncratic risk; and (iii) well-functioning security markets do not allow for the persistence of arbitrage opportunities. Arbitrage pricing model assumes that a well-diversified portfolio, rather than a "market" portfolio, which can diversify non-systematic risk and systematic risk can be measured via several factors. A multifactor APT model can be expressed as follows:

$$R_i = E\left[R_i\right] + \beta_{i1} F_1 + \beta_{i2} F_2 + e_i \tag{17}$$

Each factor has zero expected value because each measures the surprise in the systematic variable rather than the level of the variable. Chen et al. (1986) use a multifactor APT model and describe the potential macroeconomic factors as follows: change in industrial production, change in expected inflation, change in unanticipated inflation, excess return of long-term corporate bonds over long-term government bonds, excess return of long-term government bonds over T-bills.

Although the multifactor models have several advantages over the single-factor models or CAPM, two problems tend to arise when the factors are not chosen based on economic theory (Campbell et al., 1997:251): First, models overfit the data because of data-snooping bias and this hampers the predictive ability of the models future returns. Second, models may capture the empirical regularities due to market inefficiency or market participants' irrationality, this leads to obtain such high Sharpe ratios for factor portfolios that they are not consistent with underlying model of market equilibrium. Moreover, Campbell et al. (1997) state that the validity of multifactor models depends on their out-of-sample verifications based on new data. In the end, the above asset pricing models do not take consumption decision of the market participants into account since they assume that investors consume all their wealth after one period (Campbell et al. 1997:291). Since market participants evaluate many periods in their investing decisions, this assumption is not realistic at all and can be relaxed by the intertemporal equilibrium model developed by Merton (1973).

1.4.1.2. Intertemporal Equilibrium Models: Consumption-CAPM

Intertemporal equilibrium models mainly deal with unresolved issues raised by the previously discussed static asset pricing models which assume that investors consume all their wealth after one period and thus ignore consumption decisions. Intertemporal models provide insight into the forces determining the stochastic discount factor and the predictability of the time-varying excess stock returns (Campbell et al., 1997:291). In this line, CCAPM establishes a linkage between the stochastic discount factor and marginal utilities of investors' consumption through providing a dynamic consumption-based theory. In other words, CCAPM links asset prices in market equilibrium to the investor behavior through providing the time profile of consumption.

CCAPM assumes that all investors in the economy are aggregated into a representative agent who can trade freely and maximizes the expectation of a time-separable utility function (Campbell et al., 1997:293):

$$\max \mathrm{E}_t \left[\sum_{j=0}^{\infty} \delta^j U\left(C_{t+j}\right) \right] \tag{18}$$

where δ is the time discount factor, C_{t+j} is the investor's consumption in period $t+j$, and $U(C_{t+j})$ is the period utility of consumption at $t+j$. The representative agent has a budget constraint of:

$$\sum\nolimits_i w_{i,t} P_{i,t} + c_t \leq \sum\nolimits_i w_{i,t-1} \left(P_{i,t} + D_{i,t}\right) + y_t \tag{19}$$

where $w_{i,t}$ is the number of units invested in the risky asset i at time t, $P_{i,t}$ is the price of the risky asset i at time t, $D_{i,t}$ is the dividend payment of the asset, and y_t is labor income at time t. The key equation describing the investor's optimal consumption and portfolio plan is one of the first-order conditions or *Euler equations* (Campbell et al., 1997:293):

$$U'(C_t) = \delta E_t\left[\left(\frac{P_{t+1}+D_{t+1}}{P_t}\right)U'(C_{t+1})\right] \tag{20}$$

where the left hand side of the above equation is the marginal utility cost of consuming one unit less at time t; the right hand side of the equation is the expected marginal utility benefit from investing the dollar in asset *i* at time *t*, selling it at time *t+1* for (P_{t+1}+D_{t+1}/P_t) units, and consuming the proceeds (Campbell et al., 1997:294). Alternatively, we can rewrite the above equation as present-value equation type like the equation (8) obtained in Section 1.3.1:

$$P_{i,t} = \mathrm{E}_t\left[M_{t+1}\left(P_{t+1}+D_{t+1}\right)\right] \tag{21}$$

where $M_{t+1} = \delta U'(C_{t+1})/U'(C_t)$. M_{t+1} is the stochastic discount factor or pricing kernel indicating the marginal rate of substitution between consumption today and tomorrow. The above equation explains why the discount rate would be low during recessions: when C_t is low in recession times, the marginal utility is high and this lowers the ratio of marginal utilities, $U'(C_{t+1})/U'(C_t)$; on the other hand, during boom periods the discount factor should be calculated high. Finally, we can further simplify the equation (21):

$$1 = \mathrm{E}_t\left[M_{t+1}\left(1+R_{i,t+1}\right)\right] \tag{22}$$

where M_{t+1} is a stochastic discount factor and $1+R_{t+1}=(P_{t+1}+D_{t+1})/P_t$.

Although CCAPM provide theoretical explanations for the predictability of stock returns based on a rational investor behavior there are several difficulties due to the nonlinear structure of the main equation and specification of stochastic process for consumption. In this way, Grossman and Shiller (1981) take the challenge of evaluating the CCAPM quantitatively. They assume constant relative risk aversion for a representative agent who maximizes a time-separable power utility function (Campbell et al., 1997:305):

$$U(C_t) = \frac{C_t^{1-\gamma}}{1-\gamma} \tag{23}$$

where is the coefficient of risk aversion. By assuming the utility to be given by a power utility, Grossman and Shiller (1981) obtain the following specification by taking the derivative of (23) ($U'(C_t) = C_t^{-\gamma}$) with respect to consumption:

$$1 = \mathrm{E}_t\left[\left(1+R_{i,t+1}\right)\delta\left(\frac{C_{t+1}}{C_t}\right)^{-\gamma}\right] \tag{24}$$

Using this specification, Grossman and Shiller (1981) note that real stock market data is only consistent with CCAPM, if the coefficient of relative risk aversion is very large. They report that CCAPM gives much lower expected returns than evidenced in real-data. In order to match data, one needs very high levels of coefficient of risk aversion which would not be realistic for an average investor. In fact, this finding simply demonstrates an evidence of equity risk premium puzzle proposed by Mehra and Prescott (1985)[5].

Hansen (1982) proposes Generalized Method of Moments (GMM) estimation technique in order to deal with the quantitative difficulties and to estimate the CCAPM without making distributional assumptions and without ignoring either dimension of the data. In other words, GMM eliminates the serial correlation of any errors in a dynamic system. Recall (22) and the expression $M_{t+1}\left(1+R_{i,t+1}\right)-1$ is one-period-ahead forecast error which must be independent of any variable under the assumption of rational expectations. Let z_{jt} denote a variable at time t. In this way, we obtain the following equation for any asset *i* and instrument z_{it}:

$$\mathrm{E}\left[\left(M_{t+1}\left(1+R_{i,t+1}\right)-1\right)z_{jt}\right]=0 \tag{25}$$

The equation forms the basis for GMM estimation of any asset pricing model and is an element of the following equation:

$$E\boldsymbol{g}(\boldsymbol{xt},\boldsymbol{\theta}) = \mathbf{0} \tag{26}$$

where $\boldsymbol{xt}$ is a vector stochastic process and consists of *c*, $(1+R_i)$ and z_{jt} (for at least one instrument *j*); $\boldsymbol{\theta}$ is a parameter vector to be estimated and consists of δ and other parameters in the equation (25); $\boldsymbol{g}$ indicates the key orthogonality condition – one equation for each asset i and instrument z_{jt} and thus, (i,j)th element of $\boldsymbol{g}$ vector would $\left(M_{t+1}\left(1+R_{i,t+1}\right)-1\right)z_{jt}$ be for asset *i* and a particular instrument z_{jt}. GMM estimation technique can be applied in asset pricing exercises using time-series or especially

[5] We discuss equity risk premium puzzle in Section 1.6.2.

panel data structures since it overcomes the multicollinearity and autocorrelation problems in the estimation processes.

Subsequent academic researches deal with the quantitative difficulties of standard CCAPM with standard utility preferences. Their main motivation behind building alternative model specifications is that the risk aversion may vary over time with the state of the real economy. The influential study of Fama and French (1989) which reports expected returns are lower at expansion times (i.e. peak of business cycle), and higher in recession times (i.e. trough of business cycle). In this way, researchers consider time-varying risk aversion and change the standard CCAPM's assumptions about investor utility, market completeness, the stochastic process for consumption (Campbell et al., 1997:335).

One mechanism dealing with the issue is introducing the habit formation into the power-utility function of a representative agent and thus making the consumer utility sensitive to the changes in consumption levels. Constantinides (1990), Abel (1990), Deaton (1992), Campbell and Cochrane (1999) and many others provide solutions using habit formation. Particularly, Campbell and Cochrane (1999) propose so-called external habit which accounts the changes in aggregate level of consumption along with the individual level in order to explain equity premium puzzle.

Another approach is to overcome the one of the shortcomings of that the same parameter determines both risk aversion and intertemporal substitution in the standard expected utility specification. In this line, using Epstein and Zin (1989) preferences, Bansal and Yaron (2004) model consumption and dividend growth rates as containing a small predictive component in the long-run and fluctuating economic uncertainty. Their model justifies the observed equity risk premium, the risk-free rate and the return volatility by generating a stochastic discount factor and provides evidence of dividend yields predict returns and the volatility of returns is time-varying.

Finally, the CCAPM model specifications are extended by considering the heterogeneity in the market participants' preferences. Academic studies on this issue model the stochastic discount factor to be influenced not only by aggregate consumption but also its distribution. Their main motivation is that individual wage risk is countercyclical and, of course, affects the individual consumption levels. By doing so, they consider the consumption level of individual investors which is more volatile than aggregate consumption level, and provide solutions to the pricing puzzles, like equity premium and risk-free rate.

1.4.2. Behavioral Finance

Behavioral finance typically investigates the determinants of stochastic discount factor, *M*, based on the assumption that market participants are not fully rational. Shiller (1981) highlights that volatility of stock prices measured by standard deviation of annual changes in real stock prices is much higher than the standard deviations of real dividends. This indicates another important implication of that volatility of stock prices is too high to be attributed to the changes in future dividends as new information. Shiller (1981) states that the lack of price predictability evidence does not necessarily indicate the absence of irrational investors and trading activities of such investors are the main source of the excess volatility and noise in the markets. In addition to that he asserts that the observed excess volatility can be hardly explained by the rational investor theory and is an indication of "*fads*" and "*fashions*" in the markets. Hence, Shiller (1981) links the changes in the asset prices to the psychological biases based on the prospect theory by Kahneman and Tversky (1979).

Kahneman and Tversky (1979) develop prospect theory which critiques the expected utility theory of Von Neumann-Morgenstern. Prospect theory deals with decision making under risk and points out several tendencies of human behavior, namely certainty effect, and isolation effect. The former phenomenon describes the situation in which people overweight outcomes that are considered certain, relative to outcomes which are merely probable (Kahneman and Tversky, 1979: 265). The latter phenomenon is described as the situation in which people often disregard components that the alternatives share and focus on the components that distinguish them (Kahneman and Tversky, 1979: 271). Accordingly, prospect theory states that psychological issues play important role in decision making under risk.

Subsequent studies investigate the psychological evidence on individual behavior and biases in the financial markets. Ritter (2003) labels observed psychological issues as cognitive biases which are classified in seven categorizations, namely heuristics, overconfidence, mental accounting, framing, representativeness, conservatism, and disposition effect (Ritter, 2003:430). Benartzi and Thaler (2001) state that people tend to be heuristics in investment decisions and they follow 1/N rule that is to say, when they face N choices of investment alternatives, they allocate their money employing 1/N rule. Investors tend to be overconfident about their capabilities, for example they invest in local companies since they are more familiar with them. Thus, they follow too little diversification strategies in their portfolio allocation decisions (see Barberis et al., 1998; Daniel et al., 1998; Hong and Stein 1999; Barber and Odean, 2001). Mental accounting refers to the human behavior of separating decisions that should, in principle, be combined. People tend to separate household budget for food and separately for entertaining. Framing effect, as Kahneman and Tversky (1979) states, describes that presenting the same option in different formats can alter people's decisions. Specifically, individuals have a tendency to select inconsistent choices, depending on whether the question is framed to concentrate on losses or gains. Furthermore, people tend to put too much weight on recent experience, be slow to pick up on the changes when things change. Finally, investors tend to avoid paper losses and seek to realize paper gains explaining the notion that stock trading volume is high during the bull market. In sum, Baker and Wurgler (2011) report that parties, both investors and managers, in financial environment are irrational in their financing decisions.

Furthermore, the limits-to-arbitrage is one of the building blocks of behavioral finance. Miller (1977) is one of the first researchers reporting the difficulty of selling overpriced stocks. Shiller (1984) also criticizes the view that rational investors would correct mispricing arising from the trading activities of irrational investors, if there is any. He states that the number of rational investors is not much enough to exercise the arbitrage activities. DeLong et al. (1990) and Shleifer and Vishny (1997) provide explanations for limits to arbitrage. Rational arbitrageurs (i.e. financial intermediaries, hedge funds) may not be able to exercise arbitrage activities for correcting mispricing when irrational market participants withdraw their money from those institutions.

Cognitive biases along with limits to arbitrage lead us to behavioral-based stochastic discount factors determined differently from what rational-agent theory suggests.

1.5. STOCK RETURN PREDICTABILITY AND MARKET EFFICIENCY

Fama (1991) states that strong version of the EMH indicates an extreme condition in which information and trading costs are zero. Since we have positive information and trading costs in real world, this extreme version is false. However, Fama points out more important joint-hypothesis problem in which we jointly test the market efficiency and the specification of the equilibrium model ((Fama, 1991:1575). According to this statement, one can never test market efficiency unless appropriate equilibrium model is specified and risk-return is defined accurately. In other words, we must be able to separate the bad specification of testing model and market inefficiency.

Despite the presence of joint hypothesis problem, empirical literature heavily tests the market efficiency using models considering the stylized facts of the data and theoretical background. Particularly, the academic studies by Campbell and Shiller (1987, 1988a, 1988b, 1991), Fama and French (1988b, 1989), and many followers deepen our understanding about the debate on stock return predictability and market efficiency. Those studies shed light on the misinterpretation that stock return predictability is not consistent with the market efficiency. The misinterpretations arises from the fact that RWM suggests return are not predictable on the basis of current information. However, the aforementioned seminal papers provide theoretical background that predictability is consistent with time-varying aggregate risk. Campbell and Shiller's (1988b) present-value approximation identity[6] suggest that high prices must be followed by high future dividends, low future returns, or some combination of two; furthermore, investors' expectations must follow the same

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[6] We discuss present-value relation among prices, dividends, and return in more detail in Section 1.3.

pattern. In other words, variations in the dividend-price ratio lead to variations in the expected future stock returns, and implies time-varying discount rates and return predictability. Fama and French (1988a) provide consistent evidence with this finding and stress another important implication that dividend yields forecasts returns not dividend growth. Their finding implies that the stock return predictability is consistent with market efficiency.

Furthermore, Fama and French's (1989) study shows that expected returns are found to be lower when the business conditions are good, whereas the expected returns are higher when the business conditions are weak. Put another way, variations in the stock returns can be explained by the changing business cycles: we evidence low prices and high expected returns when, aggregate consumption and investments levels are low, unemployment is high, and vice versa (Cochrane, 2011:1052). Fama and French's (1989) empirical analyses also suggest that default premium and term premium can explain the variations in the expected returns on both stocks and bonds. Moreover, they prove that expected returns on both stocks and bonds are somewhat moving closely together. Those empirical evidences prove that we may expect time-varying expected returns and some level of predictability since aggregate risks for consumption/investment levels are tightly linked to fluctuations in the real economic activity even in efficient markets (Rapach and Zhou, 2013:2). The presence of stock return predictability due to changing business cycles implies time-varying risk premium demand for taking risk associated with the investment; and this is consistent with the rational-investor approach.

However, asset pricing models following rational-investor theory are consistent with the market efficiency if only they do not exceed the certain theoretical bounds[7]. Thus, we should expect limited stock return predictability evidence generating R^2 of 1% or less. When the imposed bounds are exceed by asset pricing models, we suspect for incorrect specification of the models or market inefficiencies due to irrational investor behavior, behavioral/psychological biases, and empirical regularities. In those circumstances, some theoretical models and empirical facts explain how investors are able to obtain positive return using, for

[7] For a detailed discussion please see Section 2 of the study by Rapach and Zhou (2013).

example, technical analysis which is said to be useless in the context of EMH (Park and Irwin, 2007: 805; Neely et al., 2014: 2). Theoretical models explain the predictability or positive trading profits generated by technical trading rules by noise in current equilibrium prices, traders' sentiments, herding behavior. If there are heterogeneous beliefs and expectations among investors and differences in time for investors to receive information, Brown and Jennings (1989), Grundy and McNichols (1989) and Blume et al. (1994) report that it would be possible to obtain proper information about price signals using past prices and volume data.

As Cespa and Vives (2012) report, heterogeneous investors give different responses to information, especially in recession times; and this would drive prices away from its fundamental prices. Furthermore, noise traders (irrational investors) under- or over-react to different types of information along with responding differently. Once they overreact, the price levels similarly move away from their fundamental values. In this line, DeLong et al. (1990) indicate that the arbitrage activities by arbitrageurs (rational investors) are limited because of the fundamental risk, limits-to-arbitrage[8]. In such a scenario, it is possible to observe stock return predictability or trading profits due to the market frictions and behavioral biases.

Park and Irwin (2007) document some empirical explanations for the evidence on stock return predictability or trading profits generated by technical analysis: Order flows, temporary market inefficiencies, risk premiums, market microstructure deficiencies or data snooping. Using support and resistance levels that track order flows, Brock et al. (1992) reveal predictive power in the US stock market. Temporary market inefficiency can be explained by structural changes (technological developments, corporate governance, and institutional developments) in the stock markets and self-destructive nature of technical trading rules. Timmermann and Granger (2004) assert that once a predictable pattern is identified by technical trading systems, the profitability of that pattern disappears in the near future due to the public awareness. As Hsu and Kuan (2005) state, the mature, trading rules fail to outperform the buy-and-hold strategies in mature and highly liquid markets. In conjunction with this, Shynkevich (2012) points out that the successful financial

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[8] See the discussion on behavioral finance discipline in Section 1.4.2.

innovation of late 1990s along with the development in the market microstructure in early 2000s increase market efficiency for the US market. Chen et al. (2009) and Yamamoto (2012) highlight that transaction costs are high in the (analyzed) markets and nonsynchronous trading also destroys the profitability of trading rules.

1.6. EQUITY RISK PREMIUM

This section discusses importance and determinants of equity risk premium as well as the equity risk premium puzzle. Our discussion here heavily borrows from the study of Damodaran (2009).

The equity risk premium takes part in asset pricing and valuation models in finance and has a crucial importance in decision making processes, particularly allocation of wealth (consumption) across risky assets (Damodaran, 2009:290). The equity risk premium can be expressed as the premium that investors demand for the average risky asset. In this line, equity risk premium should be calculated accurately since it directly affects the expected return (on every risky asset) which we demand for a risky investment (Damodaran, 2009:291). It is clear from those statements that equity risk premium provides us to determine the price of a risk for different types of investments with the same expected value. For instance, when the risk premium for the risky investment rises, investors demand higher price for that risk and thus, are willing to pay lower prices.

1.6.1. The Determinants of Equity Risk Premium

Damodaran (2009) reports the determinants of equity risk premium as: (i) Risk aversion, (ii) economic risk, (iii) information, (iv) liquidity, (v) catastrophic risk, and (vi) the behavioral/irrational component. He highlights the fact that equity risk premiums would be higher as the risk aversion of the investors increases. The changes on risk aversion depend on two main facts: First one is the investor age, and second one is preference for current consumption. Bakshi and Chen (1994) report that investors' risk aversion increases as they get aged. Moreover, Damodaran (2009) states that equity risk premiums should be higher when saving rates decrease in an economy.

Lettau et al.'s (2008) study provide evidence consistent with the fact that equity risk premium is lower when the macroeconomic quantity variables including inflation, interest rates, aggregate output level etc. have predictable component. Conversely, equity risk premiums would be higher when those macroeconomic variables are highly volatile. Brandt and Wang (2003) reveal the fact that equity risk premiums in the economy tend to increase when the uncertainty of macroeconomic variables (e.g. inflation) increases rather than do their levels. The relation between equity risk premium and information is not clear at all.

The quality and relevancy of information affect the direction of equity risk premiums. However, information differences in financial markets considerably affect the equity risk premiums; for instance investors demand higher risk premiums in some emerging markets (Russia) than the others (India) (Damodaran, 2009:297).

Investors in financial markets plan their investing activities by considering the risk associated with the liquidity of the assets. They demand higher equity risk premium on the illiquid assets for which investors pay relatively high transactions costs and large discounts in order to liquidate their positions (Damodaran, 2009:297). Gibson and Mougeot (2004) reports that the liquidity premium represents a non-negligible, negative and time-varying component of the total market risk premium. Furthermore, Baekart, et al. (2007) report that local market liquidity is an important driver of expected returns in emerging markets and explain the differences of equity returns across emerging markets by the differences of their liquidity levels.

Catastrophic events like latest financial turmoil triggered by the mortgage delinquencies in the US cause the equity risk premiums to rise dramatically since the investments of many market participants lose value.

Finally, psychological biases determine the levels of equity risk premiums. Although we review some of the behavioral biases in a previous section, Damodaran (2009) stresses two behavioral component of the equity risk premium: The money illusion and narrow framing. The money illusion indicates the case in which equity premiums will rise in periods when inflation is higher than expected. Narrow framing can be defined as a situation in which the investors make investment decisions in isolation, without accounting the context of their existing portfolios.

1.6.2. Equity Risk Premium Puzzle

Mehra and Prescott (1985) report empirical evidence that the equity risk premium in the US is too high (6%) that investors would need extremely large coefficient of risk aversion in order to demand this premium. Several studies attempt to provide explanations for this puzzle (Damodaran, 2009:299): Statistical artifact, disaster insurance, taxes, alternative preference structures, and myopic loss aversion.

Particularly, Dimson et al. (2009) indicate that the equity risk premium is calculated very high due to selecting one of the most successful equity markets, the US stock market, and the number they suggest is closer to 4% against 6%. Another view in explaining such a high level of equity risk premium is the disaster insurance. According to this view, stock market volatility does not fully reflect the potential volatility (e.g. disasters, financial turmoil), risky assets like stocks should have high level of equity risk premiums to compensate potential collapse in the consumption levels. Furthermore, McGrattan and Prescott (2001) suggest that the high equity risk premiums are due to declining marginal tax rate. Proposing alternative preference structures, Epstein and Zin (1991) separate the risk aversion from risk aversion at a point in time to consumption variation across time based on the argument that investors are much more risk averse when it comes to the latter (Damodaran, 2009:300). This situation can also explain the high equity risk premiums since even small changes in consumption can cause big changes in marginal utility function. Thaler et al. (1997) defines myopic loss aversion as the combination of a greater sensitivity to losses than to gains and a tendency to evaluate outcomes frequently. In this way, the investors with myopic loss aversion and updating their positions very frequently perceive higher risk and lead the equity premium to be high.

Although the standard CCAPM specifications are not able justify the high level of historical equity risk premiums, Damodaran (2009) highlights the important fact that the above explanations shed light the dangers of using historical equity risk premiums and suggest alternative equity risk premium calculations, namely survey premiums and implied equity premiums.

CHAPTER TWO
LITERATURE REVIEW

"[Using similar data from other sources] is a common practice in the social sciences. For example, suppose that a researcher has discovered that a certain variable predicts US stock prices. In the absence of new data from the US, the researcher may use international data from other stock markets to see if the finding holds only for US stock prices or holds more generally in other markets. Presence of the pattern in other markets is then considered strong corroborative evidence for the hypothesis, while absence of the pattern is interpreted as evidence against the hypothesis. There are two problems with this approach. First, the time series of the dependent and explanatory variables are often strongly correlated and are far from representing independent samples. Second, because institutional structures differ across markets, the hypothesized effect could well be present in the US data but not in other markets. In this case failure to find evidence of the effect from other markets does not necessarily lead to a revision in the p-value computed from the US study."

Timmermann and Granger, 2004, p. 219

The literature on the stock return predictability debate generally focuses on testing the predictive ability of past returns and/or additional forecasting variables, such as dividend yield, interest rate levels etc. Moreover, academic studies also investigate the predictive ability of these two types of variables in the long-horizon and/or short-horizon for either broad stock market or individual securities returns. Since we have a myriad studies for each category, in this chapter, we report the studies testing the predictive power of technical trading rules and macroeconomic variables including financial ratios on especially broad stock market returns in the long-run.

We organize the outline of following sections quite differently. The literature on the technical trading rules in Section 2.1 is inherently organized based on the developments in the statistical issues. Thus, we first discuss early evidences using technical trading strategies, and then report their limitations and shortcomings. After reporting statistical issues and we discuss a milestone paper by Brock et al. (1992) which influences the subsequent studies considerably in terms of estimation procedures, model-based bootstrapping. In this way, we present the studies on developed and emerging markets following Brock et al. (1992). Another important statistical issue, data snooping, by Sullivan et al. (1999) is reported. Finally, we document recent evidence considering data-snooping and other statistical issues.

The next section 2.2 reports the studies on macroeconomic indicators including financial ratios, interest rate and term structure variables, macroeconomic quantity variables, and firm-based variables. The term "macroeconomic" may not cover the all of the variables as a whole; however, it covers most of the forecasting variables other than past returns. The term "macroeconomic" is also selected on purpose in order to better differentiate this section from the previous one. This section is organized based on the developments in terms of statistical issues and introduction/modification of forecasting variables. Thus, our review in this section first concentrates on studies analyzing the US market. We first document early studies using interest rates and term structure variables, and then the studies using financial ratios, including dividend yields, earnings-price ratios etc. Later on, following the early groundbreaking studies we discuss the rapid development period of the literature. Statistical issues and recommendations for further studies are also reported. After having discussed the debate on a particular market, the US stock market, we finally present international evidence.

2.1. STUDIES ON TECHNICAL TRADING RULES

Technical analysis consists of various techniques including chart analysis (bar charts, candle charts, point and figure charts, chart patterns, support and resistance levels etc.), cycles analysis (amplitude, length, phase, harmonicity, synchronicity, left and right translation, detrending etc.), trend analysis, moving averages, and momentum indicators and oscillators (rate of change, Welles Wilder's RSI, stochastics, moving average convergence divergence (MACD), parabolics, commodity channel index etc.), and volume signals and indicators (On-Balance-Volume, Volume Accumulator etc.). Despite the variety of technical indicator rules academics commonly analyze the profitability of technical trading strategies that generate trading signals in mathematical form (Park and Irwin, 2007:787).

Early evidence

Cowles's (1933) seminal paper is one of the earliest analyses on the aggregate stock market return forecastability. Cowles constructs a portfolio based on the forecasts generated by the editors of *Wall Street Journal*, the proponents of the Dow Theory[9]. Cowles (1933) finds that forecasts based on the Dow Theory produce lower annualized returns than that of buy-and-hold portfolio of Dow-Jones Industrial Average (DJIA) during the period 1928-1932. The outstanding academic research during 1960s investigate the forecastability of stock returns using the technical trading strategies such as filter rules, moving averages, stop-loss orders, channels, momentum oscillators, and relative strength. Later, Alexander (1961, 1964) tests one of the most popular technical trading system namely the filter rules. Alexander (1964) compares the performances of portfolios based on certain filter rules and that of buy-and-hold portfolios that invest in the US market indices. The empirical findings suggest that portfolios based on certain filter rules produce higher returns than buy-and-hold portfolios. Different from Alexander's (1964) study, Fama and Blume (1966) tests the filter rules on the individual stocks in the DJIA rather than broad market indices. They compare the annual mean returns generated by filter rules and buy-and-hold strategy during the period spanning from 1956 to 1962. Fama and Blume find that only three small filter rules produce higher returns than those of buy-and-hold strategy, however, those excess returns may become negative after taking transaction costs into account. Cootner (1962), Van Horne and Parker (1967, 1968), and James (1968) apply another technical strategy of moving averages on the individual US stocks. Like Fama and Blume (1966), their analyses on the individual securities data suggest that moving averages do not generate excess profits over the buy-and-hold strategy. Levy (1967) examines the investment selection via relative strengths of individual US securities listed in New York Stock Exchange and reveals superior profits by investing in securities with relatively strong price movements. However, Levy (1967) highlights the fact that superior performance of securities with relative strengths is due to the extraordinary risk, and random walk theory

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[9] Please see Brown et al. (1998) for detailed information about the analyses of Cowles and of the proponents of Dow Theory.

cannot be refuted. In a complementary study to Levy (1967), Jensen and Bennington (1970) consider the riskiness of technical trading strategy of relative strength and conclude that trading rules based on relative strength are not profitable.

Limitations and shortcomings of the early studies

Aforementioned academic researches on stock markets, however, have several non-negligible limitations (Park and Irwin, 2007:791). First, they focus on a limited number of particular trading strategies and dismiss the other trading systems. Second, most of the studies do not implement statistical significance tests for their results. The results of the some studies (e.g. James' (1968)) conducting *Z*-tests or *t*-tests may also be biased because of the well-known fact that financial returns are skewed, leptokurtic, conditionally heteroskedastic, autocorrelated, and time-varying. Third, risk-return trade-off in technical trading strategies is not taken into consideration in the studies (except Jensen and Bennington (1970)) and this may lead overrejection of the random-walk hypothesis. Fourth, data snooping bias may alter the findings of those studies. And fifth, they generally do not apply out-of-sample verification which is essential and ultimate test of any predictive model (Campbell, 2008: 3).

Statistical Issues and milestone paper by Brock et al. (1992)

Subsequent academic studies on technical trading systems overcome the shortcomings and improve the limitations of the previous studies in terms of econometric methodologies. They consider at least one of the following issues in their testing procedures including appropriate statistical tests (model-based bootstrapping), risk adjustments, out-of-sample verification for the models, transaction costs, and data-snooping (reality check). In this way, Brock et al. (1992) conduct one of the influential studies in the technical analysis literature and introduce model-based bootstrap procedure which overcomes the shortcomings of conventional statistical significance tests when financial time series are not normally distributed. They examine the profitability of moving average oscillators and trading range break-out (i.e. support and resistance levels) on the DJIA data over the period between 1897 and 1986. The reason behind selecting those two popular technical trading rules is to address the potential data-snooping bias however; they do not conduct any reality check for that issue. The actual return series are compared to the pseudo samples generated by model-bootstrap procedure on the popular models, namely random walk with drift, autoregressive process of order one (AR(1)), generalized autoregressive conditional heteroskedasticity in mean (GARCH-M) model, and exponential GARCH (EGARCH) model of Nelson (1991). Their empirical results suggest that buy signals generated by trading rules generate higher returns than sell signals, and buy signals are found to be less volatile than sell signals. The differences between buy and sell signals are found to be positive indicating that returns simulated by trading rule models perform substantially better than actual return series, buy-and-hold strategy. Overall, they evidence that trading rules especially moving averages have a significant predictive power on stock returns.

Developed market studies following Brock et al. (1992)

Using the developed market data (mostly US and/or UK data), Hudson et al. (1996), Mills (1997), Bessembinder and Chan (1998), Ito (1999), Taylor (2000), and Day and Wang (2002) conduct studies in the light of the Brock et al.'s (1992) study and their common findings can be summarized as follows: Technical trading strategies generate significant profits, nevertheless, they are negligible or eliminated after taking transaction costs into account. Particularly, Mills (1997) states that the empirical findings are consistent with that of the Brock et al's (1992) study for the same sample period; however the trading profits in the recent sub-sample spans 1982 to 1994 diminishes and trading rules fail to outperform buy-and-hold strategy. This finding is very similar to that of Kwon and Kish (2002) and suggests an evidence of structural change in the recent subsample period which is not analyzed by the Brock et al. (1992). Bessembinder and Chan (1998) assert that the trading profits become negligible after considering transaction costs. The authors also conclude that their own findings as well as the findings of Brock et al. (1992) are not necessarily inconsistent with the market efficiency because of the measurement errors (for the returns) due to nonsynchronous trading. Ito (1999) examines the US, Canadian, Japanese, and Taiwanese data and confirms that trading systems fail to generate excess returns for only the US market. Taylor (2000) applies Brock et al.'s (1992) methods along with the double moving-average rules. Taylor investigates the profitability of those trading rules on the DJIA, S&P-500 (spot and futures), FTSE-

100 (spot and futures), FTA indices, and twelve individual stocks listed in the UK stock exchange. The empirical analyses are in line with the findings of Hudson et al. (1996) and suggest that although the moving averages generate significant profits, they are eliminated after transaction costs are taken into account. Day and Wang (2002) support evidence that trading profits are not significantly different from the buy-and-hold strategy when daily returns from trading portfolios of Dow Jones securities are adjusted for both dividends and interest earned on the proceeds from short sales.

Emerging market evidence after Brock et al. (1992)

The studies on emerging markets by Bessembinder and Chan (1995), Ito (1999), Ratner and Leal (1999), Coutts and Cheung (2000), Parisi and Vasquez (2000), Gunasekarage and Power (2001) provide supportive evidence that technical trading systems generate excess profits as previously reported by Brock et al. (1992). Bessembinder and Chan (1995) analyze Asian stock markets and report that trading rules are generating excess profits in developing markets (Malaysia, Thailand, and Taiwan) vis-à-vis developed markets (Hong Kong and Japan). The authors also note that trading signals from the US markets in addition to domestic signals have significant forecasting power on the Asian markets. Ratner and Leal (1999) conduct an analysis on ten emerging markets in Asia and Latin America and their empirical findings suggest that technical trading rules fail to generate profits in seven out of ten markets. The three exceptions are Taiwan, Thailand and Mexico; and those results are in line with the findings of Bessembinder and Chan (1995). Coutts and Cheung (2000) analyze the Hong Kong stock market over the period between 1985 and 1997. They conclude that the trading strategies, namely moving average oscillator and trading break-out rules produce highly significant abnormal returns. Parisi and Vasquez (2000) report similar results with that of the Brock et al.'s (1992) study and confirm the profitability of the trading rules in Chile stock market over the period between 1987 and 1998. Gunasekarage and Power (2001) analyze South Asian stock market data and their findings indicate that technical trading strategies have significant predictive ability for stock returns and outperform buy-and-hold strategy. Ünal (1992), Köse (1993), Öncel (1993), and Kıyılar (1997) tests the performance of filter rules using individual securities traded on Borsa

Istanbul, Turkish Stock market, and the authors conclude that trading strategies based on tested filter rules generate profits. Moreover, Güney (2002) provides evidence that technical trading rules including moving averages, momentum, and the other technical trading rules outperform buy-and-hold strategy in Borsa Istanbul.

Data snooping bias by Sullivan et al. (1999)

According to the comprehensive survey of Park and Irwin (2007), approximately half of the empirical studies on technical trading rules are conducted after the seminal studies of Sweeney (1986) and Brock et al. (1992) providing evidence against that technical analysis is profitable for foreign exchange (FX) and stock markets, respectively. The above reported studies following those seminal works consider statistical tests transaction costs, and risk adjustment, however, they do not apply reality check for addressing data-snooping bias which leads researchers to overestimate the excess returns, profits and to reach spurious conclusions. Brock et al. (1992) are of course aware of the data-snooping bias but they only acknowledge this well-known fact by only implementing wild bootstrapping procedure instead of proposing an appropriate statistical test across all trading rules (not only the best trading rule). Furthermore, until the beginning of 2000s, academics including Fama (1998), Malkiel (2003), and Cochrane (2001) remain highly skeptical of the technical analysts' claims and they argue that the predictable patterns (trading profits) are identified (discovered) due to data snooping.

The groundbreaking study of Sullivan et al.'s (1999) study deals with this issue and contribute to the existing studies by introducing a bootstrap reality check procedure of White (2000) in order to address data-snooping biases. The empirical analysis of their paper extends both 26 technical trading rules and the time-series data analyzed in Brock et al. (1992). The authors consider technical trading systems, namely filters, moving averages, support and resistance, channel break-outs and on-balance volume averages on the daily DJIA data over the period between 1897 and 1996. The performances of technical trading strategies are measured by mean return and Sharpe ratio. The empirical results reveal the fact that technical trading rules generate excess profits even after taking transaction costs into account. The bootstrap reality check *p*-value is zero indicating that the results do not suffer from data-snooping bias. They also apply out-of-sample verification for the technical trading systems, however, out-of-sample forecasting ability of the trading rules are found to be poor vis-à-vis in-sample fit. The authors conclude that efficiency of the US markets increased in recent period of time.

Ready (2002) also suggests using reality check procedure and criticizes the previous studies that do not implement statistical tests for addressing data-snooping bias. Sullivan et al. (2003) extend their previous study (Sullivan et al. (1999)) along with considering calendar frequency (day of the week effect, January effect, holiday effect) trading rules introduced in Sullivan et al. (2001). Sullivan et al.'s (2003) analyze very large number (17,298) of calendar frequency and technical trading rules using the US data (27,447 observations) over the period 1897-1998. Their empirical results suggest that trading rules generate significant profits and outperform buy-and-hold strategy over both full-sample and a recent sub-sample that spans 1987 to 1998. However, bootstrap reality check *p*-value for the recent sub-sample is about 0.98, indicating that the return in recent sub-sample is statistically insignificant and suffers from data-snooping bias. Sullivan et al. (2003) also state that recent sub-sample data is more reliable since they are based on publicly traded futures contracts. Accordingly, they conclude that it would be premature to state that trading and calendar rules outperform buy-and-hold strategy.

Recent evidence considering data-snooping and other statistical issues

Several recent empirical studies which consider data snooping problem, transaction costs, risk-adjustment, statistical tests provide mixed results for both developed and developing stock markets. For instance, Hsu and Kuan (2005), Hatgioannides and Mesomeris (2007), Metghalchi et al. (2008), Hsu et al. (2010), Metghalchi et al. (2012) provide evidence that technical trading strategies produce profits even after controlling data snooping bias, and taking transaction costs into account. Particularly, Hsu and Kuan (2005) report that technical trading rules are able to generate profits in younger stock market indices, namely NASDAQ and Russell-2000. Hatgioannides and Mesomeris (2007) examine the four Latin American (Mexico, Brazil, Argentina, and Chile) and four Asian emerging capital market economies (Philippines, Taiwan, Thailand, and Indonesia) using daily stock prices. They report that trading rules outperform buy-and-hold strategy in all markets before transaction costs are taken into account. After considering transaction costs, trading rule are still found to be profitable for only Asian emerging markets.

Metghalchi et al. (2008) conduct an analysis to investigate the profitability of trading rules in Swedish stock market over the period between 1986 and 2004 and find that moving average rules are able to generate significant profits after controlling data snooping bias and considering transaction costs. Hsu et al. (2010) analyze various growth US stock market indices (S&P SmallCap 600, Russell 2000, and NASDAQ Composite) and six MSCI emerging market indices (Emerging Markets, Brazil, South Korea, Malaysia, Mexico, and Taiwan) along with their ETFs. Hsu et al. (2010) conduct Reality Check test of Romano and Wolf (2005) in addition to White's (2000) test in order to test data-snooping for trading rules. Their empirical results indicate that trading rules are able to produce significant profits, however, their predictive ability weaken after the introduction of ETFs. Metghalchi et al. (2012) present one of the most recent and comprehensive studies on a large sample of sixteen European stock markets including mature and growing capital market economies over the period spanning from 1990 to 2006. Their empirical results suggest that technical trading rules outperform buy-and-hold strategy after accounting transaction costs.

Contrary to the findings of these studies, Hsu and Kuan (2005), Marshall et al (2008), Chen et al. (2009), Bajgrowicz and Scaillet (2012), Shynkevich (2012), Yamamoto (2012) report that technical trading rules fail to generate significant trading profits after considering transaction costs and/or controlling data snooping bias. Hsu and Kuan's (2005) empirical findings suggest no profitable trading rule for the mature indices namely, DJIA and S&P500. Marshall et al. (2008) analyze intraday (5-minutes interval) data in the US market over the period between January 2002 and December 2003. The reason behind analyzing intraday data is to address the concerns of market participants that technical analysis is more highly valued the shorter the time horizon. They conduct statistical reality check procedures in despite of analyzing well-known trading rules, such as Filter, Moving Average, Support and Resistance, Channel Breakout, and On-Balance Volume Rules. Their analyses reveal the fact that 7846 trading rules fail to generate significant profits for the US market.

Chen et al. (2009) analyze eight Asian stock market indices over the period 1975-2006. Their empirical results suggest that profits generated by various trading rules diminish after accounting transaction costs and data snooping. They conclude that institutional adjustments such as non-synchronous trading and transaction costs should be taken into account since they affect the implications of the empirical findings substantially. Bajgrowicz and Scaillet (2012) examine the DJIA index over the period 1897-2011 and they apply the false discovery rate to control the data snooping bias. The trading rules fail to beat the market after the introduction of low transaction costs. Shynkevich (2012) analyzes individual security data in the US market over the period 1970–2009. The analyses are carried on the value and growth portfolios and portfolios consisting of large and small stocks. Shynkevich (2012) reports better predictability for portfolios consisting of companies with smaller market capitalization. However, there is no evidence of predictability for growth corporations with the low book-to-market ratios. Yamamoto (2012) analyzes the intraday (5-minutes) data over the period from September 2006 to August 2007 in Japanese market through implementing trading rules which are formulated according to order-flow imbalance and order-book imbalance. The empirical findings demonstrate that all of the technical rules fail to outperform buy-and-hold strategy.

Other studies with different perspectives

In this part of the literature review, we cover several representative technical trading studies that are conducted on stock markets and implementing econometric frameworks similar to ours, such as conventional econometric techniques for parameter optimization, model based bootstrap procedures, and reality check tests. However, the performance of the technical trading strategies is also tested in other financial markets, namely FX markets and futures markets. Park and Irwin (2007) conclude that early academic research detected technical trading profits until 1990s. Particularly, Smidt (1965) tests the profitability of momentum oscillators in futures markets; Sweeney (1986) applies filter rules in FX markets; following the study of Donchian (1960), Irwin and Uhrig (1984) investigate the forecasting ability of channels in futures markets; and unlike the studies on stock markets, the findings of the studies on FX and futures markets reveal significant net profits. However, Olson

(2004) notes that the profitability of technical trading strategies in FX market has disappeared after 1990s (Park and Irwin, 2007:805).

In addition to that there are a number of seminal papers using genetic programming (Allen and Karjalainen, 1999; Neely and Weller, 1999, 2001; Wang, 2000; Hülagi and Selçuk, 2001; Ready, 2002; Egeli et al., 2003; Neely, 2003; Kırmızıtaş, 2004; Altay and Satman, 2005; Avci, 2007; Karymshakov and Abdykaparov, 2012) and nonlinear algorithms (Gençay 1998a, 1998b, 1999, Gençay and Stengos, 1998; Fernández-Rodríguez et al. 2000, 2003, Boyacıoğlu and Avcı, 2010) in order to optimize trading rules and to generate trading signals, respectively, and mostly provide evidence in favor of profitability. Despite those studies present alternative methodologies to deal with existing statistical problems they are criticized for what they introduce. For instance, Timmermann and Granger's (2004) critics is that genetic programming studies violate the assumptions of efficient market hypothesis by applying genetic programming to the data before the introduction of procedure. Put another way, the fact that forecasting methodology proposed by genetic programming that is not available to market participants is the clear violation of market efficiency assumptions. Moreover, Timmermann and Granger (2004) also criticize the usage of recently developed non-linear approach in order to test the predictive ability of trading rules that are introduced a few decades ago. Consequently, we refer to comprehensive and systematic technical trading literature reviews conducted by Park and Irwin (2007) and Menkhoff and Taylor (2007) for detailed information about the empirical studies on financial markets applying various statistical procedures.

2.2. STUDIES ON MACROECONOMIC INDICATORS

Until 1990s, the early empirical studies on stock return predictability concentrate on two types of forecasting variables such as the interest rates (along with term structure variables) and the financial ratios (such as dividend-price ratio and earnings-price ratio) other than past returns

Early evidence using interest rates and term structure variables

In this line, the academic research on the relationship between expected inflation and stock returns provide the early evidence on forecasting power of short-term interest rates and term structure variables on stock returns. Fama and Schwert (1977) conduct an analysis to examine which assets including common stocks returns, real estate returns, and labor income provide hedging against the expected and unexpected inflation by using monthly/quarterly/semi-annually the US data during the period between 1953 and 1971. In their empirical analysis, yield on treasury bills is used as a proxy for the expected component of the inflation rate. Their empirical results suggest an inverse relationship between stock returns and inflation. However, they note that little of the variation in stock returns can be explained by the expected and unexpected components of the inflation rate. Their results are similar with the results of the other seminal papers by Lintner (1975), Jaffe and Mandelker (1976), Bodie (1976), Nelson (1976).

Moreover, Gültekin (1983) and Solnik (1983) extend the study of Fama and Schwert (1977) to an international context by examining international stock markets and support the findings of Fama and Schwert (1977). Campbell (1987) investigates the predictive power of the state term structure of interest rates on stock returns. Empirical findings using postwar monthly the US data for 1959–1979 and 1979–1983 periods indicate that stock returns are successfully predicted by the state of the term structure of interest rates. Breen et al.'s (1989) conclusion of the negative correlation between nominal excess returns on stocks and nominal interest rates is consistent with Fama and Schwert's (1977) implications. Particularly, during the period between 1954 and 1986, returns on treasury bills have a significant ability to forecast the variations in the distribution of the excess returns on the stock index which is calculated as a value weighted portfolio. Ferson (1989) considers the time variation in interest rates and common stock returns as noted by Fama and Schwert (1977) and estimates regressions allowing conditional covariances of monthly returns to vary over time as the level of interest rate changes. Empirical analyses reveal an important fact that changes in conditional betas of portfolio of stocks and fixed-income securities with benchmark pricing variables are associated with the interest rate movements, especially after 1979.

Fama and French (1989) investigate the predictability of variation in the stock and the bond returns by the variables representing business conditions in the financial markets. Their empirical analyses suggest that default premium and term premium can explain the variations in the expected returns on both stocks and bonds. Moreover, they prove that expected returns on both stocks and bonds are somewhat moving closely together. The main inference from those results is that expected returns are found to be lower when the business conditions are good, whereas the expected returns are higher when the business conditions are weak.

Early evidence using financial ratios

We have a plethora of academic researches investigating the forecasting power of financial ratios, dividend yields and earnings-price ratios, on the stock returns. The motivation behind the idea can be linked to the seminal study of Black and Scholes (1974) which suggest that the best method one can examine the impacts of dividend policy on stock prices is to test the effects of dividend yield on stock returns. However, their paper also reveals the fact that there is no observable relationship between dividend policy and total returns on a risk-adjusted basis. Based on the argument relies on clientele effect, their empirical findings indicate no significant or observable relationship between different dividend yields (due to different taxation) and expected stock returns. The empirical results in this paper are consistent with the dividend irrelevance theory proposed by Miller and Modigliani (1961).

Blume (1980) investigates relationship between dividend policy and total returns in the context of Capital Asset Pricing Model of Sharpe (1964) and Lintner (1965). He examines the US data over the period from 1936 to 1976. The cross-sectional regression results suggest a positive and significant relationship, on average, between quarterly realized returns and both the beta and the anticipated quarterly dividend yield over the whole period and those results are in line with the findings of Brennan (1970), Litzenberger and Ramaswamy (1979, 1980), and Rosenberg and Marathe (1979). Additionally, the results reveal the fact that in the overall period, the average coefficient on beta becomes statistically significant as dividend yield is included in the regression indicating some form of interaction between dividend yields and riskiness of the security. In the light of this important inference, he conducts a detailed examination on the data and finds nonlinear difference between dividend-paying and non-dividend-paying stocks indicating that coefficient estimates might vary over time. For instance, in the last three decades, empirical findings show that returns of the stocks with anticipated yields in excess of the market return are higher than that of non-dividend paying stocks at each level of riskiness; however, for the first decade, total rates of returns on non-dividend paying stocks is found to be higher than the returns on most dividend paying stocks.

In another study, Shiller (1981) conducts a study to investigate the relationship between stock market return and dividend policy. He analyzes two US data sets namely, annual S&P series between 1871 and 1979 and annual DJIA series covering the period of 1928-1979. His empirical findings suggest positive and significant relationship between holding period returns and dividend price ratio for both dataset. However, coefficients of determination (R^2) for both regression estimates are found as considerably low, 6%. This low R^2 might be due to the dividend or price index data errors. Moreover, Shiller (1981) highlights that volatility of stock prices measured by standard deviation of annual changes in real stock prices is much higher than the standard deviations of real dividends. This indicates another important implication of that volatility of stock prices is too high to be attributed to the changes in future dividends as new information. The main conclusion in the paper is that dividend series are trend-stationary and stock prices are too volatile and nonstationary indicating the violations of the efficient market hypothesis. The conclusions of LeRoy and Porter (1981) are in line with the Shiller's (1981).

However, Kleidon (1986) highlights the fact that the series of dividend and prices are integrated (not stationary) in simple autoregressions indicating the presence of serious problems, like overrejection, overidentification, invalidity of the statistical techniques in empirical investigations. Moreover, he advocates that such circumstances might lead researchers (like Shiller, 1981) to reach biased conclusions. Additionally, Marsh and Merton (1986) criticize the variance bounds methodology applied in the previous studies, especially Shiller's (1981, 1982), and they advocate that those tests are unreliable for testing the stock market rationality, namely efficient market hypothesis. In contrast to Shiller's conclusion, they state that dividend series are integrated and feedback on the stock prices. Later on, Marsh and Merton (1987) develop and estimate a model to investigate the relationship between dynamic behavior of aggregate dividend payments and the change in the permanent earnings of the firms measured by the changes in stock prices. Findings obtained from the error correction models suggest that the changes in the aggregate real corporate dividends are driven by the one period lagged real changes in stock prices.

Asquith and Mullins (1983) analyze a number of listed U.S. firms which either pay the first dividend or restart dividend payments after at least 10 years of time period in order to examine the impact of dividends on stockholders' wealth. The monthly data cover the period between 1954 and 1980. The empirical results in the study reveal the fact that initiating dividend payments and/or increases in the subsequent dividend payments increase the shareholders' wealth. In particular, they highlight that the positive impact of increases in the subsequent dividend payments on the shareholders' wealth is larger than the initiation of dividend payments. Unlike the previous studies, they suggest that dividend announcement convey more unique, important and valuable information than the other announcements, such as earnings reports, do.

Rozeff (1984) conducts one of the earliest studies in order to measure the US equity risk premiums by using dividend yields. The regression results of the study suggest that the stock market returns increase as the lagged dividend yields increase indicating a positive relationship between stock market returns and the dividend yields in the prior year. His main implication from the empirical findings is that high (low) returns can be realized when the risk level in the stock market is relatively high (low), however, there is no necessary conflict with the market efficiency in the sense of Fama (1970). Shiller (1984) follows a critical approach to the predictability of asset returns. He stresses the importance of "fashions" in financial markets from a social-psychological point of view. In other words, the discussion in the paper highlights the issue that market psychology, social movements or fads are likely to have a significant impact on the behavior of asset prices. Empirical investigation on the US stock market suggests that stock prices and dividend/earnings announcements are highly correlated. However, Shiller explains these phenomena as the overreaction of stock prices to the dividends and earnings news.

Fama and French (1988a) investigate the issue using the portfolios of New York Stock Exchange (NYSE) stocks for different return horizons from one month to four months. Their empirical findings imply that the coefficient of determinations (R^2) of the regressions increase with the return horizon. Particularly, while the dividend yields explain less than 5% of the variation in the stock returns over the short return horizons, regression of returns on the yields explain more than 25% of the variations of two to four year returns. They emphasize the importance of the time-variation of the expected returns in the analysis and simply conclude that the main reason behind the fact that yields explain much more variation of the return over the long-horizon is the high positive autocorrelation of the expected returns. Campbell and Shiller's (1988a) analyses indicate that a long historical average of real earnings predicts the present value of the future real dividends successfully. After considering the information contained in stock prices they reach the conclusion of that earnings to current stock price ratio is a powerful predictor of the stock returns. The finding that the stock returns are more predictable when they are calculated over long horizons is consistent with the findings of Flood et al. (1986), Poterba and Summers (1989) and Fama and French (1988a).

Campbell and Shiller (1988b) introduce a dividend-ratio model to analyze the dynamic relationships between dividend-price ratio, expected future values of discount rates, and growth rates of dividends[10]. They implement regression and vector autoregressive (VAR) methods over the time periods of 1871-1986 and 1926-1986. Their models make significant contributions to the existing literature since the econometric framework of the models allows time variation in the variables. Their empirical findings demonstrate that variation in the dividend-price ratio can significantly be explained by the variation in real dividend growth, measured real discount rates, and unexplained factors. More importantly, stock returns are found to be somewhat predictable: The lagged log dividend-price ratio has a positive effect on stock returns, whereas the lagged real dividend growth rate has a negative effect on

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[10] The background of the dividend-ratio model of Campbell and Shiller (1988b) is discussed in Section 1.3.

the stock returns. Similarly, they also argue that the stock return predictability increases with the return horizon.

Rapid development period of the literature: Predictability Evidence

Up to this point, we report the influential studies using the forecasting variables, namely short-term interest rates, term structure variables, dividend-price ratios, and earnings-price ratios until the late 1980s. The empirical findings of those studies lead the subsequent studies up to consider the suggested forecasting variables (all together or individually), as well as, to uncover new forecasting variables in order to test the forecastability of (excess) stock returns. Campbell (1991), Cochrane (1991), Kothari and Shanken (1992), Hodrick (1992), Cochrane (1992), Nelson and Kim (1993), Ferson and Korajczyk (1995), Pesaran and Timmermann (1995), Kandel and Stambaugh (1996), Timmermann (1996), Lo and Mackinlay (1997), Kothari and Shanken (1997), Lee (1998), Naranjo et al. (1998), Lamont (1998, 2000), Pontiff and Schall (1998), Qi (1999), Barberis (2000), Baker and Wurgler (2000), Lettau and Ludvigson (2001), and Campbell and Shiller (2001) examine the predictive power of financial ratios (e.g. dividends, earnings data) and/or interest rates (along with term structure variables) on the stock returns. The empirical findings of those studies provide evidence of significant stock return predictability over the various time periods. Particularly, Campbell's (1991) findings suggest that the variance of dividend announcements accounts for only a third to a half of the variance of unexpected stock returns, put another way, the results attribute large fraction of the variance of the price-dividend ratio to variation in expected returns.

Hodrick (1992) explores alternative procedures for inference and measurement for long horizon and the results are in line with the Campbell's (1991). Similarly, Cochrane's (1992) variance decomposition analysis indicates that an increase in price-dividend ratios forecasts a significant large decline in returns. In another study, Pesaran and Timmermann (1995) analyze industrial output, and money supply along with dividend and interest rate variables and their estimation results from recursive regressions suggest that the predictability of excess returns on the US common stocks increases substantially during relatively more volatile time periods, namely 1970s. Another important implication in this paper is time varying properties of the excess stock returns so that the researchers should consider sudden shocks due to significant economic events. Furthermore, using nonlinear framework, Qi (1999) confirms the conclusions of Pesaran and Timmermann (1995).

Following the studies of Fama and French (1992, 1993), Kothari and Shanken (1997) and Pontiff and Shall (1998) investigate the predictive power of book-to-market ratio along with the dividend and interest rate variables on the US stock returns and the empirical results of both studies are very similar. Kothari and Shanken (1997) find Book-to-market ratio as a stronger predictor than dividend yields for expected real stock returns over the full-sample; however, dividend yield is stronger than book-to-market ratio over the subperiod from 1941 to 1991. On the other hand, Pontiff and Shall (1998) conclude that book-to-market ratio can explain the return variations which cannot be explained by the other variables including interest yield spreads and dividend yields. They conclude that predictive power of the book-to-market ratios on the returns is due to the relation between future earnings and book value.

Different from the previous studies, Baker and Wurgler (2000) examine the impact of Initial Public Offering (IPO) activity on the stock returns and provide evidence in favor of predictive ability of the variables controlling corporate issuing activity. The study of Lamont's (2000) is mainly inspired by the Cochrane's (1991) production based model and provides an empirical evidence that investment rate is a successful predictor for stock market returns. Another important variable, consumption-wealth ratio (*cay*) is introduced by Lettau and Ludvigson (2001) suggesting that the variations in the consumption-wealth ratio, a relatively less popular variable than dividend yields or price ratios, are strong predictors of the real stock market returns and excess returns on the Treasury bill rates.

Rapid development period of the literature: contrary evidence

Nevertheless, the following academic studies suggest contradictory evidence to the findings of the above studies: Kim et al. (1991), Mankiw et al. (1991), Richardson and Stock (1989), Jegadeesh (1990), Nelson and Kim (1990), Richardson (1993), Goetzmann and Jorion (1993), Kirby (1997), Wolf (2000) and Racine (2001). Those studies have a conclusion in common that when appropriate statistical procedures are employed in their empirical applications, the evidence of stock return predictability disappears. For instance, Goetzmann and Jorion (1993) criticize the econometric techniques (simple regressions and VARs) implemented in the previous studies and employ bootstrap methodology that incorporates the lagged price relation between returns and dividend yields. Using one-to-four year the US broad market index returns, the null hypothesis that future returns are unrelated to past dividend yields cannot be rejected by the bootstrap regressions. The strong evidence of that dividend yields can be used to forecast stock returns is not consistent with the conclusion of the seminal works by Rozeff (1984), Fama and French (1988a), Flood et al. (1986), and Campbell and Shiller (1988b).

Additionally, Kirby (1997) analyzes the data used in the paper of Fama and French (1989) covering the period between January 1927 and December 1987. The empirical investigation is carried out by multiple regressions of stock returns on the dividend yields and interest rates with Generalized Method of Moments (GMM) estimators. The results of the paper do not support the previous consensus that the long-horizon returns are highly predictable. Furthermore, Wolf (2000) implements new statistical methodology namely, subsampling in order to estimate regression parameters accurately. The analysis contains both simulation studies and real data examination. The simulation studies confirm that his proposed model in the paper performs better than GMM estimation technique. The empirical findings do not suggest any significant evidence of predictability in both short and medium investment horizons. In addition to that, in the long horizon there exists significant predictability evidence. However, the evidence of predictability disappears when a joint test for all return horizons is implemented.

Statistical issues and recommendations for further studies

In this line, a number groundbreaking papers including Nelson and Kim (1993), Stambaugh (1986, 1999), Cremers (2002), Ferson et al. (2003), Valkanov (2003), Amihud and Hurvich (2004), Lewellen (2004), Torous et al. (2004), Paye and Timmermann (2006), Campbell and Yogo (2006), Ang and Bekaert (2007), Amihud et al. (2009), and Pástor and Stambaugh (2009) shed light on the statistical issues that causes controversy on the stock return predictability issue and suggest implementing appropriate econometric techniques as well as out-of-sample verifications for the proposed models in order to overcome the shortcomings of the previous studies. Among these studies, Stambaugh (1986, 1999) reports that forecasting variables are highly persistent over time and this bias leads to inflated conventional *t*-test and thus to overreject the null hypothesis of no predictive ability. In this way, Pástor and Stambaugh (2009) develop predictive systems and eliminate the persistency among forecasting variables. Considering this issue, for example, Goetzmann and Jorion (1993), Rapach and Wohar (2006), Rapach et al. (2010, 2013), Neely et al. (2014) and many others employ wild bootstrap procedures in order to obtain accurate p-values for the *t*-tests and to overcome the data-mining (-snooping) problem which is also dealt with Cremers (2002).

Ferson et al. (2003) suggest using Newey and West's (1987) and White's (1980) heteroskedasticity-autocorrelation consistent coefficient matrix estimation techniques. Moreover, Pesaran and Timmermann (1995) and Paye and Timmermann (2006) suggest considering model uncertainty and parameter instability in the econometric procedures. Lewellen (2004) proposes bias-adjusted predictability test to gather more accurate results in the presence of structural breaks. Additionally, Campbell (2008) notes that the empirical evidence on stock return predictability is investigated mostly in in-sample analyses. Thus, the he highlights the importance of out-of-sample test as an ultimate test of (in-sample) predictive regressions.

Poor out-of-sample forecasting performance

Subsequent studies conducted after the beginning of 2000s consider the aforementioned statistical issues in their empirical exercises and most of them implement out-of-sample verification for their proposed models. Despite the fact that previous studies report predictive ability for particular variables in in-sample analyses, several studies including Cremers (2002), Goyal and Welch (2003), Welch and Goyal (2008), Lettau and Nieuwerburgh (2008) suggest no predictive ability in in-sample and/or out-of-sample analyses. Particularly, Cremers (2002) proposes a new methodology that follows Bayesian framework and allows parameter uncertainty. He attempts to use twelve economic variables including dividend yield, earnings yield, and interest rates which are previously proved to have predictive power on the excess stock returns by the existing literature. The main reason behind this logic is to avoid data snooping bias in the empirical investigation. The empirical results suggest significant evidence of predictive ability of the economic variables on the excess returns in the in-sample evaluation. Nevertheless, out-of-sample predictive power of the variables is found to be very weak.

Goyal and Welch (2003) conduct a detailed analysis to investigate the predictive power of dividend ratios on the US equity premium over the period spanning from 1926 to 2002. They evaluate the analysis not only in in-sample but also in the out-of-sample perspective by estimating rolling forecasts to predict one step ahead equity premium. Their analyses reveal the fact that dividend ratios, namely dividend price ratio and dividend yield ratio have no predictive ability in out-of-sample perspective. However, there exists significant evidence of forecasting power of the dividend ratios on the equity premium until 1990s. On the other hand, Welch and Goyal (2008) analyze the US data including dividends, earnings, risk-free rate, stock variance, book value, corporate issuing activity, T-bill rate, inflation, investment-to-capital ratio, and cay over the period between 1926 and 2005. Their empirical findings suggest that forecasting variables are not good at predicting equity premium both in-sample and out-of-sample.

Moreover, Lettau and Nieuwerburgh (2008) employ econometric techniques which allow investigating the problem by relaxing the assumption of fixed steady state mean of the economy. They propose econometric procedures to adjust the forecasting variables for shifts due to the structural breaks in the data. Their empirical findings suggest significant in-sample predictability evidence of predictability; however the out-of-sample forecasting ability of the variables is not significant. Although adjusted ratios outperform the conventional measures of the ratios, the structural shifts in the data period restrain the forecasting ability of the forecasting variables.

Furthermore, Rapach and Wohar (2006), Chen and Zhang (2007), Gray (2008) report that predictive ability of forecasting variables vary across subsamples. Bali et al. (2008) provide mixed results that the dividend payout ratio and the level of aggregate earnings do not have significant impact on excess stock returns. However, the earnings yield can significantly explain the time-series and cross-sectional variation in firm level stock returns and industry portfolio returns. To sum up, most of the studies conclude that although we evidence little in-sample predictability, the out-sample analyses suggest that the forecasting power of the variables on the stock returns disappears.

Development of strategies for out-of-sample forecasting gains

However, the studies reporting poor out-of-sample forecasting evidences inspire a number of studies in terms of introducing (modifying) new (the existing) forecasting variables and improving the forecasting strategies[11]. In this line, significant number of studies find that existing popular variables as well as the newly-introduced forecasting variables have significant forecasting power on the stock returns in both in-sample and out-of-sample perspectives. Variance risk premium (Bollerslev et al. 2009; Drechsler and Yaron 2011), stock market volatility (Guo, 2006), labor income-to-consumption ratio (Menzly et al. 2004; Santos and Veronesi, 2006), housing collateral ratio (Lustig and Van Nieuwerburgh 2005), housing to non-housing consumption ratio (Piazzesi et al., 2007), aggregate output (Rangvid, 2006), output gap (Cooper and Priestly, 2009), expected business conditions (Campbell and Diebold, 2009), oil price volatility (Driesprong et al., 2008), lagged industry portfolio returns (Hong et al., 2007), accruals (Hirshleifer et al., 2009; Guo and Jiang, 2011), corporate issuing activity (Boudoukh et al. 2007) and lagged US excess returns (Rapach et al., 2013) are proposed as strong predictors for the stock market returns (Koijen and Van Nieuwerburgh, 2011:483-484).

Furthermore, a number of studies suggest using forecasting strategies which overcome the shortcomings and limitations of previous studies and provide out-of-sample forecasting gains. The basis of those strategies can be categorized into four as (Rapach and Zhou, 2013:4); economically motivated model restrictions, forecast combination, diffusion indices, and regime shifts. Campbell and Thompson (2008) check whether any forecasting model can beat the historical average benchmark. They reach a conclusion that if sensible restrictions are imposed on the signs of coefficients and return forecasts, then predictor variables that are successful forecaster in-sample will perform better out-of-sample than historical average return forecast. Ferreira and Santa Clara (2011) provide consistent implications with the

[11] We document those strategies in this section since they are mostly tested by using finacial ratios and interest rate variables. However, they can be applied for examining the forecasting ability of technical trading rules as in Neely et al. (2014).

study of Campbell and Thompson (2008). Using the second strategy, Rapach et al. (2010) propose an econometric procedure to overcome the model and parameter uncertainty shortcomings of predictive regressions. They suggest combining individual forecasts since combining forecasts reduces forecasting volatility and are better linked to real economy. Consequently, their empirical findings suggest significant evidence out-of-sample predictive ability over the historical average.

Neely et al. (2014) apply diffusion indices strategy and employ principal component analysis to obtain very small number of uncorrelated regressors (less dimensions) that represent the common movements in the large sets of macroeconomic and technical indicators. Their empirical findings suggest that macroeconomic and technical indicators have statistically and economically predictive power on the US equity risk premium in both in-sample and out-of-sample analyses. Ludvigson and Ng (2007) and Kelly and Pruitt (2012) employ similar strategies and provide consistent evidence with that of Neely et al. (2014). Finally, considering regime shifts, Henkel et al. (2011) conduct an analysis follows a Bayesian framework and allows considering significant regime shifts in the estimation process. The empirical analyses reveal the important fact that there is a strong and robust relationship between aggregate stock return predictability and business cycles. For instance, dividend yield and term structure variables have significant predictive ability during poor economic times. However, the predictive power of those variables on the aggregate stock returns disappears during the business cycle expansions. Furhermore, Guidolin and Timmermann (2007) and Dangl and Halling (2012) evidence out-of-sample forecasting gains using the last strategy.

International evidence

We report a myriad of academic research concentrating on the US market. However, theoretical and empirical models are, of course, comprehensively tested in stock markets other than the US and in an international context. In this way, Harvey (1991, 1995), Campbell (2003), Paye and Timmermann (2006), Polk et al. (2006), Ang and Bekaert (2007), Hjalmarsson (2010), Dou et al. (2012), McMillan and Wohar (2013a), Rapach et al. (2013) and many others provide evidences on the debate. Using seemingly unrelated regression technique, Chan et al. (1991) confirms the predictability power of earnings on stock returns for the Japanese stock market. Campbell and Hamao (1992) provide supportive evidence for predictive ability of dividend-price ratio and interest rates for Japanese market. In their studies, Ackert and Smith (1993) and Schmitz (1996) find that dividend yield, interest rates, industrial production growth have significant predictive ability on the Canadian stock returns.

Bekaert and Hodrick (1992) test the predictive power of dividend yields, forward premiums, and lagged excess returns on the excess returns in the equity markets of the US, Japan, the UK, and Germany and in FX markets of the dollar relative to the yen, the pound, and the Deutsche mark. The empirical results demonstrate that the relationship between dividend yields and excess equity returns are found to have a positive direction, whereas there is an inverse relationship between forward premiums and returns in FX market. It is also evidenced that dividend yields, known as a good predictor for excess equity returns, have significant predictive power for excess returns in the FX market. In addition to that forward premiums, popular predictor for the excess returns in FX market are found to have significant predictive power for excess equity returns.

Similarly, Ferson and Harvey (1993) conduct a comprehensive study and present international evidence for the sources of risk and predictability of equity returns. Their analysis covers monthly eighteen equity market returns. They investigate the predictability of equity returns using local factors (e.g. domestic dividend yields, interest rates) as well as global factors including a world market portfolio, exchange rate fluctuations, global inflation measures, world interest rates, international default risk, and world industrial production. They estimate an empirical beta pricing model in which betas and the expected risk premium are allowed to vary over time. They stress that the proposed models estimating both local and global information variables are successful in capturing much of the variation in the national equity market returns.

Martikainen et al. (1993) provide evidence on the response of Finnish stock market to the information sources (announcements), namely accrual earnings, cash flow-based earnings and cash dividend releases. The empirical analyses reveal the fact that the Finnish stock market reacts in the direction that the signs of the unexpected net income, cash flow or cash dividend figures suggest. In addition to that several structural breaks are detected in the time series indicating that stock market prices and the other variables have time-varying properties over the sample period. According to the information about cash dividends, Finnish stock market is found not to be efficient in the semi-strong form. In addition, Bailey and Chung (1995) conduct an analysis to check the impacts of fluctuations in the exchange rate and political risk on the excess stock returns. They analyze the monthly Mexican data covering the period between 1986 and 1994. Economic risk factors and information variables including dividend yield and interest rates are used as the variables affecting the stock return levels. The empirical results suggest significant evidence that risk factors associated with Mexico's currency and sovereign debt markets have significant impacts on the excess stock returns.

Furthermore, Harvey (1995) conducts a comprehensive study to investigate the stock return predictability in six Latin American markets, eight Asian markets, three European markets, one Mideast market, and two African markets. The empirical analysis of the study including both domestic and the world information variables covering the period of 1976-1992. The set of world information variables consist of MSCI world return, the US 3-month Treasury bill return minus the 1-month return, the spread between Moody's Baa rated bonds and Aaa bonds, and the Standard and Poor's 500 dividend yield minus the 30-day Treasury bill rate. And the domestic variables include local dividend yield and a local interest rate. The empirical analyses reveal that inclusion of emerging market asset into mean-variance efficient portfolio results in increases in expected return and reduction in the risk (volatility) of portfolio. He reports no observable relationship between the US portfolio along with predictability and emerging markets. Moreover, more than half of the variation in the emerging market returns is found to be explained by local information variables. Using several financial ratios including dividend yield, price-earnings ratios Aydoğan and Güney (1997), Sevil and Şen (2000), Durukan and Evrim-Mandacı (2003), Çıtak (2005) provide evidence that the predictors have significant impact on the Turkish stock market returns. Chui and Wei (1998) investigate the predictive ability of book-to-market ratio on a number of Pacific stock markets and find significant predictive ability.

In another study, Pilotte (2003) find predictive ability for dividend yield and inflation components on the US, France, Germany, the UK, and Sweden. Sarno and Valaente (2005) exploit the futures markets information to model and significantly forecast the US, Japan, and the UK stock market returns. Rangvid (2006) analyzes the US data and the G-7 country data and suggests that share prices to GDP (price-output ratio) can explain the large fraction of the variation over time in expected returns. Polk et al. (2006) apply CAPM logic in order to estimate beta premium predictors. The calculated forecasting variables are good at capturing the variation in the equity risk premium and the results are confirmed in international context covering 22 countries. Paye and Timmermann (2006) provide evidence via estimating econometric technique allowing structural breaks in the data. They use size and industry sorted the US equity portfolios and 18 broad stock market data. The empirical results suggest that although structural breaks caused by particular forecasting variables including the lagged dividend yield, Treasury bill rate, term spread and default premium hampered their predictive ability, they still have a predictive component for stock returns.

Ang and Bekaert (2007) conduct an analysis on the predictability of developed stock market returns. Their empirical results suggest that dividend yields and short interest rates predict stock returns at only short horizons. They propose a present value model of which estimation results indicate that while short rates significantly predict the variation in dividends yields, earnings yields are successful predictors of future cash flows. On the other hand, for the Canada stock market, Deaves et al. (2008) find that returns are found to be predictable in long-horizon; however there is no significant evidence of predictability in short horizon. Kayaçetin and Güner (2007) analyze the Turkish stock market and their results demonstrate that sales-to-price ratio and debt-to-equity ratio have higher explanatory powers on the cross-sectional variability of returns on the Borsa Istanbul than firm size and book-to-market ratio. These findings are consistent with the extant literature on the US markets.

Using various developed market data, McMillan (2009), Kellard et al. (2010), Aono and Iwaisako (2010) conclude that dividend yield data have a significant impact on stock returns. Alexakis et al. (2010) conduct panel data analysis on Greek market and reach a conclusion that the financial ratios contains significant information for predicting the cross-section of stock returns.

Hjalmarsson (2010) examine the predictive ability of common forecasting variables on the excess returns of 40 stock markets including both developed and emerging markets. A new methodology is proposed and used for estimating panel data structure. The main conclusion is that short term interest rate and term spread are successful predictors of stock market returns in developed markets, but they have limited predictive ability in international data. Moreover, earnings price and dividend price ratios do not have significant impact on the returns. Chen (2012) conducts a study to investigate the implications of a dividend yield model for forecasting aggregate Japanese stock returns. Applying decomposition procedure on the stock returns, the author obtain the components of stock returns as changes in current cash flow, expected future cash flow and expected future returns. The empirical findings suggest evidence that changes in current cash flow have higher impact on the stock returns relative to future cash flows. Dou et al. (2012) analyze the monthly Australian data and use a set of variables including dividend yield, dividend-price ratio and consumer sentiment index as predictor variables. In the paper, they follow the methods of combining forecasts as proposed by Rapach et al. (2010). The empirical findings confirm that the individual out-of-sample forecasts are not useful; however combining forecasts provide out-of-sample forecasting gains.

McMillan and Wohar (2013b) consider time-variation in the stock return predictive regressions. The authors analyze bond (gilt)-equity yield ratio, the dividend yield, the payout ratio, price–earnings ratio, term spread, and the 3-month T-bill. The empirical findings suggest that the bond–equity yield ratio, the dividend yield and the price–earnings ratio have significant in-sample predictive ability for the UK stock returns. Moreover, out-of-sample forecasting power of the dividend yield and the price–earnings ratios are statistically significant. Different from the previous studies, Rapach et al. (2013) propose a new forecasting variable, lagged US equity premium. They estimate a pure econometric news-diffusion optimization model which incorporates dividend yields, 3-month T-bill rate and the US market's variables. The study provide significant stock return predictability for the stock markets of non-US industrialized markets for both in-sample and out-of-sample perspective. Similar to the findings of Ang and Bekaert (2007) and Hjalmarsson (2010), the empirical findings suggest that interest rate variables have greater impact on the excess stock returns.

While Henne et al. (2009) provides contrary evidence to the previous studies. Henne et al. (2009) investigate the impact of dividend yield variables on the risk and stock returns in German market. They also analyze the effect of the dividend stability on the stock returns and risk. The empirical findings suggest no observable relationship between dividend yield and excess return and performance of the stocks. They conclude that there exists a negative relationship between dividend yield and risk. Moreover, it is found that as the stability in dividend payments increases, risk of the stocks lowers indicating a strong relation between dividend stability and risk.

Gray (2008) examines the economic significance of predictability in Australian market. Dividend yield, price-earnings, price-book value, short rate term spread, coincident index, and leading index are used as predictors. The statistical significance of the empirical results in the paper suggests mixed results. However, economic significance of the results obtained from the analysis on full sample provides satisfactory evidence of predictability. Nevertheless, the same is not true for subsample estimation results. The results of the paper highlight the fact that different types of significance of return predictability examination lead one to different conclusions. In a more comprehensive study, McMillan and Wohar (2013a) conduct panel data analysis framework using the data for Canada, France, Germany, Hong Kong, Japan, Singapore, the UK and the US. The monthly stock price, dividend, and dividend yield data cover the period between 1973 and 2010. The main empirical finding is that the both economical and statistical significance of the relationship between stock returns and dividend are changing over time. The empirical evidence suggests mixed results across subsamples. Particularly, only the stock returns are predictable in 1970s, whereas only the dividend growth is predictable in 1980s. In addition to that both variables can be predicted in the recent subsample.

Our Study

Our study mainly follows two strategies developed by Rapach et al. (2013) and Neely et al. (2014). The former investigates the predictive powers of lagged US excess returns, US dividend yield and 3-month US T-Bill rate on the equity risk premiums of non-US industrialized countries. The latter examines the predictive power of several popular technical indicators along with a number of macroeconomic indicators on the US equity risk premiums. Our study attempts to combine those strategies through considering the macroeconomic indicators of three major markets along with the domestic macroeconomic and technical indicators in order to forecast the equity risk premiums of the selected stock markets. We take the statistical issues into account and conduct wild bootstrapping procedures rather than conventional statistical significance tests and account for parameter instability. Moreover, forecasting combination strategies are applied and data-snooping bias is addressed via employing statistical tests.

CHAPTER THREE
EMPIRICAL APPLICATION

"Finance is the most successful branch of economics in terms of theory and empirical work, the interplay between the two, and the penetration of financial research into other areas of economics and real-world applications."

Fama, 2011, p. 1

3.1. DATA

"[...] many technical analysts no longer base their forecasts solely on past prices and volume but also use earnings and dividend information and other "fundamental" data, and as many fundamental analysts now look at past price and volume patterns in addition to more traditional variables."

Campbell, Lo, and MacKinlay, 1997, p. 43

In this section, we report some information about the data used in our empirical application. In the following sections, sources of the data, time period, data processing, and data problems and limitations are discussed.

3.1.1. Data Sources

We obtain data on stock market indices and macroeconomic indicators of some selected countries mainly from *Global Financial Data* database which is one of the leading data sources in finance and economics. The remaining data on some macroeconomic indicators are collected from *Eurostat*, *OECD Statistics*, and *IMF International Finance*, *World Bank* databases, and Foreign Trade Bureaus of several countries.

3.1.2. Data Period

We use monthly data and the longest time period analyzed is from January 1988 to December 2012. Our data on country stock market indices represent the major part of the stock markets in terms of total market capitalization, traded value, and number of shares traded. We classify the selected country stock markets into three groups depending on their size and data availability. Table 1 depicts the classification of our selected stock markets.

As can be seen from Table 1, Group 1 consists of three major stock markets of the countries namely, the United States of America (USA), Japan (JPN), and Germany (GER). Group 2 covers the data period between January 1988 and December 2012 and consists of eight stock markets of the countries, namely Belgium (BEL), Greece (GRC), Malaysia (MYS), Mexico (MEX), Portugal (POR), Spain (SPN), Taiwan (TWN), and Turkey (TUR). And finally, Group 3 covers the data period from January 1998 to December 2012 and includes five stock markets of the countries namely Brazil (BRA), Hong Kong (HKG), India (IND), Russia (RUS), and South Africa (ZAF).

Table 1: Stock Markets

Country	Abbreviation	Stock Market Index
A. Group 1		
The United States of America	USA	S&P 500 Composite Index
Japan	JPN	Nikkei 225 Stock Average
Germany	GER	CDAX Composite Index
B. Group 2 (1988-2012)		
Belgium	BEL	Brussels All-Share
Greece	GRC	Athens SE General
Malaysia	MYS	Malaysia KLSE Composite
Mexico	MEX	Mexico SE IPC
Portugal	POR	Oporto PSI-20
Spain	SPN	Madrid SE General
Taiwan	TWN	Taiwan SE General
Turkey	TUR	Istanbul SE BIST-100
C. Group 3 (1998-2012)		
Brazil	BRA	Rio de Janeiro IBX-100
Hong Kong	HKG	Hang Seng Composite
India	IND	Bombay SE Sensitive
Russian Federation	RUS	Russia MICEX Composite
South Africa	ZAF	FTSE/JSE All-Share

We examine the equity premium of the stock markets that have average market capitalization less than one trillion dollar during the analyzed time-period. Moreover, the sample includes the important but fragile emerging countries that have significant trading partnership with one of the major economies (See Appendices). We can classify Group 2 and 3 stock markets in four groups according to their sizes in terms of average market capitalization values. Our sample consists of stock markets with various sizes and thus allows us to make inferences about the equity risk premium forecastability in different market structures. Furthermore, we can also classify stock markets according to their trading partnership levels with Group 1 economies, stock market turnover ratio (%), and total trade value to GDP; however we report those statistics in the Appendices.

Table 2: Stock Market Classification

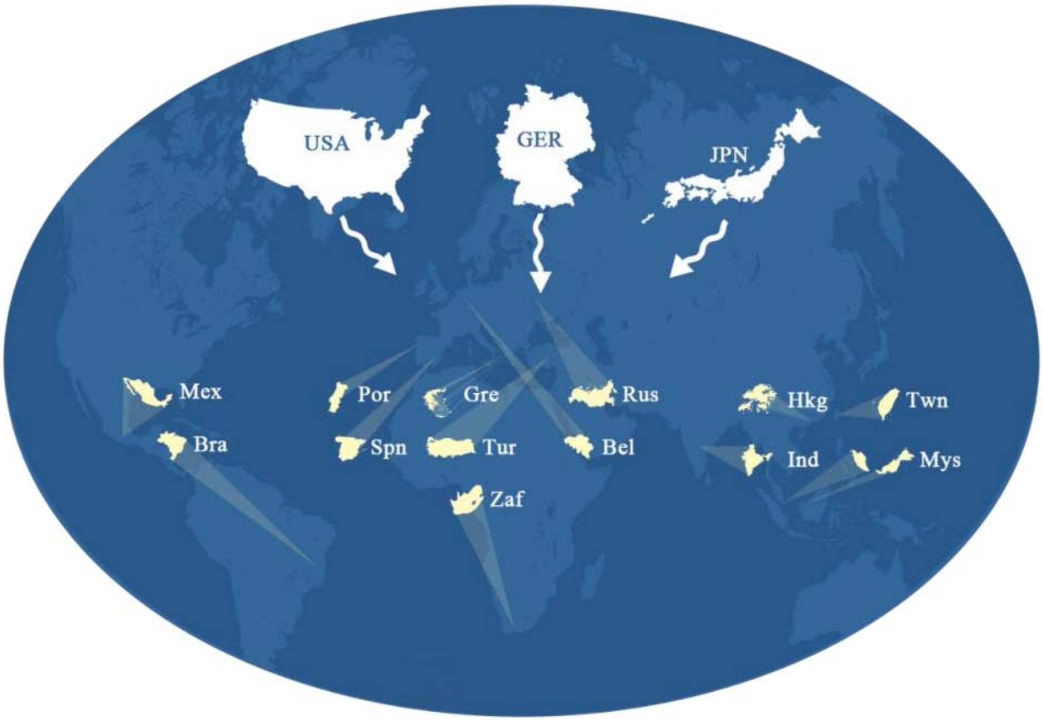
Stock Market	Average Market Capitalization (1997-2012) (Billion USD)	Size
PRT	70.43	S
GRC	108.17	S
TUR	143.52	S
MYS	220.25	M
BEL	236.85	M
MEX	249.87	M
ZAF	437.38	L
TWN	467.82	L
RUS	500.13	L
BRA	628.92	XL
IND	649.06	XL
HKG	765.51	XL
SPN	859.55	XL
GER	1258.04	Major
JPN	3459.33	Major
USA	15415.56	Major

Source: Global Financial Data

3.1.3. Data Processing

In our empirical analysis, we try to investigate the forecastability of the equity risk premiums (RP_i) of the stock markets in Group 2 and 3with their own macroeconomic (X_i), and technical indicators (T) and macroeconomic indicators (X_J) of the major stock markets in Group 1. The analysis outlook is depicted in Figure 1.

Figure 1: Analysis Outlook



The equity risk premiums of the stock markets in Group 2 and 3 are calculated based on the monthly returns which are computed by excluding the last trading day of each month in order to avoid the spurious relationship among stock markets trading in different time zones.

We consider macroeconomic and technical indicators of the markets in Group 2 and 3 as *domestic factors* and macroeconomic indicators of the major stock markets in Group 1 as *foreign factors*. We use the same domestic and foreign macroeconomic indicators namely Dividend Yield (DY), 3-month Treasury Bill Rate (TBL), Price-Earnings Ratio (PE), Equity risk premium volatility (RVOL), Inflation (INF), and Industrial Production (PRD). And following Rapach et al. (2013), we also consider the equity risk premium of the major stock markets in Group 1 as an additional foreign macroeconomic indicator. Therefore, foreign macroeconomic indicators include one additional measure that is the equity risk premium of one of the stock markets in Group 1. Additionally, we use oil prices as an international macroeconomic indicator in predicting the equity risk premiums. Changes in the U.S. Crude Oil prices (OIL) are taken into consideration as an international risk factor and incorporated into the set of macroeconomic indicators.

As a result, we use six domestic, seven foreign, and one international macroeconomic indicator, for a total of fourteen macroeconomic indicators, in order to predict equity risk premiums of the stock markets in Group 2 and 3. The list of these macroeconomic indicators and their descriptions are given in Table 3.

Table 3: Macroeconomic Indicators

Macroeconomic Indicators (X)	**Classification**			**Description**
	Domestic (Group 2/3) (X_i)	**Foreign (Group 1) (X_J)**	**International**	
Equity Risk premium (*log*)	r	RP_J	-	Difference between the continuously compounded return on the stock market and the log return on a risk-free bill.
Dividend Yield (*log*)	DY_i	DY_J	-	Dividend data are based upon the dividends reported for the trailing twelve months and do not include any forecast dividends. (log)
3-month Treasury Bill Rate (%)	TBL_i	TBL_J	-	Treasury bills are discounted and the yield reflects the yield to maturity on the ask price of a treasury bill.
Price-Earnings Ratio (*log*)	PE_i	PE_J	-	Earnings data are generally based upon trailing twelve-month as reported earnings. (log)
Equity risk premium volatility	$RVOL_i$	$RVOL_J$	-	$Vol_t \equiv \sqrt{\frac{\pi}{2}}\sqrt{12}\hat{\sigma}_t$ where $\hat{\sigma}_t = \frac{1}{12}\sum_{i=1}^{12}\lvert r_{t+1-i}\rvert$, r is return. This volatility measure is developed by Mele (2007) and modified by Neely et. al (2014).
Inflation (Δ, %)	INF_i	INF_J	-	The primary Consumer Price indices (CPI) measuring output prices are used for each country. (Δ, %)
Industrial Production (Δ, %)	PRD_i	PRD_J	-	Industrial Production Volume is used for each country. (Δ, %)
U.S. Crude Oil Prices (Δ, %)	-	-	OIL	The United States West Texas Intermediate (WTI) Crude Oil Prices. (Δ, %)

Note: (Δ, %) indicates percentage change transformation ($100*((M_t - M_{t-1})/M_{t-1})$). Subscripts *i* and *j* represents the stock markets of Group 2/3 and Group 1, respectively.

Other than these macroeconomic indicators, we use technical indicators as domestic factors in predicting the equity risk premiums of the stocks market in Groups 2 and 3. Our empirical analyses include fourteen technical indicators based on well-known moving-average (MA), momentum (MOM), and volume-based (VOL) rules. Among them the first technical indicator namely MA, is calculated as follows:

$$MA_{j,t} = \left(1/j\right)\sum_{i=0}^{j-1} P_{t-i} \;\; for \;\; j = s,l \tag{27}$$

where P_t is the level of stock price index; s and l are length of short MA and long MA, respectively ($s<l$). By comparing two moving-averages, $MA(s,l)$ rule can generate buy or sell signals ($S_{i,t}$ = 1 or $S_{i,t}$ = 0, respectively.) at the end of time t:

$$S_{i,t} = \begin{cases} 1 \; if \;\; MA_{s,t} \geq MA_{l,t} \\ 0 \; if \;\; MA_{s,t} < MA_{l,t} \end{cases} \tag{28}$$

For instance, if the stock market index prices begin to follow an upward trend, then the short MA tends to increase faster than the long MA and generate a buy signal. We use two (2) sets of MA rules. The first set is with $s=\{1,2,3\}$, and $l=\{9,12\}$. The second set is with $s=\{1,2,3\}$, and $l=\{4,6\}$.

Second technical indicator, MOM, can generate buy or sell signals ($S_{i,t}$=1 or $S_{i,t}$=0, respectively) as follows:

$$S_{i,t} = \begin{cases} 1 \; if \;\; P_t \geq P_{t-m} \\ 0 \; if \;\; P_t < P_{t-m} \end{cases} \tag{29}$$

If current stock price is higher than its level m periods ago, then MOM generates a buy signal. We analyze two sets of monthly $MOM(m)$ signals with $m=\{9,12\}$, and $m=\{4,6\}$.

Third technical indicator is on-balance volume (VOL) which can be calculated as follows:

$$OBV_t = \sum_{k=1}^{t} VOL_k D_k \tag{30}$$

where VOL_k is trading volume, and D_k is a binary variable taking value of 1 if $P_k - P_{k-1} \geq 0$ and -1 otherwise. OBV technical strategy can generate buy or sell signals ($S_{i,t}$ = 1 or $S_{i,t}$ = 0, respectively.) as follows:

$$S_{i,t} = \begin{cases} 1 \text{ } if \text{ } MA_{s,t}^{OBV} \geq MA_{l,t}^{OBV} \\ 0 \text{ } if \text{ } MA_{s,t}^{OBV} < MA_{l,t}^{OBV} \end{cases} \quad (31)$$

where $MA_{j,t}^{OBV} = (1/j)\sum_{i=0}^{j-1} OBV_{t-i} \text{ } for \text{ } j = s,l.$ We use two sets of *VOL(s,l)* rules. The first set is with *s={1,2,3}*, and *l={9,12}*. The second set is with *s={1,2,3}*, and *l={4,6}*. The list of the technical indicators of this study is presented in Table 4.

Table 4: Technical Indicators

	Length of Short (*s*) and Long (*l*) Rule	
Technical Indicator Rule (S_i)	***s={1,2,3}*, and *l={9,12}***	***s={1,2,3}*, and *l={4,6}***
Moving Average (*MA*)	MA(1,9)	MA(1,4)
	MA(1,12)	MA(1,6)
	MA(2,9)	MA(2,4)
	MA(2,12)	MA(2,6)
	MA(3,9)	MA(3,4)
	MA(3,12)	MA(3,6)
Momentum (*MOM*)	MOM(9)	MOM(4)
	MOM(12)	MOM(6)
On-Balance Volume (*VOL*)	VOL(1,9)	VOL(1,4)
	VOL(1,12)	VOL(1,6)
	VOL(2,9)	VOL(2,4)
	VOL(2,12)	VOL(2,6)
	VOL(3,9)	VOL(3,4)
	VOL(3,12)	VOL(3,6)

In our analyses, the reasons behind using two sets of rules and shortening the long *MA*, *VOL* and period *m* of *MOM* strategy are to better capture the different markets' behavior patterns and compare the predictive power of technical indicators for the future market trends. Thus, we use each set of fourteen technical indicators separately, one by one, in order to compare technical indicators with macroeconomic indicators. Although there is no theoretical background for selecting length of trading rules the literature mainly examines those popular variables with similar lengths, in order to address data-snooping bias in forecasting exercises.

Table 5 reports the summary statistics for monthly log equity risk premiums. Mean (%) statistics are ranging between -1.05% and 0.46% for the period 1988-2012. During the same period of time, standard deviation statistics are taking value between 4.22% and 14.52%. Particularly, TUR has the highest (absolute) mean and standard deviation statistics during that period. In addition to that the highest minimum and maximum return values are also belonging to TUR. At first glance summary statistics suggest that TUR is the most risky stock market among all. The same comments apply for RUS during the second period between 1998 and 2012. It is also evidenced that one-lag autocorrelation is the highest for POR and HKG during the periods of 1988-2012 and 1998-2012 respectively.

Table 5: Summary statistics, monthly equity risk premiums

i	Mean (%)	Standard Deviation (%)	Minimum (%)	Maximum (%)	*ρ*
A. 1988-2012					
BEL	0.23	4.77	-19.91	12.40	0.20
GRC	-0.68	10.00	-35.04	39.52	0.21
MYS	0.26	6.90	-23.77	28.91	0.13
MEX	0.38	7.72	-33.99	18.53	0.05
POR	-0.14	5.45	-23.92	19.69	0.26
SPN	-0.07	5.94	-21.63	15.39	0.10
TWN	-0.03	9.84	-50.24	27.74	0.10
TUR	-1.05	14.52	-53.29	58.52	-0.01
USA	0.36	4.22	-15.08	10.92	0.04
JPN	-0.22	6.25	-23.16	17.13	-0.01
GER	0.46	5.57	-20.39	18.24	0.14
B. 1998-2012					
BRA	-0.04	8.62	-49.17	28.73	-0.05
HKG	0.32	7.23	-22.13	23.05	0.17
IND	0.36	7.72	-33.89	25.84	0.09
RUS	0.89	13.42	-68.03	48.02	0.10
ZAF	0.29	5.92	-35.83	13.04	0.02
USA	0.11	4.66	-15.08	10.92	0.10
JPN	-0.10	6.07	-23.16	17.13	0.01
GER	0.30	6.15	-20.39	18.24	0.17

Note: ρ denotes (one-lag) autocorrelation.

3.1.4. Data Problems and Limitations

The availability of TBL plays an important role in selecting the samples covering the both time periods since we need them in computing the equity risk premiums. Since our sample includes countries which experienced several important economic crises, their TBL data are not regular and/or available during bad economic conditions. By the same token, most of the economies did not issue government bonds, so that we are not able to obtain long-term interest rates and accordingly term structure variables. In the absence of TBL for particular markets, several studies including Hjalmarsson (2010) use LIBOR, EURIBOR, or other short-term interbank rates. However, the interest rates other than TBL do carry even a little credit risk, and this is not fully consistent with the theoretical background. Moreover, we only use TBL to ensure the consistency for every market in our analyses.

In addition to TBL, the availability of VOL and *OECD* Recession Dates also affect the sample selection process. Moreover, we drop the two major stock markets, namely United Kingdom (UK), and France (FRA) from the Group 1 since the models using the indicators of UK (FRA) produce similar results with those of the USA (GER). Furthermore, we only analyze monthly data since the highest frequency for macroeconomic indicators data is monthly. Despite the fact that the technical analysis is more meaningful when high frequency data (daily, intra-day) is used we are in the position of analyzing monthly data in order to compare the technical indicators to macroeconomic indicators.

3.2. ECONOMETRIC METHODOLOGY

> *"Is it reasonable to use the standard t-statistic as a valid measure of significance when the test is conducted on the same data used by many earlier studies whose results influenced the choice of theory to be tested?"*
>
> *Merton, 1987, p. 107*

In this section of the chapter, first, we discuss the predictive regression framework employed in *in-sample* and *out-of-sample* analyses. And then, we cover the theoretical background of the *principal component analysis (*PCA*)* that is conducted in both in-sample and out-of-sample sections. And lastly, we present *wild bootstrap procedure* applied in the predictive regression framework in order to calculate the empirical *p*-values associated with coefficient estimates.

3.2.1. In-Sample Analysis

In-sample analyses are carried out in two complementary steps: The first contains bi-variate predictive regression model estimations and the second follows predictive regression model framework based on PCA. We estimate the following conventional bi-variate predictive regression model in order to check predictive power of macroeconomic indicators on the equity risk premium:

$$r_{t+1} = \alpha_i + \beta_i x_{i,t} + \varepsilon_{i,t+1} \tag{32}$$

where r_{t+1} is equity risk premium; $x_{i,t}$ is a predictor available at time *t*; $\varepsilon_{i,t+1}$ is a zero-mean disturbance term. Aforementioned fourteen macroeconomic indicators constitute the set of $x_{i,t}$ predictors. Accordingly, Equation (32) is run 39 (=*13x3*) times for each country in Groups 2 and 3 since we use 3 vectors of $x_{i,t}$ predictors in order to predict the future equity risk premium of one of the 13 stock markets in these groups. For instance, in order to predict equity risk premium of BEL, we use the first vector of $x_{i,t}$ predictors that includes domestic macroeconomic indicators of BEL, OIL, and the macroeconomic indicators of the US as foreign macroeconomic indicators. The other two (2) vectors of $x_{i,t}$ predictors of the equity risk premium of BEL can be formed by holding domestic macroeconomic indicators of BEL and OIL constant, and only replacing US stock market's macroeconomic indicators with the JPN's and GER's. The same process applies for the remaining twelve (12) stock market equity risk premiums of Group 2 and 3 in order to constitute the vectors of macroeconomic predictors.

For technical indicators, we estimate the following bi-variate predictive regression model by only replacing $x_{i,t}$ with $S_{i,t}$:

$$r_{t+1} = \alpha_i + \beta_i S_{i,t} + \varepsilon_{i,t+1} \tag{33}$$

where $S_{i,t}$ is a predictor available at time *t*. $S_{i,t}$ is basically a set of fourteen technical indicator rules defined in the previous section. We again run Equation (33) for 26 (=*13x2*) times for each country of Group 2 and 3 since we use 2 sets of $S_{i,t}$ predictors. In Equations (32) and (33), null hypothesis of $H_0 : \beta_i = 0$ is tested against the alternative hypothesis of $H_0 : \beta_i > 0$ since β_i is expected to be positive under alternative. Following the studies of Inoue and Killian (2004) and Neely et al. (2014), we employ such a one-sided test for the purpose of increasing the predictive power of in-sample analysis.

In the second step of in-sample analysis, following Ludvigson and Ng (2007, 2009) Neely et al. (2014) we estimate predictive regressions based on principal components[12]. In order to incorporate information from all macroeconomic indicators, we estimate the following predictive regression:

$$r_{t+1} = \alpha_i + \sum_{k=1}^{K} \beta_k \hat{F}_{k,t}^{ECON} + \varepsilon_{i,t+1} \tag{34}$$

where $\hat{F}_t^{ECON} = \left(\hat{F}_{1,t}^{ECON}, ..., \hat{F}_{K,t}^{ECON} \right)'$ denoting the vector containing the first K principal components extracted from the entire set of fourteen macroeconomic indicators, $x_t = \left(x_{1,t}, ..., x_{N,t} \right)'$ where $N = 14$.

For technical indicators, we estimate the following predictive regression:

$$r_{t+1} = \alpha_i + \sum_{k=1}^{K} \beta_k \hat{F}_{k,t}^{TECH} + \varepsilon_{i,t+1} \tag{35}$$

where $\hat{F}_t^{TECH} = \left(\hat{F}_{1,t}^{TECH}, ..., \hat{F}_{K,t}^{TECH} \right)'$ denoting the vector containing the first K principal components extracted from the entire set of fourteen technical indicators, $S_t = \left(S_{1,t}, ..., S_{N,t} \right)'$ where $N = 14$.

Finally, we incorporate information from all indicators including domestic and foreign macroeconomic indicators, OIL, and technical indicators. In this way, we estimate the following predictive regression model:

$$r_{t+1} = \alpha_i + \sum_{k=1}^{K} \beta_k \hat{F}_{k,t}^{ALL} + \varepsilon_{i,t+1} \tag{36}$$

where $\hat{F}_t^{ALL} = \left(\hat{F}_{1,t}^{ALL}, ..., \hat{F}_{K,t}^{ALL} \right)'$ denoting the K-vector containing the first K principal components extracted from the *2N*-vector of 14 macroeconomic and 14 technical indicators with either set with *s=1,2,3*, and *l=4,6* or with *s=1,2,3*, and *l=9,12*.

We test the parameter stability of the aforementioned models by calculating the *qLL* statistic proposed by Elliot and Müller (2006)[13]. The *qLL* statistic tests the null hypothesis of parameter stability. In other words, this test checks the presence of structural breaks in the parameter estimates. We reject the null hypothesis for the

[12] Please see the section 3.2.4 for the methodological explanation of the principal component analysis.
[13] See the detailed calculation steps of the *qLL* statistics in the original paper by Elliot and Müller (2006: 914).

smaller values of qLL statistics than the asymptotic critical values reported in the Table 1 of Elliot and Müller (2006:915).

3.2.2. Out-of-Sample Analysis

The following equation is estimated in order to obtain the out-of-sample equity risk premium forecasts at time t+1 based on an individual macroeconomic indicator in Equation (32):

$$\hat{r}_{t+1} = \hat{\alpha}_{t,i} + \hat{\beta}_{t,i} x_{i,t} \tag{37}$$

where $\hat{\alpha}_{t,i}$ and $\hat{\beta}_{t,i}$ are the ordinary least square (OLS) estimates from regressing $\{r_s\}_{s=2}^{t}$ on a constant and $\{x_{i,s}\}_{s=1}^{t-1}$.

The out-of-sample forecast based on an individual technical indicator in the Equation (33) is obtained from the following equation:

$$\hat{r}_{t+1} = \hat{\alpha}_{t,i} + \hat{\beta}_{t,i} S_{i,t} \tag{38}$$

where $\hat{\alpha}_{t,i}$ and $\hat{\beta}_{t,i}$ are the OLS estimates from regressing $\{r_s\}_{s=2}^{t}$ on a constant and $\{S_{i,s}\}_{s=1}^{t-1}$. In addition to forecasts obtained from individual indicators the out-of-sample forecasts based principal components are obtained and given by[14]:

$$\hat{r}_{t+1}^{j} = \hat{\alpha}_t + \sum_{k=1}^{K} \hat{\beta}_{t,k} \hat{F}_{1:t,k,t}^{j} \text{ for } j = \text{ECON, TECH, or ALL} \tag{39}$$

where $\hat{F}_{1:t,k,t}^{j}$ denotes the kth principal component extracted from the sets of indicators including x_{it} (j=ECON), S_{it} (j=TECH), or all macroeconomic and technical indicators taken together (j=ALL) and $\hat{\alpha}_t$ and $\hat{\beta}_{t,k}$ (k=1,…,K) are the OLS estimates from regressing $\{r_s\}_{s=2}^{t}$ on a constant and $\{\hat{F}_{1:t,k,s}^{j}\}_{s=1}^{t-1}$ (k=1,…,K). Moreover, we also generate additional simple average out-of-sample forecasts ($\hat{r}_{i,t}^{POOL}$) based on the arithmetic mean of forecasts generated by all individual indicators using the Equations (32) and (33):

[14] Please see the section 0 for the methodological explanation of the principal component analysis.

$$\hat{r}_{t+1}^{POOL-j} = \left[\left(\sum_{i=1}^{N} \hat{r}_{i,t+1}^{j} \right) \div N \right] \text{for } j = \text{ECON, TECH, ALL} \tag{40}$$

where *i* represents an individual indicator in the sets of indicators each consisting of *N* indicators. In the Equation (40), for *j*=ECON, TECH, *N* is equal to 14; for *j*=ALL, *N* equals the sum of the numbers of ECON and TECH indicators, 28 (*=14+14*).

Following the studies of Goyal and Welch (2003) Welch and Goyal (2008), Campbell and Thompson (2008), Ferreira and Santa-Clara (2011), and Neely et al. (2014), we compare the forecasts given by the Equations (37), (38), (39), and (40) to the forecasts produced by popular as well as a powerful benchmark model of historical average (HA):

$$\hat{r}_{t+1}^{HA} = (1/t)\sum_{s=!}^{t} r_s \tag{41}$$

HA benchmark forecast assumes a constant expected equity risk premium which can be stated as $r_{t+1} = \alpha + \varepsilon_{t+1}$.

We compute out-of-sample R^2 (R_{OS}^2) of Campbell and Thompson (2008) and mean square forecast error (*MSFE*) adjusted (*MSFE-adj*) statistics of Clark and West (2007) in order to compare the forecasts produced by the proposed predictive models to the forecasts produced by the benchmark HA model.

$$MSFE_j = \frac{\sum_{i=1}^{P}\left(r_{t+i} - \hat{r}_{t+i}^{j}\right)^2}{P},\ MSFE_{HA} = \frac{\sum_{i=1}^{P}\left(r_{t+i} - \hat{r}_{t+i}^{HA}\right)^2}{P}$$
$$\left(R_{OS}^2\right)^j = 100 \times \left(1 - \left(MSFE_j - MSFE_{HA}\right)\right) \tag{42}$$

where *j* represents predictive regression models; *P* equals the number of observations in the overall period minus the number of observations in the in-sample period; HA stands for the benchmark model, HA. R_{OS}^2 measures the proportional reduction in the *MSFE* for the competing predictive regression model forecast relative to the benchmark model. Thus, one can conclude that competing predictive regression forecasts outperform the forecasts generated by the benchmark model if R_{OS}^2 is calculated as positive. However, negative values of R_{OS}^2 suggest the opposite. Moreover, the R_{OS}^2 values calculated greater than 0.5% demonstrate economic significance of the predictive regression forecasts that outperform *HA* forecasts.

MSFE-adj of Clark and West (2007) tests the null hypothesis of $R^2_{OS} \leq 0$ against the alternative hypothesis of $R^2_{OS} > 0$ where *adj* stands for adjustment. In other words, this statistics tests the null hypothesis of the *MSFE* of historical average is less than or equal to the *MSFE* of predictive regression against alternative hypothesis that the *MSFE* of historical average is greater than the *MSFE* of predictive regression forecast. MSFE-*adj* is a useful statistic for comparing nested models and can be calculated as follows:

$$\mathrm{MSFE}-adj_j = \frac{\sum_{i=1}^{P}\left(r_{t+i}-\hat{r}^{j}_{t+i}\right)^2}{P} - \frac{\sum_{i=1}^{P}\left(\hat{r}^{HA}_{t+i}-\hat{r}^{j}_{t+i}\right)^2}{P} \tag{43}$$

If the MSFE-*adj* statistic is calculated greater than zero, we reject the null hypothesis stated above.

We check whether data-snooping can explain the out-of-sample predictive power of the model forecasts by calculating *maxMSFE-F* statistic of Clark and McCracken (2012)[15]. This reality check test the null hypothesis that benchmark model MSFE is less than or equal to minimum MSFE of all the competing models which nest the benchmark model. We compute p-value for the *maxMSFE-F* statistic via wild fixed-regressor bootstrapping procedure.

3.2.3. Portfolio Performance Analysis

In portfolio performance analysis section, we calculate certainty equivalent return (CER) for an investor who follows Markowitz's mean-variance framework and allocates its funds across equities and risk-free assets (such as 3-month T-Bill) using equity risk premium forecasts (see Campbell and Thompson (2008) and Neely et al. (2014)). At the end of time *t*, an investor with a relative risk coefficient (γ) of five invests a proportion denoted by w_t in the equities during time *t+1*:

$$w_t = \left(\frac{1}{\gamma}\right)\left(\frac{\hat{r}_{t+1}}{\hat{\sigma}^2_{t+1}}\right) \tag{44}$$

[15] See Clark and McCracken (2012) for the detailed mathematical derivation of the *maxMSFE-F* statistic.

where $\hat{r}_{t+1}$ is the forecast of equity risk premium and $\hat{\sigma}^2_{t+1}$ is forecast of its variance:

$$\hat{r}_{t+1} = \left(\sum_{i=1}^{R+t} r_i\right) / \left(R+t\right)$$
$$\hat{\sigma}^2_{t+1} = \left[\left(\sum_{i=R+1-W}^{R+t} r_i^2\right) / \left(R+t\right)\right] - \left[\left(\sum_{i=R+1-W}^{R+t} r_i\right) / \left(R+t\right)\right]^2 \quad (45)$$

where R represents the initial estimation period and equals to 70 in our analysis; W indicates moving window of past monthly returns and W is equal to 60 since we assume the investor uses five-year moving window in order to estimate the variance of equity risk premium. Following Neely et al. (2014), we let w_t take value between 0 and 1.5 in order to prevent short sales and more than 50% leverage.

For the investor investing the remainder proportion (1-w_t) in risk-free assets, the return of holding portfolio at time t+1 is as follows:

$$R_{p,t+1} = w_t r_{t+1} + R_{f,t+1} \quad (46)$$

We calculate the *Sharpe* ratio for a portfolio as:

$$SR_p = \hat{\mu}_{p*} / \hat{\sigma}_{p*} \quad (47)$$

where $\hat{\mu}_{p*}$ and $\hat{\sigma}_{p*}$ are mean portfolio return ($R_{p,t+1}$) in excess of the risk-free ($R_{f,t+1}$) rate and the standard deviation of the excess portfolio return ($R_{p,t+1}$ - $R_{f,t+1}$), respectively for the investor's portfolio over the forecast period.

We calculate the CER for a portfolio as follows:

$$\text{CER}_p = \hat{\mu}_p - \frac{1}{2}\gamma\hat{\sigma}^2_p \quad (48)$$

where $\hat{\mu}_p$ and $\hat{\sigma}^2_p$ are the mean and variance, respectively, for the investor's portfolio over the forecast period; γ is relative risk coefficient taking value of five .

After considering transaction costs, $R_{p,t+1}$ can be calculated as follows:

$$R_{p,t+1} = \left[1 + R_{f,t+1} + \left(w_t \times r_{t+1}\right)\right] \times \left[1 - \left(c \times \text{TO}_{t+1}\right)\right] - 1 \quad (49)$$

where c is basis point per transaction which is assumed to be 50 (c=50/10,000) basis points following Balduzzi and Lynch (1999), and Neely et al. (2014); *TO* stands for turnover which is the percentage of wealth traded each month. *TO* can be calculated based on the following equation:

$$\text{TO}_{t+1} = \left|\text{Target Wealth}_{\text{Risky}, t+1} - \text{Wealth}_{\text{Risky}, t+1}\right| / \text{Wealth}_{\text{Total}, t+1} \quad (50)$$

Define

$$\text{Wealth}_{\text{Total},\, t+1} = 1 + R_{f,t+1} + \left(w_t \times r_{t+1}\right) \tag{51}$$

$$\text{Wealth}_{\text{Risky},\, t+1} = w_t \times \left(1 + R_{f,t+1} + r_{t+1}\right) \tag{52}$$

$$\text{Target Wealth}_{\text{Risky},\, t+1} = w_{t+1} \times \text{Wealth}_{\text{Total},\, t+1} \tag{53}$$

"Target $\text{Wealth}_{\text{Risky}}$" and "TO" values at the last time equal to zero since we use w_{t+1} in the calculations. Thus, $R_{p,t+1}$ for the last month is given by Equation (46).

3.2.4. Principal Component Analysis

PCA is proposed by Pearson (1901) and later developed by Hotelling (1933). PCA is a multivariate statistical tool which transforms original data matrix ($X_{n\ x\ p}$) with *n* observations and *p* possibly correlated dimensions to a new data matrix ($PC_{n\ x\ k}$) with *n* observations and *k* linearly uncorrelated dimensions called "principal components" where *k* is less than or equal to *p* (Hair et al. 2010: 16). Moreover, principal components constituting the new data matrix (*n x k*) explain very large portion of the information (variance) contained in the original data matrix ($X_{n\ x\ p}$). PCA creates *k* number of principal components such that the first principal component explains the maximum variance of the original data matrix, the second explains the second most variance, and so forth. The reason behind applying PCA is to reduce the number of predictors (dimensions) without the loss of information.

The first step of PCA is generally standardizing the original data matrix (*n x p*) by subtracting the sample mean from each observation and then dividing by the sample standard deviation; in this way, we get standardized data matrix, $Z_{n\ x\ p}$. In other words, we calculate *Z*-scores of the original observations in order to get $Z_{n\ x\ p}$. Second step is to calculate the *eigenvalues* and *eigenvectors* from the covariance matrix of the standardized data matrix ($Z_{n\ x\ p}$). Eigenvectors matrix ($U_{p\ x\ k}$) represents the estimated coefficients of principal components (directions in the vector space). Diagonal elements of eigenvalues matrix ($\Lambda_{k\ x\ k}$) are the variance of respective principal components. In the third step of the PCA, we multiply the standardized data matrix ($Z_{n\ x\ p}$) by the eigenvectors matrix ($U_{p\ x\ k}$) in order to obtain "principal components" matrix ($PC_{n\ x\ k}$). Following Neely et al. (2014), we let *k* be the maximum of four for the F-ALL models and three for the F-ECON and F-TECH models .The number of principal components are selected by the adjusted R^2.

3.2.5. Wild Bootstrap Procedure

Wu (1986) develops *wild bootstrap procedure* to deal with the heteroskedasticity and multicollinearity problems in the regression models. The logic behind the wild bootstrapping procedure is to create a number of pseudo samples containing independent (predictors) and dependent (equity risk premium) variables based on residual values which are multiplied by a scalar following a distribution (i.e. standard normal distribution). We can get distributions for each *t*-statistics through estimating *t*-statistics of the slope parameters gathered from these pseudo samples. Following Neely et al. (2014), we apply wild bootstrap procedure in order to calculate the *p*-values of the *t*-statistics of respective coefficient estimates in the presence of heteroskedasticity and of persistence in predictor vectors.

We obtain the residuals based on the following multivariate predictive regression model including a constant, *N* macroeconomic (x_t), and *N* technical indicators (S_t) as independent variables using OLS algorithm:

$$\hat{\varepsilon}_{t+1} = r_{t+1} - \left(\sum_{i=1}^{N} \hat{\beta}_{i,x} x_{i,t} + \sum_{i=1}^{N} \hat{\beta}_{i,S} S_{i,t} \right) \tag{54}$$

where r_{t+1} is the equity risk premium at time $t+1$. The wild bootstrapping procedure assumes that each macroeconomic indicator (x_i) follows an AR(1) process that can be shown as follows:

$$x_{i,t+1} = \rho_{i,0} + \rho_{i,1} x_{i,t} + v_{i,t+1} \text{ for } i = 1,...,N. \tag{55}$$

Define

$$\hat{v}^{c}_{i,t+1} = x_{i,t+1} - \left(\hat{\rho}^{c}_{i,0} + \hat{\rho}^{c}_{i,1} x_{i,t} \right) \text{ for } i = 1,...,N. \tag{56}$$

where $\hat{\rho}^{c}_{i,0}$ and $\hat{\rho}^{c}_{i,1}$ stand for reduced-bias estimates of the AR(1) parameters in Equation (54) and are calculated by iterating on the *analytical second-order bias expression* for the OLS estimates (Neely et al., 2014: A2). Using fitted residuals, and estimated AR parameters, we can create a pseudo sample which includes the equity risk premium (r^*_{t+1}), and N macroeconomic variables ($x^*_{i,t+1}$) under the null hypothesis of no stock return predictability:

$$r^*_{t+1} = \bar{r} + \hat{\varepsilon}_{t+1} w_{t+1} \text{ for } t = 0,...,T-1 \tag{57}$$

$$x^*_{i,t+1} = \hat{\rho}^c_{i,0} + \hat{\rho}^c_{i,1} x^*_{i,t} + \hat{v}^c_{i,t+1} w_{t+1} \text{ for } i = 1,...,N \text{ and } t = 0,...T-1 \tag{58}$$

where $\bar{r}$ stands for the sample mean of the equity risk premium. w_{t+1} which is the random scalar drawn from standard normal distribution is multiplied by fitted residuals $\hat{\varepsilon}_{t+1}$ in the Equation (57) and by $\hat{v}^c_{i,t+1}$ in the Equation (58) in order to obtain pseudo residuals at time $t+1$ under the *wild* bootstrap procedure.

For technical indicators, wild bootstrap procedure generates pseudo sample of N technical indicators ($S^*_{i,t+1}$) under the assumption that S_i follows a first-order, two-state, Markov-switching process with the following transition matrix (Neely et al. 2014: A2):

$$P_i = \begin{pmatrix} p_i^{0,0} & p_i^{1,0} \\ p_i^{0,1} & p_i^{1,1} \end{pmatrix} \text{ for } i = 1,...,N \tag{59}$$

where

$$p_i^{j,k} = \Pr\left(S_{i,t} = k \mid S_{i,t-1} = j\right) \; for \; j,k = 0,1 \text{ and } p_i^{0,0} + p_i^{0,1} = p_i^{1,0} + p_i^{1,1} = 1 \tag{60}$$

Accordingly, the pseudo sample for N technical indicators ($S^*_{i,t+1}$) is generated via simulations (Neely et al. 2014: A2).

Wild bootstrap procedure is repeated for *2,000* times in order to generate empirical distributions for each t-statistics. The empirical p-values respective to the t-statistics are calculated as the proportion of the bootstrapped t-statistics greater than the t-statistic for the original sample.

3.3. EMPIRICAL FINDINGS

This section presents the empirical findings of *in-sample analysis* and *out-of-sample analysis*. In-sample analysis is detecting predictive power of various indicators on the equity risk premium whereas, out-of-sample analysis, which is more relevant for practitioners and investors, checks whether the data-generating process is stable or not. Moreover, employing out-of-sample analysis along with the in-sample analysis provides robustness for the empirical results. Out-of-sample analysis section also includes *portfolio performance evaluation* which analyzes the economic value of the equity risk premium forecasts produced by the proposed models for a risk-averse investor.

3.3.1. In-Sample Analysis

In-sample analysis is carried out in two complementary steps: First one contains bi-variate predictive regression model estimations and second one follows predictive regression model framework based on PCA.

Estimation results of bi-variate predictive regressions given by Equations (32) and (33) are reported in tables from APPENDIX 1 to APPENDIX 23 in detail. In order to conserve space, we report summary information related to the bi-variate predictive regression estimation results in the following tables from Table 6 to Table 11. These summary tables indicate the numbers of statistically and economically significant macroeconomic and technical predictors for the analyzed stock markets. In other words, it shows whether a particular macroeconomic indicator or technical indicator is significant at conventional levels or not.

According to Table 6, at least one of the domestic macroeconomic indicators including OIL is significant at conventional levels for all stock markets except TWN. Particularly, *DY* and *TBL*, the most studied macroeconomic indicators in the literature, are found to be significant predictors for seven stock markets, representing the 54% of all cases. POR stock market has the highest number of significant predictors, whereas the predictors of the stock markets, namely TWN, HKG and RUS perform poorly among the others. Moreover, 94.4% of the statistically significant domestic macroeconomic indicators including OIL generate R^2 greater than 0.5% indicating that the most of the statistically significant indicators are also economically significant (see Kandel and Stambaugh (1996), Xu (2004), Campbell and Thompson (2008)). However, *qLL* statistics suggest that only 75% of the models producing statistically significant predictors are structurally stable over time.

Overall, 33% of all domestic macroeconomic indicators and OIL are found to be statistically and economically significant among all cases and also the numbers of economically significant indicators during recessions and expansions are quite close to each other. The popular and most examined variables, namely DY and TBL can explain much of the variation in half of the equity risk premiums; this finding is partially consistent with the existing literature. More interestingly, when DY is a significant (insignificant) predictor for a particular equity risk premium except TWN and POR, TBL is found to be insignificant (significant).

Table 6: Domestic Macroeconomic Indicators and OIL

	Statistically Significant Indicators							# of Statistically Significant Indicators based on the following criterion				
	DY	TBL	PE	RVOL	INF	PRD	OIL	Total	qLL >CV	R^2 (%)>0.5	R^2_{EXP} (%)>0.5	R^2_{REC} (%)>0.5
BEL	0	1	1	0	0	0	1	3	2	3	2	2
GRC	0	1	1	0	0	0	1	3	1	3	2	2
MYS	0	1	0	0	1	1	0	3	3	3	2	3
MEX	1	0	1	0	0	0	0	2	2	2	2	0
POR	1	1	0	1	1	0	1	5	2	5	4	2
SPN	1	0	1	0	0	0	1	3	2	1	3	0
TWN	0	0	0	0	0	0	0	0	0	0	0	0
TUR	1	0	1	1	0	0	0	3	3	3	3	3
BRA	1	0	0	0	1	1	0	3	3	3	2	2
HKG	1	0	0	0	0	0	0	1	1	1	1	1
IND	1	1	1	0	0	0	0	3	3	3	3	3
RUS	0	1	0	0	0	0	0	1	1	1	0	1
ZAF	0	1	0	0	1	0	0	2	1	2	1	2
Total	7	7	6	2	4	2	4	32	24	30	25	21
% of Total	54%	54%	46%	15%	31%	15%	31%	35%	26%	33%	27%	23%
Total based on following criterion:												
R^2 > 0.5%	6	7	5	2	4	2	4					
R^2_{EXP} > 0.5%	5	4	4	2	4	2	4					
R^2_{REC} > 0.5%	5	5	4	1	2	2	2					

Note: 1 and 0 denote statistical significance and insignificance, respectively. CV stands for 10% critical values for qLL statistics.

The tables from Table 7 to Table 9 contain information about statistically and economically significant foreign macroeconomic predictors for the analyzed stock market equity premiums of Group 2 and 3. RP_J and TBL_J are found to be the top two statistically significant predictors in all cases. It is clear from the results that RP_J, which is statistically and economically significant in 51% of the total cases, performs as well as the domestic macroeconomic indicators of DY and TBL. However, $RVOL_J$ is only significant for 5% of the total interactions indicating poor performance of the volatility measure. The remaining indicators, namely DY_J, PE_J, INF_J, and PRD_J are found to be significant predictors on average of 23% of the total cases.

Furthermore, Table 9 denotes detailed information about how many times any stock market's macroeconomic indicator found to be statistically significant at conventional levels. Despite the fact that Mexico has high level of trading partnership with the USA (see APPENDIX 83 and APPENDIX 84), macroeconomic indicators of the USA have no significant predictive power on the equity risk premium of MEX stock market. However, in the predictive regression of the RP_{USA} on the equity risk premium of MEX, *p*-value of the slope is estimated as 0.13 which is very close to 0.10 threshold value. More interestingly, macroeconomic indicators of JPN are found to have no significant predictive power on the equity risk premiums of all analyzed Asian stock markets, namely MYS, TWN, HKG, and IND.

According to Table 9, macroeconomic indicators of GER are the most successful predictors, generating for a total number of 33 statistically significant predictors of equity risk premiums of the stock markets in Group 2 and 3. Particularly, RP_{GER}, DY_{GER}, TBL_{GER}, and INF_{GER}, some of macroeconomic indicators of GER, rank first among the other major stock markets since they generate maximum number of statistically significant predictors for the equity risk premiums. Japanese macroeconomic indicators perform poorly generating only fifteen significant indicators among all cases. RP_{GER} and RP_{USA} have significant predictive power on eight stock markets, exceeding the performance of RP_{JPN} which is found to be statistically significant for only four stock market equity risk premiums. It is also noteworthy that TBL_{GER} and is found to be significant for eight stock markets. In addition to that, the maximum number of significant PRD_J is reached by PRD_{USA} indicating that the investors in Group 2 and 3 might give the highest weight to the changes in the level of industrial production of the US among all.

According to Table 8, the total number of economically significant RP_J indicators is higher during recessions than expansions denoting the fact that investor perception in the stock markets in Group 2 and 3 is more sensitive to information flow from major stock market returns during bad economic conditions. The same applies for PRD_J indicators of which the total number showing economic significance is higher during recession periods. Overall, 26% of the all foreign macroeconomic indicators are found to be statistically and economically significant among all cases; however there exists a clear difference between the total number of significant indicators during good and bad economic cycles. Nevertheless, only 78% of models producing the statistically significant predictors are found to be structurally stable over time based on the calculated *qLL* statistics.

Overall, the performance of the domestic and foreign macroeconomic indicators is mediocre. However, at least one of them can predict the equity risk premium. More importantly, some foreign factors can explain the variation when any domestic variable have a predictive ability for the equity risk premiums. Put another way, they may carry complementary information. For instance, while none of the domestic factors can predict TWN equity risk premium, some foreign factors including RP_J, TBL_J, and PRD_J have significant power on the equity risk premium of TWN. This fact motivates us to incorporate information from the domestic factors and foreign factors in order to estimate equity risk premium. Nevertheless, parameter estimates of the bi-variate predictive regression suffer from parameter instability over time due to the structural breaks in the macroeconomic data. This shows spurious evidence for macroeconomic indicators; however, combining information from both factors might alter the results and may or may not work for solving the parameter instability problem. Finally, we cannot find any consistent evidence with the theory positing that gradual information diffusion from a country might be able to predict the stock returns in the trading partner countries (Rizova 2010, Rapach et al., 2013). Although RP_J is found to be most successful predictor among foreign factors, they are not able capture the variation in the equity risk premium of their important trading partners.

Table 7: Individual Foreign Macroeconomic Indicators

	Statistically Significant Indicators							# of Statistically Significant Indicators based on the following criterion				
	RPJ	**DYJ**	**TBLJ**	**PEJ**	**RVOLJ**	**INFJ**	**PRDJ**	**Total**	qLL **>CV**	R^2 **(%)>0.5**	R^2_{EXP} **(%)>0.5**	R^2_{REC} **(%)>0.5**
BEL<USA	1	1	0	0	0	0	1	3	3	2	1	2
BEL<JPN	1	0	1	0	0	0	0	2	2	2	1	1
BEL<GER	1	0	1	0	0	0	1	3	3	3	1	3
GRC<USA	1	0	1	0	0	0	0	2	1	2	1	2
GRC<JPN	1	1	0	1	0	0	0	3	1	3	0	3
GRC<GER	1	1	0	0	0	1	0	3	0	3	3	2
MYS<USA	1	0	0	0	0	1	0	2	2	1	2	1
MYS<JPN	0	0	0	0	0	0	0	0	0	0	0	0
MYS<GER	0	1	0	1	0	0	0	2	2	2	0	2
MEX<USA	0	0	0	0	0	0	0	0	0	0	0	0
MEX<JPN	0	0	0	0	0	1	0	1	1	1	1	0
MEX<GER	1	0	0	1	0	0	0	2	2	2	1	2
POR<USA	1	1	0	0	0	1	0	3	1	2	3	1
POR<JPN	1	0	1	1	0	0	0	3	2	2	2	1
POR<GER	1	1	1	0	0	1	0	4	3	4	4	2
SPN<USA	1	1	0	0	0	0	1	3	3	2	2	2
SPN<JPN	0	0	1	0	0	0	0	1	1	1	1	0
SPN<GER	1	0	1	0	0	1	0	3	3	3	2	2
TWN<USA	1	0	0	0	0	0	1	2	2	2	1	2
TWN<JPN	0	0	0	0	0	0	0	0	0	0	0	0
TWN<GER	1	0	1	0	0	0	0	2	2	2	1	1
TUR<USA	1	0	0	0	0	0	1	2	2	2	1	1
TUR<JPN	0	0	0	0	1	0	0	1	0	1	1	1
TUR<GER	0	0	0	0	0	0	0	0	0	0	0	0
BRA<USA	0	0	0	0	0	1	1	2	2	2	1	2
BRA<JPN	0	0	0	0	0	1	0	1	0	1	0	1
BRA<GER	0	0	1	0	0	1	0	2	1	2	1	2
HKG<USA	0	0	0	0	0	0	1	1	1	1	0	1
HKG<JPN	0	0	0	0	0	0	0	0	0	0	0	0
HKG<GER	1	0	1	0	0	0	1	3	3	3	1	3
IND<USA	0	1	0	0	0	0	0	1	1	1	1	1
IND<JPN	0	0	0	0	0	0	0	0	0	0	0	0
IND<GER	0	0	1	1	1	1	1	5	3	5	2	5
RUS<USA	0	0	0	0	0	1	0	1	1	1	0	1
RUS<JPN	1	0	1	0	0	0	0	2	1	2	0	2
RUS<GER	0	0	0	0	0	1	0	1	1	1	1	1
ZAF<USA	1	0	0	0	0	0	1	2	2	2	0	2
ZAF<JPN	0	0	1	0	0	0	0	1	1	1	0	1
ZAF<GER	1	1	1	0	0	0	0	3	3	3	0	3

Note: 1 and 0 denote statistical significance and insignificance, respectively. CV stands for 10% critical values for qLL statistics.

Table 8: Summary Table for Foreign Macroeconomic Indicators

	Statistically Significant Indicators							# of Statistically Significant Indicators based on the following criterion				
	RP_J	**DY_J**	**TBL_J**	**PE_J**	**$RVOL_J$**	**INF_J**	**PRD_J**	**Total**	***qLL* >CV**	**R^2 (%)>0.5**	**R^2_{EXP} (%)>0.5**	**R^2_{REC} (%)>0.5**
Total	20	9	14	5	2	12	10	72	56	67	36	56
% of Total Cases	51%	23%	36%	13%	5%	31%	26%	26%	21%	25%	13%	21%
R^2 (%)>0.5	20	6	14	4	2	11	10					
R^2_{EXP} (%)>0.5	8	5	7	2	1	8	5					
R^2_{REC} (%)>0.5	18	6	9	5	2	6	10					

Note: CV stands for 10% critical values for qLL statistics.

Table 9: Overall Performance of Foreign Macroeconomic Indicators

	USA	**JPN**	**GER**
RP_J	8	4	8
DY_J	4	1	4
TBL_J	1	5	8
PE_J	0	2	3
$RVOL_J$	0	1	1
INF_J	4	2	6
PRD_J	7	0	3

Note: Subscript j stands for the country set consisting of USA, JPN, and GER.

Summary bi-variate predictive regression estimation results of first set of technical indicators with *s={1,2,3}* and *l={4,6}* and of second set with *s={1,2,3}* and *l={9,12}*are indicated in Table 10 and Table 11, respectively.

Table 10 reports that MA(1,6) is found to be statistically significant predictor for nine stock markets, representing approximately 69% of the total stock markets. MA(1,4), MOM(6), *VOL(1,6)*, *VOL(3,4)* have significant predictive power on approximately 60% of the total stock markets of Group 2 and 3. Almost half (48%) of the technical indicators with *l={4,6}* is found to be statistically and economically significant over all stock markets. All of the stock markets except BRA have at least one statistically and economically significant technical indicator predictor. Particularly, GRC and POR stock markets have the highest number (fourteen) of significant predictors, whereas the technical predictors of BRA, IND and RUS perform the worst among the others.

According to Table 11, *VOL(1,12)* is a statistically significant predictor of eight stock market equity premiums. Technical indicators of *MA(1,9)*, *VOL(1,9)*, and *VOL(2,12)*, taking the second place, are found to be significant predictors of 54% of the equity risk premiums of stock markets. All of the stock markets except TUR and ZAF have at least one statistically and economically significant technical indicator predictor. Particularly, BEL, GRC, and POR stock markets have the highest number (fourteen) of significant predictors, whereas the technical predictors of TUR and ZAF perform the worst among the others. Overall, 46% of the first set of technical indicators is found to be economically and statistically significant predictor for the equity risk premiums.

Bi-variate predictive regression results demonstrate that technical indicators have greater and more significant impact on the equity risk premiums than both domestic and foreign macroeconomic indicators. Put another way, technical indicators typically perform better than, most of the individual domestic or foreign macroeconomic indicators for predicting the future equity risk premium. *qLL* statistics also reveal the fact that models with individual technical indicators are mostly stable over time for all stock markets except GRC of which only two technical indicators are structurally stable among fourteen significant ones. We also evidence little structural instability for the predictors of BEL. Empirical findings indicate that shortening the long technical indicator rules results in minor differences in the total number of statistically and economically significant predictors for all cases. However, there are substantial changes in the total number of statistically and economically significant predictors for TWN, TUR, IND, and ZAF when we use different sets of technical indicators. It is also clear from findings that technical indicators perform much better in recession periods than in expansion periods.

Table 10: Technical Indicators, $s=\{1,2,3\}$; $l=\{4,6\}$

	Statistically Significant Indicators														# of Statistically Significant Indicators based on the following criterion				
	MA (1,4)	MA (1,6)	MA (2,4)	MA (2,6)	MA (3,4)	MA (3,6)	MOM (4)	MOM (6)	VOL (1,4)	VOL (1,6)	VOL (2,4)	VOL (2,6)	VOL (3,4)	VOL (3,6)	Total	qLL >CV	R^2 (%)>0.5	R^2_{EXP} (%)>0.5	R^2_{REC} (%)>0.5
BEL	1	1	1	1	1	1	1	1	1	1	0	1	0	1	12	8	12	11	10
GRC	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	0	14	10	14
MYS	1	1	1	0	0	0	0	0	1	1	1	1	1	0	8	8	8	1	8
MEX	0	1	0	0	1	1	0	0	0	0	0	0	1	0	4	4	4	0	4
POR	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	13	14	13	13
SPN	1	1	1	1	0	1	1	1	1	1	0	0	0	0	9	9	9	0	9
TWN	1	1	1	0	0	0	1	0	1	1	1	1	1	1	10	10	10	8	8
TUR	0	1	0	0	1	0	1	0	0	0	0	0	1	0	4	4	4	4	3
BRA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HKG	1	1	0	0	0	0	0	1	1	1	0	0	0	0	5	5	5	2	5
IND	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	0	1
RUS	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	0
ZAF	1	0	1	1	0	0	0	0	0	1	1	0	1	0	6	6	6	2	6
Total	8	9	7	5	5	5	6	7	7	8	5	5	7	4	88	69	88	52	81
% of Total	62%	69%	54%	38%	38%	38%	46%	54%	54%	62%	38%	38%	54%	31%	48%	38%	48%	29%	45%
R^2 (%)>0.5	8	9	7	5	5	5	6	7	7	8	5	5	7	4					
R^2_{EXP} (%)>0.5	6	5	5	2	4	2	4	3	3	4	4	4	4	2					
R^2_{REC} (%)>0.5	8	8	6	5	4	5	4	6	7	8	5	5	7	3					

Note: 1 and 0 denote statistical significance and insignificance, respectively. CV stands for 10% critical values for qLL statistics.

Table 11: Technical Indicators, *s={1,2,3}* ; *l={9,12}*

	Statistically Significant Indicators														# of Statistically Significant Indicators based on the following criterion				
	MA (1,9)	MA (1,12)	MA (2,9)	MA (2,12)	MA (3,9)	MA (3,12)	MOM (9)	MOM (12)	VOL (1,9)	VOL (1,12)	VOL (2,9)	VOL (2,12)	VOL (3,9)	VOL (3,12)	Total	*qLL* >CV	R^2 (%)>0.5	R^2_{EXP} (%)>0.5	R^2_{REC} (%)>0.5
BEL	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	11	14	14	14
GRC	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	2	14	3	14
MYS	1	1	0	0	0	0	0	0	1	1	1	1	0	0	6	6	6	0	6
MEX	0	1	0	0	0	0	0	0	0	0	0	1	0	0	2	1	2	1	2
POR	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	14	14	9	14
SPN	1	1	1	1	0	1	1	0	1	1	1	1	1	1	12	12	12	10	11
TWN	1	0	0	0	0	0	0	0	1	1	0	0	0	0	3	3	3	3	2
TUR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BRA	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	0	1
HKG	1	0	0	1	1	1	1	0	1	1	0	0	1	0	8	8	8	1	8
IND	0	0	0	1	1	1	1	1	0	1	1	1	0	1	9	9	9	1	9
RUS	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
ZAF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	7	6	4	6	5	6	6	5	7	8	6	7	5	6	84	68	84	43	82
% of Total	54%	46%	31%	46%	38%	46%	46%	38%	54%	62%	46%	54%	38%	46%	46%	37%	46%	24%	45%
R^2 **(%)>0.5**	7	6	4	6	5	6	6	5	7	8	6	7	5	6					
R^2_{EXP} **(%)>0.5**	4	3	2	3	2	2	4	2	6	5	3	2	2	3					
R^2_{REC} **(%)>0.5**	6	6	4	6	5	6	5	5	7	8	6	7	5	6					

Note: 1 and 0 denote statistical significance and insignificance, respectively. CV stands for 10% critical values for *qLL* statistics.

In the second step of in-sample analysis, following Ludvigson and Ng (2007, 2009) Neely et al. (2014) we estimate predictive regressions based on principal components. The numbers of principal components (*K*) are selected by the adjusted R^2. Tables from Table 12 to Table 13 report the estimation results given by the Equation (34) with $K=3$. The results show that principal components estimated from the set of macroeconomic indicators including GER's indicators are found to be the best performers among all. In conjunction with this, when we incorporate GER's indicators into x_t vector, the coefficient estimate on at least one principal component is found to be significant at conventional levels for all stock market equity premiums except of RUS. 56% of principal components formed with this set are found to be statistically and economically significant for all stock market equity premiums. Surprisingly, the performances of the principal components estimated using the x_t vectors containing USA macroeconomic indicators are poor contrary to expectations since the USA economy (as well as the USA stock market) is the biggest among the markets in Group 1. Particularly, the estimates of all principal components with each set of foreign macroeconomic indicators are statistically and economically significant for predicting the IND's stock market equity risk premium. Furthermore, 83%, 63%, and 50% of the estimated principal components are found to be both statistically and economically significant predictors for the equity risk premium of GRC, TUR, and POR, respectively. The bad performer macroeconomic principal component predictors belong to MYS, SPN, TWN of Group 2, and BRA of Group 3 of which the principal components are found to be rarely significant.

Overall, it is clear from the empirical findings that there are considerable differences among the predictive powers of macroeconomic principal components on the equity risk premiums of the stock markets in Group 2 and 3 and approximately 44% of all estimated principal components for stock markets are found to be statistically and economically significant. The empirical results reveal the fact that total number of significant principal components is higher during recessions vis-á-vis expansions. We also evidence significant structural parameter instability in some of the F-ECON models, especially for the stock markets, namely GRC, MEX, TWN, and BRA of which the statistically significant principal components are all structurally instable over time.

Table 12: Principal Component Predictive Regressions, F-ECON

	Component	**Slope**	***p*-value**	R^2 **(%)**	R^2_{EXP} **(%)**	R^2_{REC} **(%)**	***qLL***
BEL<USA	F1-ECON	0.13	0.28	1.79	0.70	2.43	**-19.46**
BEL<USA	F2-ECON	0.37	**0.04**				
BEL<JPN	F1-ECON	0.20	**0.08**	1.64	0.17	2.44	-22.46
BEL<JPN	F2-ECON	0.22	0.16				
BEL<JPN	F3-ECON	0.29	0.14				
BEL<GER	F1-ECON	0.40	**0.02**	2.39	2.13	2.62	**-21.20**
BEL<GER	F2-ECON	0.19	0.18				
GRC<USA	F1-ECON	0.04	0.43	1.03	-1.41	3.20	**-29.94**
GRC<USA	F2-ECON	0.68	**0.07**				
GRC<JPN	F1-ECON	0.60	**0.07**	2.40	-2.91	7.56	**-24.39**
GRC<JPN	F2-ECON	0.87	**0.02**				
GRC<GER	F1-ECON	0.54	**0.06**	1.69	0.82	2.48	**-31.81**
GRC<GER	F2-ECON	0.73	**0.06**				
MYS<USA	F1-ECON	0.17	0.20	0.21	-0.36	1.49	**-16.57**
MYS<JPN	F1-ECON	0.15	0.24	0.18	0.80	-0.24	**-16.78**
MYS<GER	F1-ECON	0.30	**0.05**	1.07	0.33	2.24	-17.29
MYS<GER	F2-ECON	0.35	0.19				
MEX<USA	F1-ECON	0.21	0.20	0.97	3.02	-1.08	-20.39
MEX<USA	F2-ECON	0.27	0.22				
MEX<USA	F3-ECON	0.41	0.16				
MEX<JPN	F1-ECON	0.23	0.15	1.57	3.92	-0.13	**-20.17**
MEX<JPN	F2-ECON	0.62	**0.04**				
MEX<GER	F1-ECON	0.09	0.38	1.96	3.65	0.30	**-18.30**
MEX<GER	F2-ECON	0.73	**0.02**				
POR<USA	F1-ECON	0.04	0.45	2.31	3.45	0.75	-19.41
POR<USA	F2-ECON	0.09	0.35				
POR<USA	F3-ECON	0.62	**0.01**				
POR<JPN	F1-ECON	0.12	0.22	1.66	2.63	0.44	-16.28
POR<JPN	F2-ECON	0.49	**0.02**				
POR<GER	F1-ECON	0.19	0.16	2.88	4.42	0.77	-19.20
POR<GER	F2-ECON	0.47	**0.02**				
POR<GER	F3-ECON	0.37	**0.10**				
SPN<USA	F1-ECON	0.14	0.24	0.17	1.12	-0.75	**-18.42**
SPN<JPN	F1-ECON	0.10	0.31	0.09	0.73	0.31	**-18.04**
SPN<GER	F1-ECON	0.25	0.13	1.14	1.38	1.29	-16.60
SPN<GER	F2-ECON	0.31	**0.10**				
TWN<USA	F1-ECON	0.39	0.14	0.69	1.37	-0.46	**-14.78**
TWN<JPN	F1-ECON	0.31	0.17	0.57	1.44	-0.73	**-13.50**
TWN<GER	F1-ECON	0.48	**0.07**	1.02	1.46	0.73	**-13.64**
TUR<USA	F1-ECON	0.59	**0.09**	2.38	1.24	4.34	-14.09
TUR<USA	F2-ECON	1.32	**0.01**				
TUR<JPN	F1-ECON	0.00	0.48	4.39	4.42	4.35	-17.83
TUR<JPN	F2-ECON	1.70	**0.01**				
TUR<JPN	F3-ECON	1.65	**0.01**				
TUR<GER	F1-ECON	0.16	0.32	2.93	2.73	3.25	-14.75
TUR<GER	F2-ECON	1.53	**0.01**				
TUR<GER	F3-ECON	0.87	0.16				

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

Table 13: Principal Component Predictive Regressions, F-ECON

	Component	**Slope**	***p*-value**	R^2 **(%)**	R^2_{EXP} **(%)**	R^2_{REC} **(%)**	***qLL***
BRA<USA	F1-ECON	0.12	0.31	0.09	-0.57	0.55	**-16.84**
BRA<JPN	F1-ECON	0.22	0.23	0.35	-1.20	1.65	**-19.19**
BRA<GER	F1-ECON	0.19	0.23	1.17	-2.50	3.50	**-19.23**
BRA<GER	F2-ECON	0.44	**0.07**				
HKG<USA	F1-ECON	0.07	0.37	1.90	-0.90	4.34	-19.50
HKG<USA	F2-ECON	0.20	0.31				
HKG<USA	F3-ECON	0.70	0.14				
HKG<JPN	F1-ECON	0.01	0.45	1.57	-1.44	4.20	-17.55
HKG<JPN	F2-ECON	0.03	0.48				
HKG<JPN	F3-ECON	0.66	**0.07**				
HKG<GER	F1-ECON	0.23	0.17	2.77	1.02	4.29	-17.01
HKG<GER	F2-ECON	0.22	0.29				
HKG<GER	F3-ECON	0.82	**0.05**				
IND<USA	F1-ECON	0.86	**0.01**	6.62	3.14	9.77	-18.85
IND<USA	F2-ECON	0.72	**0.04**				
IND<USA	F3-ECON	0.61	**0.07**				
IND<JPN	F1-ECON	0.98	**0.01**	7.31	1.29	13.39	**-18.52**
IND<JPN	F2-ECON	0.94	**0.01**				
IND<GER	F1-ECON	1.27	**0.00**	8.06	3.50	12.27	**-20.98**
RUS<USA	F1-ECON	0.16	0.38	0.89	-0.12	3.24	-12.75
RUS<USA	F2-ECON	0.64	**0.08**				
RUS<JPN	F1-ECON	0.47	0.19	2.94	-1.46	12.32	-15.86
RUS<JPN	F2-ECON	0.45	0.20				
RUS<JPN	F3-ECON	1.27	**0.02**				
RUS<GER	F1-ECON	0.04	0.45	0.01	-0.59	4.29	**-19.82**
ZAF<USA	F1-ECON	0.11	0.31	2.37	-4.36	8.23	-14.23
ZAF<USA	F2-ECON	0.15	0.26				
ZAF<USA	F3-ECON	0.60	**0.07**				
ZAF<JPN	F1-ECON	0.01	0.47	1.23	-2.93	4.85	-14.11
ZAF<JPN	F2-ECON	0.04	0.45				
ZAF<JPN	F3-ECON	0.43	0.14				
ZAF<GER	F1-ECON	0.05	0.46	3.41	-5.35	11.05	-15.46
ZAF<GER	F2-ECON	0.33	**0.10**				
ZAF<GER	F3-ECON	0.64	**0.05**				

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

The estimation results of principal components given by the Equation (35) are reported in Table 14. According to the Panel A of Table 14, at least one of the principal components extracted from the technical indicators set with *s={1,2,3}* and *{l=4,6}* are statistically significant for all stock markets except MEX, IND, and RUS of which none are also economically significant at conventional levels. Panel B of Table 14 report the estimation results of principal components extracted from the technical indicators set with *s={1,2,3}* and *{l=9,12}*. None of the estimated principal components are statistically significant for TUR, BRA, and ZAF. Overall, there are significant changes in the predictive power of the technical indicators sets on the equity risk premiums.

Changing the long technical indicator rules improves the predictive ability of the principal components on some of the equity risk premium of Group 2 and 3 indicating the existence of different market structures, investor behaviors on risk perceptions. In other words, various lengths of short and long technical indicator rules are good at capturing different market movements, behavior patterns, investment information flows etc. Accordingly, the estimation results suggest that the variation in the equity risk premiums of GRC, MYS, POR, TWN, TUR, BRA, HKG, and ZAF are better explained by the technical indicators set with *s={1,2,3}* and *{l=4,6}* than the other set. On the other hand, the variations in the equity risk premiums of the remaining stock markets in Group 2 and 3 are better explained by the technical indicators set with *s={1,2,3}* and *{l=9,12}*.

The explanatory power of the F-TECH models are mostly found to be higher in recession periods vis-à-vis expansion periods. The calculated *qLL* statistics suggest that there is no structural instability in those models.

Table 14: Predictive Regression Estimation Results, F-TECH

	Component	Slope	*p*-value	R^2 (%)	R^2_{EXP} (%)	R^2_{REC} (%)	*qLL*
A. s={1,2,3} ; {l=4,6}							
BEL	F1-TECH	0.28	**0.00**	2.89	4.38	2.07	-10.04
GRC	F1-TECH	0.72	**0.00**	7.87	2.49	6.77	-14.70
GRC	F2-TECH	1.67	**0.00**				
MYS	F1-TECH	0.28	**0.03**	2.78	-1.39	4.89	-5.24
MYS	F2-TECH	0.72	**0.03**				
MEX	F1-TECH	0.20	0.15	0.58	-0.18	1.34	-7.32
POR	F1-TECH	0.46	**0.00**	7.44	5.91	7.72	-5.86
POR	F2-TECH	0.30	**0.09**				
POR	F3-TECH	0.38	0.14				
SPN	F1-TECH	0.23	**0.04**	1.25	0.07	2.82	-7.14
TWN	F1-TECH	0.43	**0.02**	3.46	2.48	0.78	-4.93
TWN	F2-TECH	1.00	**0.01**				
TUR	F1-TECH	0.38	**0.10**	0.57	0.89	0.04	-7.38
BRA	F1-TECH	0.06	0.39	1.78	-0.41	0.37	-6.48
BRA	F2-TECH	0.82	**0.03**				
HKG	F1-TECH	0.20	0.14	2.96	-0.79	2.15	-10.06
HKG	F2-TECH	0.54	0.15				
HKG	F3-TECH	0.90	**0.09**				
IND	F1-TECH	0.15	0.22	0.34	-0.18	0.81	-7.47
RUS	F1-TECH	0.05	0.43	0.02	-0.07	0.19	-7.87
ZAF	F1-TECH	0.22	**0.08**	1.60	-1.23	4.07	-6.32
B. s={1,2,3} ; l={9, 12}							
BEL	F1-TECH	0.30	**0.00**	3.80	4.44	3.45	-9.69
GRC	F1-TECH	0.58	**0.00**	3.42	0.07	6.38	-12.20
MYS	F1-TECH	0.22	**0.10**	0.95	-2.48	5.11	-5.59
MEX	F1-TECH	0.06	0.36	2.80	0.21	-0.10	-9.76
MEX	F2-TECH	1.06	**0.02**				
POR	F1-TECH	0.36	**0.00**	4.31	1.32	8.40	-7.02
SPN	F1-TECH	0.26	**0.01**	4.01	1.62	2.47	-6.82
SPN	F2-TECH	0.88	**0.01**				
TWN	F1-TECH	0.19	0.18	1.27	0.64	-0.03	-4.86
TWN	F2-TECH	0.75	**0.05**				
TUR	F1-TECH	0.06	0.44	0.02	-0.04	0.12	-7.35
BRA	F1-TECH	0.07	0.37	0.08	-0.17	0.24	-7.62
HKG	F1-TECH	0.25	**0.09**	1.46	-1.75	4.25	-6.28
IND	F1-TECH	0.30	**0.08**	1.61	0.15	2.93	-6.27
RUS	F1-TECH	0.00	0.52	2.28	0.00	0.00	-8.90
RUS	F2-TECH	0.75	**0.05**				
RUS	F3-TECH	1.30	**0.10**				
ZAF	F1-TECH	0.10	0.28	0.33	-1.13	1.59	-8.56

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

Finally, we incorporate information from all indicators including domestic and foreign macroeconomic indicators, OIL, and technical indicators. The Tables from Table 15 through Table 19 report the estimation results given by Equation (36). Total numbers of statistically significant predictors to total number of extracted principal components are found to be approximately 56%. We also observe that the gap between the number of economically significant predictors during the recession and expansion times is around 12%. This number is estimated higher in recession times than in expansion times.

Furthermore, using different sets of technical indicators within the entire set of all indicators in order to extract principal components predictors creates differences among the performances of predictors of the equity risk premiums. Thus, interpretation of the estimation results reported in the tables is carried out in two parts based on the different sets of technical indicators. Accordingly, we first examine the estimation results using the data vector of fourteen macroeconomic and fourteen technical indicators with $s=\{1,2,3\}$ and $l=4,6$. 57% of the all principal components are found to be statistically and economically significant predictors of the equity risk premiums of the markets in Group 2 and 3. While the principal component predictors of BEL, and POR perform very well (100% performance), all of the predictors of RUS have the worst performance among all and they are all found to be statistically insignificant. The ratio of significant predictors to total number of extracted principal components are ranging between 70% and 88% for the equity risk premiums of TWN, IND, ZAF, GRC, and SPN. The principal component predictors derived from the entire indicators with GER macroeconomic indicators perform the best among all.

Secondly, we interpret the estimation results using the data vector of fourteen macroeconomic and fourteen technical indicators with $s=\{1,2,3\}$, and $l=\{9,12\}$. The empirical findings demonstrate that at least one, put another way, 54% of the all principal components are found to be statistically and economically significant predictors of the stock market equity risk premiums of Group 2 and 3 for certain cases of different foreign macroeconomic indicators. Particularly, over 89% of the principal components belong to POR, HKG, and IND cases are found to be both statistically and economically significant predictors. Principal components extracted from the entire dataset containing foreign macroeconomic indicators of the USA and JPN are statistically insignificant predictors for the equity risk premiums of some of the markets in Group 3, namely BRA, and ZAF. In addition to that, principal components extracted from the *2N* data vector including the USA macroeconomic indicators are insignificant for TWN. The principal component predictors derived from the entire indicators with GER macroeconomic indicators perform the best among all.

Overall, the variation in the equity risk premiums of all markets in Group 2 and 3 can be significantly explained with a combination of entire sets of indicators. For instance, the principal component predictors of RUS equity risk premium are statistically insignificant at conventional levels when we use the entire set containing domestic macroeconomic indicators, OIL, any sets of foreign macroeconomic indicators, and technical indicators with $s=\{1,2,3\}$ and $l=\{4,6\}$. However, at least one of the predictors are estimated significant when we replace previously used technical indicators set in the entire set of indicators with the technical indicators set $s=\{1,2,3\}$ and $l=\{9,12\}$. Moreover, analyzed sets of indicators are also found as economically significant. Coefficients of determination (R^2) are found to be higher in the *F-ALL* predictive regression models for the GRC, MYS, POR, MEX, TUR, TWN, BRA, and ZAF when we apply the data vector containing technical indicators with $s=\{1,2,3\}$ and $l=\{4,6\}$. The variations in the remaining stock market equity premiums are better explained by the other data vector formed by replacing the previous technical indicators set with the set $s=\{1,2,3\}$ and $l=\{9,12\}$. The suggested models also produce both statistically and economically significant principal component predictors for the equity risk premiums of all stock markets. According to *qLL* statistics, proposed models with statistically significant principal components of predictors (with either $l=\{4,6\}$ or $l=\{9,12\}$) are found to be stable over time for all stock markets except GRC of which all of the models suffer from structural instability over time.

Factor loadings for the extracted principal components of F-ALL models are depicted in the figures from APPENDIX 24 to APPENDIX 49. Factor loadings represent the weights and correlations between each indicator and the principal component. The size of the blue, red, green, and purple colored areas in each column represents the magnitude and the sign of factor loadings of, respectively, first, second, third, and fourth principal components on each indicator. If the size of the factor loading is high, then we can say that it is more relevant in defining the dimension of that principal component. It is clear from the figures that foreign macroeconomic indicators contribute to the models as well as domestic macroeconomic indicators. Furthermore, individual technical indicators have positive and higher loadings than that of macroeconomic indicators for most of the cases.

Table 15: Principal Component Predictive Regression, F-ALL

TECH	*i<j*	Component	Slope	*p*-value	R^2 (%)	R^2_{EXP} (%)	R^2_{REC} (%)	*qLL*
l={4, 6}	BEL<USA	F1-ALL	0.29	**0.00**	3.36	5.18	2.72	**-17.09**
l={9, 12}	BEL<USA	F1-ALL	0.29	**0.00**	4.50	6.74	3.30	-17.22
l={9, 12}	BEL<USA	F2-ALL	0.21	0.14				
l={4, 6}	BEL<JPN	F1-ALL	0.28	**0.01**	3.11	5.00	2.58	**-18.90**
l={9, 12}	BEL<JPN	F1-ALL	0.29	**0.00**	3.88	7.12	3.14	**-18.19**
l={4, 6}	BEL<GER	F1-ALL	0.28	**0.00**	4.24	6.64	3.28	-18.04
l={4, 6}	BEL<GER	F2-ALL	0.31	**0.03**				
l={9, 12}	BEL<GER	F1-ALL	0.28	**0.00**	5.54	8.25	4.12	-17.81
l={9, 12}	BEL<GER	F2-ALL	0.33	**0.02**				
l={9, 12}	BEL<GER	F3-ALL	0.24	0.18				
l={4, 6}	GRC<USA	F1-ALL	0.72	**0.00**	5.00	5.33	6.11	**-32.83**
l={9, 12}	GRC<USA	F1-ALL	0.56	**0.00**	3.50	-0.13	7.18	**-28.41**
l={4, 6}	GRC<JPN	F1-ALL	0.71	**0.00**	6.11	2.45	9.33	**-27.03**
l={4, 6}	GRC<JPN	F2-ALL	0.37	0.19				
l={4, 6}	GRC<JPN	F3-ALL	0.64	**0.09**				
l={9, 12}	GRC<JPN	F1-ALL	0.57	**0.00**	4.03	-1.01	8.58	**-25.37**
l={9, 12}	GRC<JPN	F2-ALL	0.39	0.16				
l={4, 6}	GRC<GER	F1-ALL	0.71	**0.00**	4.98	2.92	7.08	**-33.92**
l={9, 12}	GRC<GER	F1-ALL	0.57	**0.00**	3.54	0.35	6.44	**-31.74**
l={4, 6}	MYS<USA	F1-ALL	0.27	**0.03**	1.88	0.13	5.45	-16.13
l={4, 6}	MYS<USA	F2-ALL	0.26	**0.06**				
l={9, 12}	MYS<USA	F1-ALL	0.19	**0.09**	1.55	-1.81	6.63	**-18.51**
l={9, 12}	MYS<USA	F2-ALL	0.34	**0.05**				
l={4, 6}	MYS<JPN	F1-ALL	0.26	**0.05**	2.13	1.42	3.15	-18.10
l={4, 6}	MYS<JPN	F2-ALL	0.17	0.16				
l={4, 6}	MYS<JPN	F3-ALL	0.40	0.14				
l={9, 12}	MYS<JPN	F1-ALL	0.19	0.13	1.88	-0.84	5.22	-18.12
l={9, 12}	MYS<JPN	F2-ALL	0.21	0.11				
l={9, 12}	MYS<JPN	F3-ALL	0.45	**0.10**				
l={4, 6}	MYS<GER	F1-ALL	0.27	**0.02**	3.28	1.05	5.99	-16.85
l={4, 6}	MYS<GER	F2-ALL	0.32	**0.04**				
l={4, 6}	MYS<GER	F3-ALL	0.38	0.15				
l={4, 6}	MYS<GER	F4-ALL	0.46	0.13				
l={9, 12}	MYS<GER	F1-ALL	0.20	**0.08**	2.82	-1.18	7.66	-19.00
l={9, 12}	MYS<GER	F2-ALL	0.38	**0.01**				
l={9, 12}	MYS<GER	F3-ALL	0.40	0.15				
l={9, 12}	MYS<GER	F4-ALL	0.37	0.17				

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

Table 16: Principal Component Predictive Regression, F-ALL

TECH	***i<j***	**Component**	**Slope**	***p*-value**	**R^2 (%)**	**R^2_{EXP} (%)**	**R^2_{REC} (%)**	***qLL***
l={4, 6}	MEX<USA	F1-ALL	0.19	0.15	2.33	3.54	1.12	-16.62
l={4, 6}	MEX<USA	F2-ALL	0.19	0.24				
l={4, 6}	MEX<USA	F3-ALL	0.17	0.31				
l={4, 6}	MEX<USA	F4-ALL	0.72	**0.04**				
l={9, 12}	MEX<USA	F1-ALL	0.05	0.38	1.87	4.20	0.17	**-26.06**
l={9, 12}	MEX<USA	F2-ALL	0.09	0.41				
l={9, 12}	MEX<USA	F3-ALL	0.74	**0.02**				
l={4, 6}	MEX<JPN	F1-ALL	0.18	0.15	3.06	4.47	1.70	-18.04
l={4, 6}	MEX<JPN	F2-ALL	0.20	0.20				
l={4, 6}	MEX<JPN	F3-ALL	0.87	**0.00**				
l={9, 12}	MEX<JPN	F1-ALL	0.05	0.35	3.09	4.18	2.02	**-30.64**
l={9, 12}	MEX<JPN	F2-ALL	0.12	0.29				
l={9, 12}	MEX<JPN	F3-ALL	0.94	**0.00**				
l={4, 6}	MEX<GER	F1-ALL	0.18	0.15	4.30	4.22	4.40	-15.90
l={4, 6}	MEX<GER	F2-ALL	0.09	0.34				
l={4, 6}	MEX<GER	F3-ALL	1.07	**0.00**				
l={9, 12}	MEX<GER	F1-ALL	0.03	0.38	3.63	4.41	2.87	**-24.59**
l={9, 12}	MEX<GER	F2-ALL	0.23	0.17				
l={9, 12}	MEX<GER	F3-ALL	1.01	**0.01**				
l={4, 6}	POR<USA	F1-ALL	0.46	**0.00**	7.51	7.67	7.62	-12.86
l={4, 6}	POR<USA	F2-ALL	0.26	**0.08**				
l={9, 12}	POR<USA	F1-ALL	0.35	**0.00**	5.01	3.25	8.19	**-19.39**
l={9, 12}	POR<USA	F2-ALL	0.28	**0.07**				
l={4, 6}	POR<JPN	F1-ALL	0.45	**0.00**	7.29	7.03	7.74	-14.08
l={4, 6}	POR<JPN	F2-ALL	0.23	**0.09**				
l={9, 12}	POR<JPN	F1-ALL	0.35	**0.00**	4.91	2.82	7.84	**-19.32**
l={9, 12}	POR<JPN	F2-ALL	0.24	**0.08**				
l={4, 6}	POR<GER	F1-ALL	0.45	**0.00**	8.09	8.54	7.75	-18.01
l={4, 6}	POR<GER	F2-ALL	0.36	**0.01**				
l={9, 12}	POR<GER	F1-ALL	0.35	**0.00**	5.67	4.13	8.16	**-20.74**
l={9, 12}	POR<GER	F2-ALL	0.38	**0.01**				

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

Table 17: Principal Component Predictive Regression, F-ALL

TECH	***i<j***	**Component**	**Slope**	***p*-value**	**R^2 (%)**	**R^2_{EXP} (%)**	**R^2_{REC} (%)**	***qLL***
l={4, 6}	SPN<USA	F1-ALL	0.22	**0.03**	1.30	0.07	4.46	**-17.35**
l={9, 12}	SPN<USA	F1-ALL	0.24	**0.01**	3.49	0.25	7.78	-20.66
l={9, 12}	SPN<USA	F2-ALL	0.19	0.13				
l={9, 12}	SPN<USA	F3-ALL	0.36	**0.09**				
l={9, 12}	SPN<USA	F4-ALL	0.38	0.13				
l={4, 6}	SPN<JPN	F1-ALL	0.22	**0.04**	1.23	0.06	3.53	**-17.50**
l={9, 12}	SPN<JPN	F1-ALL	0.24	**0.01**	3.13	1.12	5.79	-17.86
l={9, 12}	SPN<JPN	F2-ALL	0.20	0.14				
l={9, 12}	SPN<JPN	F3-ALL	0.31	**0.10**				
l={9, 12}	SPN<JPN	F4-ALL	0.28	0.20				
l={4, 6}	SPN<GER	F1-ALL	0.22	**0.03**	2.35	0.56	5.39	-17.64
l={4, 6}	SPN<GER	F2-ALL	0.30	**0.08**				
l={4, 6}	SPN<GER	F3-ALL	0.27	0.18				
l={9, 12}	SPN<GER	F1-ALL	0.24	**0.01**	3.60	1.78	6.56	-18.93
l={9, 12}	SPN<GER	F2-ALL	0.34	**0.05**				
l={9, 12}	SPN<GER	F3-ALL	0.40	**0.06**				
l={4, 6}	TWN<USA	F1-ALL	0.41	**0.02**	4.51	3.08	6.93	-16.20
l={4, 6}	TWN<USA	F2-ALL	0.49	0.13				
l={4, 6}	TWN<USA	F3-ALL	0.33	0.23				
l={4, 6}	TWN<USA	F4-ALL	0.95	**0.01**				
l={9, 12}	TWN<USA	F1-ALL	0.16	0.17	1.19	2.34	0.32	-15.50
l={9, 12}	TWN<USA	F2-ALL	0.45	0.16				
l={4, 6}	TWN<JPN	F1-ALL	0.39	**0.02**	4.07	4.49	3.36	-16.65
l={4, 6}	TWN<JPN	F2-ALL	0.40	0.14				
l={4, 6}	TWN<JPN	F3-ALL	0.94	**0.01**				
l={9, 12}	TWN<JPN	F1-ALL	0.15	0.21	1.87	3.63	-0.36	-17.17
l={9, 12}	TWN<JPN	F2-ALL	0.36	0.18				
l={9, 12}	TWN<JPN	F3-ALL	0.69	**0.07**				
l={4, 6}	TWN<GER	F1-ALL	0.41	**0.02**	4.46	3.75	5.82	-20.05
l={4, 6}	TWN<GER	F2-ALL	0.51	**0.07**				
l={4, 6}	TWN<GER	F3-ALL	0.91	**0.02**				
l={9, 12}	TWN<GER	F1-ALL	0.16	0.17	2.76	3.03	2.32	-20.17
l={9, 12}	TWN<GER	F2-ALL	0.50	**0.09**				
l={9, 12}	TWN<GER	F3-ALL	0.84	**0.02**				
l={4, 6}	TUR<USA	F1-ALL	0.43	**0.06**	2.94	2.77	3.22	-15.12
l={4, 6}	TUR<USA	F2-ALL	0.44	0.19				
l={4, 6}	TUR<USA	F3-ALL	1.17	**0.02**				
l={4, 6}	TUR<USA	F4-ALL	0.76	0.11				
l={9, 12}	TUR<USA	F1-ALL	0.11	0.38	2.16	1.82	3.53	-17.50
l={9, 12}	TUR<USA	F2-ALL	0.42	0.21				
l={9, 12}	TUR<USA	F3-ALL	1.29	**0.02**				
l={4, 6}	TUR<JPN	F1-ALL	0.42	**0.08**	3.46	2.80	5.32	-15.68
l={4, 6}	TUR<JPN	F2-ALL	0.04	0.44				
l={4, 6}	TUR<JPN	F3-ALL	1.75	**0.00**				
l={9, 12}	TUR<JPN	F1-ALL	0.10	0.39	2.52	2.56	3.28	-17.47
l={9, 12}	TUR<JPN	F2-ALL	0.03	0.46				
l={9, 12}	TUR<JPN	F3-ALL	1.63	**0.01**				
l={4, 6}	TUR<GER	F1-ALL	0.38	**0.09**	3.04	2.39	4.31	-19.36
l={4, 6}	TUR<GER	F2-ALL	0.16	0.40				
l={4, 6}	TUR<GER	F3-ALL	1.54	**0.01**				
l={9, 12}	TUR<GER	F1-ALL	0.07	0.45	2.30	2.24	2.61	-22.47
l={9, 12}	TUR<GER	F2-ALL	0.20	0.38				
l={9, 12}	TUR<GER	F3-ALL	1.46	**0.01**				

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

Table 18: Principal Component Predictive Regression, F-ALL

TECH	$i<j$	Component	Slope	p-value	R^2 (%)	R^2_{EXP} (%)	R^2_{REC} (%)	qLL
l={4, 6}	BRA<USA	F1-ALL	0.05	0.41	2.51	2.23	2.69	-18.48
l={4, 6}	BRA<USA	F2-ALL	0.17	0.26				
l={4, 6}	BRA<USA	F3-ALL	0.18	0.29				
l={4, 6}	BRA<USA	F4-ALL	0.83	**0.03**				
l={9, 12}	BRA<USA	F1-ALL	0.07	0.36	0.10	-1.04	1.78	**-21.08**
l={4, 6}	BRA<JPN	F1-ALL	0.06	0.39	2.21	-1.36	4.45	-23.12
l={4, 6}	BRA<JPN	F2-ALL	0.21	0.23				
l={4, 6}	BRA<JPN	F3-ALL	0.31	0.20				
l={4, 6}	BRA<JPN	F4-ALL	0.69	**0.05**				
l={9, 12}	BRA<JPN	F1-ALL	0.07	0.38	0.09	-0.62	2.35	**-20.11**
l={4, 6}	BRA<GER	F1-ALL	0.04	0.46	5.26	2.04	7.28	-21.92
l={4, 6}	BRA<GER	F2-ALL	0.17	0.28				
l={4, 6}	BRA<GER	F3-ALL	0.60	**0.04**				
l={4, 6}	BRA<GER	F4-ALL	1.05	**0.00**				
l={9, 12}	BRA<GER	F1-ALL	0.09	0.35	2.44	-4.25	6.64	-23.16
l={9, 12}	BRA<GER	F2-ALL	0.16	0.28				
l={9, 12}	BRA<GER	F3-ALL	0.41	0.13				
l={9, 12}	BRA<GER	F4-ALL	0.69	**0.10**				
l={4, 6}	HKG<USA	F1-ALL	0.19	0.11	1.48	0.51	4.27	**-23.14**
l={4, 6}	HKG<USA	F2-ALL	0.32	0.15				
l={9, 12}	HKG<USA	F1-ALL	0.21	**0.09**	3.75	0.32	7.05	-17.35
l={9, 12}	HKG<USA	F2-ALL	0.39	**0.10**				
l={9, 12}	HKG<USA	F3-ALL	0.58	**0.07**				
l={4, 6}	HKG<JPN	F1-ALL	0.18	0.11	2.72	-1.31	6.24	-22.28
l={4, 6}	HKG<JPN	F2-ALL	0.17	0.27				
l={4, 6}	HKG<JPN	F3-ALL	0.39	0.18				
l={4, 6}	HKG<JPN	F4-ALL	0.58	**0.10**				
l={9, 12}	HKG<JPN	F1-ALL	0.22	**0.08**	3.46	-1.43	7.86	-16.60
l={9, 12}	HKG<JPN	F2-ALL	0.19	0.25				
l={9, 12}	HKG<JPN	F3-ALL	0.71	**0.04**				
l={4, 6}	HKG<GER	F1-ALL	0.18	0.11	2.18	2.19	3.61	**-23.00**
l={4, 6}	HKG<GER	F2-ALL	0.45	**0.07**				
l={9, 12}	HKG<GER	F1-ALL	0.20	**0.08**	5.00	1.45	8.09	-19.03
l={9, 12}	HKG<GER	F2-ALL	0.53	**0.04**				
l={9, 12}	HKG<GER	F3-ALL	0.68	**0.04**				

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

Table 19: Principal Component Predictive Regression, F-ALL

TECH	***i<j***	**Component**	**Slope**	***p*-value**	**R^2 (%)**	**R^2_{EXP} (%)**	**R^2_{REC} (%)**	***qLL***
l={4, 6}	IND<USA	F1-ALL	0.11	0.29	7.76	4.43	10.77	-22.64
l={4, 6}	IND<USA	F2-ALL	0.99	**0.01**				
l={4, 6}	IND<USA	F3-ALL	0.57	**0.08**				
l={4, 6}	IND<USA	F4-ALL	0.77	**0.03**				
l={9, 12}	IND<USA	F1-ALL	0.24	**0.10**	11.74	6.93	16.08	-21.93
l={9, 12}	IND<USA	F2-ALL	1.25	**0.00**				
l={9, 12}	IND<USA	F3-ALL	0.13	0.37				
l={9, 12}	IND<USA	F4-ALL	1.14	**0.00**				
l={4, 6}	IND<JPN	F1-ALL	0.12	0.25	8.42	1.57	14.61	-21.75
l={4, 6}	IND<JPN	F2-ALL	1.00	**0.01**				
l={4, 6}	IND<JPN	F3-ALL	1.05	**0.00**				
l={9, 12}	IND<JPN	F1-ALL	0.26	**0.08**	10.32	2.79	17.59	-21.76
l={9, 12}	IND<JPN	F2-ALL	0.80	**0.01**				
l={9, 12}	IND<JPN	F3-ALL	1.31	**0.00**				
l={4, 6}	IND<GER	F1-ALL	0.10	0.28	9.74	4.35	14.80	-20.63
l={4, 6}	IND<GER	F2-ALL	1.35	**0.00**				
l={4, 6}	IND<GER	F3-ALL	0.50	**0.10**				
l={9, 12}	IND<GER	F1-ALL	0.24	**0.10**	12.48	5.19	19.08	-20.50
l={9, 12}	IND<GER	F2-ALL	1.41	**0.00**				
l={9, 12}	IND<GER	F3-ALL	0.53	**0.07**				
l={9, 12}	IND<GER	F4-ALL	0.60	**0.03**				
l={4, 6}	RUS<USA	F1-ALL	0.07	0.43	0.03	0.49	1.65	**-21.92**
l={9, 12}	RUS<USA	F1-ALL	0.02	0.47	3.14	1.27	7.13	-16.86
l={9, 12}	RUS<USA	F2-ALL	0.45	0.19				
l={9, 12}	RUS<USA	F3-ALL	0.22	0.32				
l={9, 12}	RUS<USA	F4-ALL	1.32	**0.01**				
l={4, 6}	RUS<JPN	F1-ALL	0.13	0.34	0.86	0.39	2.34	**-26.85**
l={4, 6}	RUS<JPN	F2-ALL	0.51	0.15				
l={9, 12}	RUS<JPN	F1-ALL	0.10	0.35	4.99	-0.04	15.72	-14.16
l={9, 12}	RUS<JPN	F2-ALL	0.64	0.12				
l={9, 12}	RUS<JPN	F3-ALL	0.15	0.38				
l={9, 12}	RUS<JPN	F4-ALL	1.72	**0.00**				
l={4, 6}	RUS<GER	F1-ALL	0.06	0.45	0.03	0.12	1.24	**-25.26**
l={9, 12}	RUS<GER	F1-ALL	0.01	0.51	2.89	0.93	7.07	-18.94
l={9, 12}	RUS<GER	F2-ALL	0.31	0.29				
l={9, 12}	RUS<GER	F3-ALL	0.09	0.43				
l={9, 12}	RUS<GER	F4-ALL	1.48	**0.01**				
l={4, 6}	ZAF<USA	F1-ALL	0.20	**0.08**	1.56	-1.26	6.34	**-15.81**
l={9, 12}	ZAF<USA	F1-ALL	0.09	0.29	0.34	-2.89	5.70	-17.02
l={4, 6}	ZAF<JPN	F1-ALL	0.19	**0.09**	1.38	-3.04	7.33	**-14.71**
l={9, 12}	ZAF<JPN	F1-ALL	0.08	0.28	0.26	-3.25	5.50	-16.64
l={4, 6}	ZAF<GER	F1-ALL	0.20	**0.07**	3.74	-3.86	10.70	-18.34
l={4, 6}	ZAF<GER	F2-ALL	0.15	0.28				
l={4, 6}	ZAF<GER	F3-ALL	0.46	**0.04**				
l={9, 12}	ZAF<GER	F1-ALL	0.08	0.24	2.78	-4.82	9.80	-17.52
l={9, 12}	ZAF<GER	F2-ALL	0.03	0.43				
l={9, 12}	ZAF<GER	F3-ALL	0.54	**0.02**				

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

Panels A through D of Table 20 report summary information about the explanatory power (R^2) of the predictive regression models based on principal components analysis, namely F-ECON, F-TECH, and F-ALL. The percentages in the table denote the ratio of the number of the models satisfying the given criteria stated in the first row of each panel to the total number of all models with data vectors shown in the first two columns. Panel A of Table 20 indicate that explanatory power of all models are higher during recession periods than in expansion periods regardless of whether we use the technical indicator set ($S_{i,t}$) with *s=1,2,3*, *l=4,6* or S_{it} with *s=1,2,3*, *l=9,12* for constituting F-TECH or F-ALL models. In other words, $R^2_{REC}(\%)$ are found to be greater than $R^2_{EXP}(\%)$ for approximately 64%, 73%, and 78% of the all F-ECON, F-TECH, and F-ALL, respectively. This indicates that the models, especially F-ALL, better explain the variation in the equity risk premiums of the stock markets in Group 2 and 3 in bad economic conditions.

According to Panel B and C of Table 20, R^2 of *F-ALL* models are found to be higher than of both F-ECON and F-TECH models for most (over 80%) of the cases. This indicates that incorporating information from both macroeconomic and technical indicators improves the performances of models and increases the explanatory power of the predictors on the equity risk premiums. That is to say, fundamental and technical analyses capture different types of market movements or behaviors and empirical results suggest using the models taking macroeconomic and technical indicators all together rather than models considering either macroeconomic or technical indicators. Moreover, Panel D of Table 20 reports the comparison of the explanatory powers of F-TECH and F-ECON models indicating that F-TECH is explaining the variation in the equity risk premiums of the markets in Group 2 and 3 better than F-ECON models in overall period; however their performances are changing during expansion and recession periods.

Table 20: Explanatory Powers of the F- Models

Models with X_{it} and S_{it}		F_{ECON}	F_{TECH}	F_{ALL}
A.	$R^2_{REC}(\%) > R^2_{EXP}(\%)$			
ALL	*s=1,2,3*; *l=4,6*	64.10%	76.92%	79.49%
	s=1,2,3; *l=9,12*	64.10%	69.23%	76.92%
			State of Economy	
		Overall Period	**Expansion**	**Recession**
B.	$R^2_{F\text{-}ALL}(\%) \geq R^2_{F\text{-}ECON}(\%)$			
ALL	*s=1,2,3*; *l=4,6*	84.62%	82.05%	79.49%
	s=1,2,3; *l=9,12*	82.05%	69.23%	87.18%
USA	*s=1,2,3*; *l=4,6*	76.92%	92.31%	69.23%
	s=1,2,3; *l=9,12*	84.62%	69.23%	84.62%
JPN	*s=1,2,3*; *l=4,6*	84.62%	69.23%	92.31%
	s=1,2,3; *l=9,12*	76.92%	76.92%	92.31%
GER	*s=1,2,3*; *l=4,6*	92.31%	84.62%	76.92%
	s=1,2,3; *l=9,12*	84.62%	61.54%	84.62%
C.	$R^2_{F\text{-}ALL}(\%) \geq R^2_{F\text{-}TECH}(\%)$			
ALL	*s=1,2,3*; *l=4,6*	69.23%	79.49%	89.74%
	s=1,2,3; *l=9,12*	84.62%	71.79%	84.62%
USA	*s=1,2,3*; *l=4,6*	69.23%	84.62%	76.92%
	s=1,2,3; *l=9,12*	76.92%	69.23%	84.62%
JPN	*s=1,2,3*; *l=4,6*	53.85%	61.54%	92.31%
	s=1,2,3; *l=9,12*	84.62%	61.54%	76.92%
GER	*s=1,2,3*; *l=4,6*	84.62%	92.31%	100.00%
	s=1,2,3; *l=9,12*	92.31%	84.62%	92.31%
D.	$R^2_{F\text{-}TECH}(\%) \geq R^2_{F\text{-}ECON}(\%)$			
ALL	*s=1,2,3*; *l=4,6*	66.67%	58.97%	43.59%
	s=1,2,3; *l=9,12*	56.41%	43.59%	48.72%
USA	*s=1,2,3*; *l=4,6*	61.54%	61.54%	46.15%
	s=1,2,3; *l=9,12*	61.54%	46.15%	53.85%
JPN	*s=1,2,3*; *l=4,6*	69.23%	61.54%	38.46%
	s=1,2,3; *l=9,12*	53.85%	46.15%	53.85%
GER	*s=1,2,3*; *l=4,6*	69.23%	53.85%	46.15%
	s=1,2,3; *l=9,12*	53.85%	38.46%	38.46%

Note: R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions). *ALL* indicates the condition in which all foreign macroeconomic indicators are taken into consideration.

We report summary information about the structural stability based on the *qLL* statistics in Table 21. The percentages in the table denote the ratio of the number of the models structurally stable over time to the total number of all models with data vectors shown in the first two columns. The F-ECON models are stable over time for approximately half of the stock markets; whereas of the F-TECH models are structurally stable for all stock markets. Accordingly, F-ALL models are found to be structurally stable over time for about 65% of the stock markets. We also report that models with GER foreign macroeconomic indicators are more stable over time indicating that they are less subject to structural breaks in in-sample fit. It should be also noted that the F-ALL models consisting of GER indicators and technical indicators vector with either *l={4,6}* or *l={9,12}* are stable over time for all stock markets except GRC.

Table 21: Structural Stability of the F- Models

Models with X_{it} and S_{it}		F_{ECON}	F_{TECH}	F_{ALL}
A. *qLL* > CV				
ALL	*s=1,2,3*; *l=4,6*	48.72%	100.00%	64.10%
	s=1,2,3; *l=9,12*	48.72%	100.00%	66.67%
USA	*s=1,2,3*; *l=4,6*	53.85%	100.00%	53.85%
	s=1,2,3; *l=9,12*	53.85%	100.00%	61.54%
JPN	*s=1,2,3*; *l=4,6*	46.15%	100.00%	61.54%
	s=1,2,3; *l=9,12*	46.15%	100.00%	61.54%
GER	*s=1,2,3*; *l=4,6*	46.15%	100.00%	76.92%
	s=1,2,3; *l=9,12*	46.15%	100.00%	76.92%

Note: CV stands for 10% critical values for *qLL* statistics.

Table 23 and Table 24 report structurally stable regression model estimates which produce at least one statistically significant parameter and the highest R^2. It is evidenced that the performances of PE and RP_{USA} stand out in bi-variate regression models using macroeconomic indicators data vector. According to Table 24, PCA regression models with GER macroeconomic indicators and technical indicators with *l={4,6}* have higher R^2 values than that of the other models. Furthermore, incorporating all macroeconomic and technical indicators into the models (F-ALL) provides significant in-sample fitting gains. Additionally, we test the overall significance of the PCA models based on the F-statistics of which *p*-values are obtained via bootstrapping. Unlike for the F-ECON and F-TECH models, we reject the null hypothesis of that all parameters in the F-ALL models (reported in Table 24) are jointly equal to zero. It is also noteworthy that although F-ALL models for GRC have significant R^2, those models lack of structural stability based on the *qLL* statistics[16].

[16] We only reported F-statistics for the best F- models with more than one independent variables in addition to intercept term.

More importantly, we realize that the standard deviation of the stock market turnover ratio can partially clarify why suggested F-ALL models with particular technical indicators set are able predict the equity risk premiums relatively better than the other set. To make a complete inference for our sample we calculate the stock market turnover ratio between the year 1997 and 2011 (See APPENDIX 90). According to the findings the equity risk premiums of stock markets with more volatile (less volatile) turnover ratios are better explained by the F-ALL models with *l={9,12}* (*l={4,6}*). The only exception is BEL which does not obey our proposed rule however, the equity risk premium of BEL can already be predicted by F-ALL with *l={4,6}* and with a very high R^2 of 4.24. The results are reported in Table 22. This does not give full satisfaction but it is a possible clarification for the situation. Our explanation still holds when we calculate the standard deviation of stock market turnover ratio over the period spanning from 1989 to 2011 except for BEL and TUR. In sum, the remaining ten stock markets confirm our inference. Finally, classifications of the stock markets according to their market capitalization, market capitalization to GDP ratio, or the country's GDP, trading partnership levels, level of economic development do not fit the situation.

To sum up, stock market turnover ratio values are obtained from the World Bank Data set and calculated as total traded value over the total market capitalization. If we assume that market capitalization is constant and total traded value is volatile over time, technical trading rules giving much more weight to the distant past are probably able to capture the variation in the equity risk premium.

Table 22: Standard Deviation of Stock Market Turnover Ratio

Stock Market	**Standard Deviation of Stock market Turnover Ratio (1997-2012)**	**Long Length of Technical Indicator Rule**
MEX	4.49	*l={4,6}*
ZAF	12.59	*l={4,6}*
MYS	15.38	*l={4,6}*
BEL	**16.11**	***l={9,12}***
BRA	18.16	*l={4,6}*
POR	22.94	*l={4,6}*
GRC	27.98	*l={4,6}**
TUR	29.66	*l={4,6}*
SPN	31.21	*l={9,12}*
RUS	32.72	*l={9,12}*
HKG	45.30	*l={9,12}*
IND	64.95	*l={9,12}*

Source: World Bank. The data for TWN is not available. * denotes that F-ALL model for GRC suffer from parameter instability.

Table 23: The Best In-Sample Fit in Bi-variate Estimates

	Domestic Macroeconomic Indicators		**Foreign Macroeconomic Indicators**		**Technical Indicators**	
i	R^2 (%)	X_i	R^2 (%)	X_i	R^2 (%)	S_i
BEL	2.42	PE	7.86	RPJ_{USA}	3.97	MA(2,9)
GRC	4.95	TBL	3.26	$TBLJ_{USA}$	3.83	MOM(12)
MYS	1.74	INF	1.29	DYJ_{GER}	4.45	MA(1,4)
MEX	2.13	DY	3.32	PEJ_{GER}	1.87	VOL(3,4)
POR	1.32	RVOL	4.66	RPJ_{USA}	7.10	MA(1,4)
SPN	0.25	PE	2.13	RPJ_{USA}	3.88	VOL(1,12)
TWN	-	-	1.71	$TBLJ_{GER}$	3.31	VOL(1,6)
TUR	2.94	PE	2.18	RPJ_{USA}	3.06	VOL(3,4)
BRA	1.64	PRD	2.89	$INFJ_{GER}$	1.21	MOM(12)
HKG	3.87	DY	5.02	$PRDJ_{USA}$	2.71	VOL(1,9)
IND	7.18	PE	2.64	$INFJ_{GER}$	2.76	MA(2,12)
RUS	1.89	TBL	4.17	$TBLJ_{JPN}$	2.26	MOM(6)
ZAF	1.83	INF	3.93	$PRDJ_{USA}$	2.14	MA(2,4)

Note: X_i and S_i denote macroeconomic and technical indicators, respectively. – indicates absence of a stable regression model which produce at least one statistically significant predictor for the stock market.

Table 24: The Best In-Sample Fit in F- Model Estimates

	F-ECON Models		**F-TECH Models**		**F-ALL Models**		
i	R^2 (%)	***J***	R^2 (%)	***l***	R^2 (%)	***J***	***l***
BEL	1.64	JPN	3.80	*l={9,12}*	5.54	GER	*l={9,12}*
GRC	-	-	7.87	*l={4,6}*	-	-	-
MYS	1.07*	GER	2.78	*l={4,6}*	3.28	GER	*l={4,6}*
MEX	-	-	2.80	*l={9,12}*	4.30	GER	*l={4,6}*
POR	2.88	GER	7.44	*l={4,6}*	8.09	GER	*l={4,6}*
SPN	1.14*	GER	4.01	*l={9,12}*	3.60	GER	*l={9,12}*
TWN	-	-	3.46	*l={4,6}*	4.51	USA	*l={4,6}*
TUR	4.39	JPN	0.57	*l={4,6}*	3.46	JPN	*l={4,6}*
BRA	-	-	1.78*	*l={4,6}*	5.26	GER	*l={4,6}*
HKG	2.77*	GER	2.96*	*l={4,6}*	5.00	GER	*l={9,12}*
IND	6.62	USA	1.61	*l={9,12}*	12.48	GER	*l={9,12}*
RUS	2.94*	JPN	2.28*	*l={9,12}*	4.99	JPN	*l={9,12}*
ZAF	3.41*	GER	1.60	*l={4,6}*	3.74	GER	*l={4,6}*

Note: *J* represents one the stock markets in Group 1, and *l* stands for long technical indicator rule. – indicates absence of a stable regression model which produce at least one statistically significant predictor for the stock market. * denotes the overall insignificance (not able to reject the null hypothesis of $R^2 = 0$ at conventional levels) of the model which contains more than one principal component parameter estimates (β, predictor).

3.3.2. Out-of-Sample Analysis

In out-of-sample analysis, we use the first seventy observations during the period from March 1989 and December 1994 for the markets in Group 2 and February 1999 and November 2004 period for the markets in Group 3 as the initial estimation period and the remaining observations are used as the forecast period. Following the studies of Hansen and Timmermann's (2012) and Neely et al. (2014) that state out-of-sample tests of predictive ability have better size properties when the length of out-of-sample period covers the large proportion of the whole sample, we select the length of in-sample period such that it balances having adequate observations in in-sample period in order to make accurate long out-of-sample forecasting evaluation.

Out-of-sample forecasting results based on the bi-variate predictive regressions given by Equations (37) and (38) are reported in tables from APPENDIX 50 to APPENDIX 80 in detail. Like in in-sample analysis, we report those tables in the Appendices part of the thesis in order to conserve space. The first four columns of those tables contain information about the *MSFE*, R^2_{OS} calculations, and *MSFE-adj* statistics related to the out-of-sample forecasting analyses based on the bi-variate predictive regressions using domestic macroeconomic indicators and OIL. Fourth and fifth columns of those tables report information about R^2_{OS} and *MSFE-adj* statistics, respectively. R^2_{OS} and *MSFE-adj* measures indicate whether the calculated MSFE values in the are statistically significant.

According to the empirical findings reported in tables from APPENDIX 50 to APPENDIX 54, domestic macroeconomic indicators including OIL perform poorly since they are outperformed by the benchmark HA model for most of the stock markets in Group 2 and 3. Particularly, the most successful macroeconomic indicator in terms of statistical and economic significance is found to be TBL which outperforms the HA for five stock market equity premiums, 31% of all cases. RVOL, PRD and OIL are the worst performers which are outperformed by HA for all stock markets. The most successful forecasters are belonging to IND stock market of which DY, TBL, and PE outperform HA. None of the forecasts produced by the bi-variate predictive regressions based on macroeconomic indicators and OIL outperform HA for the stock markets namely, MEX, POR, SPN, TWN, TUR, HKG, and RUS.

Furthermore, the forecasting performances of the domestic macroeconomic indicators and OIL depend on economic conditions. Particularly, INF forecasts become the best forecasting indicator among the others and beat the HA forecasts for five stock market equity premiums during the expansion periods. Nevertheless, the forecasts generated by the INF fail to outperform HA forecasts for all the stock markets during the recession periods. In addition, forecasts generated by RVOL perform the best among all indicators and outperform HA forecasts for five stock markets. However, RVOL forecasts become the worst among all and fail to outperform HA forecasts for any stock markets.

Out-of-sample forecasts generated by the predictive regression models using macroeconomic indicators of the stock markets in Group 1 are reported in tables from APPENDIX 55 to APPENDIX 67. Individual foreign macroeconomic indicator forecasts perform even worse than domestic macroeconomic indicator forecasts. Particularly, 18% (seven out of thirty-nine) of all forecasts generated by the bi-variate predictive regressions using TBL_J beat the HA forecasts. While the overall performance of TBL_J is similar to its performance in expansion times, TBL_J is found to be outperforming HA forecasts for 23% of the stock markets in recession times. RP_J comes in the second place in the overall period; and RP_J forecasts outperform the HA forecasts for five (13%) cases among all. However, RP_J is found the best forecaster in recession times and beating HA forecasts for 28% of the stock markets. The forecasts produced by PE_J, INF_J, and PRD_J outperform HA forecasts for about 8% of the stock markets. It is also noteworthy that PEJ and INFJ are the best forecasters among all and the number of times they are beating HA forecasts rises threefold in expansion times. The performance of the PRD_J also varies across different economic conditions. While PRD_J forecasts outperform the forecasts by HA for 15% of the total stock markets in recessions, none of the forecasts generated by PRD_J beat HA forecasts during expansions. None of the forecasts generated by the predictive regression using DY_J and $RVOL_J$ perform better than HA forecasts. In the overall period, 14% of the foreign macroeconomic forecasters are found to be statistically significant and outperform HA forecasts for BEL, GRC, POR, and RUS whereas none of the foreign macroeconomic forecasters of HKG and IND outperform HA forecasts. However, it is clear from the findings that the performances of predictive regression model forecasts are significantly changing when we analyze expansion and recession periods separately. This indicates that market participants follow different sources of information arising in major stock markets of Group 1, during various economic conditions.

Similar to in-sample analysis, forecasts produced by the macroeconomic indicators of GER are found to be the best among the foreign macroeconomic indicators. Particularly, 52% of the foreign macroeconomic forecasters of GER are statistically significant and outperforming HA forecasts. However, the forecasting performances of the USA and JPN macroeconomic indicators are, however, as much as half of the performances of GER's.

We report the out-of-sample forecasting results of the predictive regression models based on the technical indicators in tables from APPENDIX 68 to APPENDIX 80. Out-of-sample forecasting results of bi-variate predictive regression models based on technical indicators set with *s={1,2,3}* and *l={4,6}* are reported in the first fourteen rows and the remaining parts of the tables contain information about the results based on technical indicators set with *s={1,2,3}* and *l={9,12}*. According to the empirical findings, at least one of the individual technical indicators forecasts outperform the HA forecasts. Particularly, out-of-sample forecasts generated by MA(1,4), MA(1,6), MA(2,4), MA(2,6), MA(3,4), MA(3,6), MOM(4), MOM(6), VOL(1,4), VOL(1,6) outperform the HA forecasts for 38% of the stock markets in Group 2 and 3. At least one of the individual technical indicators within the set of *s={1,2,3}* and *l={4,6}* produce statistically significant forecasts beating the *HA* forecasts for the equity premiums of all stock markets except TUR, BRA, and IND. All of the individual forecasters outperform the HA forecasts for POR. The forecasting performances of the technical indicators set with *s={1,2,3}* and *l={9,12}* are similar to the aforementioned set of technical indicators. MOM(12), VOL(1,9), VOL(1,12), VOL(2,9), VOL(2,12), VOL(3,9), VOL(3,12) forecasts are statistically and significant beating HA forecasts for the 31% of all stock markets. The remaining individual technical indicator forecasts outperform the HA forecasts and they are all found to be significant forecasters for the 23% of the stock market equity premiums. In addition to that all of the individual forecasters outperform the HA forecasts for the equity risk premiums of POR, BEL, and GRC stock markets using either technical indicators set with long technical indicator rule.

Empirical findings also suggest significant differences among the performances of individual technical indicators within both technical indicators sets during expansion and recession periods. For instance, the average performances of the forecasts produced by predictive regression models are worse in good economic conditions than in bad economic conditions. While 17% (14%) of the individual technical forecasters with long technical indicator rule of *l={4,6}* (*l={9,12}*) outperform HA in expansion period, 34% (40%) of the forecasts estimated by the individual technical indicators with *l={4,6}* (*l={9,12}*) perform better than HA forecasts during recession periods. It is also clear from the empirical findings that individual technical indicators have better performances than both domestic and foreign macroeconomic indicators. At least one of the individual technical forecasters of TUR is outperforming HA forecasts in only expansions. 29% of the individual technical forecasters outperform HA forecasts in only recessions for IND of which none of the individual technical indicators are found to be significant in overall period, as previously noted.

Finally, the out-of-sample forecasting results based on the principal components (given by equation (39)), and on the combined averages (given by equation (40)) of all indicators taken together are reported in the following tables from Table 25 to Table 37. Fourth and fifth columns of those tables report information about R^2_{OS} and *MSFE-adj* statistics, respectively. R^2_{OS} and *MSFE-adj* measures indicate whether the calculated MSFE values in the are statistically significant. The out-of-sample forecasting performances of the PC-ECON are relatively poor compared to the performances POOL-ECON forecasts. The empirical findings suggest that 31% (8%) of the all forecasts generated by POOL-ECON (PC-ECON) beat the HA forecasts. 31% of the both POOL-TECH and PC-TECH forecasts found to be performing better than HA forecasts. The performances of the POOL-ALL (PC-ALL) forecasts vary depending on which technical indicators rules are used for constituting the sets of entire indicators. Particularly, 33% (36%) of forecasts produced by POOL-ALL (PC-ALL) perform better than HA forecasts when we use the entire set of indicators with long technical indicator rules of *l={4,6}*. On the other hand, using entire indicators sets containing long technical indicator rules of *l={9,12}*, we find that 33% (26%) of the POOL-ALL (PC-ALL) forecasts beat HA forecasts. Overall, at least one of the forecasts generated by those combined models outperforms *HA* forecasts for the equity risk premiums of the all stock markets except MYS, TUR, and RUS.

Furthermore, we detect salient changes in the performances of the forecasts generated by POOL-TECH, PC-TECH, POOL-ALL, and PC-ALL under different economic conditions. Particularly forecasts generated by those models perform better in recession than in expansion periods. While 23% (15%) of combined technical forecasters with long technical indicator rule of *l={4,6}* (*l={9,12}*) outperform HA in expansion times, 46% (42%) of the forecasts estimated by the combined technical indicators with *l={4,6}* (*l={9,12}*) perform better than HA forecasts during recession periods. There are remarkable differences between the performances of both POOL-ALL and PC-ALL models during expansion and recession periods. We find that 51% (21%) of the POOL-ALL forecasts outperform the HA forecasts during recession (expansion) periods. However, 46% (15%) of the forecasts produced by the PC-ALL models are able to beat the HA forecasts in bad (good) economic conditions. These variations in the performances of the POOL-ALL and PC-ALL forecasts under different economic circumstances might stem from the changes in the performances of the other models due to various economic conditions.

The out-of-sample forecasting results of the POOL-ECON, PC-ECON, POOL-ALL, and PC-ALL models suggest that the indicator sets constituted by using GER indicators perform better than other combinations of foreign indicators of the markets in Group 1 in the overall period. 40% (33%) of the forecasts produced by those models using GER indicators and technical indicators set with *l={4,6}* (*l={9,12}*) are found to be outperforming HA forecasts. Particularly, 54% (15%) of the forecasts generated by POOL-ECON (PC-ECON) models with GER indicators beat the HA forecasts. The out-of-sample forecasts generated by POOL-ALL models with GER indicators perform the best and outperform the HA forecasts for 38% of the total stock market equity premiums when we use technical indicator set with *l={4,6}* or *l={9,12}*. We also find that forecasts generated by POOL-ALL models with the USA and JPN indicators beat the HA forecasts for 31% of the total stock markets regardless of whether we use technical indicator set with *l={4,6}* or *l={9,12}*.

However, the out-of-sample forecasting performances of PC-ALL models are found to be quite similar to that of POOL-ALL. For instance, the forecasts generated by PC-ALL models with the USA and JPN indicators are found to be outperforming the HA forecasts for, respectively, 31% and 23% of the total stock markets regardless of whether we use technical indicator set with *l={4,6}* or *l={9,12}*. On the other hand, PC-ALL forecasts are found to be the best among all and beat HA forecasts for 54% (23%) of the stock market equity risk premiums when entire set of indicators include GER's macroeconomic indicators and technical indicators set with *l={4,6}* (*l={9,12}*).

3.3.2.1. Portfolio Performance Analysis

Portfolio performance measures of Sharpe ratio given by Equation (47) and the CER gains (Δ (%)) given by Equation (48) are calculated in order to measure the economic value of equity risk premium forecasts for a mean-variance investor with a risk aversion coefficient of five. The CER gain can be defined as the difference between the CER based on the forecasts generated by predictive regressions and CER based on HA forecasts.

We report Sharpe ratio in the sixth columns of the tables from APPENDIX 50 to APPENDIX 54. Sharpe ratios produced by TBL and OIL outperform the Sharpe ratio of HA for nine (69%) of the stock markets in Group 2 and 3. Sharpe ratios calculated based on DY, RVOL, and INF take the second place and 62% of them produce higher Sharpe ratios than that of HA. Nevertheless, Sharpe ratios of PRD beat the HA for only 46% of the stock markets. Moreover, all of the domestic macroeconomic indicators and OIL produce higher Sharpe ratios than that of the HA for SPN. Macroeconomic indicators of RUS perform the worst among all; none of the domestic macroeconomic forecasters of RUS is found to be higher than HA. The empirical findings suggest that the 60% of the domestic macroeconomic indicators and OIL produce higher Sharpe ratios than that of HA, on average. The CER gains generated by TBL and RVOL are positive for 47% of the stock markets in Group 2 and 3. Moreover, 40% of the CER gains by INF are found to be positive. None of the domestic macroeconomic indicators generate positive CER gains for the GRC market. Some of the CER gains produced by PE, RVOL, PRD, and OIL reduce to negative from positive values after taking transaction costs into account. Particularly, none of the CER gains generated by OIL are found to be positive after accounting transaction costs. Moreover, the CER gains of all macroeconomic indicators of GRC and SPN become negative after taking transaction costs into consideration. It is also clear from the findings that the CER gains are higher during recessions vis-á-vis expansions for all of the domestic macroeconomic indicators except PRD and OIL.

Tables from APPENDIX 55 and APPENDIX 67 report the portfolio performance analysis of foreign macroeconomic indicators. The number of higher Sharpe ratios produced by the foreign macroeconomic indicators than that of HA is ranging between 22 (56%) and 28 (72%) among 39 (=*13x3*) interactions. The Sharpe ratios calculated by RP_J , PEJ, and RVOLJ are found to be higher than those of HA for 72% of all cases. Moreover, Sharpe ratios produced by DY_J take the second place and are found to be higher for 69% of the cases. At least eight Sharpe ratios (38%) are higher than that of HA for the stock markets in Group 2 and 3.

The CER gains produced by RP_J are positive for 64% of stock markets. The CER gains generated by the remaining indicators are positive for the range between 36% and 46% of all cases. However, most of the CER gains by the RP_J reduce to negative from positive values after taking transaction costs into account. Only 15% of the CER gains by RP_J are positive. The most of the CER gains by PRD_J and INF_J also reduce to negative from positive values when transaction costs are considered. The performances of remaining indicators in terms of utility gains are similar regardless of whether we consider transaction costs. The CER gains by foreign macroeconomic indicators generate mixed results during different economic conditions, namely recession and expansion periods. The CER gains are higher (lower) during recession vis-á-vis expansion periods for DY_J, TBL_J, $RVOL_J$, and PRD_J (RP_J, PE_J, and INF_J).

The most successful macroeconomic predictors belong to the USA with higher Sharpe ratios for 73% of the total interactions. The macroeconomic indicators of GER and JPN produce higher ratios than that of HA for, respectively, 68% and

59% of the total interactions. In accordance with the Sharpe Ratio calculations, RP_J indicators produce much more positive CER gains than the other foreign macroeconomic indicators. 64% of the CER gains produced by RP_J are positive and the most successful RP_J indicators belong to the US. Nevertheless, the number of positive CER gains by RPJ decreases dramatically after accounting transaction costs; RPJ produce positive CER gains for only 15% of the total cases. When transaction costs are taken into account, TBL_J producing positive CER gains for 44% of the total cases perform the best among all. The USA and GER macroeconomic indicators are still ranked as the first and the second, respectively.

We report portfolio performance analysis results for technical indicators in the Tables from APPENDIX 68 to APPENDIX 80. The number of higher Sharpe ratios produced by the technical indicators than those of HA is ranging between 54% and 85%. Particularly, the Sharpe ratios of VOL(1,6) are calculated higher than those of HA for 85% of the stock markets in Groups 2 and 3. Sharpe ratios generated by all technical indicators set with *{l=4,6}* are found to be higher than those of HA for GRC, POR, and SPN. When we use technical indicators set with *{l=9,12}* The number of higher Sharpe ratios produced by the technical indicators than those of HA is ranging between 54% and 77%. The Sharpe ratios calculated based on MOM(12) and VOL(1,12) are higher than those of HA for 77% of the total cases. Sharpe ratios generated by all technical indicators are higher than those of HA for BEL, GRC, POR, SPN, and HKG.

The highest number of positive CER gains is generated by MA(1,9) with 85% of the total cases. MA(3,6) and VOL(1,6) are found to be positive for 77% of the stock markets. In addition to that the 69% of the CER gains produced by MA(1,4), MA(1,6), MA(2,4), MOM(4), VOL(1,4), MA(1,12), MA(2,9), and VOL(3,9) are calculated as positive. In particular, the CER gains generated by all technical indicators are found to be positive for POR regardless of whether we use technical indicators set with *l={4,6}* or *l={9,12}*. In addition to that, The CER gains produced by technical indicators set with *{l=9,12}* are all positive for BEL, GRC, and SPN. The estimation results also suggest that the CER gains are larger for recession periods vis-á-vis expansion periods for many of the technical indicators. After accounting for transaction costs, it is evidenced that some of the positive CER gains become negative; however, at least one of the technical indicators can still produce positive CER gains for the stock markets in Groups 2 and 3.

The portfolio performance analysis results based on the principal components and on the combined averages of all indicators taken together are reported in the following tables from Table 25 to Table 37. The Sharpe ratios produced by POOL-ECON (PC-ECON) are calculated higher than those of HA for, respectively 85% (77%) of the stock markets. Particularly, all of the POOL-ECON and PC-ECON Sharpe ratios outperform those of HA for BEL, MYS, POR, SPN, TWN, and IND. The CER gains by POOL-ECON (PC-ECON) are estimated positive for 85% (38%) of the total interactions. Particularly, all of the CER gains produced by POOL-ECON and PC-ECON are positive for BEL, IND, RUS, and ZAF. When we consider transaction costs relative high turnovers reduce positive CER gains to negative values. The total positive POOL-ECON (PC-ECON) CER gains decreases by 13% (8%) to the ratio of 72% (31%) of all interactions. It is clear from the findings that POOL-ECON forecasts perform better than PC-ECON forecasts in terms of utility gains. Moreover, the utility gains are larger in recession vis-á-vis expansion periods for POOL-ECON and PC-ECON.

The Sharpe ratios generated by POOL-TECH and PC-TECH by using long technical indicator rule of *l={4,6}* (*l={9,12}*) are positive for 77% (62%) of the stock markets in Group 2 and 3. Put another way, POOL-TECH and PC-TECH models produce higher Sharpe ratios than that of HA for all stock markets except BRA and RUS. It is also evidenced that the performance of those models in generating higher Sharpe ratios than those of HA are very similar to the ability of producing positive CER gains. In other words, POOL-TECH and PC-TECH forecasts which produce higher Sharpe ratios than those of HA also produce positive CER gains for the same stock markets except TWN and IND. It is clear from the findings that the CER gains are substantially larger for recession vis-á-vis expansion periods for POOL-TECH and PC-TECH. Furthermore, the performance of technical indicator set with *l={4,6}* is clearly better than that of the set with *l={9,12}*. The CER gains by POOL-TECH (PC-TECH) with *l={4,6}*, however, become negative from positive values for HKG (TUR and IND) after considering transaction costs.

POOL-ALL and PC-ALL with technical indicator rule of *l={4,6}* (*l={9,12}*) produce higher Sharpe ratios than those of HA for, respectively, 77% (82%), and 67% (79%) of the total interactions. According to the empirical findings, either POOL-ALL or PC-ALL with *l={4,6}* produce higher Sharpe ratios than those of HA for all stock markets except RUS. It is also evidenced that at least one of the PC-ALL Sharpe ratios are found to be higher than those of HA when we apply long technical indicator rule of *l={9,12}*. The CER gains by POOL-ALL and PC-ALL with technical indicator rule of *l={4,6}* (*l={9,12}*) are calculated as positive for, respectively, 92% (64%) and 82% (54%) of the total interactions. Particularly, we calculate positive CER gains by using either POOL-ALL or PC-TECH with *l={4,6}* for all cases. POOL-ALL and PC-ALL with *l={9,12}* can also generate positive CER gains for all interactions except the case of MEX. In accordance with the previous findings, the CER gains are larger for recession vis-á-vis expansion periods for POOL-ALL and PC-ALL. It is noteworthy that the performance of POOL-ALL with *l={4,6}* is remarkable since the CER gains are positive for all (100%) interactions. When transactions costs are taken into considerations the number of positive CER gains decreases due to the relatively high turnovers. The CER gains by POOL-ALL and PC-ALL with technical indicator rule of *l={4,6}* (*l={9,12}*) are calculated as positive for, respectively, 85% (49%) and 74% (41%) of all interactions. We also note that POOL and PC models using the USA and GER macroeconomic indicators data perform better than the other models with the macroeconomic indicators of JPN. Particularly, the number of times the models with GER (USA) indicators produce higher Sharpe ratios (utility gains) than that of HA is found to be the highest. Overall, portfolio performance analyses reveal the fact that combining information from macroeconomic and technical indicators provides sizeable increases in utility (the CER) gains.

While the out-of-sample forecasting abilities of the forecasting models in terms of MSFE are relatively poor, the forecasts generated by the same models produce significant profits. This is in line with the finding of Leitch and Tanner (1991) who report that many firms purchase professional forecasts of economic and financial variables that frequently fail to outperform forecasts from simple time-series models. Furthermore, forecast profitability is a more relevant metric for assessing forecasts, helping to explain the value of professional forecasts to firms.

Table 25: Out-of-Sample Forecasting Results, BEL

		Overall Period						Expansion Times			Recession Times		
	Model	**MSFE**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
	BEL-HA	24.36			1.58	0.02	1.43						
l={4,6}	POOL-TECH	23.85	***2.06***	**2.15**	2.81	***0.12***	2.27	***1.91***	**1.58**	2.87	***2.14***	**1.60**	2.73
l={4,6}	PC-TECH	23.71	***2.67***	**2.08**	4.02	***0.16***	3.22	***2.69***	**1.70**	4.78	***2.65***	**1.44**	3.16
l={9,12}	POOL-TECH	23.61	***3.06***	**2.22**	4.54	***0.17***	4.22	***2.43***	**1.76**	4.63	***3.39***	**1.66**	4.44
l={9,12}	PC-TECH	23.40	***3.91***	**2.34**	5.77	***0.20***	5.40	***3.18***	**1.91**	6.50	***4.29***	**1.70**	4.95
BEL<USA	POOL-ECON	23.96	***1.64***	**1.67**	2.37	***0.12***	1.61	***0.96***	0.87	1.35	***2.00***	**1.43**	3.49
	PC-ECON	24.74	-1.57	**1.26**	1.67	***0.11***	0.20	-7.85	-0.22	-2.07	***1.75***	**1.42**	5.88
l={4,6}	POOL-ALL	23.87	***1.98***	**2.11**	2.89	***0.13***	2.35	***1.63***	**1.53**	2.29	***2.16***	**1.63**	3.56
l={4,6}	PC-ALL	24.59	-0.96	1.05	3.48	***0.15***	2.17	-2.04	0.45	3.16	-0.40	0.95	3.84
l={9,12}	POOL-ALL	23.73	***2.56***	**2.20**	4.11	***0.16***	3.68	***2.00***	**1.72**	3.34	***2.85***	**1.69**	4.95
l={9,12}	PC-ALL	24.10	***1.07***	**1.68**	5.31	***0.19***	4.27	-1.32	0.99	4.06	***2.33***	**1.39**	6.70
BEL<JPN	POOL-ECON	24.20	***0.63***	1.04	0.92	***0.08***	0.37	***1.16***	**1.25**	1.35	***0.35***	0.51	0.42
	PC-ECON	25.34	-4.06	0.32	-0.75	***0.08***	-2.33	-3.52	0.16	1.78	-4.34	0.28	-3.63
l={4,6}	POOL-ALL	24.00	***1.48***	**2.00**	2.43	***0.11***	1.98	***1.72***	**1.83**	2.27	***1.35***	**1.33**	2.59
l={4,6}	PC-ALL	24.02	***1.37***	**1.30**	4.36	***0.17***	3.62	***0.76***	1.05	4.02	***1.70***	0.98	4.73
l={9,12}	POOL-ALL	23.85	***2.08***	**2.15**	3.86	***0.15***	3.50	***2.11***	**1.96**	3.33	***2.06***	**1.49**	4.43
l={9,12}	PC-ALL	23.81	***2.25***	**1.66**	5.38	***0.19***	4.83	***1.23***	**1.35**	5.61	***2.79***	**1.25**	5.10
BEL<GER	POOL-ECON	24.10	***1.04***	**1.52**	1.53	***0.10***	0.93	***1.80***	**1.62**	1.86	***0.64***	0.76	1.14
	PC-ECON	24.37	-0.07	0.68	2.92	***0.14***	2.53	-0.38	0.50	1.57	***0.09***	0.49	4.42
l={4,6}	POOL-ALL	23.95	***1.67***	**2.24**	2.66	***0.12***	2.19	***2.02***	**1.96**	2.40	***1.49***	**1.48**	2.94
l={4,6}	PC-ALL	23.68	***2.78***	**1.84**	4.83	***0.18***	3.88	***1.99***	**1.46**	5.59	***3.19***	**1.35**	3.97
l={9,12}	POOL-ALL	23.80	***2.28***	**2.34**	3.97	***0.15***	3.60	***2.40***	**2.12**	3.41	***2.21***	**1.60**	4.59
l={9,12}	PC-ALL	23.57	***3.22***	**2.14**	7.45	***0.23***	6.80	***3.46***	**1.92**	9.24	***3.10***	**1.38**	5.47

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value. *l* stands for the length of long technical indicator rule.

Table 26: Out-of-Sample Forecasting Results, GRC

		Overall Period						Expansion Times			Recession Times		
	Model	**MSFE**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
	GRC-HA	95.23			6.86	-0.01	6.80						
l={4,6}	POOL-TECH	91.20	***4.23***	**3.55**	3.81	***0.11***	3.19	***2.79***	**2.19**	3.02	***5.46***	**2.82**	4.80
l={4,6}	PC-TECH	90.62	***4.84***	**3.31**	3.28	***0.11***	2.58	***1.83***	**1.73**	2.11	***7.41***	**2.84**	4.73
l={9,12}	POOL-TECH	92.56	***2.80***	**2.44**	1.98	***0.06***	1.65	***0.53***	0.74	-0.05	***4.74***	**2.57**	4.53
l={9,12}	PC-TECH	92.09	***3.29***	**2.45**	1.77	***0.07***	1.36	***0.15***	0.73	-0.21	***5.98***	**2.58**	4.25
GRC<USA	POOL-ECON	93.43	***1.89***	**2.24**	2.38	***0.07***	1.92	***1.74***	**1.72**	2.42	***2.01***	**1.55**	2.35
	PC-ECON	102.65	-7.80	-0.13	-4.43	***0.02***	-5.63	-6.99	0.38	-2.18	-8.48	-0.50	-7.17
l={4,6}	POOL-ALL	92.07	***3.31***	**3.50**	3.84	***0.11***	3.42	***2.55***	**2.53**	3.15	***3.96***	**2.57**	4.72
l={4,6}	PC-ALL	93.69	***1.61***	**2.83**	-1.26	***0.13***	-3.29	***7.96***	**3.12**	3.41	-3.81	0.49	-6.19
l={9,12}	POOL-ALL	92.83	***2.52***	**2.61**	2.85	***0.08***	2.56	***1.34***	1.22	1.70	***3.53***	**2.35**	4.31
l={9,12}	PC-ALL	95.96	-0.78	**2.46**	1.34	***0.13***	0.59	-6.06	**1.54**	-0.50	***3.74***	**1.93**	3.67
GRC<JPN	POOL-ECON	93.86	***1.43***	**1.69**	1.24	***0.02***	0.86	***0.35***	0.44	0.43	***2.35***	**1.79**	2.27
	PC-ECON	99.61	-4.61	-0.44	-1.44	-0.04	-1.98	-9.94	-1.19	-2.82	-0.05	0.92	0.29
l={4,6}	POOL-ALL	92.28	***3.09***	**3.25**	3.43	***0.10***	3.05	***1.88***	**1.79**	1.98	***4.13***	**2.74**	5.25
l={4,6}	PC-ALL	94.93	***0.31***	**1.96**	5.05	***0.15***	4.11	-3.88	0.67	4.71	***3.89***	**2.10**	5.46
l={9,12}	POOL-ALL	93.04	***2.30***	**2.36**	2.41	***0.06***	2.16	***0.64***	0.67	0.50	***3.71***	**2.51**	4.82
l={9,12}	PC-ALL	93.64	***1.67***	**1.95**	1.30	***0.06***	0.66	-3.47	0.08	-1.38	***6.06***	**2.78**	4.64
GRC<GER	POOL-ECON	93.63	***1.67***	**2.24**	0.76	***0.04***	0.18	***2.08***	**2.03**	1.74	***1.32***	**1.24**	-0.44
	PC-ECON	98.74	-3.69	0.94	-7.07	***0.05***	-9.71	-5.02	0.94	-4.98	-2.55	0.35	-9.50
l={4,6}	POOL-ALL	92.16	***3.22***	**3.64**	3.57	***0.11***	3.10	***2.73***	**2.71**	2.93	***3.65***	**2.58**	4.37
l={4,6}	PC-ALL	93.22	***2.10***	**2.46**	2.18	***0.12***	0.42	-5.50	0.77	0.70	***8.60***	**2.62**	4.04
l={9,12}	POOL-ALL	92.90	***2.44***	**2.73**	2.50	***0.07***	2.16	***1.51***	**1.39**	1.47	***3.24***	**2.39**	3.79
l={9,12}	PC-ALL	96.80	-1.66	**1.79**	-0.59	***0.10***	-2.79	-6.87	0.82	-2.52	***2.80***	**1.81**	1.83

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value. *l* stands for the length of long technical indicator rule.

Table 27: Out-of-Sample Forecasting Results, MYS

		Overall Period						Expansion Times			Recession Times		
	Model	**MSFE**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
	MYS-HA	49.10			2.85	0.00	2.78						
l={4,6}	POOL-TECH	48.54	***1.15***	1.21	2.60	***0.13***	2.05	-0.06	0.38	2.71	***2.36***	1.21	2.34
l={4,6}	PC-TECH	48.81	***0.60***	0.91	2.45	***0.12***	1.81	-1.41	0.02	2.68	***2.61***	1.08	1.89
l={9,12}	POOL-TECH	49.31	-0.43	0.13	1.16	***0.06***	0.86	-3.57	-1.34	1.23	***2.73***	**1.24**	0.97
l={9,12}	PC-TECH	49.59	-0.99	0.14	0.86	***0.06***	0.48	-5.11	-1.26	1.20	***3.17***	1.17	-0.03
MYS<USA	POOL-ECON	49.13	-0.06	0.10	1.56	***0.08***	1.21	-3.70	-1.61	1.09	***3.59***	**1.94**	2.82
	PC-ECON	52.90	-7.74	-0.82	-0.39	***0.00***	-1.04	-22.69	-1.70	-0.12	***7.30***	**1.68**	-1.13
l={4,6}	POOL-ALL	48.77	***0.67***	0.71	2.46	***0.12***	2.10	-1.71	-0.85	2.13	***3.07***	**1.61**	3.34
l={4,6}	PC-ALL	51.71	-5.32	-0.02	2.40	***0.12***	0.91	-17.40	-0.88	2.88	***6.84***	**1.77**	1.19
l={9,12}	POOL-ALL	49.17	-0.13	0.13	1.58	***0.08***	1.32	-3.52	-1.66	1.24	***3.27***	**1.59**	2.50
l={9,12}	PC-ALL	52.78	-7.49	-0.52	1.06	***0.07***	0.50	-21.49	-1.65	1.98	***6.60***	**1.38**	-1.38
MYS<JPN	POOL-ECON	49.34	-0.49	-0.36	0.47	***0.03***	0.09	-2.72	-1.61	0.44	***1.77***	**1.40**	0.58
	PC-ECON	52.90	-7.72	-1.00	-0.32	***0.02***	-0.49	-19.53	-1.52	-0.30	***4.16***	1.21	-0.37
l={4,6}	POOL-ALL	48.87	***0.47***	0.61	2.08	***0.11***	1.71	-1.22	-0.68	1.90	***2.18***	**1.37**	2.58
l={4,6}	PC-ALL	52.42	-6.76	-0.63	2.03	***0.10***	1.36	-16.48	-1.12	1.81	***3.01***	1.21	2.65
l={9,12}	POOL-ALL	49.26	-0.33	-0.06	1.06	***0.06***	0.79	-3.02	-1.63	0.89	***2.39***	**1.36**	1.53
l={9,12}	PC-ALL	52.49	-6.89	-0.61	1.17	***0.08***	0.71	-18.01	-1.32	1.67	***4.30***	**1.28**	-0.17
MYS<GER	POOL-ECON	49.02	***0.17***	0.27	0.74	***0.04***	0.38	-3.56	-1.79	0.56	***3.93***	**1.86**	1.21
	PC-ECON	54.38	-10.74	-0.47	-2.13	***0.01***	-2.83	-30.44	-1.97	-0.99	***9.07***	**1.36**	-5.22
l={4,6}	POOL-ALL	48.70	***0.81***	0.81	2.26	***0.11***	1.89	-1.62	-0.89	1.96	***3.26***	**1.63**	3.05
l={4,6}	PC-ALL	51.26	-4.40	0.00	2.81	***0.13***	1.60	-16.68	-1.54	3.15	***7.96***	**1.55**	1.98
l={9,12}	POOL-ALL	49.09	***0.02***	0.21	1.25	***0.06***	0.98	-3.42	-1.74	0.91	***3.48***	**1.61**	2.16
l={9,12}	PC-ALL	56.04	-14.13	-1.22	0.86	***0.08***	-0.03	-34.00	-1.96	2.20	***5.87***	**1.67**	-2.66

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value. *l* stands for the length of long technical indicator rule.

Table 28: Out-of-Sample Forecasting Results, MEX

		Overall Period						Expansion Times			Recession Times		
	Model	**MSFE**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
	MEX-HA	53.42			12.57	0.03	12.49						
l={4,6}	POOL-TECH	53.57	-0.28	0.06	0.98	***0.05***	0.57	-1.71	-1.38	-0.75	***0.61***	0.46	3.78
l={4,6}	PC-TECH	54.05	-1.18	-0.07	2.01	***0.09***	1.56	-3.33	-1.54	-0.56	***0.15***	0.35	6.16
l={9,12}	POOL-TECH	53.63	-0.39	-0.15	-1.53	0.00	-1.81	-0.41	-0.30	-0.99	-0.39	-0.06	-2.43
l={9,12}	PC-TECH	55.76	-4.38	-1.86	-5.51	-0.05	-5.79	-0.50	-0.34	-1.15	-6.80	-1.85	-12.52
MEX<USA	POOL-ECON	53.27	***0.27***	0.67	0.05	0.02	-0.24	-0.79	-0.36	-0.83	***0.93***	1.09	1.46
	PC-ECON	55.82	-4.49	0.17	-4.67	-0.05	-5.46	-10.63	-0.45	-4.04	-0.68	0.57	-5.80
l={4,6}	POOL-ALL	53.34	***0.15***	0.34	0.52	0.03	0.26	-1.06	-1.20	-0.73	***0.90***	0.78	2.52
l={4,6}	PC-ALL	57.00	-6.71	-0.24	-4.93	-0.07	-6.02	-12.93	-1.07	-2.97	-2.84	0.37	-8.18
l={9,12}	POOL-ALL	53.39	***0.05***	0.32	-0.72	0.01	-0.96	-0.54	-0.37	-1.07	***0.42***	0.67	-0.18
l={9,12}	PC-ALL	58.29	-9.12	1.08	-1.96	0.03	-3.33	-26.26	-0.30	-2.25	***1.51***	**1.48**	-1.62
MEX<JPN	POOL-ECON	53.04	***0.72***	1.21	0.16	0.02	-0.15	***0.27***	0.57	-0.46	***0.99***	1.08	1.17
	PC-ECON	54.64	-2.28	1.11	-2.35	-0.02	-2.93	-5.81	0.66	-2.09	-0.10	0.89	-2.84
l={4,6}	POOL-ALL	53.22	***0.38***	0.58	0.54	0.03	0.28	-0.51	-0.49	-0.54	***0.93***	0.77	2.28
l={4,6}	PC-ALL	54.45	-1.92	1.07	-0.07	0.02	-0.76	-8.62	0.00	-1.95	***2.23***	**1.28**	2.93
l={9,12}	POOL-ALL	53.27	***0.28***	0.71	-0.66	0.01	-0.90	0.00	0.24	-0.89	***0.46***	0.69	-0.32
l={9,12}	PC-ALL	54.26	-1.57	**1.63**	-1.00	***0.05***	-1.77	-16.49	0.57	-1.50	***7.69***	**1.57**	-0.29
MEX<GER	POOL-ECON	52.92	***0.93***	**1.33**	0.00	***0.03***	-0.21	-0.06	0.29	-0.05	***1.55***	**1.40**	0.06
	PC-ECON	54.63	-2.27	0.47	-3.83	-0.01	-4.62	-6.74	-0.10	-2.95	***0.50***	0.65	-5.40
l={4,6}	POOL-ALL	53.16	***0.48***	0.65	0.58	***0.04***	0.35	-0.68	-0.66	-0.34	***1.20***	0.89	2.06
l={4,6}	PC-ALL	54.89	-2.75	0.80	-2.89	0.00	-3.81	-10.88	-0.04	-1.81	***2.29***	0.97	-4.75
l={9,12}	POOL-ALL	53.22	***0.37***	0.77	-0.70	0.02	-0.90	-0.16	0.07	-0.70	***0.69***	0.86	-0.72
l={9,12}	PC-ALL	53.43	-0.03	**1.61**	-2.33	***0.03***	-3.21	-16.19	0.41	-0.92	***10.00***	**1.58**	-4.75

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value. *l* stands for the length of long technical indicator rule.

Table 29: Out-of-Sample Forecasting Results, POR

		Overall Period						Expansion Times			Recession Times		
	Model	**MSFE**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**
	POR-HA	30.75			2.48	-0.03	2.39						
l={4,6}	POOL-TECH	28.86	***6.16***	**3.81**	5.40	***0.19***	4.62	***6.43***	**3.04**	8.70	***5.81***	**2.34**	2.01
l={4,6}	PC-TECH	28.57	***7.10***	**3.81**	6.89	***0.22***	5.86	*7.77*	**3.04**	11.81	***6.23***	**2.33**	1.96
l={9,12}	POOL-TECH	29.61	***3.71***	**2.65**	2.69	***0.14***	2.18	***2.13***	**1.50**	3.81	***5.79***	**2.24**	1.63
l={9,12}	PC-TECH	29.55	***3.92***	**2.72**	3.57	***0.17***	2.95	***1.99***	**1.62**	5.65	***6.45***	**2.23**	1.64
POR<USA	POOL-ECON	30.27	***1.59***	**1.89**	1.86	***0.10***	1.34	***2.92***	**2.03**	2.81	-0.17	0.11	0.88
	PC-ECON	32.27	-4.93	**1.48**	0.57	***0.13***	-0.89	-0.01	**1.88**	6.00	-11.39	-0.39	-4.73
l={4,6}	POOL-ALL	29.37	***4.50***	**3.90**	3.92	***0.16***	3.33	***5.20***	**3.33**	5.97	***3.57***	**2.10**	1.80
l={4,6}	PC-ALL	29.80	***3.12***	**3.17**	6.04	***0.21***	4.29	***5.70***	**2.54**	11.67	-0.29	**2.09**	0.56
l={9,12}	POOL-ALL	29.79	***3.14***	**2.64**	1.88	***0.11***	1.43	***2.89***	**1.81**	2.04	***3.48***	**1.96**	1.76
l={9,12}	PC-ALL	30.66	***0.30***	**2.52**	3.00	***0.18***	2.02	***1.88***	**2.28**	6.20	-1.77	1.17	0.10
POR<JPN	POOL-ECON	30.59	***0.52***	0.98	0.12	***0.04***	-0.22	***1.58***	**1.42**	0.44	-0.88	-1.26	-0.21
	PC-ECON	32.27	-4.94	0.54	-4.62	***0.07***	-5.63	***0.76***	**1.30**	3.64	-12.43	-2.61	-12.74
l={4,6}	POOL-ALL	29.53	***3.99***	**3.76**	3.31	***0.14***	2.74	***4.51***	**3.06**	4.71	***3.30***	**2.19**	1.85
l={4,6}	PC-ALL	29.96	***2.59***	**2.85**	6.11	***0.22***	4.84	***4.83***	**2.50**	11.42	-0.37	**1.39**	1.00
l={9,12}	POOL-ALL	29.94	***2.64***	**2.46**	1.38	***0.10***	0.95	***2.22***	**1.55**	1.11	***3.20***	**2.06**	1.72
l={9,12}	PC-ALL	31.39	-2.08	**1.68**	2.44	***0.17***	1.43	-3.06	**1.31**	5.10	-0.78	1.22	0.05
POR<GER	POOL-ECON	30.25	***1.63***	**2.09**	1.78	***0.10***	1.21	***3.19***	**2.30**	3.18	-0.43	-0.31	0.32
	PC-ECON	31.48	-2.37	0.85	-1.45	***0.11***	-3.41	***3.56***	**1.79**	5.77	-10.17	-2.24	-8.53
l={4,6}	POOL-ALL	29.37	***4.50***	**3.96**	3.91	***0.16***	3.28	***5.29***	**3.30**	5.85	***3.47***	**2.21**	1.89
l={4,6}	PC-ALL	29.88	***2.83***	**3.20**	5.35	***0.20***	4.01	***5.12***	**2.80**	9.96	-0.18	**1.56**	0.88
l={9,12}	POOL-ALL	29.78	***3.17***	**2.75**	1.92	***0.12***	1.43	***3.00***	**1.88**	2.14	***3.38***	**2.09**	1.74
l={9,12}	PC-ALL	31.00	-0.81	**2.28**	2.75	***0.17***	1.64	***0.54***	**2.03**	6.30	-2.58	1.05	-0.57

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value. *l* stands for the length of long technical indicator rule.

Table 30: Out-of-Sample Forecasting Results, SPN

		Overall Period						Expansion Times			Recession Times		
	Model	**MSFE**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
	SPN-HA	36.75			1.94	-0.06	1.85						
l={4,6}	POOL-TECH	36.64	***0.29***	0.66	0.64	***0.01***	0.23	-0.77	-0.32	-1.08	***1.56***	**1.39**	2.73
l={4,6}	PC-TECH	36.56	***0.51***	0.90	0.89	***0.04***	0.32	-0.81	-0.01	-1.08	***2.09***	**1.36**	3.28
l={9,12}	POOL-TECH	36.12	***1.71***	**1.75**	2.80	***0.11***	2.55	***0.66***	0.81	1.59	***2.96***	**1.57**	4.26
l={9,12}	PC-TECH	36.11	***1.74***	**1.70**	2.71	***0.11***	2.38	***0.51***	0.78	1.27	***3.21***	**1.54**	4.47
SPN<USA	POOL-ECON	36.63	***0.32***	0.64	0.64	***0.04***	0.11	***0.62***	0.65	-0.23	-0.04	0.11	1.71
	PC-ECON	37.95	-3.28	1.19	0.01	***0.09***	-1.77	-6.17	0.74	-1.20	***0.16***	1.02	1.49
l={4,6}	POOL-ALL	36.60	***0.41***	0.76	0.73	***0.03***	0.33	***0.04***	0.25	-0.66	***0.85***	1.03	2.42
l={4,6}	PC-ALL	38.48	-4.73	0.62	-0.24	***0.09***	-2.38	-10.20	0.06	-3.47	***1.82***	**1.40**	3.69
l={9,12}	POOL-ALL	36.29	***1.23***	**1.52**	2.14	***0.08***	1.85	***0.79***	0.82	0.99	***1.77***	**1.35**	3.54
l={9,12}	PC-ALL	36.92	-0.46	**1.93**	1.03	***0.11***	-0.81	-7.65	0.73	-3.29	***8.13***	**2.61**	6.27
SPN<JPN	POOL-ECON	36.73	***0.05***	0.33	-0.62	***0.00***	-1.05	***0.61***	0.67	-0.08	-0.62	-0.77	-1.28
	PC-ECON	37.75	-2.74	0.77	-2.14	***0.07***	-3.68	-2.37	0.95	-0.61	-3.18	-0.56	-3.79
l={4,6}	POOL-ALL	36.65	***0.27***	0.63	0.27	***0.01***	-0.08	***0.02***	0.22	-0.74	***0.58***	0.95	1.49
l={4,6}	PC-ALL	37.03	-0.78	**1.27**	-0.72	***0.08***	-2.50	-3.10	0.80	-2.79	***1.99***	**1.56**	1.83
l={9,12}	POOL-ALL	36.33	***1.12***	**1.55**	2.06	***0.08***	1.81	***0.76***	0.84	0.94	***1.55***	**1.41**	3.44
l={9,12}	PC-ALL	37.36	-1.67	1.21	0.59	***0.11***	-1.06	-4.35	0.72	-1.20	***1.54***	**1.36**	2.80
SPN<GER	POOL-ECON	36.66	***0.25***	0.59	-0.01	***0.02***	-0.56	***0.63***	0.67	0.07	-0.21	-0.16	-0.11
	PC-ECON	38.03	-3.50	0.16	-1.36	***0.06***	-2.08	-5.05	0.30	-2.90	-1.65	-0.60	0.55
l={4,6}	POOL-ALL	36.61	***0.38***	0.77	0.58	***0.02***	0.17	***0.03***	0.25	-0.63	***0.79***	**1.27**	2.04
l={4,6}	PC-ALL	38.13	-3.75	0.25	-1.23	***0.06***	-2.68	-8.64	-0.30	-6.34	***2.09***	**1.55**	4.99
l={9,12}	POOL-ALL	36.30	***1.22***	**1.65**	2.19	***0.09***	1.90	***0.77***	0.85	0.99	***1.75***	**1.59**	3.64
l={9,12}	PC-ALL	37.61	-2.35	0.83	-0.10	***0.08***	-0.98	-7.66	-0.09	-4.71	***4.00***	**1.95**	5.49

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value. *l* stands for the length of long technical indicator rule.

Table 31: Out-of-Sample Forecasting Results, TWN

			Overall Period					Expansion Times			Recession Times		
	Model	**MSFE**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**
	TWN-HA	57.74			2.11	-0.08	2.07						
l={4,6}	POOL-TECH	56.80	***1.63***	**1.81**	0.61	***0.04***	0.16	***0.23***	0.97	0.24	***3.50***	**1.57**	1.60
l={4,6}	PC-TECH	57.35	***0.67***	**1.69**	-0.11	***0.04***	-0.75	-0.74	1.15	-0.14	***2.57***	**1.23**	-0.06
l={9,12}	POOL-TECH	57.76	-0.04	0.52	-0.05	***-0.03***	-0.21	-0.69	-0.01	-0.09	***0.83***	0.64	0.05
l={9,12}	PC-TECH	58.20	-0.81	0.26	-0.14	***-0.03***	-0.29	-1.45	-0.10	-0.06	***0.05***	0.40	-0.36
TWN<USA	POOL-ECON	57.54	***0.34***	1.05	0.27	***-0.01***	0.09	***0.53***	1.07	0.27	***0.10***	0.27	0.27
	PC-ECON	57.77	-0.06	**1.36**	-0.87	***0.00***	-1.25	-0.31	**1.34**	-0.47	***0.27***	0.47	-1.98
l={4,6}	POOL-ALL	56.92	***1.41***	**1.99**	0.62	***0.03***	0.32	***0.85***	1.21	0.42	***2.17***	**1.60**	1.16
l={4,6}	PC-ALL	57.37	***0.63***	**2.94**	0.11	***0.09***	-1.72	-6.05	**1.83**	-0.47	***9.61***	**2.35**	1.63
l={9,12}	POOL-ALL	57.53	***0.36***	0.87	0.21	***-0.02***	0.05	***0.13***	0.49	0.16	***0.68***	0.72	0.34
l={9,12}	PC-ALL	59.26	-2.63	**1.52**	-3.59	***-0.01***	-4.63	-5.46	0.93	-4.81	***1.17***	1.21	-0.29
TWN<JPN	POOL-ECON	57.69	***0.08***	0.43	-0.26	***-0.04***	-0.43	***0.40***	0.80	-0.03	-0.36	-0.30	-0.90
	PC-ECON	58.56	-1.43	0.36	-2.05	***-0.04***	-2.22	-0.56	0.90	-1.38	-2.60	-0.72	-3.88
l={4,6}	POOL-ALL	56.97	***1.33***	**1.99**	0.49	***0.03***	0.19	***0.83***	1.15	0.23	***2.01***	**1.73**	1.20
l={4,6}	PC-ALL	58.84	-1.91	**2.21**	-2.35	***0.08***	-4.26	-6.18	**1.51**	-2.76	***3.82***	**1.65**	-1.37
l={9,12}	POOL-ALL	57.59	***0.26***	0.76	0.09	***-0.02***	-0.06	***0.07***	0.41	0.00	***0.52***	0.69	0.33
l={9,12}	PC-ALL	61.02	-5.69	0.96	-4.37	***0.01***	-5.40	-11.29	0.48	-5.60	***1.84***	1.04	-1.06
TWN<GER	POOL-ECON	57.48	***0.45***	1.10	-0.04	***-0.02***	-0.26	***0.62***	1.12	0.20	***0.23***	0.39	-0.68
	PC-ECON	58.20	-0.80	0.74	-0.84	***0.00***	-1.08	***0.53***	**1.36**	-0.19	-2.59	-0.51	-2.63
l={4,6}	POOL-ALL	56.88	***1.49***	**2.08**	0.74	***0.04***	0.42	***0.89***	1.22	0.42	***2.29***	**1.77**	1.61
l={4,6}	PC-ALL	57.11	***1.08***	**2.92**	-1.44	***0.08***	-3.23	-1.88	**2.24**	-0.79	***5.05***	**1.87**	-3.29
l={9,12}	POOL-ALL	57.48	***0.44***	1.03	0.26	***-0.01***	0.08	***0.16***	0.54	0.20	***0.82***	0.92	0.41
l={9,12}	PC-ALL	59.66	-3.33	0.80	-0.02	***0.07***	-0.82	-3.53	1.04	0.61	-3.08	-0.24	-1.71

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value. *l* stands for the length of long technical indicator rule.

Table 32: Out-of-Sample Forecasting Results, TUR

		Overall Period						Expansion Times			Recession Times		
	Model	**MSFE**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
	TUR-HA	178.53			42.33	-0.08	42.31						
l={4,6}	POOL-TECH	178.65	-0.07	0.41	0.59	***0.01***	0.41	***0.44***	0.76	0.50	-0.55	-0.08	0.74
l={4,6}	PC-TECH	179.92	-0.78	0.35	0.22	***0.02***	-0.02	***0.24***	0.81	0.36	-1.76	-0.12	0.04
l={9,12}	POOL-TECH	180.07	-0.86	-2.13	-0.64	-0.14	-0.69	-0.45	-1.25	-0.15	-1.25	-1.76	-1.34
l={9,12}	PC-TECH	180.60	-1.16	-1.57	-0.65	-0.14	-0.70	-0.92	-1.39	-0.38	-1.39	-1.05	-1.04
TUR<USA	POOL-ECON	176.81	***0.96***	1.15	0.64	***-0.05***	0.50	***0.20***	0.53	0.04	***1.70***	1.03	1.49
	PC-ECON	184.47	-3.33	**1.31**	0.90	***0.03***	0.55	-9.95	0.25	1.00	***3.02***	**1.52**	0.77
l={4,6}	POOL-ALL	177.44	***0.61***	0.96	0.71	***-0.01***	0.59	***0.52***	0.87	0.19	***0.69***	0.60	1.45
l={4,6}	PC-ALL	188.21	-5.42	1.09	0.16	***0.01***	-0.10	-9.28	0.38	-0.98	-1.72	1.07	1.82
l={9,12}	POOL-ALL	178.22	***0.17***	0.45	0.16	-0.10	0.07	0.00	0.20	-0.10	***0.34***	0.41	0.52
l={9,12}	PC-ALL	187.79	-5.19	0.88	-2.31	***-0.06***	-2.83	-9.05	0.35	0.45	-1.48	0.87	-6.32
TUR<JPN	POOL-ECON	177.29	***0.70***	1.07	0.49	***-0.07***	0.42	-0.08	0.28	-0.12	***1.44***	1.12	1.36
	PC-ECON	187.66	-5.11	**1.33**	-0.57	***-0.01***	-1.23	-7.13	0.99	1.98	-3.18	0.94	-4.23
l={4,6}	POOL-ALL	177.72	***0.45***	0.85	0.53	***-0.02***	0.42	***0.36***	0.71	-0.02	***0.54***	0.56	1.33
l={4,6}	PC-ALL	188.10	-5.36	**1.34**	0.91	***0.02***	0.57	-7.88	1.08	1.20	-2.95	0.88	0.48
l={9,12}	POOL-ALL	178.53	***0.00***	0.20	0.07	-0.11	0.00	-0.18	-0.07	-0.25	***0.17***	0.30	0.51
l={9,12}	PC-ALL	186.39	-4.40	**1.26**	-3.08	-0.08	-3.54	-6.14	1.07	1.69	-2.74	0.77	-9.98
TUR<GER	POOL-ECON	178.13	***0.23***	0.58	-0.06	-0.08	-0.17	***0.09***	0.38	0.08	***0.36***	0.43	-0.27
	PC-ECON	185.35	-3.82	1.06	-3.97	-0.08	-4.56	-8.51	0.46	-0.45	***0.68***	1.05	-9.08
l={4,6}	POOL-ALL	178.14	***0.22***	0.58	0.48	***-0.02***	0.35	***0.43***	0.77	0.23	***0.02***	0.16	0.84
l={4,6}	PC-ALL	186.26	-4.33	1.09	-1.23	***-0.03***	-1.68	-4.84	1.05	-0.14	-3.84	0.56	-2.83
l={9,12}	POOL-ALL	178.97	-0.25	-0.30	-0.31	-0.12	-0.38	-0.10	0.02	-0.09	-0.39	-0.41	-0.63
l={9,12}	PC-ALL	187.73	-5.15	0.68	-6.28	-0.09	-6.97	-6.01	0.61	1.01	-4.33	0.36	-16.76

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value. *l* stands for the length of long technical indicator rule.

Table 33: Out-of-Sample Forecasting Results, BRA

		Overall Period						Expansion Times			Recession Times		
	Model	**MSFE**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
	BRA-HA	45.33			10.77	0.01	10.70						
l={4,6}	POOL-TECH	45.47	-0.29	-0.12	-0.24	-0.03	-0.51	-1.36	-0.94	-0.86	***0.20***	0.43	0.26
l={4,6}	PC-TECH	45.83	-1.10	-0.77	-0.93	-0.06	-1.18	-1.94	-1.07	-1.30	-0.72	-0.28	-0.64
l={9,12}	POOL-TECH	45.77	-0.96	-0.92	-1.07	-0.05	-1.29	-0.12	0.06	-0.14	-1.35	-1.06	-1.78
l={9,12}	PC-TECH	46.00	-1.48	-1.05	-1.26	-0.07	-1.51	-0.76	-0.35	-0.43	-1.81	-0.99	-1.91
BRA<USA	POOL-ECON	45.26	***0.17***	0.39	0.50	***0.01***	0.25	-0.07	-0.03	-0.11	***0.28***	0.40	0.99
	PC-ECON	47.36	-4.47	-0.73	-2.00	***0.03***	-2.25	***0.26***	0.55	-0.25	-6.63	-1.31	-3.36
l={4,6}	POOL-ALL	45.33	0.00	0.20	0.16	-0.01	-0.03	-0.66	-0.90	-0.45	***0.30***	0.52	0.65
l={4,6}	PC-ALL	46.99	-3.66	0.08	0.31	***0.05***	-1.23	-4.88	-0.12	1.53	-3.11	0.22	-0.63
l={9,12}	POOL-ALL	45.49	-0.35	-0.34	-0.19	-0.02	-0.38	-0.02	0.05	-0.09	-0.49	-0.37	-0.26
l={9,12}	PC-ALL	46.18	-1.86	0.06	-2.01	0.00	-2.69	-5.10	-0.38	-5.38	-0.38	0.45	0.63
BRA<JPN	POOL-ECON	45.45	-0.27	0.03	0.19	0.00	-0.11	-1.21	-1.10	-1.28	***0.17***	0.34	1.34
	PC-ECON	47.80	-5.45	0.56	0.66	***0.06***	0.31	-3.13	-0.08	-4.08	-6.51	0.60	4.37
l={4,6}	POOL-ALL	45.43	-0.22	-0.04	0.01	-0.02	-0.20	-1.22	-1.41	-1.03	***0.24***	0.44	0.83
l={4,6}	PC-ALL	48.08	-6.06	0.72	0.96	***0.04***	-0.36	-8.20	-1.10	-2.03	-5.08	1.01	3.30
l={9,12}	POOL-ALL	45.59	-0.56	-0.50	-0.34	-0.03	-0.56	-0.59	-0.68	-0.66	-0.55	-0.31	-0.07
l={9,12}	PC-ALL	48.66	-7.33	0.59	0.88	***0.06***	-0.15	-5.02	0.19	-3.81	-8.39	0.55	4.54
BRA<GER	POOL-ECON	44.92	***0.92***	1.10	1.17	***0.03***	0.80	-1.19	-0.91	-0.75	***1.89***	**1.56**	2.69
	PC-ECON	46.17	-1.86	0.32	-0.74	***0.02***	-1.57	-13.35	-0.88	-5.69	***3.39***	1.17	3.13
l={4,6}	POOL-ALL	45.17	***0.36***	0.67	0.50	0.00	0.26	-1.22	-1.09	-0.79	***1.09***	**1.30**	1.52
l={4,6}	PC-ALL	44.63	***1.54***	**1.65**	3.74	***0.14***	2.07	-9.27	-0.52	-0.92	***6.48***	**2.23**	7.43
l={9,12}	POOL-ALL	45.32	***0.03***	0.21	0.12	-0.01	-0.11	-0.59	-0.46	-0.43	***0.30***	0.48	0.55
l={9,12}	PC-ALL	46.34	-2.23	0.41	-1.85	***0.01***	-3.26	-8.76	-0.39	-4.97	***0.75***	0.96	0.56

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value. *l* stands for the length of long technical indicator rule.

Table 34: Out-of-Sample Forecasting Results, HKG

		Overall Period						Expansion Times			Recession Times		
	Model	**MSFE**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**
	HKG-HA	42.10			0.60	0.07	0.45						
l={4,6}	POOL-TECH	42.07	***0.07***	0.33	0.37	***0.08***	-0.08	-1.14	-0.63	-1.05	***1.17***	0.75	2.89
l={4,6}	PC-TECH	42.02	***0.20***	0.51	0.52	***0.08***	0.11	-1.85	-0.57	-1.48	***2.06***	0.95	4.05
l={9,12}	POOL-TECH	41.94	***0.38***	0.57	1.19	***0.13***	0.80	-5.52	-1.05	-2.70	***5.72***	**1.38**	8.22
l={9,12}	PC-TECH	42.05	***0.11***	0.61	1.28	***0.14***	0.89	-7.55	-1.03	-2.81	***7.06***	**1.42**	8.67
HKG<USA	POOL-ECON	41.59	***1.21***	0.98	2.59	***0.14***	2.21	-0.97	-0.34	1.07	***3.19***	**1.33**	5.30
	PC-ECON	43.36	-2.99	0.75	-0.46	***0.11***	-1.40	-9.32	-0.43	1.59	***2.74***	0.94	-3.95
l={4,6}	POOL-ALL	41.79	***0.74***	0.83	1.62	***0.11***	1.27	-0.93	-0.65	0.03	***2.25***	1.22	4.43
l={4,6}	PC-ALL	44.69	-6.15	-0.09	0.15	***0.10***	-0.95	-11.34	-1.00	-1.26	-1.45	0.48	2.59
l={9,12}	POOL-ALL	41.69	***0.98***	0.73	2.26	***0.14***	1.92	-3.08	-0.86	-0.68	***4.66***	**1.43**	7.57
l={9,12}	PC-ALL	41.53	***1.35***	**1.58**	2.49	***0.16***	1.37	-6.43	0.78	0.58	***8.41***	**1.37**	6.12
HKG<JPN	POOL-ECON	42.40	-0.70	-0.47	-1.55	0.06	-1.96	-2.13	-1.48	-2.91	***0.60***	0.61	0.89
	PC-ECON	43.75	-3.91	0.37	-5.93	0.05	-6.86	-6.77	-0.64	-4.62	-1.32	0.69	-8.25
l={4,6}	POOL-ALL	42.20	-0.23	-0.03	-0.59	0.07	-0.97	-1.53	-1.41	-1.96	***0.94***	0.76	1.85
l={4,6}	PC-ALL	45.90	-9.03	-0.28	-7.24	-0.01	-9.31	-15.31	-1.76	-8.75	-3.34	0.61	-4.51
l={9,12}	POOL-ALL	42.07	***0.07***	0.36	0.51	***0.11***	0.13	-3.59	-1.20	-3.02	***3.40***	**1.30**	6.88
l={9,12}	PC-ALL	43.19	-2.57	1.03	-0.46	***0.13***	-1.50	-8.38	0.32	-1.67	***2.68***	1.04	2.04
HKG<GER	POOL-ECON	41.73	***0.90***	**1.80**	1.64	***0.11***	1.35	***0.69***	1.01	1.23	***1.08***	**1.53**	2.34
	PC-ECON	42.42	-0.76	0.84	1.63	***0.13***	0.69	***1.35***	**1.37**	6.57	-2.68	-0.28	-6.94
l={4,6}	POOL-ALL	41.87	***0.54***	0.93	1.05	***0.09***	0.73	-0.16	0.03	0.12	***1.18***	1.11	2.66
l={4,6}	PC-ALL	41.80	***0.72***	1.12	2.69	***0.14***	1.98	***1.84***	1.05	3.32	-0.29	0.38	1.61
l={9,12}	POOL-ALL	41.71	***0.94***	0.83	2.08	***0.13***	1.79	-2.10	-0.85	-0.97	***3.70***	**1.47**	7.54
l={9,12}	PC-ALL	42.24	-0.33	**1.41**	-0.10	***0.12***	-1.79	-2.30	**1.30**	5.15	***1.45***	0.78	-9.15

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value. *l* stands for the length of long technical indicator rule.

Table 35: Out-of-Sample Forecasting Results, IND

		Overall Period						Expansion Times			Recession Times		
	Model	**MSFE**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
	IND-HA	57.92			6.70	0.07	6.63						
l={4,6}	POOL-TECH	58.15	-0.41	-0.32	-0.12	0.05	-0.32	-1.62	-1.51	-1.40	***0.69***	0.74	1.73
l={4,6}	PC-TECH	58.09	-0.30	-0.03	0.16	0.06	-0.05	-1.92	-1.64	-1.82	***1.16***	0.87	3.05
l={9,12}	POOL-TECH	57.48	***0.75***	0.64	2.93	***0.15***	2.75	-2.07	-0.39	0.58	***3.29***	1.04	6.41
l={9,12}	PC-TECH	57.37	***0.94***	0.76	3.69	***0.17***	3.47	-2.61	-0.31	1.21	***4.14***	1.12	7.39
IND<USA	POOL-ECON	57.28	***1.10***	**1.90**	1.51	***0.11***	1.22	***1.05***	1.08	1.11	***1.14***	**1.81**	2.16
	PC-ECON	58.20	-0.48	**1.85**	4.09	***0.18***	3.33	***5.03***	**2.04**	6.11	-5.45	0.45	1.48
l={4,6}	POOL-ALL	57.68	***0.41***	0.91	0.79	***0.09***	0.59	-0.18	-0.21	-0.03	***0.95***	1.22	2.00
l={4,6}	PC-ALL	56.87	***1.80***	**1.83**	3.36	***0.17***	2.37	***4.76***	**2.06**	6.13	-0.86	0.25	-0.28
l={9,12}	POOL-ALL	57.23	***1.18***	0.97	2.49	***0.14***	2.31	-0.30	-0.03	0.33	***2.52***	1.18	5.68
l={9,12}	PC-ALL	54.84	***5.32***	**2.71**	7.09	***0.24***	6.45	***4.13***	**1.93**	7.34	***6.39***	**1.89**	7.11
IND<JPN	POOL-ECON	57.56	***0.61***	0.85	0.71	***0.09***	0.27	***1.00***	0.87	0.83	***0.26***	0.34	0.60
	PC-ECON	55.89	***3.50***	**1.84**	2.10	***0.15***	0.60	***4.23***	**1.70**	2.99	***2.84***	0.91	1.03
l={4,6}	POOL-ALL	57.81	***0.18***	0.41	0.40	***0.08***	0.17	-0.18	-0.15	-0.13	***0.50***	0.55	1.21
l={4,6}	PC-ALL	58.22	-0.52	0.86	0.57	***0.13***	-0.66	***1.58***	1.21	4.62	-2.40	0.27	-4.94
l={9,12}	POOL-ALL	57.39	***0.92***	0.76	2.07	***0.13***	1.82	-0.28	-0.02	0.23	***1.99***	0.89	4.78
l={9,12}	PC-ALL	57.04	***1.51***	**1.59**	4.01	***0.19***	2.36	-1.59	1.00	3.17	***4.30***	**1.26**	5.49
IND<GER	POOL-ECON	56.25	***2.88***	**2.34**	3.86	***0.18***	3.41	***1.67***	1.04	0.98	***3.97***	**2.26**	8.05
	PC-ECON	54.16	***6.48***	**2.24**	5.77	***0.22***	4.44	***5.17***	**1.26**	-0.35	***7.66***	**2.00**	14.72
l={4,6}	POOL-ALL	57.13	***1.35***	**2.07**	2.09	***0.13***	1.84	***0.14***	0.32	0.03	***2.45***	**2.28**	5.09
l={4,6}	PC-ALL	52.75	***8.93***	**2.60**	7.84	***0.25***	7.01	***5.81***	**1.38**	1.36	***11.74***	**2.34**	17.34
l={9,12}	POOL-ALL	56.62	***2.23***	**1.61**	3.54	***0.17***	3.32	***0.11***	0.25	0.67	***4.14***	**1.66**	7.78
l={9,12}	PC-ALL	54.19	***6.43***	**2.42**	8.24	***0.26***	6.67	-1.16	**1.24**	4.00	***13.27***	**2.12**	14.61

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value. *l* stands for the length of long technical indicator rule.

Table 36: Out-of-Sample Forecasting Results, RUS

		Overall Period						Expansion Times			Recession Times		
	Model	**MSFE**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
	RUS-HA	142.92			-0.39	0.13	-0.50						
l={4,6}	POOL-TECH	145.39	-1.73	-1.57	-2.77	0.08	-3.14	-1.69	-1.36	-1.95	-1.80	-0.80	-5.13
l={4,6}	PC-TECH	147.60	-3.27	-1.53	-9.13	0.05	-9.74	-2.31	-1.02	-4.95	-5.40	-1.12	-19.48
l={9,12}	POOL-TECH	144.54	-1.13	-1.05	-2.04	0.09	-2.31	-0.17	0.01	1.23	-3.25	-1.39	-9.79
l={9,12}	PC-TECH	147.38	-3.12	-1.37	-8.29	0.05	-8.79	-0.50	-0.03	1.00	-8.86	-1.58	-30.10
RUS<USA	POOL-ECON	142.89	***0.03***	0.19	1.80	0.12	1.62	-0.47	-0.68	0.31	***1.11***	0.99	4.96
	PC-ECON	146.27	-2.35	0.02	1.56	0.09	0.99	-4.26	-1.34	-2.82	***1.86***	0.88	10.97
l={4,6}	POOL-ALL	144.04	-0.78	-1.38	-0.22	0.10	-0.43	-1.02	-1.47	-0.62	-0.27	-0.19	0.35
l={4,6}	PC-ALL	147.08	-2.91	-1.50	-8.23	0.06	-8.84	-1.71	-0.85	-3.48	-5.55	-1.24	-19.45
l={9,12}	POOL-ALL	143.63	-0.50	-0.77	0.09	0.11	-0.09	-0.27	-0.32	0.88	-0.99	-0.87	-1.98
l={9,12}	PC-ALL	145.69	-1.94	0.59	0.65	0.11	-0.26	-0.84	0.53	5.58	-4.34	0.25	-11.59
RUS<JPN	POOL-ECON	142.12	***0.56***	0.79	3.49	***0.14***	3.24	-0.56	-0.75	-0.05	***3.01***	1.20	11.49
	PC-ECON	149.33	-4.48	0.70	1.10	0.13	-0.78	-5.29	-0.91	-8.17	-2.71	1.19	22.00
l={4,6}	POOL-ALL	143.60	-0.47	-0.53	0.87	0.11	0.66	-1.05	-1.45	-0.73	***0.79***	0.80	4.29
l={4,6}	PC-ALL	155.50	-8.80	-1.11	-5.03	0.07	-6.12	-4.31	-0.82	-7.69	-18.66	-0.79	1.26
l={9,12}	POOL-ALL	143.22	-0.21	-0.06	1.19	0.12	0.99	-0.30	-0.42	0.79	***0.01***	0.26	1.94
l={9,12}	PC-ALL	144.23	-0.91	0.94	8.33	***0.18***	7.29	-3.51	-0.15	2.58	***4.79***	**1.53**	20.49
RUS<GER	POOL-ECON	142.35	***0.40***	0.91	2.17	***0.14***	1.97	-0.11	-0.14	0.80	***1.51***	1.12	5.08
	PC-ECON	145.45	-1.77	0.60	6.42	***0.18***	5.47	-4.90	-0.93	-3.22	***5.10***	1.18	27.62
l={4,6}	POOL-ALL	143.76	-0.58	-1.07	-0.05	0.11	-0.24	-0.84	-1.18	-0.42	-0.03	0.05	0.48
l={4,6}	PC-ALL	146.99	-2.84	-1.58	-7.60	0.06	-8.13	-1.96	-1.02	-3.84	-4.79	-1.19	-16.80
l={9,12}	POOL-ALL	143.34	-0.29	-0.52	0.28	0.12	0.11	-0.09	-0.05	1.13	-0.74	-0.79	-1.88
l={9,12}	PC-ALL	147.97	-3.53	0.00	-3.12	0.11	-4.11	-1.18	0.69	5.79	-8.69	-0.62	-24.17

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value. *l* stands for the length of long technical indicator rule.

Table 37: Out-of-Sample Forecasting Results, ZAF

		Overall Period						Expansion Times			Recession Times		
	Model	**MSFE**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**
	ZAF-HA	23.43			6.66	0.05	6.49						
l={4,6}	POOL-TECH	23.29	***0.61***	0.69	2.10	***0.11***	1.47	-2.17	-0.53	-0.13	***4.05***	**1.70**	9.01
l={4,6}	PC-TECH	23.23	***0.87***	0.87	3.10	***0.14***	2.35	-3.15	-0.33	0.51	***5.84***	**1.72**	11.10
l={9,12}	POOL-TECH	23.69	-1.09	-0.49	-1.27	0.02	-1.55	-2.05	-1.36	-1.28	***0.08***	0.25	-1.38
l={9,12}	PC-TECH	23.81	-1.60	-0.41	-1.49	0.02	-1.82	-3.06	-1.44	-1.48	***0.19***	0.36	-1.71
ZAF<USA	POOL-ECON	23.13	***1.30***	1.09	2.76	***0.13***	2.35	-0.19	-0.04	0.39	***3.14***	1.16	10.18
	PC-ECON	24.69	-5.38	0.22	3.00	***0.14***	0.90	-11.12	-0.61	-0.98	***1.72***	0.68	15.54
l={4,6}	POOL-ALL	23.18	***1.09***	0.98	2.24	***0.11***	1.78	-1.02	-0.48	-0.07	***3.69***	**1.50**	9.46
l={4,6}	PC-ALL	24.35	-3.91	0.15	4.34	***0.18***	2.85	-7.36	-0.63	0.94	***0.35***	0.66	15.03
l={9,12}	POOL-ALL	23.40	***0.16***	0.36	0.90	***0.07***	0.63	-1.03	-1.16	-0.41	***1.64***	0.78	4.95
l={9,12}	PC-ALL	23.93	-2.10	0.18	0.00	0.04	-1.25	-7.22	-1.18	-2.57	***4.21***	1.00	7.99
ZAF<JPN	POOL-ECON	23.37	***0.28***	0.49	1.08	***0.07***	0.80	-0.66	-1.15	-0.17	***1.44***	0.83	4.98
	PC-ECON	24.79	-5.79	-0.79	-2.24	0.00	-2.96	-5.06	-1.68	-2.38	-6.69	-0.19	-1.73
l={4,6}	POOL-ALL	23.30	***0.56***	0.69	1.53	***0.09***	1.09	-1.25	-0.67	-0.36	***2.81***	**1.39**	7.39
l={4,6}	PC-ALL	24.05	-2.63	0.07	2.62	***0.13***	1.67	-6.18	-0.69	1.02	***1.77***	0.82	7.62
l={9,12}	POOL-ALL	23.52	-0.37	-0.08	-0.03	0.04	-0.26	-1.29	-1.55	-0.70	***0.78***	0.53	2.00
l={9,12}	PC-ALL	23.92	-2.09	0.20	-1.02	0.03	-1.42	-4.34	-1.15	-1.40	***0.70***	0.75	0.04
ZAF<GER	POOL-ECON	23.15	***1.20***	**1.66**	2.19	***0.11***	1.74	***0.08***	0.28	0.31	***2.58***	**1.94**	8.03
	PC-ECON	23.17	***1.13***	**1.70**	7.38	***0.24***	5.75	-8.08	0.22	0.63	***12.51***	**2.45**	28.75
l={4,6}	POOL-ALL	23.19	***1.04***	1.11	2.17	***0.11***	1.68	-0.87	-0.40	-0.11	***3.40***	**1.91**	9.28
l={4,6}	PC-ALL	23.24	***0.81***	**1.39**	6.50	***0.22***	4.82	-9.54	-0.41	0.91	***13.61***	**2.17**	24.06
l={9,12}	POOL-ALL	23.40	***0.14***	0.35	0.56	***0.06***	0.28	-0.89	-1.07	-0.43	***1.41***	0.93	3.61
l={9,12}	PC-ALL	23.35	***0.34***	**1.33**	5.36	***0.20***	3.90	-10.37	-0.86	-2.19	***13.58***	**2.80**	29.56

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value. *l* stands for the length of long technical indicator rule.

Table 38 reports the *p*-values for the Clark and McCracken's (2012) reality check *maxMSFE-F* statistics which tests the null hypothesis of none of the forecasts produced by competing twenty-eight models outperform that of the benchmark model, *HA*. *P*-values are computed via wild fixed-regressor bootstrap procedure. We evidence that all of the *p*-values are greater than conventional levels for TUR, BRA, and HKG indicating that the out-of-sample forecasting exercises for those countries suffer from data-snooping problem. However, the out-of-sample predictive powers of forecasts for the remaining stock markets are free of this problem. It is also noteworthy that the best F-ALL models in-sample analyses are also found to be free of data-snooping problem for all stock markets except TUR, BRA, HKG, and ZAF. However, ZAF forecasts are free of data-snooping problem when they are estimated by using macroeconomic indicators of USA.

Table 38: *P*-Value for *maxMSFE-F* Statistics

	USA		**JPN**		**GER**	
i	***l={4,6}***	***l={9,12}***	***l={4,6}***	***l={9,12}***	***l={4,6}***	***l={9,12}***
BEL	**0.00**	**0.00**	**0.02**	**0.02**	**0.01**	**0.01**
GRC	**0.00**	**0.01**	**0.00**	**0.01**	**0.00**	**0.02**
MYS	**0.02**	0.19	**0.01**	0.20	**0.01**	0.20
MEX	0.49	0.54	0.54	0.56	**0.09**	**0.08**
POR	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**
SPN	0.39	**0.03**	0.38	**0.02**	0.33	**0.02**
TWN	**0.10**	0.65	0.12	0.92	**0.08**	0.90
TUR	0.32	0.31	0.83	0.99	0.78	0.74
BRA	0.62	0.51	0.42	0.45	0.59	0.62
HKG	0.21	0.22	0.39	0.61	0.39	0.61
IND	**0.02**	**0.02**	**0.03**	**0.02**	**0.00**	**0.01**
RUS	0.35	0.57	**0.09**	**0.07**	0.40	0.52
ZAF	**0.09**	**0.10**	0.18	0.19	0.14	0.15

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. *l* stands for the length of long technical indicator rule.

CONCLUSION

The main purpose of our study is to investigate the forecastability of equity risk premium which takes part in asset pricing and valuation models in finance and has a crucial importance in decision making processes. We combine the ideas of the studies by Rapach et al. (2013) and Neely et al. (2014) and attempt to improve their implications. Following the former one, we consider macroeconomic indicators of the major stock markets, namely the US, Japan, and Germany as *foreign factors* in addition to the domestic macroeconomic variables of the examined thirteen stock markets. The main motivation behind this idea is the fact that gradual information diffusion from a country might be able to predict the stock returns in the trading partner countries. Furthermore, following the latter study, we examine the predictive power of popular technical indicators on the equity risk premium. The existing literature investigates the profitability of technical trading rules extensively; however, the predictive power of technical indicators on equity risk premium is not specifically investigated directly before Neely et al. (2014) which examine only the US market.

In this way, we contribute to the existing literature in the following ways. First, to the best of our knowledge, this is the first study testing the predictive power of technical indicators on the equity risk premiums of the selected stock markets.

Second, following the study of Rapach et al. (2013), we show that macroeconomic indicators and equity risk premium of Germany perform even better than those of the US for the selected markets. This demonstrates that the investors and portfolio managers should not only consider the impact of the US to other markets but also the impact of other major markets, especially Germany, on the relatively smaller stock markets in terms of market capitalization.

Third, we compare the predictive and forecasting performances of technical indicators to that of the macroeconomic indicators including foreign factors. We find that incorporating information from all macroeconomic and technical indicators improves the predictive and forecasting power of the models. Accordingly, we suggest using the equity risk premium forecasts based on both the technical (past prices, volume patterns) and fundamental (dividend, earnings information) analyses for the analyzed stock markets. Moreover, we clarify why particular technical trading strategies with various length rules better explain the variation in the equity risk premiums of the stock markets.

Fourth, we employ both in-sample and out-of-sample evidence of predictive power of macroeconomic and technical indicators in order to increase the reliability of our findings. We consider the statistical issues raised by the early studies and employ recent econometric techniques as well as several suggested forecasting strategies, namely economically motivated model restrictions, forecast combination, and diffusion indices.

Fifth, we analyze the equity risk premium forecasts with utility based metrics in addition to the other forecast comparison statistic, mean square forecast error. Portfolio performance analysis provides evidence of the economic value of equity risk premium forecasts for a risk-averse investor and gives a clear insight about the practicability of the equity risk premium forecasts in the real world exercises.

In our empirical application, we analyze monthly data and the longest time period analyzed is from January 1988 to December 2012. The sample includes the important but fragile emerging countries that have significant trading partnership with one of the major economies. We consider the statistical issues raised by the literature, such as parameter stability and data-snooping bias. The empirical analysis proceeds in several steps. First, we carry out our estimations in in-sample perspective. Second, we employ out-of-sample analysis in order to measure validity of our models.

In in-sample analysis part, the estimation results of the bi-variate predictive regressions suggest limited predictive ability for both domestic and foreign macroeconomic indicators. The numbers of economically significant domestic indicators during expansions and recessions are quite close to each other; however foreign macroeconomic indicators, especially equity risk premiums and changes in the industrial production levels of major stock markets have more predictive power in recessions vis-à-vis expansions. This indicates the fact that investor risk perception is more sensitive to information flow from major stock market returns and production output changes in big economies during bad economic conditions. Macroeconomic indicators of Germany are the most successful predictors. One might think that a high number of the European countries in the sample causes that; however some of the macroeconomic indicators of Germany have significant impact on Asian and American stock markets. Nevertheless, the parameter estimates of some of the bivariate regressions are not stable over time. Finally, we cannot find any consistent evidence with the theory positing that gradual information diffusion from a country might be able to predict the stock returns in the trading partner countries (Rizova 2010, Rapach et al., 2013). Overall, the performance of the domestic and foreign macroeconomic indicators is mediocre.

Bi-variate predictive regression results demonstrate that technical indicators have greater and more significant impact on the equity risk premiums than both domestic and foreign macroeconomic indicators. Bi-variate predictive regression results demonstrate that technical indicators have greater and more significant impact on the equity risk premiums than both domestic and foreign macroeconomic indicators. The empirical results suggest that shortening the long technical indicator rules results in minor differences in the total number of statistically and economically significant predictors for all cases. However, there are substantial changes in the total number of statistically and economically significant predictors for Taiwan, Turkey, India, and South Africa when we use different sets of technical indicators. It is also clear from the findings that individual technical indicators perform better in recessions.

In the second step of in-sample analysis, we regress equity risk premium on the principal components extracted from the set of macroeconomic and/or technical indicators. The results show that principal components estimated from the set of macroeconomic indicators including Germany's indicators are found to be the best performers among all. Surprisingly, the performances of the principal components estimated using the x_t vectors containing the US macroeconomic indicators are poor contrary to expectations since the US economy (as well as the US stock market) is the biggest among the markets in Group 1. Overall, 44% of all estimated principal components for stock markets are found to be statistically and economically significant. We also evidence significant structural parameter instability in some of the dimensionally-reduced macroeconomic indicators models (F-ECON), especially for the stock markets, namely Greece, Mexico, Taiwan, and Brazil of which the statistically significant principal components are all structurally instable over time.

The dimensionally-reduced technical indicators model (F-TECH) is explaining the variation in the equity risk premiums of the markets in Group 2 and 3 better than F-ECON models in overall period. Changing the long technical indicator rules improves the predictive ability of the principal components on some of the equity risk premium of Group 2 and 3 indicating the existence of different market structures, investor behaviors on risk perceptions. In other words, various lengths of short and long technical indicator rules are good at capturing different market movements, behavior patterns, investment information flows etc. The explanatory power of the F-TECH models are mostly found to be higher in recession periods vis-à-vis expansion periods. The calculated *qLL* statistics suggest that there is no structural instability in those models.

The variation in the equity risk premiums of all markets in Group 2 and 3 can be significantly explained with a dimensionally-reduced all indicators model (F-ALL) model using combination of entire sets of indicators. The explanatory powers of F-ALL models are found to be higher than that of both F-ECON and F-TECH models for most (over 80%) of the cases. This indicates that incorporating information from both macroeconomic and technical indicators improves the performances of models and increases the explanatory power of the predictors on the equity risk premiums. That is to say, the empirical results suggest using the models that take macroeconomic and technical indicators all together rather than models considering only macroeconomic or technical indicators. The performance of F-ALL models in recession periods is higher for most (78%) of the cases than that of the other F- models. Moreover, F-ALL models are found to be structurally stable over time for about 65% of the stock markets. We also report that models with foreign macroeconomic indicators of Germany are more stable over time indicating that they are less subject to structural breaks in in-sample fit.

We realize that the standard deviation of the stock market turnover ratio can partially clarify why suggested F-ALL models with particular technical indicators set are able predict the equity risk premiums relatively better than the other models using the other technical indicators set. According to the findings the equity risk premiums of stock markets with more volatile (less volatile) turnover ratios are better explained by the F-ALL models with $l=\{9,12\}$ ($l=\{4,6\}$). This does not give full satisfaction but it is the most possible clarification for the situation. The bottom line is that when market capitalization is constant and total traded value is volatile over time, technical trading rules giving much more weight to the distant past are probably able to capture the variation in the equity risk premium.

Out-of-sample forecasting results suggest that domestic macroeconomic indicators including oil price changes perform poorly since they are outperformed by the benchmark historical-average model for most of the stock markets. Individual foreign macroeconomic indicator forecasts perform even worse than domestic macroeconomic indicator forecasts. Similar to in-sample analysis, forecasts produced by the macroeconomic indicators of Germany are found to be the best among the foreign macroeconomic indicators. The performances of predictive regression model forecasts are significantly changing when we analyze expansion and recession periods separately. This indicates that market participants follow different sources of information arising in major stock markets of Group 1, during various economic conditions. It is also clear from the empirical findings that individual technical indicators are not able beat historical-average model for most of the cases but they have better performances than both domestic and foreign macroeconomic indicators. Overall, combining forecasts provide forecasting gains and we have at least one model, especially POOL-ALL and/or PC-ALL models, outperforming benchmark model for all cases. This is consistent with the findings of Rapach et al. (2010). Furthermore, the forecasts generated by POOL-ALL, and PC-ALL outperform historical-average model more times in recessions than expansions. However, we evidence data-snooping problems for Turkey, Brazil, and Hong-Kong.

Portfolio performance analysis produce much better results than out-of-sample forecasting. We conclude that forecasts generated by the models, especially combined average models significantly outperform the historical-average model in terms of Sharpe ratios and Certainty-equivalent-returns gains even after accounting for transaction costs. It is also clear from the findings that the forecasts generate significantly higher utility gains in recession periods vis-à-vis expansion periods. Those results are in line with the finding of Leitch and Tanner (1991) who report that many firms purchase professional forecasts of economic and financial variables that frequently fail to outperform forecasts from simple time-series models in terms of *Mean Squared Forecast Errors* since forecast profitability is a more relevant metric for assessing forecasts, helping to explain the value of professional forecasts to firms.

The general findings can be summarized as follows:

- The in-sample predictive performance of the individual domestic and foreign macroeconomic indicators is mediocre.
- The individual foreign macroeconomic indicators perform as well as the individual domestic indicators in in-sample.
- Individual technical indicators perform even better than macroeconomic indicators, on average.
- Shortening the long technical indicator rules provide in-sample fitting for some of the stock markets, indicating different market structures, investor behaviors, and risk perceptions.
- Incorporating information from all indicators including domestic and foreign macroeconomic indicators, oil price changes, and technical indicators provides in-sample fitting gains. F-ALL models have higher predictive power on equity premiums than the other models. This indicates that the macroeconomic and technical predictors essentially contain complementary information and the coefficient estimates of the F-ALL models are found to be much more stable over time.
- The equity risk premiums of stock markets with more volatile (less volatile) turnover ratios are better explained by the F-ALL models with $l=\{9,12\}$ ($l=\{4,6\}$) indicating the fact that technical trading rules giving much more weight to the distant past are probably able to capture the variation in the equity risk premium.
- Predictive performance of the models is closely related to the business cycle fluctuations, and they generally perform much better in recessions vis-à-vis expansions.
- Out-of-sample forecasting results suggest poor performance of the models relative to in-sample fitting; however, the strategy of combining forecasts provides out-of-sample gains. In this way, combined average models are

found to be more successful in beating the benchmark model than individual forecasters.

- Portfolio performance analysis suggests good performance of the models, and investors (with a risk aversion coefficient of five) following the forecasts generated by proposed models obtain positive returns over the buy-and-hold strategy.

Professional investors, decision makers, and academics can benefit from the empirical results in this thesis. Professional investors can use generated equity risk premium forecasts which outperform the benchmark model in terms of portfolio performance measures, namely Sharpe ratio or investor utility-gain. By doing so, they can allocate the assets more efficiently and enhance the investment performances. Investors that arrange the weight of risky asset investments in their portfolio based on the equity risk premium forecasts by proposed models can generate excess positive returns over the passive investment strategy. Moreover, investors make future consumption/savings plan based on the equity risk premium forecasts. The expectations about equity risk premium forecasts lead investors to save too much or over investment in risky asset, hence the equity risk premium forecasts produced by the dimensionally reduced models may provide guidance for investors.

Executives can also benefit from the equity premium forecasts. Equity risk is essentially price for risk and a key component into expected return which is a determinant of cost of equity, and thus weighted average cost of capital. Most of the asset pricing models (e.g. Capital Asset Pricing Model) require accurate and appropriate equity risk premium for the portfolio of all risky assets, thus real-time accurate equity risk premium forecast is essential. Since the magnitude equity risk premium forecasts affects (increase) expected returns for all risky investments, and accordingly (decrease) their value, the accurate and outperforming forecasts generated by models incorporating information from all analyzed indicators can provide executives to take actions for the value of their corporations. For instance, investing in new assets or increasing the capacity of their businesses is determined by whether the investments are able to generate excess returns over the costs. The equity risk premium forecasts play important role in those decisions since increasing equity risk premium levels lead to higher cost of capital and thus less overall investment and slower economic growth.

Policy makers, governments make their long-term plans according to their expectations of returns from investing. Particularly, governments need equity risk premium forecasts in order to evaluate their investments (infrastructural investments,) and their obligations (e.g. pension funds, health care). Particularly, decision makers can benefit from the accurate equity risk premium forecasts in order to determine how much to set aside to cover the future obligations of pension funds, health care obligations or to take infrastructural investment decisions.

Furthermore, academics can benefit from the results of estimated models. In this thesis, we do not take a stand on the market efficiency. Within the limits of our methodology, our attempt can be regarded as measuring efficiency rather than testing it. The variations in the dividend-price ratio lead to variations in the expected future stock returns, and imply time-varying discount rates and return predictability. We may expect time-varying expected returns and some level of predictability since aggregate risks for consumption/investment levels are tightly linked to fluctuations in the real economic activity even in efficient markets (Rapach and Zhou, 2013:2). The frictions in the trading process can also generate predictability. Moreover, investing in assets involves risk, for this reason, evidence of price predictability does not necessarily mean malfunctioning of markets or market inefficiencies but instead means a compensation for time-varying aggregate risk. In the light of our empirical results and above considerations, further study may develop models and statistical procedures to better address and test these facts by using additional indicators in different frequencies over the short or long horizons.

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APPENDICES

APPENDIX 1: Predictive Regression Estimation Results, Domestic Macroeconomic Indicators

	Indicator	**Slope**	***p*-value**	**R^2 (%)**	**R^2_{EXP} (%)**	**R^2_{REC} (%)**	***qLL***
BEL	DY	0.57	0.13	0.19	-1.07	0.89	-11.10
	TBL	0.20	**0.01**	1.40	3.31	0.35	-11.05
	PE	2.75	**0.01**	2.42	-1.05	4.34	-10.57
	RVOL	4.34	0.27	0.26	0.62	0.06	-12.07
	INF	0.75	0.27	0.19	1.80	-0.69	-9.49
	PRD	0.01	0.36	0.07	-0.33	0.29	-9.32
	OIL	0.07	**0.07**	1.60	2.30	1.22	**-16.98**
GRC	DY	0.52	0.38	0.06	-0.13	0.22	**-19.89**
	TBL	0.08	**0.00**	4.95	5.26	4.68	-11.46
	PE	2.27	**0.03**	0.88	-0.47	2.07	**-15.43**
	RVOL	4.52	0.20	0.42	0.52	0.33	**-18.81**
	INF	0.10	0.44	0.01	0.25	-0.19	**-18.63**
	PRD	0.00	0.50	0.00	0.00	0.00	**-17.75**
	OIL	0.16	**0.01**	2.03	6.23	-1.67	**-26.73**
MYS	DY	1.99	0.16	0.92	2.13	-0.56	-6.71
	TBL	0.29	**0.08**	0.60	-1.24	2.84	-11.49
	PE	0.19	0.33	0.01	-0.28	0.35	-5.27
	RVOL	0.21	0.54	0.00	-0.16	0.19	-9.79
	INF	2.31	**0.00**	1.74	1.68	1.82	-9.98
	PRD	0.14	**0.07**	1.06	0.79	1.39	-11.50
	OIL	0.03	0.31	0.18	0.11	0.26	-7.55
MEX	DY	3.77	**0.02**	2.13	3.80	0.48	-7.64
	TBL	0.02	0.40	0.07	0.17	-0.02	-10.81
	PE	4.20	**0.03**	1.37	2.39	0.35	-8.74
	RVOL	2.12	0.32	0.06	0.12	0.00	**-14.95**
	INF	0.56	0.12	0.50	-0.26	1.27	-9.01
	PRD	0.34	0.18	0.36	-0.48	1.19	-7.55
	OIL	0.04	0.24	0.26	0.83	-0.31	-9.73
POR	DY	1.15	**0.10**	0.64	-0.11	1.66	**-14.00**
	TBL	0.11	**0.05**	0.82	1.70	-0.38	**-12.83**
	PE	0.43	0.22	0.09	-0.12	0.38	-11.02
	RVOL	10.32	**0.03**	1.32	3.09	-1.10	-11.86
	INF	1.09	**0.04**	0.90	2.07	-0.71	-11.01
	PRD	0.00	0.44	0.01	-0.01	0.03	-12.79
	OIL	0.06	**0.04**	1.10	1.20	0.96	**-15.83**

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 2: Predictive Regression Estimation Results, Domestic Macroeconomic Indicators

	Indicator	**Slope**	***p*-value**	**R^2 (%)**	**R^2_{EXP} (%)**	**R^2_{REC} (%)**	***qLL***
SPN	DY	0.40	**0.03**	0.08	0.61	-0.62	-8.50
	TBL	0.07	0.23	0.25	0.50	-0.09	-10.02
	PE	1.02	**0.10**	0.25	0.84	-0.54	-7.23
	RVOL	5.26	0.19	0.26	-0.98	1.89	**-16.19**
	INF	0.79	0.18	0.36	1.41	-1.03	-10.77
	PRD	0.03	0.12	0.71	0.96	0.39	-10.88
	OIL	0.07	**0.07**	1.26	1.87	0.46	**-14.43**
TWN	DY	1.29	0.22	1.63	2.31	0.46	-6.27
	TBL	0.27	0.12	0.56	0.49	0.68	-4.41
	PE	2.45	0.12	1.12	2.24	-0.80	-6.88
	RVOL	1.75	0.36	0.07	0.07	0.06	-6.72
	INF	0.16	0.43	0.02	0.06	-0.03	-6.50
	PRD	0.04	0.25	0.14	-0.07	0.50	-6.65
	OIL	0.04	0.32	0.18	0.22	0.13	-5.13
TUR	DY	3.92	**0.03**	2.23	1.50	3.42	-10.59
	TBL	0.01	0.31	0.03	0.03	0.02	-10.75
	PE	3.53	**0.01**	2.94	2.28	4.02	-9.35
	RVOL	5.66	**0.09**	0.65	0.73	0.52	-8.04
	INF	0.13	0.33	0.06	-0.11	0.34	-9.29
	PRD	0.00	0.49	0.00	0.00	0.00	-9.67
	OIL	0.01	0.47	0.00	-0.03	0.06	-9.66

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 3: Predictive Regression Estimation Results, Domestic Macroeconomic Indicators

	Indicator	**Slope**	***p*-value**	R^2 **(%)**	R^2_{EXP} **(%)**	R^2_{REC} **(%)**	***qLL***
BRA	DY	3.05	**0.07**	1.28	0.32	1.88	-7.86
	TBL	0.03	0.34	0.04	0.08	0.01	-6.80
	PE	2.41	0.14	0.60	-1.36	1.82	-12.60
	RVOL	0.12	0.47	0.00	0.00	0.00	-9.64
	INF	1.80	**0.04**	1.13	4.68	-1.11	-10.60
	PRD	0.47	**0.03**	1.64	3.37	0.55	-6.75
	OIL	0.01	0.47	0.01	0.08	-0.04	-8.12
HKG	DY	6.26	**0.03**	3.87	5.59	2.37	-9.71
	TBL	0.17	0.33	0.27	0.22	0.30	-9.85
	PE	1.32	0.20	0.22	-0.76	1.08	-6.72
	RVOL	6.89	0.20	0.89	-0.55	2.15	-11.95
	INF	0.19	0.40	0.05	0.29	-0.17	-8.44
	PRD	0.75	0.28	0.29	0.51	0.10	-9.88
	OIL	0.05	0.21	0.54	0.21	0.84	-8.14
IND	DY	6.83	**0.00**	7.07	2.75	10.98	-8.35
	TBL	0.97	**0.01**	5.34	0.57	9.65	-11.70
	PE	10.62	**0.00**	7.18	6.54	7.75	-7.46
	RVOL	4.90	0.31	0.20	-0.32	0.66	-12.39
	INF	0.03	0.44	0.00	0.04	-0.02	**-13.13**
	PRD	0.01	0.45	0.00	-0.02	0.02	-8.69
	OIL	0.04	0.25	0.32	-0.01	0.62	-10.34
RUS	DY	0.38	0.42	0.06	-0.06	0.33	-8.71
	TBL	0.30	**0.04**	1.89	0.34	5.22	-8.56
	PE	0.25	0.38	0.02	0.35	-0.67	-8.50
	RVOL	1.37	0.45	0.04	-0.15	0.46	-10.23
	INF	0.65	0.20	0.27	0.15	0.53	-5.96
	PRD	0.27	0.20	0.28	0.90	-1.07	-11.58
	OIL	0.09	0.18	0.55	0.12	1.48	-12.14
ZAF	DY	0.47	0.55	0.03	0.04	0.02	-8.75
	TBL	0.40	**0.01**	3.21	-3.91	9.42	**-18.24**
	PE	1.32	0.37	0.27	1.23	-0.56	-9.86
	RVOL	0.12	0.47	0.00	0.00	0.00	-9.53
	INF	1.54	**0.07**	1.83	1.33	2.26	-5.92
	PRD	0.46	0.28	0.20	-0.37	0.70	-9.42
	OIL	0.04	0.21	0.53	0.36	0.68	-10.44

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 4: Predictive Regression Estimation Results, Foreign Macroeconomic Indicators

	Indicator	**Slope**	***p*-value**	**R^2 (%)**	**R^2_{EXP} (%)**	**R^2_{REC} (%)**	***qLL***
BEL<USA	RPJ	31.39	**0.00**	7.86	-0.15	12.29	-10.30
	DYJ	0.50	**0.06**	0.10	-0.14	0.24	-12.14
	TBLJ	0.05	0.45	0.05	0.65	-0.29	-12.46
	PEJ	0.48	0.34	0.17	-0.66	0.63	**-13.17**
	RVOLJ	0.96	0.37	0.01	-0.03	0.03	**-17.33**
	INFJ	0.35	0.37	0.06	-0.39	0.31	-10.63
	PRDJ	1.21	**0.06**	2.82	3.45	2.48	-10.12
BEL<JPN	RPJ	8.19	**0.05**	1.19	-2.62	3.30	-12.16
	DYJ	0.12	0.55	0.01	0.24	-0.11	-12.76
	TBLJ	0.22	**0.05**	0.98	2.60	0.08	-9.16
	PEJ	0.42	0.13	0.28	-0.95	0.96	**-15.01**
	RVOLJ	0.62	0.42	0.01	-0.12	0.08	**-12.90**
	INFJ	0.77	0.14	0.37	0.99	0.02	**-19.56**
	PRDJ	0.12	0.22	0.25	0.11	0.33	**-13.32**
BEL<GER	RPJ	14.66	**0.01**	3.06	-3.80	6.85	-12.17
	DYJ	1.22	0.12	0.42	-0.39	0.87	-10.56
	TBLJ	0.27	**0.01**	1.72	3.62	0.67	-11.79
	PEJ	0.37	0.42	0.11	0.90	-0.33	**-17.10**
	RVOLJ	2.06	0.36	0.07	-0.22	0.22	**-16.54**
	INFJ	0.97	0.11	0.46	1.75	-0.25	-8.99
	PRDJ	0.06	**0.05**	1.02	-0.39	1.80	-9.70
GRC<USA	RPJ	51.16	**0.00**	4.67	6.57	2.99	**-16.87**
	DYJ	0.37	0.61	0.01	-0.41	0.38	**-19.74**
	TBLJ	0.80	**0.00**	3.26	-1.28	7.28	-11.29
	PEJ	1.00	0.24	0.16	0.44	-0.09	**-23.13**
	RVOLJ	6.79	0.24	0.12	-0.53	0.70	**-18.29**
	INFJ	0.14	0.47	0.00	-0.17	0.16	**-17.39**
	PRDJ	1.35	0.18	0.78	-0.25	1.69	**-16.93**
GRC<JPN	RPJ	14.69	**0.07**	0.85	0.10	1.52	**-16.81**
	DYJ	3.39	**0.01**	2.50	-3.95	8.20	-11.11
	TBLJ	0.23	0.31	0.24	-2.05	2.27	**-18.21**
	PEJ	2.63	**0.00**	2.49	-1.61	6.11	**-13.15**
	RVOLJ	8.99	0.20	0.28	0.49	0.09	**-30.91**
	INFJ	0.88	0.28	0.11	0.62	-0.35	**-15.93**
	PRDJ	0.02	0.48	0.00	-0.05	0.05	**-16.90**
GRC<GER	RPJ	35.48	**0.00**	4.01	4.01	4.01	**-15.17**
	DYJ	4.79	**0.03**	1.46	2.54	0.51	**-14.06**
	TBLJ	0.13	0.29	0.09	-1.03	1.07	**-19.92**
	PEJ	0.87	0.19	0.13	-0.16	0.38	**-21.10**
	RVOLJ	0.06	0.50	0.00	0.00	0.00	**-18.46**
	INFJ	2.71	**0.04**	0.82	2.62	-0.78	**-16.72**
	PRDJ	0.01	0.46	0.00	0.00	0.00	**-18.61**

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 5: Predictive Regression Estimation Results, Foreign Macroeconomic Indicators

	Indicator	**Slope**	***p*-value**	**R^2 (%)**	**R^2_{EXP} (%)**	**R^2_{REC} (%)**	***qLL***
MYS<USA	RPJ	13.42	**0.10**	0.69	0.81	0.54	-7.18
	DYJ	1.34	0.41	0.36	-1.37	2.46	-5.52
	TBLJ	0.18	0.13	0.37	-0.15	1.00	-9.37
	PEJ	0.67	0.19	0.15	1.01	-0.89	-8.41
	RVOLJ	4.82	0.24	0.13	-0.55	0.96	**-12.88**
	INFJ	1.42	**0.06**	0.46	1.43	-0.72	-6.51
	PRDJ	0.76	0.18	0.54	0.31	0.81	-8.98
MYS<JPN	RPJ	4.67	0.30	0.19	-0.71	1.27	-7.78
	DYJ	0.24	0.49	0.03	0.19	-0.17	-7.92
	TBLJ	0.02	0.48	0.01	-0.12	0.16	-5.43
	PEJ	0.16	0.53	0.02	-0.01	0.05	-6.91
	RVOLJ	0.60	0.48	0.00	0.13	-0.15	-10.35
	INFJ	0.56	0.32	0.09	0.14	0.04	-9.30
	PRDJ	0.02	0.47	0.00	0.01	-0.01	-9.28
MYS<GER	RPJ	6.22	0.20	0.26	0.22	0.32	-9.69
	DYJ	3.07	**0.06**	1.29	-2.30	5.64	-9.65
	TBLJ	0.11	0.22	0.15	0.69	-0.51	-9.88
	PEJ	1.79	**0.06**	1.20	-1.07	3.94	-7.75
	RVOLJ	0.22	0.50	0.00	-0.04	0.05	-8.96
	INFJ	0.38	0.34	0.03	0.20	-0.17	-5.63
	PRDJ	0.01	0.44	0.02	0.12	-0.11	-6.96
MEX<USA	RPJ	12.66	0.13	0.51	-1.13	2.14	-9.78
	DYJ	1.96	0.34	0.65	1.44	-0.15	-7.16
	TBLJ	0.06	0.42	0.04	-0.23	0.30	-11.06
	PEJ	0.35	0.43	0.04	0.22	-0.15	-10.61
	RVOLJ	4.99	0.32	0.12	-0.22	0.46	-9.50
	INFJ	1.61	0.16	0.49	-0.79	1.76	-9.95
	PRDJ	0.98	0.14	0.74	-0.83	2.31	**-12.90**
MEX<JPN	RPJ	3.65	0.34	0.09	0.16	0.03	-12.60
	DYJ	0.64	0.18	0.16	0.75	-0.43	-11.51
	TBLJ	0.24	0.18	0.49	1.16	-0.18	-7.23
	PEJ	0.28	0.49	0.05	-0.10	0.20	-9.07
	RVOLJ	1.90	0.43	0.02	0.00	0.05	-10.15
	INFJ	1.95	**0.07**	0.94	1.87	0.01	-7.18
	PRDJ	0.29	0.11	0.64	-0.79	2.06	-9.50
MEX<GER	RPJ	11.37	**0.07**	0.73	-0.54	2.01	-11.26
	DYJ	2.26	0.18	0.58	0.90	0.26	-10.66
	TBLJ	0.07	0.35	0.04	-0.41	0.49	-11.99
	PEJ	3.27	**0.01**	3.32	1.01	5.62	-7.94
	RVOLJ	6.72	0.16	0.29	-0.11	0.68	-9.59
	INFJ	0.87	0.31	0.15	1.00	-0.69	-7.25
	PRDJ	0.07	0.13	0.54	-1.42	2.48	-9.37

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 6: Predictive Regression Estimation Results, Foreign Macroeconomic Indicators

	Indicator	**Slope**	***p*-value**	R^2 **(%)**	R^2_{EXP} **(%)**	R^2_{REC} **(%)**	***qLL***
POR<USA	RPJ	27.55	**0.00**	4.66	6.70	1.85	-10.56
	DYJ	0.90	**0.06**	0.26	0.97	-0.71	**-15.70**
	TBLJ	0.03	0.50	0.02	0.08	-0.08	**-14.57**
	PEJ	0.46	0.25	0.12	0.39	-0.26	**-16.10**
	RVOLJ	4.14	0.22	0.16	-0.14	0.56	**-16.79**
	INFJ	1.51	**0.06**	0.83	1.65	-0.28	**-16.68**
	PRDJ	1.11	0.12	1.82	-0.59	5.11	-9.71
POR<JPN	RPJ	8.15	**0.08**	0.90	1.26	0.42	-9.54
	DYJ	0.15	0.56	0.02	0.14	-0.15	**-15.04**
	TBLJ	0.32	**0.01**	1.72	3.97	-1.37	-9.92
	PEJ	0.58	**0.08**	0.41	0.13	0.80	**-13.02**
	RVOLJ	1.81	0.36	0.04	-0.07	0.19	**-14.52**
	INFJ	0.68	0.25	0.22	-0.50	1.20	**-12.96**
	PRDJ	0.02	0.46	0.00	0.03	-0.03	-11.18
POR<GER	RPJ	19.73	**0.00**	4.26	6.36	1.38	-8.68
	DYJ	2.41	**0.03**	1.27	1.66	0.73	-9.30
	TBLJ	0.33	**0.00**	2.03	3.24	0.38	**-14.62**
	PEJ	0.04	0.38	0.00	0.01	-0.01	**-15.78**
	RVOLJ	0.21	0.50	0.00	0.00	0.01	**-14.73**
	INFJ	1.86	**0.01**	1.32	3.18	-1.23	-11.07
	PRDJ	0.02	0.31	0.11	0.26	-0.10	-11.84
SPN<USA	RPJ	20.42	**0.02**	2.13	0.28	4.58	-12.77
	DYJ	0.75	**0.05**	0.15	0.88	-0.81	-10.67
	TBLJ	0.02	0.42	0.01	0.07	-0.07	**-12.85**
	PEJ	0.37	0.31	0.06	0.07	0.06	-11.93
	RVOLJ	0.60	0.42	0.00	0.07	-0.08	-12.52
	INFJ	0.42	0.36	0.05	0.36	-0.36	-12.13
	PRDJ	1.18	**0.09**	1.71	1.78	1.61	-10.06
SPN<JPN	RPJ	6.45	0.14	0.47	-0.60	1.89	-9.18
	DYJ	0.24	0.51	0.03	0.03	0.05	**-13.16**
	TBLJ	0.28	**0.04**	1.07	2.47	-0.79	-7.58
	PEJ	0.52	0.11	0.28	0.56	-0.09	-10.83
	RVOLJ	2.54	0.36	0.06	-0.14	0.33	-12.40
	INFJ	0.31	0.37	0.04	0.41	-0.46	-11.93
	PRDJ	0.06	0.34	0.04	-0.33	0.54	**-14.57**
SPN<GER	RPJ	10.79	**0.06**	1.06	0.22	2.18	-9.73
	DYJ	1.42	0.13	0.37	1.26	-0.82	-7.23
	TBLJ	0.28	**0.04**	1.23	0.75	1.85	-11.06
	PEJ	0.47	0.39	0.11	-0.21	0.53	**-14.59**
	RVOLJ	3.92	0.24	0.16	-0.52	1.05	-12.24
	INFJ	1.51	**0.05**	0.73	1.04	0.32	-10.59
	PRDJ	0.03	0.27	0.15	-0.12	0.51	-12.46

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 7: Predictive Regression Estimation Results, Foreign Macroeconomic Indicators

	Indicator	**Slope**	***p*-value**	**R^2 (%)**	**R^2_{EXP} (%)**	**R^2_{REC} (%)**	***qLL***
TWN<USA	RPJ	19.46	**0.10**	0.81	-0.57	3.17	-6.06
	DYJ	0.56	0.55	0.04	-0.17	0.39	-6.31
	TBLJ	0.37	0.13	0.82	1.41	-0.17	-5.51
	PEJ	1.12	0.20	0.24	0.59	-0.35	-5.92
	RVOLJ	2.39	0.45	0.02	0.09	-0.11	-9.04
	INFJ	1.40	0.23	0.25	0.51	-0.20	-4.13
	PRDJ	1.38	**0.08**	0.97	0.52	1.75	-6.55
TWN<JPN	RPJ	2.33	0.39	0.03	-0.10	0.24	-6.40
	DYJ	1.09	0.28	0.31	0.79	-0.51	-4.52
	TBLJ	0.37	0.18	0.78	1.70	-0.77	-4.47
	PEJ	0.29	0.49	0.04	0.08	-0.04	-6.11
	RVOLJ	4.39	0.34	0.08	0.66	-0.91	-6.18
	INFJ	0.13	0.48	0.00	-0.01	0.02	-6.93
	PRDJ	0.16	0.29	0.12	0.00	0.33	-8.42
TWN<GER	RPJ	20.60	**0.04**	1.62	-0.24	4.79	-4.64
	DYJ	1.54	0.30	0.18	-0.07	0.60	-6.91
	TBLJ	0.52	**0.04**	1.71	2.58	0.22	-6.06
	PEJ	1.23	0.18	0.32	0.15	0.59	-7.90
	RVOLJ	4.57	0.29	0.09	0.20	-0.10	-8.70
	INFJ	1.30	0.18	0.22	0.00	0.61	-9.27
	PRDJ	0.04	0.29	0.12	0.76	-0.98	-6.55
TUR<USA	RPJ	50.22	**0.01**	2.18	3.86	-0.59	-9.37
	DYJ	3.66	0.21	0.61	0.05	1.54	-7.50
	TBLJ	0.04	0.41	0.00	0.01	0.00	**-16.65**
	PEJ	1.45	0.25	0.16	-0.47	1.21	**-17.07**
	RVOLJ	10.07	0.26	0.13	0.09	0.20	**-14.49**
	INFJ	1.16	0.31	0.07	0.17	-0.10	-8.73
	PRDJ	2.75	**0.03**	1.56	-0.29	4.61	-8.29
TUR<JPN	RPJ	15.82	0.11	0.48	1.10	-0.54	-10.53
	DYJ	1.07	0.23	0.12	0.00	0.32	**-16.74**
	TBLJ	0.19	0.37	0.09	-0.15	0.47	-9.19
	PEJ	0.23	0.36	0.01	-0.03	0.07	-11.36
	RVOLJ	45.80	**0.00**	3.48	3.31	3.76	**-18.03**
	INFJ	0.07	0.48	0.00	0.01	-0.02	-7.95
	PRDJ	0.02	0.46	0.00	0.00	0.00	-7.92
TUR<GER	RPJ	18.42	0.12	0.52	1.07	-0.38	-8.51
	DYJ	3.64	0.18	0.41	-0.09	1.23	-7.86
	TBLJ	0.32	0.24	0.27	0.35	0.14	-10.61
	PEJ	2.45	0.12	0.51	0.54	0.46	-6.95
	RVOLJ	9.88	0.24	0.17	0.42	-0.25	-12.49
	INFJ	0.79	0.40	0.03	0.18	-0.21	-7.44
	PRDJ	0.08	0.23	0.18	-0.62	1.51	**-19.94**

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 8: Predictive Regression Estimation Results, Foreign Macroeconomic Indicators

	Indicator	Slope	*p*-value	R^2 (%)	R^2_{EXP} (%)	R^2_{REC} (%)	*qLL*
BRA<USA	RPJ	1.69	0.43	0.01	0.10	-0.04	-8.93
	DYJ	2.19	0.17	0.56	-1.02	1.55	-8.81
	TBLJ	0.10	0.33	0.09	0.66	-0.27	-7.57
	PEJ	0.71	0.23	0.23	0.11	0.31	**-13.95**
	RVOLJ	1.93	0.45	0.02	-0.26	0.20	-11.11
	INFJ	1.49	**0.10**	0.73	-1.43	2.09	-7.60
	PRDJ	1.27	**0.04**	1.76	1.14	2.15	-5.90
BRA<JPN	RPJ	3.81	0.35	0.11	0.19	0.06	-9.49
	DYJ	0.82	0.26	0.16	0.97	-0.35	-7.09
	TBLJ	2.61	0.27	0.55	-2.31	2.35	-8.71
	PEJ	0.37	0.35	0.09	0.48	-0.15	-6.97
	RVOLJ	0.78	0.42	0.00	0.00	0.01	-11.66
	INFJ	3.22	**0.04**	1.83	-0.57	3.33	**-16.18**
	PRDJ	0.01	0.51	0.00	-0.05	0.03	-6.75
BRA<GER	RPJ	4.13	0.32	0.14	0.43	-0.04	-10.33
	DYJ	0.88	0.37	0.10	-0.25	0.32	-7.87
	TBLJ	0.58	**0.08**	1.28	-3.81	4.48	**-15.79**
	PEJ	1.73	0.16	0.68	-0.94	1.69	-7.89
	RVOLJ	9.48	0.14	0.68	-1.38	1.98	-9.79
	INFJ	3.74	**0.02**	2.89	2.08	3.40	-8.84
	PRDJ	0.06	0.19	0.43	-0.33	0.91	-8.71
HKG<USA	RPJ	16.92	0.13	1.38	0.96	1.74	-7.02
	DYJ	1.84	0.56	0.42	1.75	-0.74	-10.02
	TBLJ	0.02	0.39	0.00	0.00	0.00	-8.79
	PEJ	0.54	0.29	0.15	1.11	-0.69	-12.52
	RVOLJ	0.93	0.50	0.01	0.12	-0.09	**-13.18**
	INFJ	1.07	0.24	0.40	1.59	-0.64	-8.81
	PRDJ	2.09	**0.03**	5.02	-4.80	13.57	-8.92
HKG<JPN	RPJ	8.39	0.17	0.57	-0.52	1.51	-7.11
	DYJ	0.05	0.61	0.00	0.02	-0.02	-8.44
	TBLJ	2.45	0.20	0.52	-1.79	2.52	-10.06
	PEJ	0.14	0.31	0.01	-0.17	0.18	-8.84
	RVOLJ	1.62	0.47	0.02	0.29	-0.23	-9.83
	INFJ	0.68	0.39	0.09	0.73	-0.48	-9.67
	PRDJ	0.13	0.24	0.21	-0.44	0.78	-9.99
HKG<GER	RPJ	15.64	**0.05**	2.08	2.64	1.58	-6.45
	DYJ	0.72	0.35	0.07	-0.68	0.73	-7.79
	TBLJ	0.78	**0.03**	2.49	-1.20	5.71	-12.59
	PEJ	1.26	0.28	0.38	1.42	-0.52	-9.97
	RVOLJ	8.88	0.13	0.63	0.50	0.75	-10.35
	INFJ	0.48	0.40	0.05	0.64	-0.46	-7.27
	PRDJ	0.12	**0.06**	1.79	0.09	3.26	-7.56

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 9: Predictive Regression Estimation Results, Foreign Macroeconomic Indicators

	Indicator	**Slope**	***p*-value**	**R^2 (%)**	**R^2_{EXP} (%)**	**R^2_{REC} (%)**	***qLL***
IND<USA	RPJ	2.71	0.39	0.03	0.78	-0.65	-8.95
	DYJ	4.38	**0.10**	1.85	1.87	1.84	-9.86
	TBLJ	0.13	0.32	0.12	-0.37	0.56	-11.83
	PEJ	1.05	0.22	0.43	0.99	-0.08	**-14.48**
	RVOLJ	4.55	0.29	0.11	-0.28	0.47	**-14.32**
	INFJ	0.47	0.36	0.06	-0.63	0.68	-7.41
	PRDJ	0.55	0.32	0.27	-1.87	2.21	-7.97
IND<JPN	RPJ	1.17	0.48	0.01	-0.08	0.09	-8.09
	DYJ	0.20	0.40	0.01	-0.05	0.06	-11.58
	TBLJ	4.03	0.14	1.09	-2.29	4.15	-10.39
	PEJ	0.27	0.42	0.04	0.08	0.01	-10.24
	RVOLJ	2.89	0.39	0.04	-0.06	0.13	**-14.17**
	INFJ	0.18	0.47	0.00	0.18	-0.15	**-22.89**
	PRDJ	0.21	0.20	0.45	1.21	-0.24	-7.69
IND<GER	RPJ	1.79	0.43	0.02	-0.52	0.52	-11.08
	DYJ	1.97	0.25	0.42	0.12	0.69	-11.50
	TBLJ	1.05	**0.01**	3.51	-1.81	8.33	**-17.95**
	PEJ	2.90	**0.05**	1.57	2.25	0.96	-8.69
	RVOLJ	13.02	**0.07**	1.06	-1.22	3.13	**-13.14**
	INFJ	3.93	**0.02**	2.64	-3.73	8.40	-8.77
	PRDJ	0.11	**0.08**	1.27	1.17	1.35	-10.26
RUS<USA	RPJ	0.37	0.47	0.00	0.01	-0.02	-8.83
	DYJ	1.48	0.25	0.10	0.20	-0.13	-7.22
	TBLJ	0.23	0.32	0.16	0.68	-0.97	-6.48
	PEJ	1.82	0.11	0.58	-0.32	2.52	-6.80
	RVOLJ	13.74	0.11	0.46	-0.29	2.06	-9.79
	INFJ	3.55	**0.05**	1.54	-0.82	6.59	-9.71
	PRDJ	0.46	0.37	0.09	-0.22	0.74	-6.88
RUS<JPN	RPJ	18.02	**0.07**	0.92	-0.31	3.56	**-14.60**
	DYJ	2.57	0.19	0.59	1.13	-0.55	-5.31
	TBLJ	11.74	**0.00**	4.17	-1.28	15.78	-7.45
	PEJ	1.93	0.12	0.94	0.80	1.23	-4.73
	RVOLJ	2.64	0.44	0.01	0.12	-0.21	-8.47
	INFJ	3.29	0.14	0.71	-1.60	5.64	**-15.00**
	PRDJ	0.12	0.40	0.07	0.29	-0.42	-7.06
RUS<GER	RPJ	1.62	0.41	0.01	0.07	-0.14	**-14.79**
	DYJ	0.50	0.48	0.01	-0.04	0.12	-8.77
	TBLJ	0.79	0.13	0.90	-0.92	4.79	**-14.99**
	PEJ	0.32	0.45	0.01	0.01	0.00	-7.96
	RVOLJ	8.40	0.25	0.20	-0.26	1.17	-7.66
	INFJ	4.88	**0.02**	1.83	1.30	2.97	-7.38
	PRDJ	0.08	0.27	0.27	0.59	-0.40	-7.76

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 10: Predictive Regression Estimation Results, Foreign Macroeconomic Indicators

	Indicator	**Slope**	***p*-value**	**R^2 (%)**	**R^2_{EXP} (%)**	**R^2_{REC} (%)**	***qLL***
ZAF<USA	RPJ	16.64	**0.04**	2.30	-5.65	9.22	-7.60
	DYJ	0.60	0.15	0.08	-0.31	0.41	-8.59
	TBLJ	0.12	0.19	0.21	0.45	0.01	-8.37
	PEJ	0.40	0.34	0.14	0.42	-0.11	-10.69
	RVOLJ	4.79	0.19	0.27	1.28	-0.60	-12.09
	INFJ	0.20	0.42	0.02	0.41	-0.31	-9.76
	PRDJ	1.41	**0.01**	3.93	0.16	7.22	-11.63
ZAF<JPN	RPJ	4.41	0.25	0.27	-1.52	1.83	-7.52
	DYJ	0.60	0.13	0.16	0.44	-0.09	-9.79
	TBLJ	2.90	**0.10**	1.25	-0.24	2.55	-11.29
	PEJ	0.38	0.17	0.18	-0.02	0.35	-10.68
	RVOLJ	1.87	0.35	0.04	0.13	-0.05	-10.49
	INFJ	0.01	0.51	0.00	0.01	-0.01	-8.75
	PRDJ	0.09	0.26	0.19	-0.69	0.95	**-13.50**
ZAF<GER	RPJ	14.82	**0.02**	3.22	-6.12	11.35	-9.22
	DYJ	1.86	**0.09**	0.83	0.42	1.18	-10.22
	TBLJ	0.48	**0.06**	1.62	-2.29	5.03	-10.06
	PEJ	0.59	0.43	0.14	0.67	-0.31	-9.08
	RVOLJ	3.45	0.27	0.17	0.98	-0.55	-10.39
	INFJ	1.10	0.23	0.46	0.40	0.51	-7.66
	PRDJ	0.04	0.24	0.35	0.89	-0.12	-12.02

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 11: Predictive Regression Estimation Results, Technical Indicators

	Indicator	Slope	*p*-value	R^2 (%)	R^2_{EXP} (%)	R^2_{REC} (%)	*qLL*
BEL	MA(1,4)	1.39	**0.01**	1.99	0.95	2.57	-11.75
	MA(1,6)	1.81	**0.00**	3.37	3.19	3.48	-11.93
	MA(2,4)	1.06	**0.04**	1.17	1.66	0.90	-10.10
	MA(2,6)	1.43	**0.01**	2.09	3.89	1.09	-9.81
	MA(3,4)	1.10	**0.04**	1.24	2.91	0.31	-10.37
	MA(3,6)	1.51	**0.01**	2.35	3.50	1.72	-11.05
	MOM(4)	1.81	**0.00**	3.41	5.25	2.39	-8.30
	MOM(6)	1.78	**0.00**	3.21	3.09	3.28	-11.81
	VOL(1,4)	1.40	**0.01**	2.00	0.25	2.97	**-13.67**
	VOL(1,6)	1.95	**0.00**	3.81	4.74	3.30	**-13.14**
	VOL(2,4)	0.34	0.30	0.12	0.57	-0.13	-11.05
	VOL(2,6)	1.12	**0.04**	1.30	2.70	0.52	**-13.34**
	VOL(3,4)	0.49	0.22	0.25	0.49	0.12	**-13.80**
	VOL(3,6)	1.15	**0.03**	1.35	4.61	-0.45	**-14.65**
BEL	MA(1,9)	1.91	**0.00**	3.71	2.89	4.17	-10.83
	MA(1,12)	1.71	**0.00**	2.96	4.19	2.27	-10.09
	MA(2,9)	1.98	**0.00**	3.97	5.45	3.15	-10.95
	MA(2,12)	1.62	**0.01**	2.66	2.64	2.68	-12.04
	MA(3,9)	1.64	**0.00**	2.73	3.29	2.41	-12.26
	MA(3,12)	1.43	**0.02**	2.07	1.94	2.15	-11.69
	MOM(9)	1.42	**0.01**	2.08	0.78	2.80	**-13.01**
	MOM(12)	1.41	**0.01**	2.08	0.50	2.96	-11.49
	VOL(1,9)	1.89	**0.00**	3.61	4.15	3.31	-10.66
	VOL(1,12)	1.77	**0.00**	3.16	4.35	2.51	-11.11
	VOL(2,9)	1.51	**0.01**	2.32	3.73	1.53	**-13.65**
	VOL(2,12)	1.59	**0.01**	2.56	3.59	1.99	-12.05
	VOL(3,9)	1.49	**0.01**	2.25	3.82	1.38	**-13.69**
	VOL(3,12)	1.58	**0.01**	2.52	3.77	1.82	-11.55

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 12: Predictive Regression Estimation Results, Technical Indicators

	Indicator	**Slope**	***p*-value**	**R^2 (%)**	**R^2_{EXP} (%)**	**R^2_{REC} (%)**	***qLL***
GRC	MA(1,4)	3.19	**0.00**	2.47	1.81	3.04	**-14.49**
	MA(1,6)	3.70	**0.00**	3.30	2.28	4.21	**-14.36**
	MA(2,4)	3.57	**0.00**	3.09	3.68	2.56	**-16.68**
	MA(2,6)	3.41	**0.01**	2.82	0.15	5.17	**-17.67**
	MA(3,4)	3.53	**0.00**	3.01	4.26	1.91	**-16.60**
	MA(3,6)	1.70	**0.08**	0.70	-1.27	2.44	**-14.88**
	MOM(4)	2.21	**0.03**	1.19	-1.47	3.53	**-15.50**
	MOM(6)	3.08	**0.00**	2.29	0.02	4.30	**-14.43**
	VOL(1,4)	5.57	**0.00**	7.50	7.24	7.73	**-15.61**
	VOL(1,6)	4.63	**0.00**	5.18	3.43	6.73	**-15.40**
	VOL(2,4)	5.45	**0.00**	7.18	8.13	6.34	**-19.36**
	VOL(2,6)	4.23	**0.00**	4.33	1.45	6.88	**-14.83**
	VOL(3,4)	4.05	**0.00**	3.96	2.54	5.22	**-18.01**
	VOL(3,6)	3.64	**0.00**	3.20	2.04	4.23	**-16.17**
GRC	MA(1,9)	3.80	**0.00**	3.49	-0.22	6.76	**-12.90**
	MA(1,12)	3.77	**0.00**	3.44	-0.13	6.59	**-13.07**
	MA(2,9)	2.95	**0.01**	2.11	-1.07	4.91	**-15.36**
	MA(2,12)	3.30	**0.00**	2.62	-0.31	5.21	**-13.69**
	MA(3,9)	2.46	**0.02**	1.46	-0.60	3.29	**-13.46**
	MA(3,12)	3.24	**0.00**	2.53	-0.69	5.38	-12.04
	MOM(9)	3.14	**0.00**	2.37	-0.07	4.53	**-13.79**
	MOM(12)	4.01	**0.00**	3.83	1.53	5.86	-10.57
	VOL(1,9)	4.00	**0.00**	3.87	2.24	5.31	**-15.07**
	VOL(1,12)	3.82	**0.00**	3.51	0.71	5.99	**-13.87**
	VOL(2,9)	2.95	**0.01**	2.10	-0.03	3.97	**-15.97**
	VOL(2,12)	2.72	**0.02**	1.78	-0.54	3.83	**-14.76**
	VOL(3,9)	3.27	**0.00**	2.59	0.23	4.67	**-13.69**
	VOL(3,12)	2.71	**0.01**	1.78	-0.13	3.45	**-13.47**

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 13: Predictive Regression Estimation Results, Technical Indicators

	Indicator	Slope	*p*-value	R^2 (%)	R^2_{EXP} (%)	R^2_{REC} (%)	*qLL*
MYS	MA(1,4)	3.03	**0.00**	4.45	1.75	7.71	-4.97
	MA(1,6)	1.12	**0.10**	0.61	-1.68	3.39	-5.26
	MA(2,4)	1.28	**0.09**	0.81	-0.09	1.90	-5.54
	MA(2,6)	0.94	0.17	0.44	-0.54	1.61	-6.41
	MA(3,4)	0.02	0.49	0.00	-0.03	0.04	-9.39
	MA(3,6)	0.55	0.29	0.14	-0.69	1.16	-7.06
	MOM(4)	1.08	0.11	0.57	-1.11	2.59	-6.05
	MOM(6)	1.11	0.14	0.57	-2.21	3.93	-6.28
	VOL(1,4)	2.08	**0.01**	2.14	-0.46	5.30	-5.34
	VOL(1,6)	2.57	**0.00**	3.14	-0.39	7.42	-7.01
	VOL(2,4)	1.35	**0.08**	0.88	-0.58	2.64	-5.68
	VOL(2,6)	1.93	**0.02**	1.69	-0.25	4.05	-5.02
	VOL(3,4)	1.78	**0.02**	1.51	-0.71	4.19	-6.84
	VOL(3,6)	1.08	0.13	0.54	-1.12	2.55	-6.26
MYS	MA(1,9)	1.25	**0.10**	0.73	-1.34	3.24	-7.09
	MA(1,12)	1.59	**0.07**	1.11	-1.65	4.45	-5.34
	MA(2,9)	0.99	0.15	0.45	-1.02	2.23	-6.75
	MA(2,12)	1.04	0.15	0.48	-1.72	3.15	-6.58
	MA(3,9)	0.84	0.19	0.33	-1.61	2.67	-6.62
	MA(3,12)	0.80	0.25	0.29	-1.73	2.73	-7.05
	MOM(9)	0.97	0.17	0.43	-1.72	3.04	-7.31
	MOM(12)	0.68	0.27	0.20	-1.90	2.76	-6.33
	VOL(1,9)	1.75	**0.04**	1.41	-2.00	5.54	-6.58
	VOL(1,12)	1.85	**0.03**	1.56	-1.87	5.71	-5.82
	VOL(2,9)	1.65	**0.04**	1.26	-1.24	4.29	-5.42
	VOL(2,12)	1.68	**0.05**	1.25	-1.95	5.13	-5.57
	VOL(3,9)	1.06	0.15	0.51	-1.55	3.00	-6.70
	VOL(3,12)	0.82	0.25	0.29	-1.71	2.71	-6.93

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 14: Predictive Regression Estimation Results, Technical Indicators

	Indicator	Slope	*p*-value	R^2 (%)	R^2_{EXP} (%)	R^2_{REC} (%)	*qLL*
MEX	MA(1,4)	1.28	0.12	0.61	-0.24	1.45	-7.58
	MA(1,6)	1.42	**0.10**	0.72	0.38	1.05	-7.40
	MA(2,4)	1.09	0.16	0.45	0.30	0.60	-8.29
	MA(2,6)	1.03	0.19	0.37	-0.38	1.12	-8.10
	MA(3,4)	1.55	**0.07**	0.92	0.38	1.45	-7.97
	MA(3,6)	1.49	**0.09**	0.80	0.33	1.27	-7.38
	MOM(4)	1.05	0.18	0.40	-0.26	1.06	-6.86
	MOM(6)	0.97	0.21	0.31	-0.18	0.81	-9.18
	VOL(1,4)	0.51	0.32	0.09	-0.38	0.56	-8.55
	VOL(1,6)	0.09	0.46	0.00	-0.01	0.02	-11.38
	VOL(2,4)	0.42	0.34	0.07	-0.06	0.20	-8.09
	VOL(2,6)	0.05	0.47	0.00	-0.02	0.02	-9.07
	VOL(3,4)	2.28	**0.02**	1.87	0.41	3.32	-6.47
	VOL(3,6)	0.44	0.35	0.07	-0.26	0.40	-8.71
MEX	MA(1,9)	1.03	0.20	0.34	-0.25	0.92	-8.23
	MA(1,12)	1.68	**0.09**	0.84	0.56	1.13	-7.19
	MA(2,9)	1.26	0.16	0.52	0.02	1.01	-6.90
	MA(2,12)	1.02	0.22	0.30	0.75	-0.15	-7.62
	MA(3,9)	0.80	0.25	0.21	0.33	0.08	-8.59
	MA(3,12)	0.92	0.25	0.25	0.54	-0.04	-7.17
	MOM(9)	0.86	0.26	0.23	0.54	-0.08	-7.75
	MOM(12)	1.60	0.13	0.73	0.42	1.04	-6.94
	VOL(1,9)	0.14	0.44	0.01	0.03	-0.02	-10.58
	VOL(1,12)	1.00	0.22	0.30	-0.67	1.26	**-17.07**
	VOL(2,9)	0.03	0.49	0.00	0.01	-0.01	**-13.25**
	VOL(2,12)	1.81	**0.05**	1.00	-1.93	3.92	**-21.42**
	VOL(3,9)	1.06	0.13	0.38	-0.17	0.93	**-15.51**
	VOL(3,12)	0.51	0.31	0.08	-0.42	0.59	**-13.28**

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 15: Predictive Regression Estimation Results, Technical Indicators

	Indicator	**Slope**	***p*-value**	**R^2 (%)**	**R^2_{EXP} (%)**	**R^2_{REC} (%)**	***qLL***
POR	MA(1,4)	2.93	**0.00**	7.10	9.60	3.68	-7.56
	MA(1,6)	2.28	**0.00**	4.31	4.84	3.59	-6.70
	MA(2,4)	2.33	**0.00**	4.53	7.88	-0.07	-7.31
	MA(2,6)	2.41	**0.00**	4.82	5.09	4.44	-8.11
	MA(3,4)	1.95	**0.00**	3.17	3.67	2.47	-7.11
	MA(3,6)	1.67	**0.00**	2.31	1.02	4.08	-9.06
	MOM(4)	2.68	**0.00**	5.97	7.18	4.32	-7.93
	MOM(6)	2.32	**0.00**	4.48	5.37	3.27	-9.01
	VOL(1,4)	2.84	**0.00**	6.62	3.81	10.48	-6.14
	VOL(1,6)	2.61	**0.00**	5.64	1.72	11.02	-7.02
	VOL(2,4)	2.10	**0.00**	3.65	1.84	6.12	-7.47
	VOL(2,6)	2.71	**0.00**	6.07	4.43	8.31	-8.55
	VOL(3,4)	2.19	**0.00**	3.94	3.18	4.99	-8.77
	VOL(3,6)	1.72	**0.00**	2.44	0.39	5.25	**-14.99**
POR	MA(1,9)	1.96	**0.00**	3.19	2.00	4.83	-8.92
	MA(1,12)	2.10	**0.00**	3.65	1.36	6.79	-9.16
	MA(2,9)	1.81	**0.00**	2.73	0.53	5.76	-8.29
	MA(2,12)	1.95	**0.00**	3.16	1.15	5.91	-8.20
	MA(3,9)	1.89	**0.00**	2.97	1.38	5.15	-8.25
	MA(3,12)	2.06	**0.00**	3.53	0.37	7.86	-8.35
	MOM(9)	1.76	**0.00**	2.57	1.81	3.61	-9.83
	MOM(12)	1.60	**0.00**	2.14	-0.14	5.26	-9.57
	VOL(1,9)	2.66	**0.00**	5.86	3.40	9.24	-6.98
	VOL(1,12)	2.43	**0.00**	4.91	2.28	8.50	-7.85
	VOL(2,9)	2.09	**0.00**	3.59	1.38	6.63	-7.73
	VOL(2,12)	1.56	**0.01**	2.00	-0.42	5.33	-10.14
	VOL(3,9)	1.51	**0.02**	1.89	-0.11	4.65	-11.27
	VOL(3,12)	1.51	**0.01**	1.90	-0.32	4.94	-9.87

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 16: Predictive Regression Estimation Results, Technical Indicators

	Indicator	**Slope**	***p*-value**	**R^2 (%)**	**R^2_{EXP} (%)**	**R^2_{REC} (%)**	***qLL***
SPN	MA(1,4)	1.32	**0.03**	1.18	-0.34	3.20	-7.11
	MA(1,6)	1.55	**0.02**	1.62	0.08	3.66	-8.16
	MA(2,4)	1.05	**0.07**	0.75	0.30	1.36	-8.48
	MA(2,6)	0.97	**0.09**	0.64	0.24	1.17	-9.39
	MA(3,4)	0.65	0.19	0.29	0.29	0.29	-9.58
	MA(3,6)	1.01	**0.10**	0.69	-0.62	2.42	-10.42
	MOM(4)	1.29	**0.04**	1.12	0.43	2.03	-8.20
	MOM(6)	1.51	**0.02**	1.55	0.16	3.39	-7.01
	VOL(1,4)	1.24	**0.05**	1.06	-0.75	3.46	-8.25
	VOL(1,6)	1.40	**0.03**	1.33	0.02	3.07	-7.67
	VOL(2,4)	0.67	0.18	0.31	0.01	0.70	-10.81
	VOL(2,6)	0.89	0.11	0.54	0.03	1.23	-10.77
	VOL(3,4)	0.84	0.13	0.48	-0.31	1.53	-10.04
	VOL(3,6)	0.63	0.20	0.27	0.13	0.45	-9.89
SPN	MA(1,9)	1.43	**0.02**	1.38	0.86	2.07	-8.02
	MA(1,12)	1.12	**0.07**	0.83	0.23	1.64	-8.62
	MA(2,9)	1.03	**0.09**	0.72	-0.26	2.03	-8.21
	MA(2,12)	1.03	**0.09**	0.71	0.52	0.96	-8.88
	MA(3,9)	0.85	0.13	0.49	-0.47	1.76	-10.19
	MA(3,12)	1.21	**0.05**	0.99	1.11	0.83	-8.26
	MOM(9)	1.20	**0.06**	0.97	1.64	0.09	-7.80
	MOM(12)	0.81	0.13	0.45	0.83	-0.05	-10.25
	VOL(1,9)	1.92	**0.00**	2.53	1.72	3.60	-6.29
	VOL(1,12)	2.39	**0.00**	3.88	3.63	4.22	-5.36
	VOL(2,9)	2.07	**0.00**	2.91	2.75	3.12	-6.28
	VOL(2,12)	1.97	**0.00**	2.67	2.62	2.73	-7.63
	VOL(3,9)	1.71	**0.01**	2.00	1.06	3.25	-9.82
	VOL(3,12)	2.04	**0.01**	2.84	3.09	2.51	-7.18

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 17: Predictive Regression Estimation Results, Technical Indicators

	Indicator	**Slope**	***p*-value**	**R^2 (%)**	**R^2_{EXP} (%)**	**R^2_{REC} (%)**	***qLL***
TWN	MA(1,4)	3.19	**0.00**	2.94	2.65	3.42	-3.95
	MA(1,6)	2.17	**0.02**	1.36	2.11	0.06	-4.25
	MA(2,4)	2.39	**0.02**	1.65	1.75	1.48	-3.92
	MA(2,6)	0.66	0.27	0.12	0.71	-0.88	-4.89
	MA(3,4)	1.35	0.13	0.52	1.15	-0.54	-4.55
	MA(3,6)	0.62	0.30	0.11	0.48	-0.52	-4.99
	MOM(4)	1.66	**0.07**	0.79	1.72	-0.79	-4.63
	MOM(6)	0.48	0.33	0.07	0.30	-0.33	-5.45
	VOL(1,4)	2.31	**0.02**	1.50	0.36	3.44	-6.22
	VOL(1,6)	3.44	**0.00**	3.31	2.70	4.36	-9.43
	VOL(2,4)	2.59	**0.01**	1.89	1.43	2.67	-6.20
	VOL(2,6)	2.64	**0.01**	1.91	1.96	1.83	-6.86
	VOL(3,4)	2.50	**0.02**	1.74	1.70	1.81	-11.04
	VOL(3,6)	1.93	**0.05**	1.03	0.41	2.10	-6.98
TWN	MA(1,9)	1.78	**0.06**	0.91	2.09	-1.10	-5.01
	MA(1,12)	1.09	0.17	0.34	0.83	-0.50	-5.27
	MA(2,9)	0.80	0.24	0.18	0.80	-0.87	-4.24
	MA(2,12)	1.03	0.19	0.31	0.74	-0.44	-5.33
	MA(3,9)	0.27	0.41	0.02	-0.04	0.13	-4.95
	MA(3,12)	0.03	0.50	0.00	0.00	0.01	-4.91
	MOM(9)	0.10	0.45	0.00	0.01	-0.02	-6.16
	MOM(12)	0.28	0.40	0.02	-0.17	0.36	-4.67
	VOL(1,9)	2.51	**0.02**	1.73	1.94	1.37	-6.77
	VOL(1,12)	2.66	**0.01**	1.91	1.84	2.04	-6.23
	VOL(2,9)	1.18	0.17	0.38	0.65	-0.06	-7.13
	VOL(2,12)	1.32	0.15	0.46	0.58	0.27	-6.73
	VOL(3,9)	1.03	0.21	0.29	0.25	0.34	-6.33
	VOL(3,12)	0.34	0.40	0.03	-0.07	0.21	-4.53

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 18: Predictive Regression Estimation Results, Technical Indicators

	Indicator	Slope	*p*-value	R^2 (%)	R^2_{EXP} (%)	R^2_{REC} (%)	*qLL*
TUR	MA(1,4)	1.93	0.13	0.40	1.29	-1.06	-8.60
	MA(1,6)	2.98	**0.05**	0.94	1.13	0.62	-7.23
	MA(2,4)	2.02	0.13	0.45	0.56	0.26	-8.31
	MA(2,6)	1.44	0.22	0.21	0.32	0.04	-7.51
	MA(3,4)	3.08	**0.04**	1.02	0.55	1.80	-8.45
	MA(3,6)	1.49	0.22	0.22	0.11	0.41	-7.53
	MOM(4)	2.23	**0.10**	0.51	0.63	0.31	-7.56
	MOM(6)	0.87	0.34	0.07	0.11	0.01	-7.94
	VOL(1,4)	1.18	0.27	0.14	0.80	-0.94	-8.31
	VOL(1,6)	0.29	0.44	0.01	0.06	-0.08	-7.52
	VOL(2,4)	0.95	0.31	0.10	0.16	-0.01	-7.71
	VOL(2,6)	0.27	0.44	0.01	0.01	0.00	-8.49
	VOL(3,4)	5.45	**0.00**	3.06	3.84	1.77	-11.77
	VOL(3,6)	1.15	0.25	0.14	0.31	-0.15	-9.18
TUR	MA(1,9)	2.08	0.15	0.42	0.43	0.40	-7.46
	MA(1,12)	0.41	0.43	0.02	-0.01	0.05	-7.85
	MA(2,9)	1.12	0.26	0.12	-0.07	0.43	-7.32
	MA(2,12)	0.11	0.48	0.00	0.03	-0.04	-8.14
	MA(3,9)	0.26	0.46	0.01	0.04	-0.05	-8.35
	MA(3,12)	0.20	0.46	0.00	0.07	-0.11	-8.16
	MOM(9)	0.28	0.45	0.01	-0.06	0.12	-7.59
	MOM(12)	0.31	0.45	0.01	0.00	0.03	-7.33
	VOL(1,9)	0.10	0.47	0.00	-0.01	0.03	-7.40
	VOL(1,12)	1.03	0.34	0.09	0.16	-0.01	-7.12
	VOL(2,9)	0.17	0.48	0.00	0.02	-0.02	-7.30
	VOL(2,12)	0.31	0.45	0.01	-0.01	0.03	-8.48
	VOL(3,9)	0.38	0.42	0.01	-0.04	0.10	-8.22
	VOL(3,12)	0.52	0.41	0.02	-0.12	0.25	-7.77

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 19: Predictive Regression Estimation Results, Technical Indicators

	Indicator	**Slope**	***p*-value**	R^2 **(%)**	R^2_{EXP} **(%)**	R^2_{REC} **(%)**	***qLL***
BRA	MA(1,4)	1.11	0.18	0.55	-1.54	1.86	-8.50
	MA(1,6)	0.01	0.49	0.00	-0.01	0.00	-7.33
	MA(2,4)	0.42	0.38	0.08	-0.94	0.73	-7.72
	MA(2,6)	0.75	0.27	0.25	1.66	-0.64	-6.62
	MA(3,4)	1.20	0.17	0.65	-1.51	2.01	-7.46
	MA(3,6)	1.26	0.15	0.69	2.21	-0.26	-6.41
	MOM(4)	0.56	0.33	0.15	0.56	-0.11	-8.45
	MOM(6)	0.20	0.44	0.02	-0.03	0.04	-6.57
	VOL(1,4)	1.26	0.16	0.74	-0.02	1.22	-8.02
	VOL(1,6)	0.85	0.25	0.33	-0.52	0.86	-6.75
	VOL(2,4)	0.93	0.24	0.41	-0.35	0.89	-7.15
	VOL(2,6)	0.43	0.35	0.08	-0.08	0.19	-8.23
	VOL(3,4)	0.55	0.33	0.14	0.41	-0.03	-8.14
	VOL(3,6)	0.35	0.37	0.06	0.19	-0.03	-7.32
BRA	MA(1,9)	0.58	0.33	0.13	0.50	-0.10	-7.98
	MA(1,12)	0.14	0.45	0.01	-0.06	0.05	-9.27
	MA(2,9)	1.24	0.18	0.58	1.63	-0.08	-9.92
	MA(2,12)	0.01	0.49	0.00	0.01	0.00	-8.81
	MA(3,9)	1.41	0.12	0.80	0.27	1.14	-7.22
	MA(3,12)	0.90	0.26	0.28	-0.50	0.78	-7.53
	MOM(9)	0.06	0.48	0.00	0.02	-0.01	-8.36
	MOM(12)	1.78	**0.07**	1.21	-0.81	2.49	-9.10
	VOL(1,9)	0.61	0.33	0.17	0.30	0.09	-7.81
	VOL(1,12)	0.56	0.32	0.14	0.65	-0.17	-6.57
	VOL(2,9)	0.54	0.33	0.14	0.45	-0.06	-7.34
	VOL(2,12)	0.63	0.30	0.18	0.55	-0.06	-7.35
	VOL(3,9)	0.62	0.29	0.18	-0.70	0.73	-7.79
	VOL(3,12)	0.16	0.45	0.01	-0.18	0.13	-7.96

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 20: Predictive Regression Estimation Results, Technical Indicators

	Indicator	**Slope**	***p*-value**	**R^2 (%)**	**R^2_{EXP} (%)**	**R^2_{REC} (%)**	***qLL***
HKG	MA(1,4)	1.98	**0.04**	2.03	0.62	3.25	-7.02
	MA(1,6)	1.42	**0.10**	1.06	-1.05	2.90	-7.39
	MA(2,4)	0.47	0.33	0.11	-0.54	0.68	**-13.38**
	MA(2,6)	0.34	0.36	0.06	-0.28	0.36	-11.32
	MA(3,4)	0.33	0.39	0.06	-0.22	0.30	-10.90
	MA(3,6)	0.76	0.26	0.31	-0.17	0.72	-10.61
	MOM(4)	0.58	0.30	0.17	-0.35	0.63	-8.69
	MOM(6)	1.60	**0.08**	1.34	-2.66	4.83	-7.44
	VOL(1,4)	1.94	**0.04**	1.94	1.37	2.44	-12.72
	VOL(1,6)	1.78	**0.07**	1.57	0.15	2.80	-11.66
	VOL(2,4)	0.20	0.41	0.02	-0.18	0.19	-11.94
	VOL(2,6)	1.08	0.19	0.57	-1.03	1.96	-8.93
	VOL(3,4)	0.41	0.37	0.08	0.11	0.06	-11.60
	VOL(3,6)	1.11	0.20	0.60	-0.85	1.86	-10.22
HKG	MA(1,9)	1.79	**0.06**	1.64	-1.33	4.22	-7.42
	MA(1,12)	1.03	0.21	0.53	-1.36	2.18	-7.70
	MA(2,9)	1.27	0.12	0.85	-1.72	3.09	-7.88
	MA(2,12)	2.01	**0.04**	2.04	-1.95	5.51	-6.77
	MA(3,9)	1.68	**0.07**	1.48	-1.40	3.99	-7.34
	MA(3,12)	1.57	**0.09**	1.26	-1.89	4.00	-6.93
	MOM(9)	1.50	**0.10**	1.09	-1.72	3.54	-6.22
	MOM(12)	0.60	0.31	0.18	-0.30	0.60	-7.81
	VOL(1,9)	2.40	**0.02**	2.71	0.87	4.32	-6.61
	VOL(1,12)	2.14	**0.05**	2.01	-0.14	3.89	-5.11
	VOL(2,9)	0.85	0.28	0.32	-0.99	1.46	-9.16
	VOL(2,12)	0.86	0.28	0.32	-1.02	1.49	-10.58
	VOL(3,9)	2.33	**0.04**	2.42	-2.01	6.28	-6.65
	VOL(3,12)	1.00	0.21	0.43	-0.44	1.18	-8.06

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 21: Predictive Regression Estimation Results, Technical Indicators

	Indicator	**Slope**	***p*-value**	**R^2 (%)**	**R^2_{EXP} (%)**	**R^2_{REC} (%)**	***qLL***
IND	MA(1,4)	0.13	0.45	0.01	-0.04	0.05	-8.53
	MA(1,6)	0.33	0.41	0.04	-0.27	0.32	-9.97
	MA(2,4)	1.05	0.21	0.46	-0.61	1.43	-9.06
	MA(2,6)	0.60	0.32	0.15	-0.66	0.88	-7.56
	MA(3,4)	0.76	0.27	0.24	-0.89	1.26	-9.00
	MA(3,6)	0.70	0.32	0.19	-0.64	0.95	-7.17
	MOM(4)	0.32	0.41	0.04	-0.07	0.15	-9.36
	MOM(6)	2.14	**0.06**	1.79	-0.05	3.45	-6.41
	VOL(1,4)	0.02	0.51	0.00	-0.03	0.03	-8.35
	VOL(1,6)	1.44	0.12	0.87	3.32	-1.34	-6.93
	VOL(2,4)	0.41	0.38	0.07	-0.08	0.21	**-14.20**
	VOL(2,6)	1.31	0.15	0.71	0.75	0.67	-7.63
	VOL(3,4)	0.79	0.26	0.25	0.04	0.44	-7.92
	VOL(3,6)	0.80	0.26	0.27	-1.17	1.56	-8.33
IND	MA(1,9)	0.92	0.28	0.32	-0.33	0.91	-9.01
	MA(1,12)	1.76	0.11	1.21	0.32	2.02	-7.58
	MA(2,9)	1.63	0.12	1.05	-0.29	2.26	-7.40
	MA(2,12)	2.63	**0.02**	2.76	0.25	5.03	-7.26
	MA(3,9)	1.89	**0.08**	1.39	-0.76	3.33	-7.49
	MA(3,12)	2.28	**0.05**	2.04	0.30	3.61	-7.64
	MOM(9)	2.06	**0.06**	1.66	0.65	2.57	-8.00
	MOM(12)	1.73	**0.10**	1.16	0.46	1.80	-8.59
	VOL(1,9)	0.98	0.22	0.39	0.87	-0.04	-7.49
	VOL(1,12)	1.75	**0.09**	1.25	0.38	2.05	-6.87
	VOL(2,9)	2.03	**0.06**	1.69	0.19	3.04	-5.84
	VOL(2,12)	2.03	**0.06**	1.70	0.20	3.06	-7.06
	VOL(3,9)	1.09	0.20	0.49	-0.48	1.37	-8.40
	VOL(3,12)	1.60	**0.10**	1.05	0.22	1.81	-7.71

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 22: Predictive Regression Estimation Results, Technical Indicators

	Indicator	Slope	*p*-value	R^2 (%)	R^2_{EXP} (%)	R^2_{REC} (%)	*qLL*
RUS	MA(1,4)	0.47	0.41	0.04	-0.27	0.70	-7.12
	MA(1,6)	0.16	0.47	0.00	0.08	-0.16	-7.11
	MA(2,4)	0.34	0.44	0.02	-0.07	0.22	-7.54
	MA(2,6)	0.46	0.42	0.04	-0.08	0.28	-6.75
	MA(3,4)	0.63	0.37	0.07	-0.10	0.43	-8.62
	MA(3,6)	0.72	0.38	0.08	0.21	-0.19	-10.24
	MOM(4)	1.48	0.28	0.36	-0.37	1.92	-6.39
	MOM(6)	3.74	**0.03**	2.26	3.10	0.46	-6.55
	VOL(1,4)	1.19	0.28	0.26	-0.19	1.21	-7.56
	VOL(1,6)	1.07	0.28	0.20	0.83	-1.14	-12.05
	VOL(2,4)	0.92	0.35	0.15	0.49	-0.59	-8.51
	VOL(2,6)	0.14	0.46	0.00	-0.03	0.07	**-13.56**
	VOL(3,4)	0.12	0.48	0.00	0.01	-0.02	-11.30
	VOL(3,6)	1.36	0.24	0.32	0.10	0.78	**-13.31**
RUS	MA(1,9)	2.39	0.14	0.92	1.46	-0.23	-6.84
	MA(1,12)	0.59	0.39	0.05	0.07	0.00	-8.36
	MA(2,9)	1.47	0.27	0.33	1.27	-1.65	-9.85
	MA(2,12)	0.68	0.37	0.07	0.05	0.10	-8.11
	MA(3,9)	0.62	0.36	0.06	0.19	-0.22	-8.63
	MA(3,12)	1.31	0.27	0.24	0.03	0.69	-9.01
	MOM(9)	1.35	0.25	0.26	0.14	0.50	-8.41
	MOM(12)	0.52	0.38	0.04	0.00	0.12	-8.79
	VOL(1,9)	0.59	0.39	0.06	0.19	-0.23	-8.54
	VOL(1,12)	0.49	0.40	0.04	-0.06	0.24	-10.57
	VOL(2,9)	1.66	0.20	0.44	0.49	0.34	-7.35
	VOL(2,12)	1.55	0.20	0.37	0.03	1.08	-7.42
	VOL(3,9)	1.37	0.23	0.30	0.60	-0.33	-7.21
	VOL(3,12)	3.01	**0.05**	1.33	1.18	1.65	-8.23

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 23: Predictive Regression Estimation Results, Technical Indicators

	Indicator	**Slope**	***p*-value**	R^2 **(%)**	R^2_{EXP} **(%)**	R^2_{REC} **(%)**	***qLL***
ZAF	MA(1,4)	1.65	**0.05**	2.13	-2.53	6.19	-8.19
	MA(1,6)	1.02	0.19	0.74	-1.29	2.51	-9.49
	MA(2,4)	1.60	**0.05**	2.14	0.64	3.44	-7.95
	MA(2,6)	1.62	**0.07**	1.90	-0.64	4.11	-6.93
	MA(3,4)	1.08	0.14	0.94	0.44	1.38	-8.81
	MA(3,6)	0.78	0.25	0.46	-0.87	1.61	-7.47
	MOM(4)	0.73	0.27	0.40	-1.86	2.36	-7.67
	MOM(6)	0.81	0.24	0.46	-1.59	2.25	-7.57
	VOL(1,4)	0.97	0.14	0.86	0.22	1.42	-7.72
	VOL(1,6)	1.24	**0.10**	1.29	-0.63	2.96	-8.01
	VOL(2,4)	1.03	**0.10**	0.93	1.12	0.77	-7.16
	VOL(2,6)	1.01	0.14	0.89	0.27	1.43	-7.47
	VOL(3,4)	1.25	**0.08**	1.35	-2.37	4.59	-6.96
	VOL(3,6)	1.04	0.14	0.91	-1.12	2.68	-7.91
ZAF	MA(1,9)	0.74	0.25	0.37	-0.67	1.28	-9.53
	MA(1,12)	0.01	0.50	0.00	-0.03	0.03	-10.40
	MA(2,9)	1.25	0.14	1.04	-1.37	3.14	-6.37
	MA(2,12)	0.53	0.34	0.17	-0.81	1.03	-8.61
	MA(3,9)	0.24	0.41	0.04	0.60	-0.44	-11.54
	MA(3,12)	0.37	0.39	0.08	-0.37	0.47	-11.61
	MOM(9)	0.08	0.48	0.00	0.19	-0.16	-10.50
	MOM(12)	0.42	0.38	0.10	-0.39	0.53	-9.38
	VOL(1,9)	0.83	0.21	0.58	-1.14	2.07	-9.51
	VOL(1,12)	0.38	0.37	0.12	-0.80	0.92	-9.28
	VOL(2,9)	1.03	0.16	0.84	-1.14	2.56	-7.32
	VOL(2,12)	0.45	0.33	0.16	-0.66	0.87	-8.76
	VOL(3,9)	1.01	0.15	0.81	-0.09	1.59	-8.79
	VOL(3,12)	0.85	0.19	0.56	-1.23	2.11	-7.95

Note: Bold values indicate statistical significance at conventional levels. 0.00 indicates less than 0.005 in absolute value. R^2_{EXP} (R^2_{REC}) statistics are computed for OECD-dated business-cycle expansions (recessions).

APPENDIX 24: F-ALL Factor Loadings for BEL

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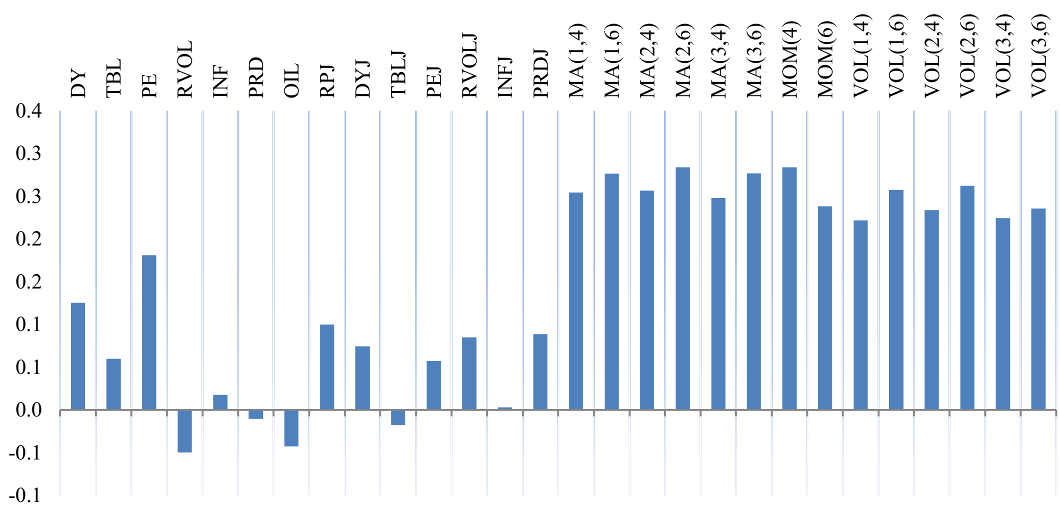

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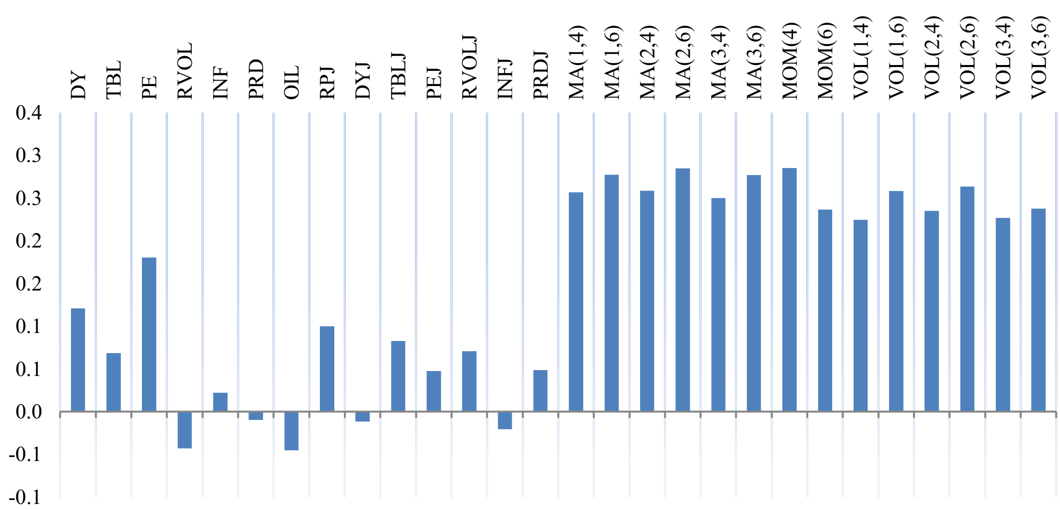

BEL<GER

APPENDIX 25: F-ALL Factor Loadings for BEL

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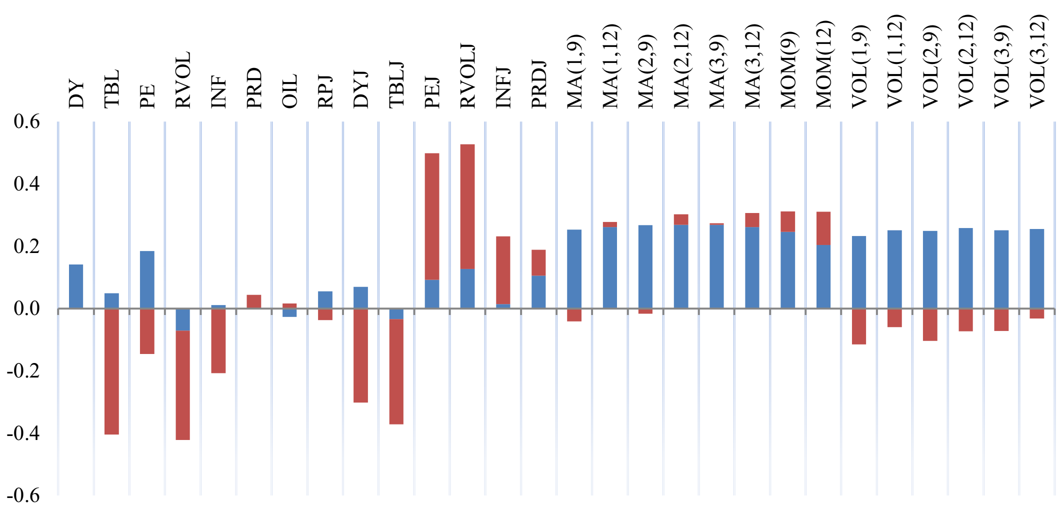

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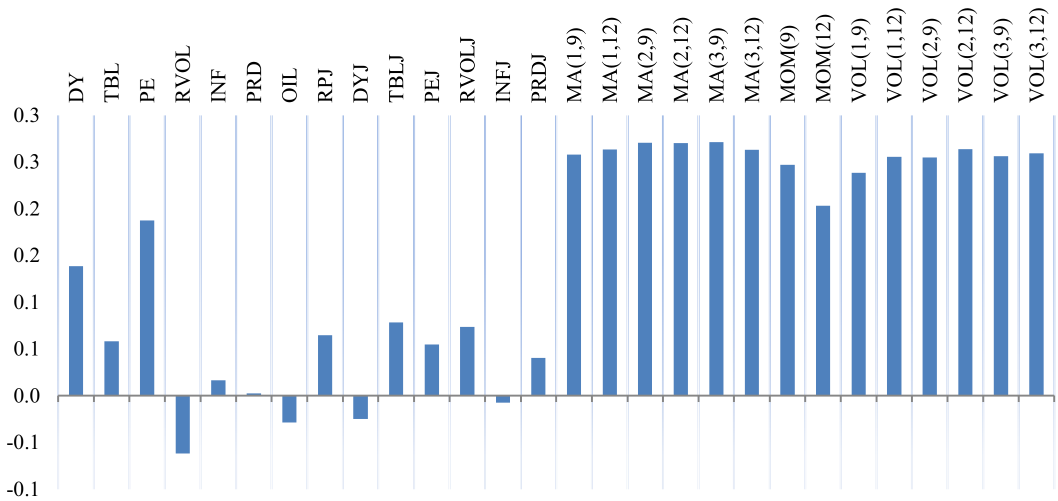
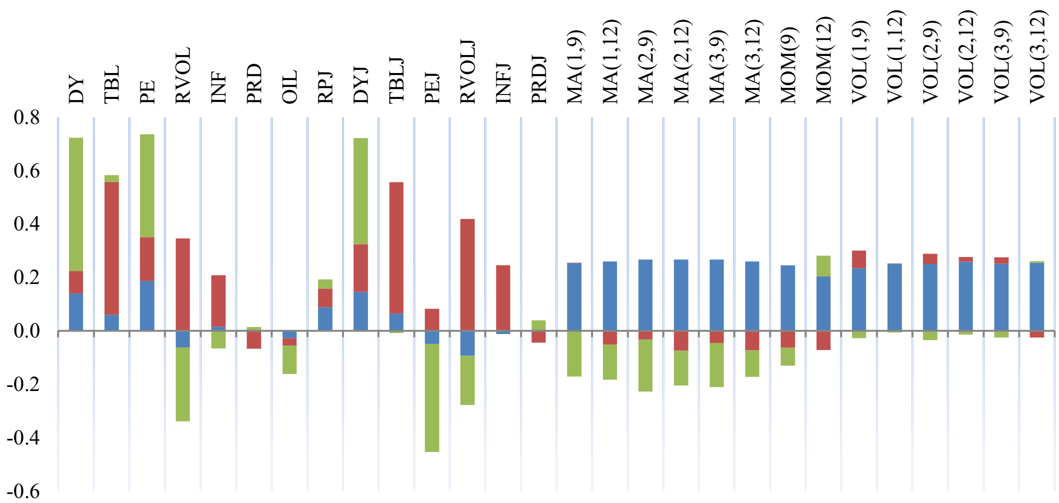


BEL<GER



APPENDIX 26: F-ALL Factor Loadings for GRC

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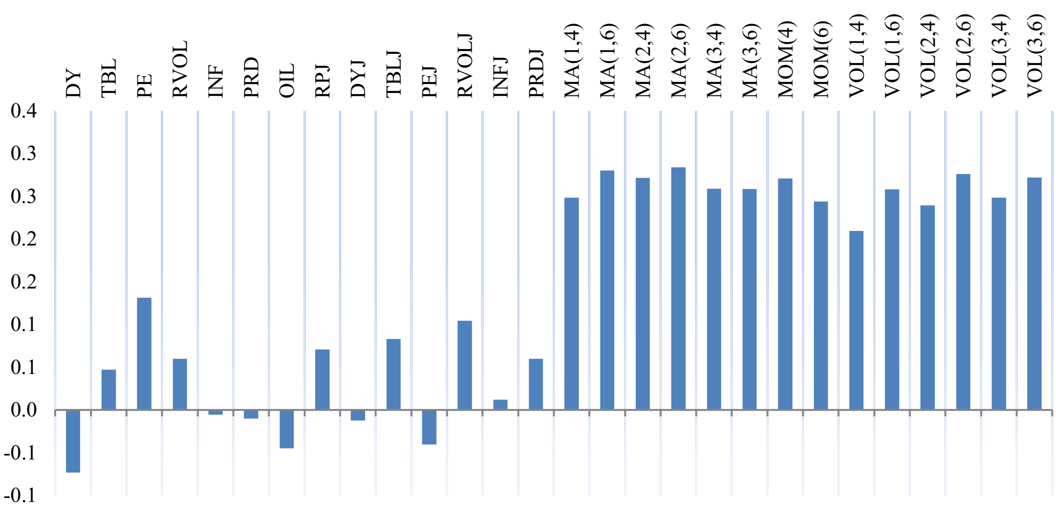

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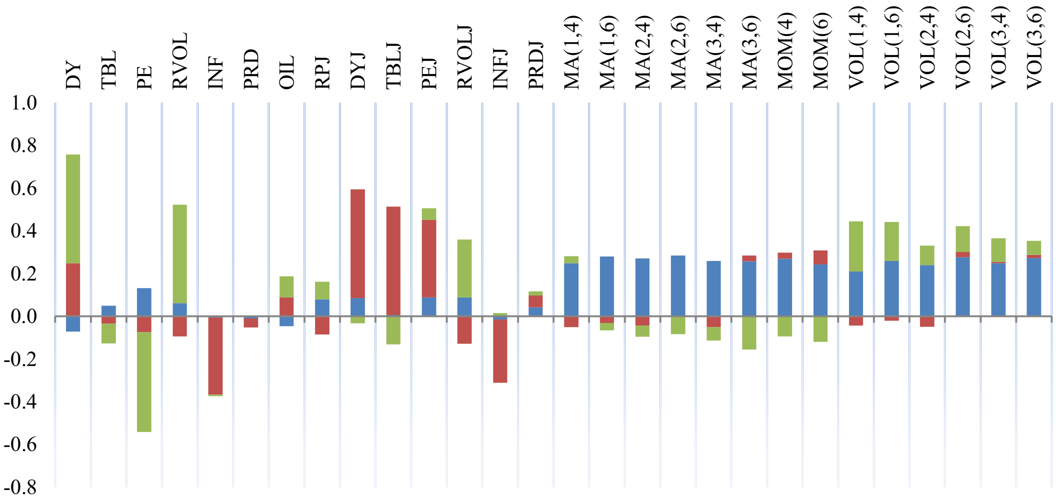

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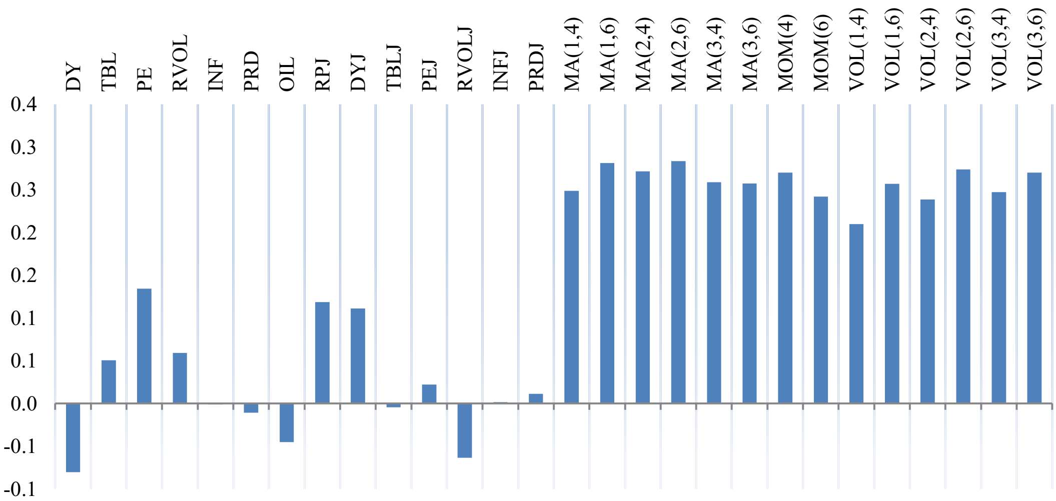

APPENDIX 27: F-ALL Factor Loadings for GRC

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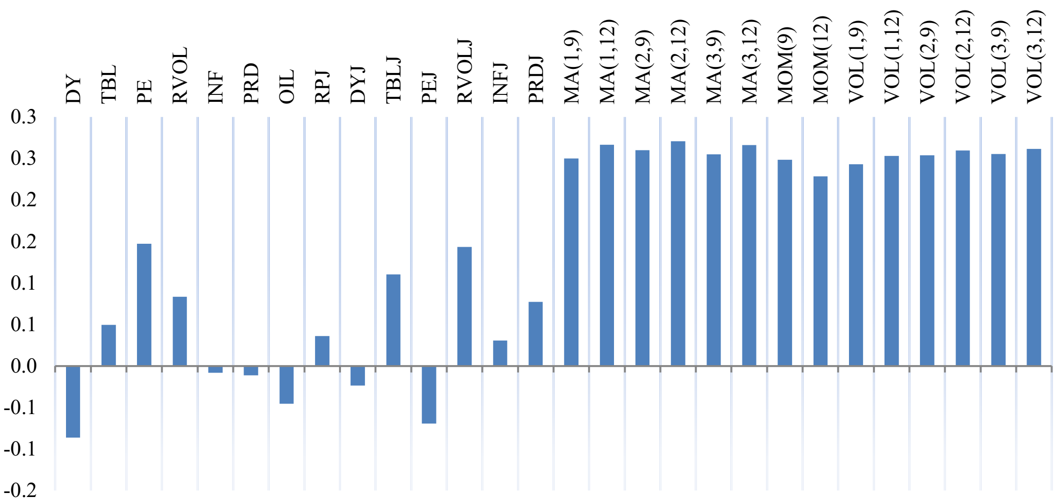

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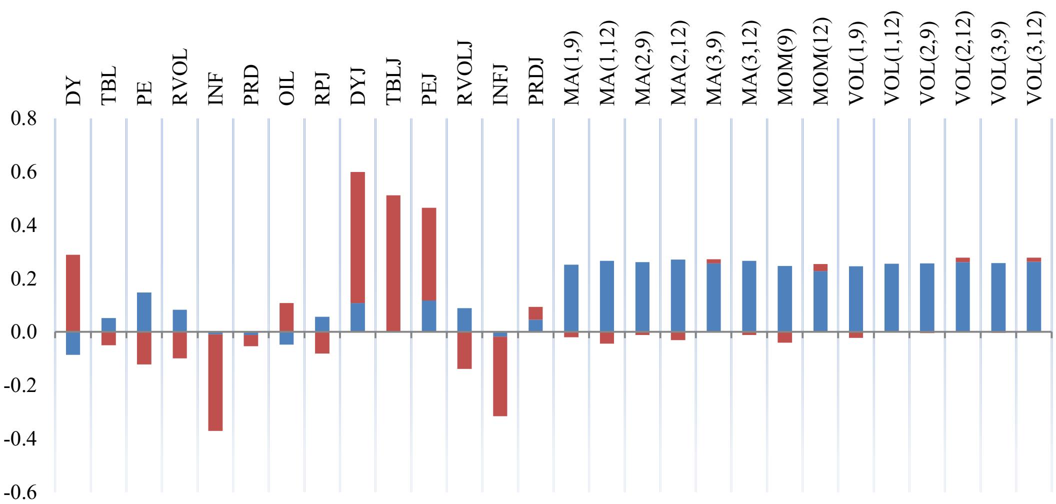

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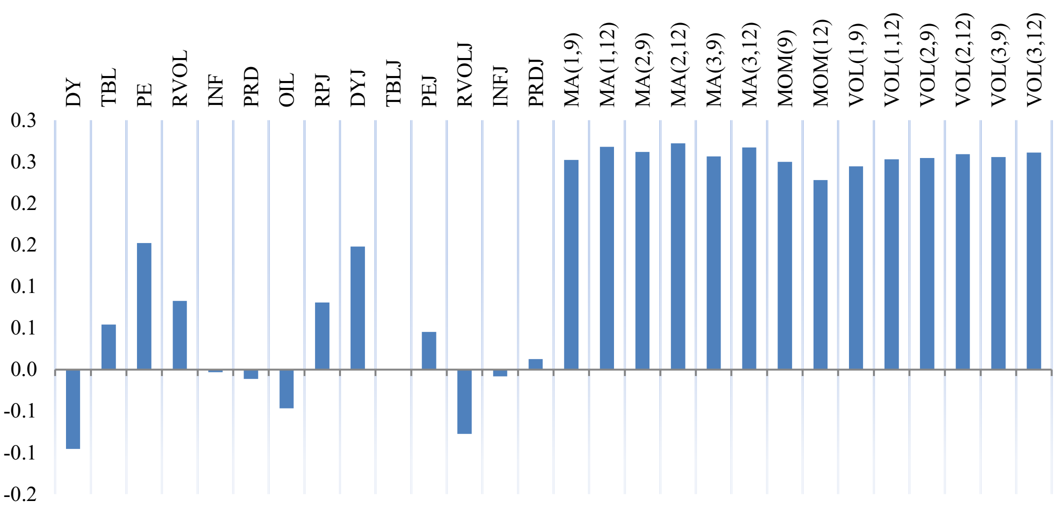
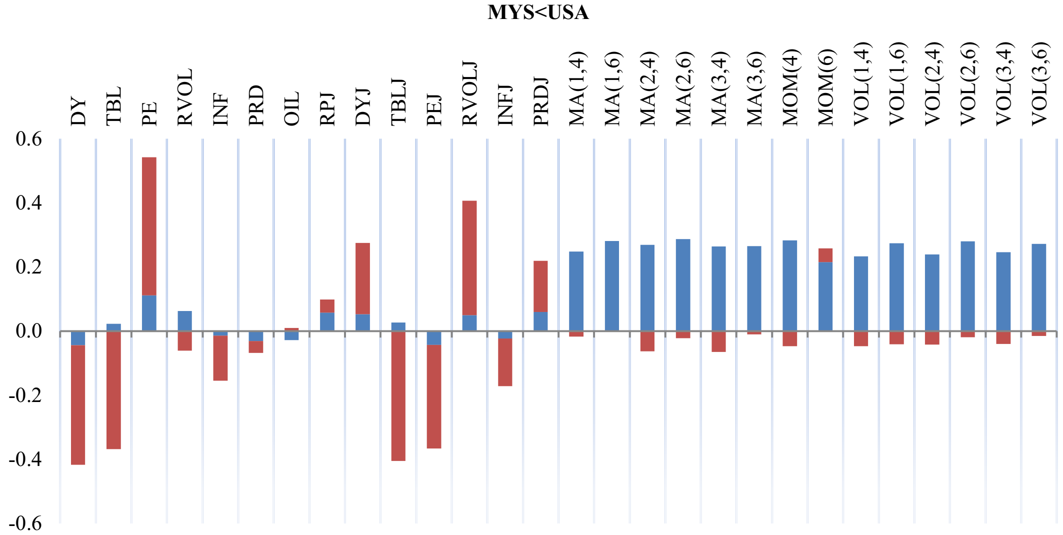
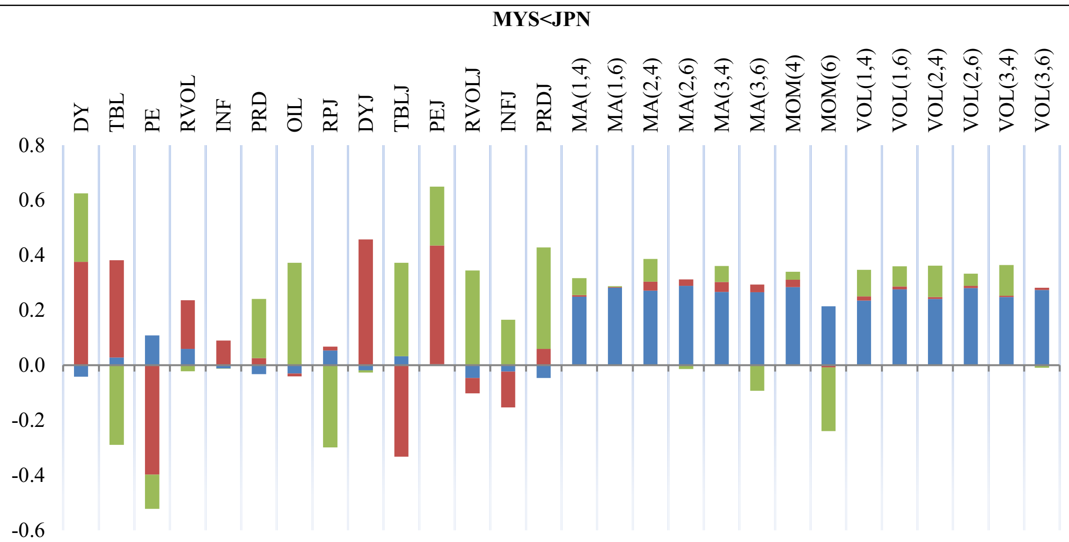
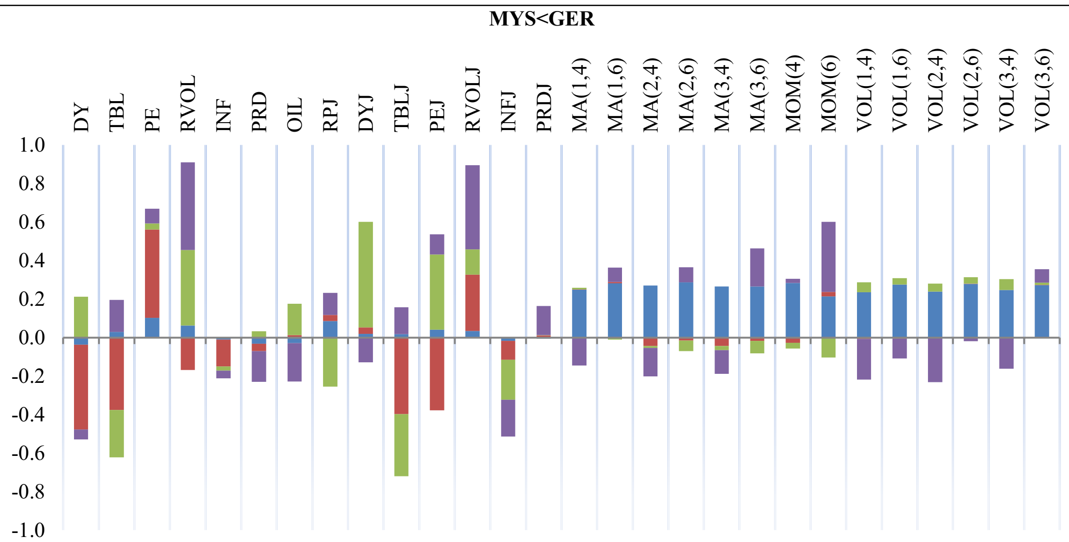


APPENDIX 28: F-ALL Factor Loadings for MYS







APPENDIX 29: F-ALL Factor Loadings for MYS

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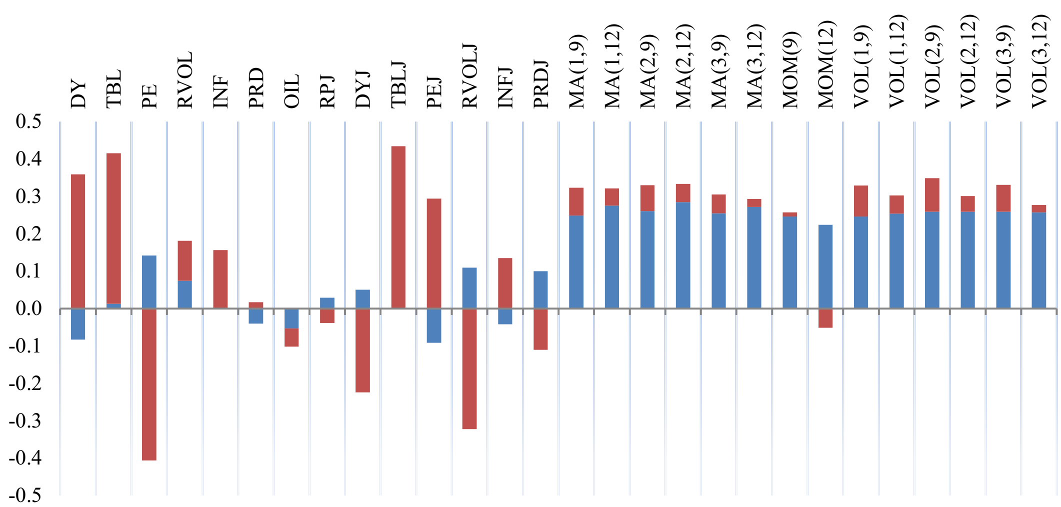

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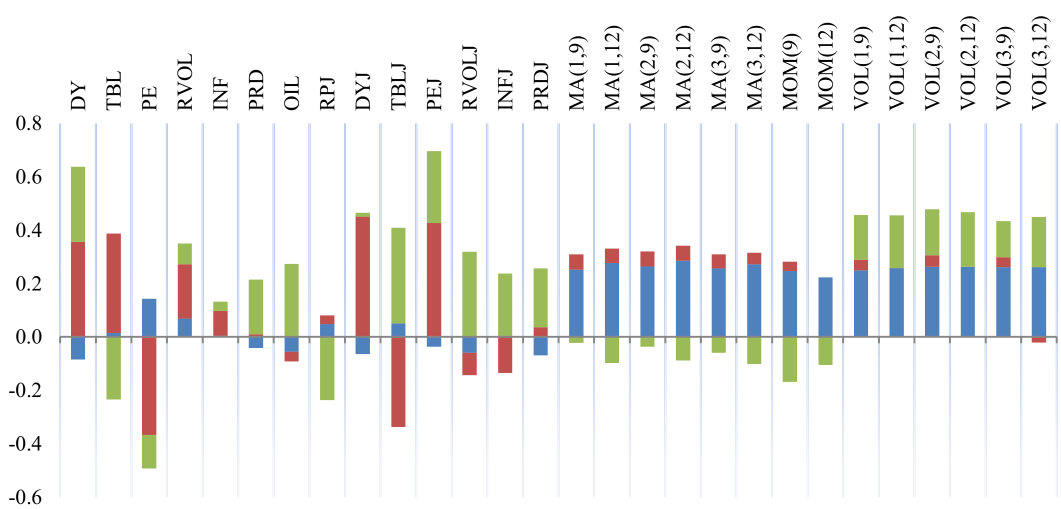

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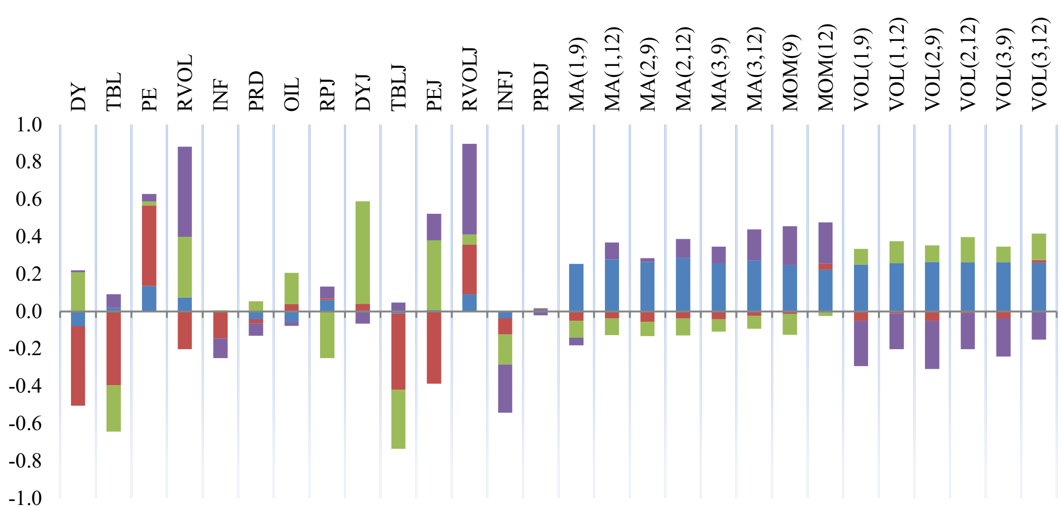
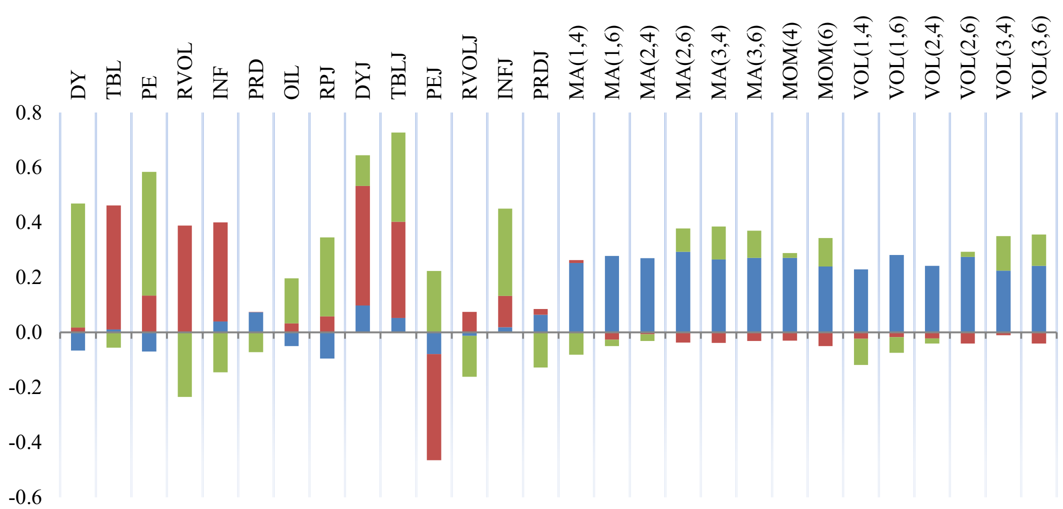


APPENDIX 30: F-ALL Factor Loadings for MEX

MEX<USA

MEX<JPN



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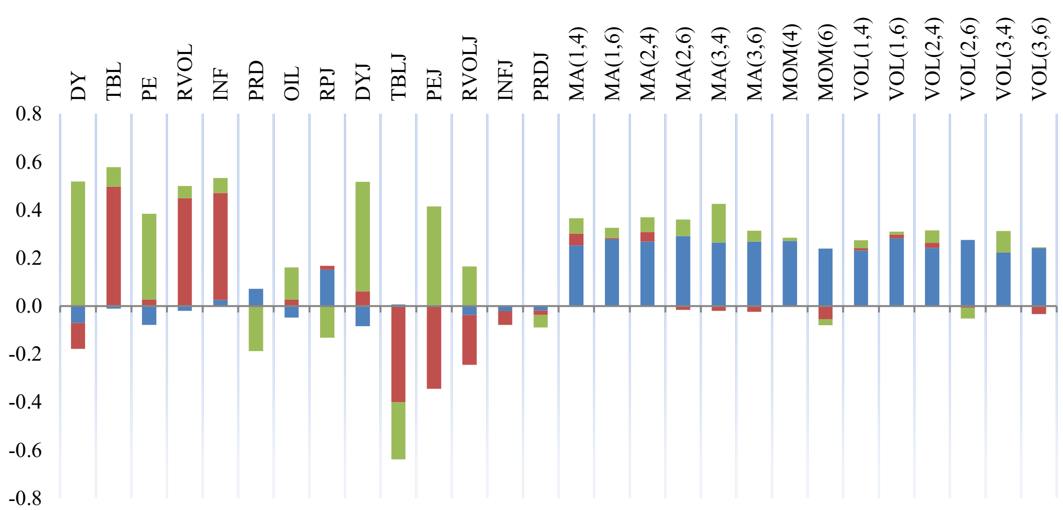
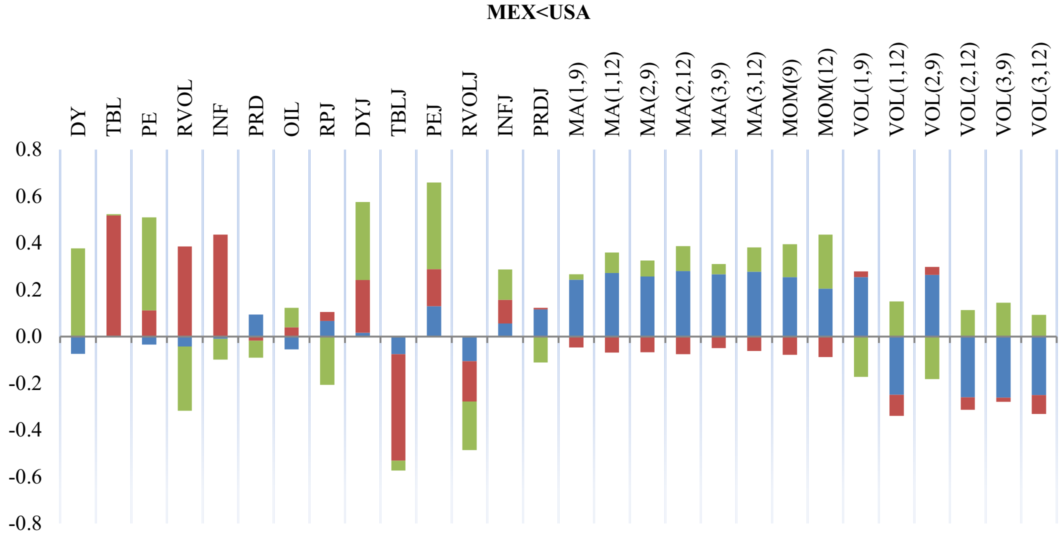
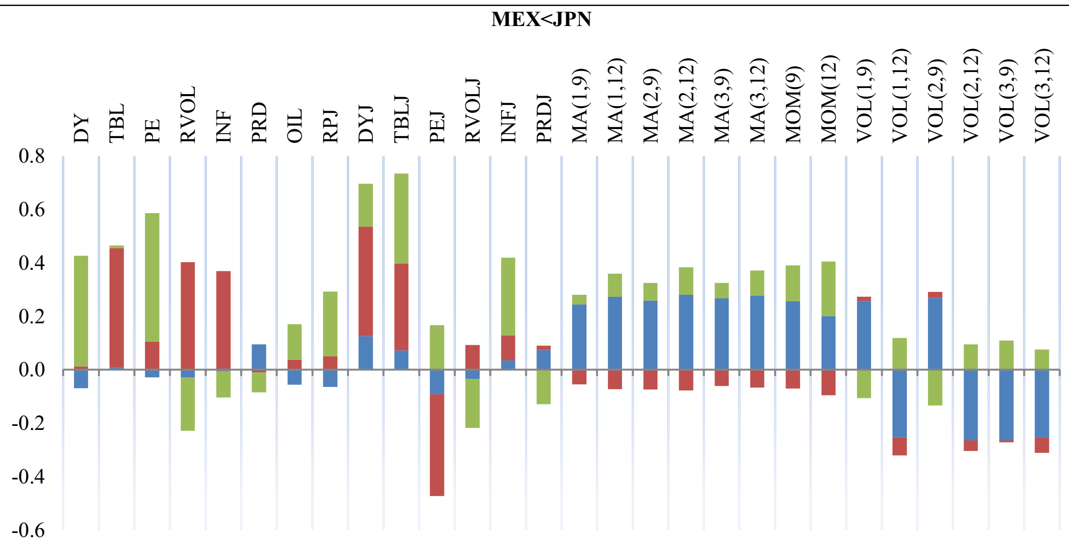
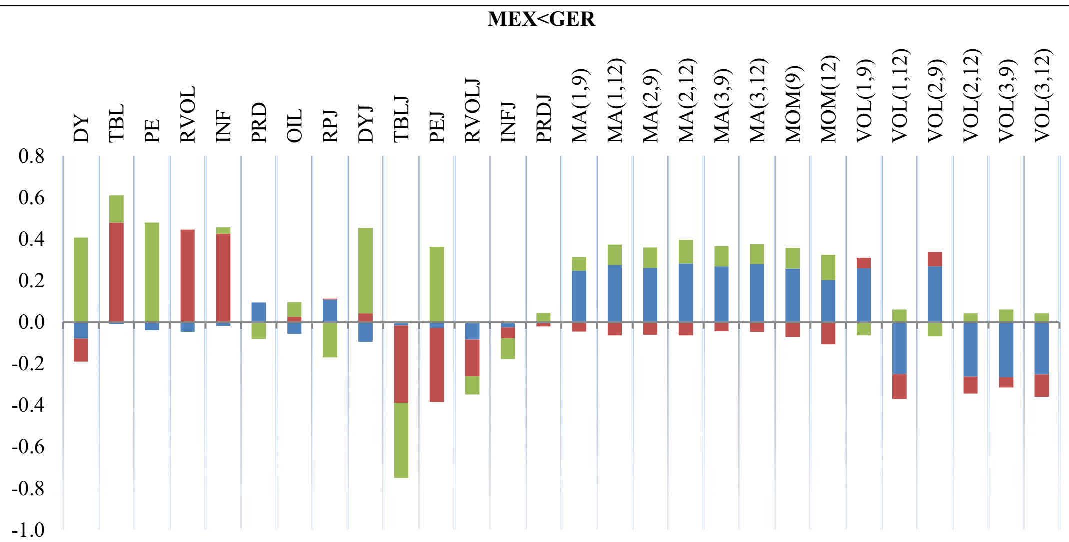


APPENDIX 31: F-ALL Factor Loadings for MEX

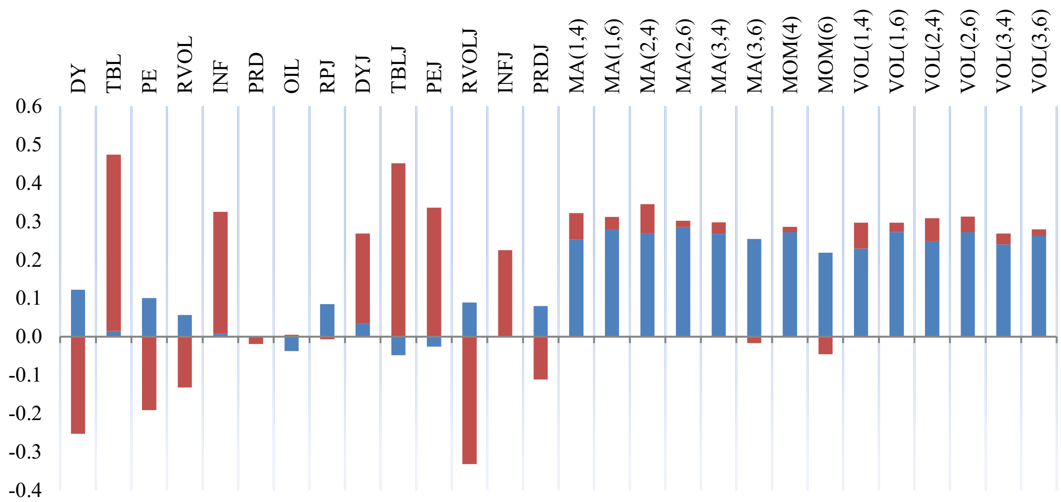






APPENDIX 32: F-ALL Factor Loadings for POR

POR<USA



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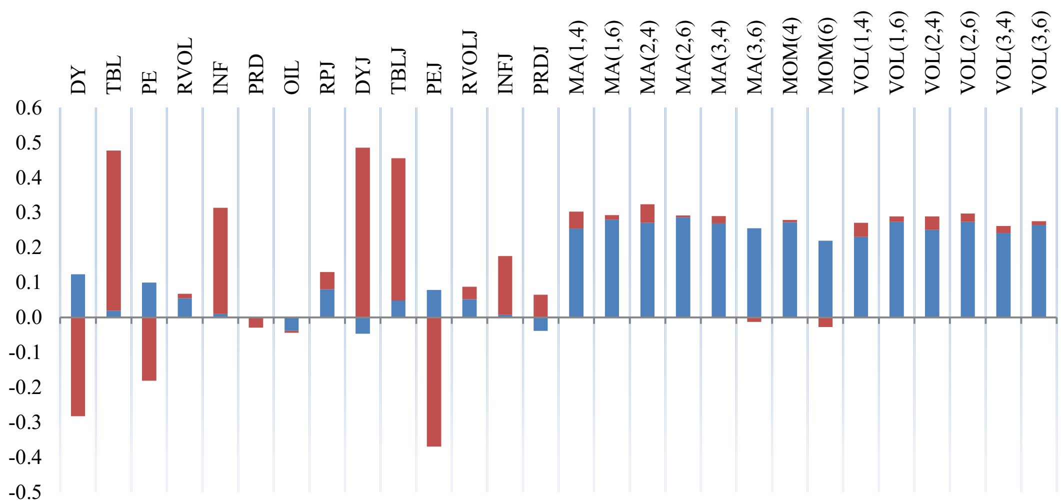

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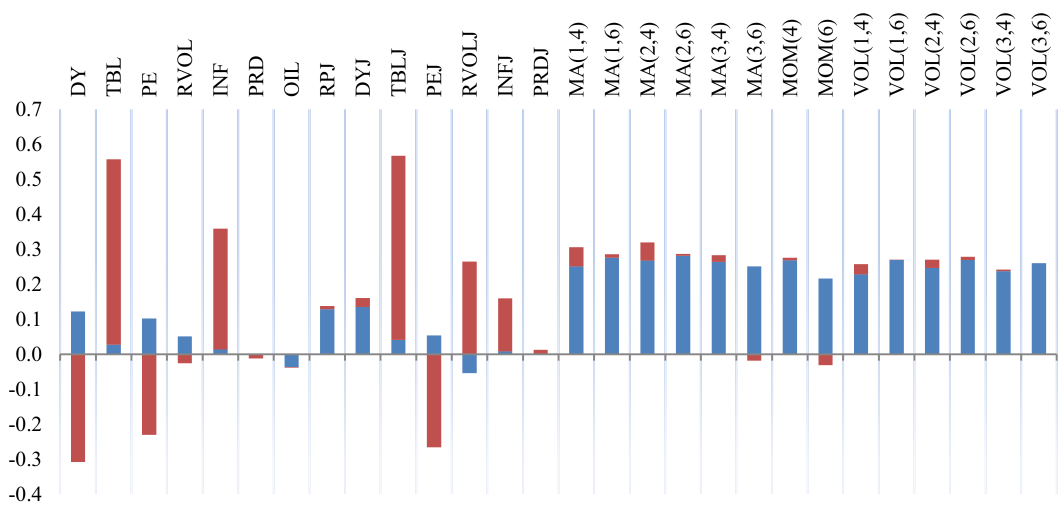

APPENDIX 33: F-ALL Factor Loadings for POR

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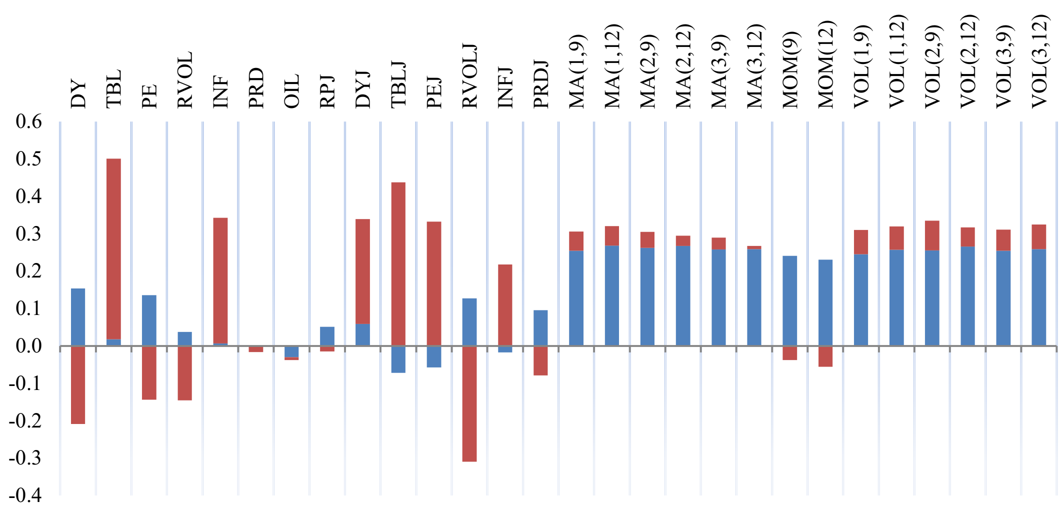

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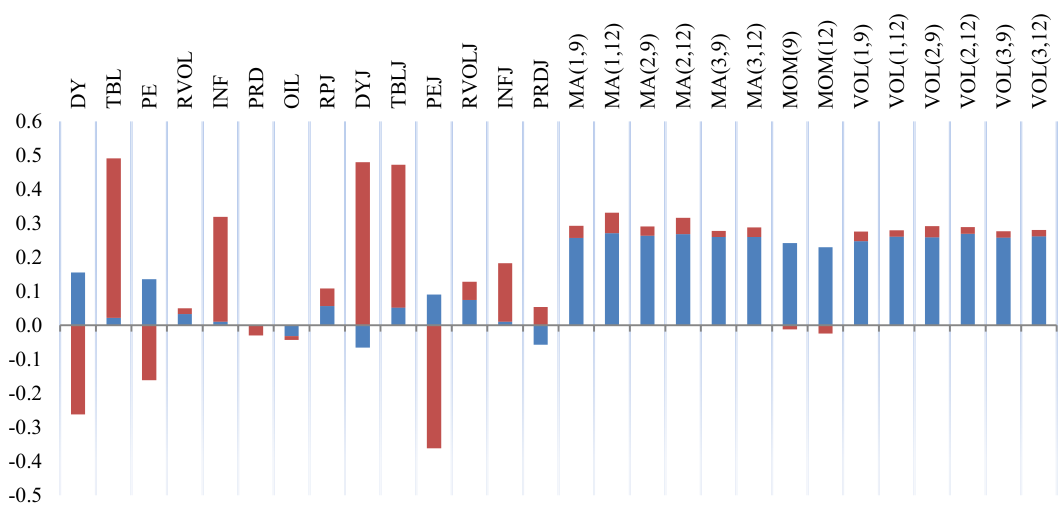

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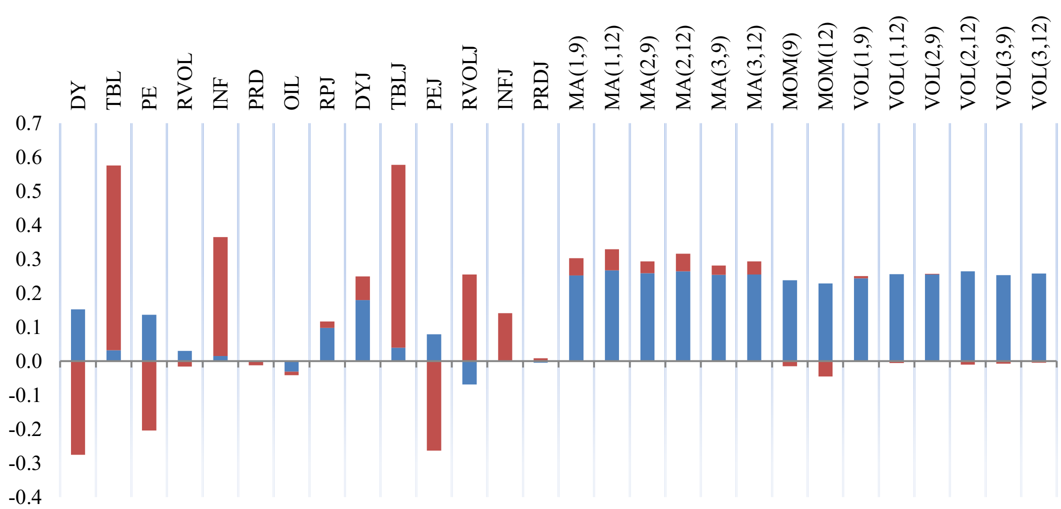

APPENDIX 34: F-ALL Factor Loadings for SPN

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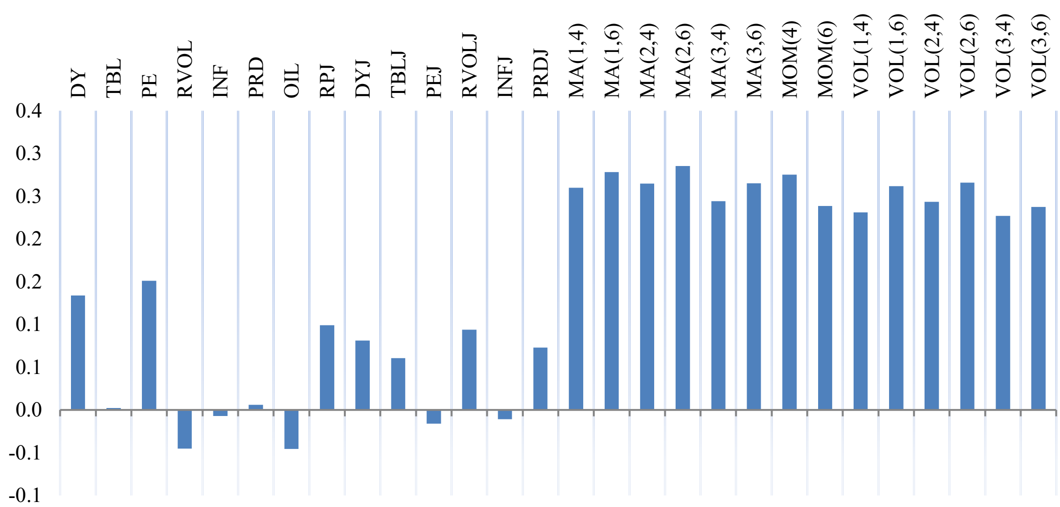

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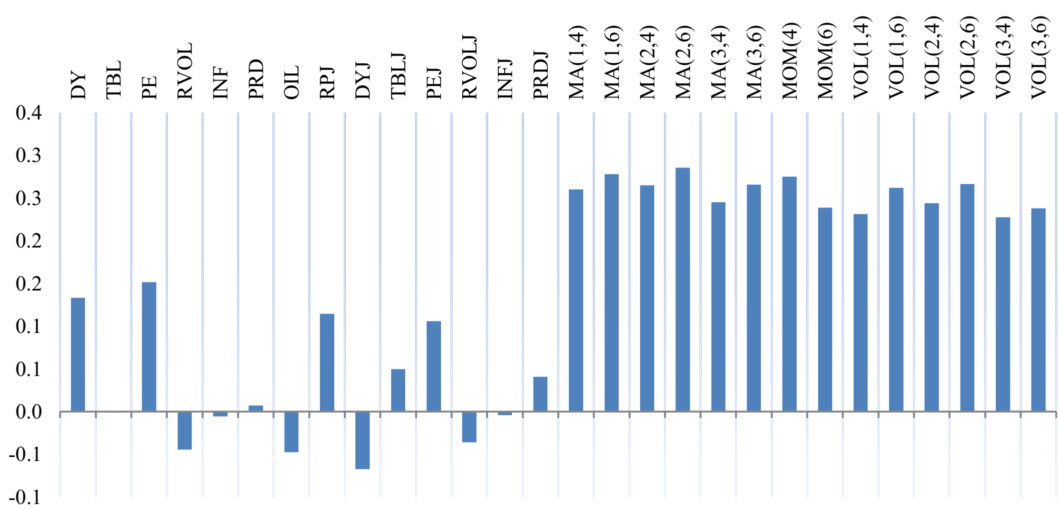

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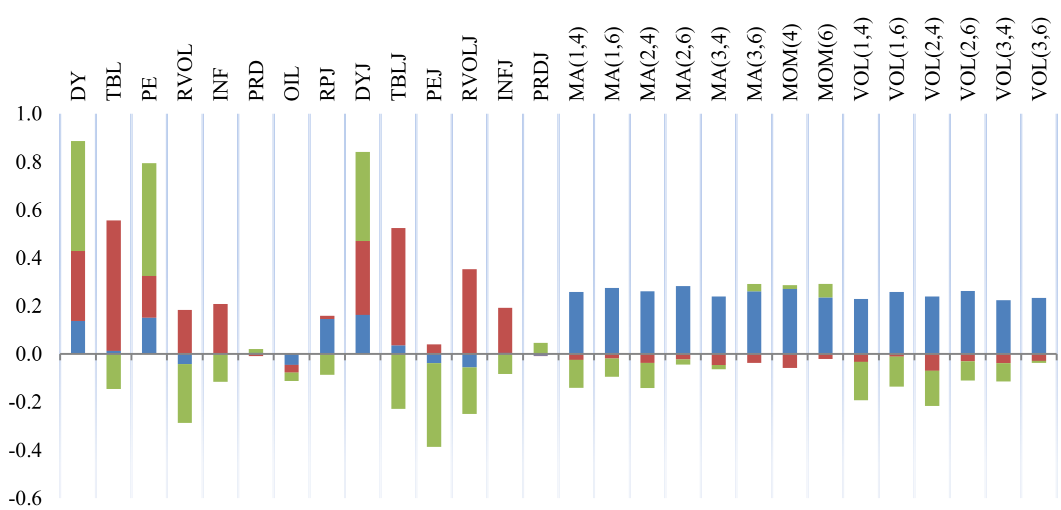
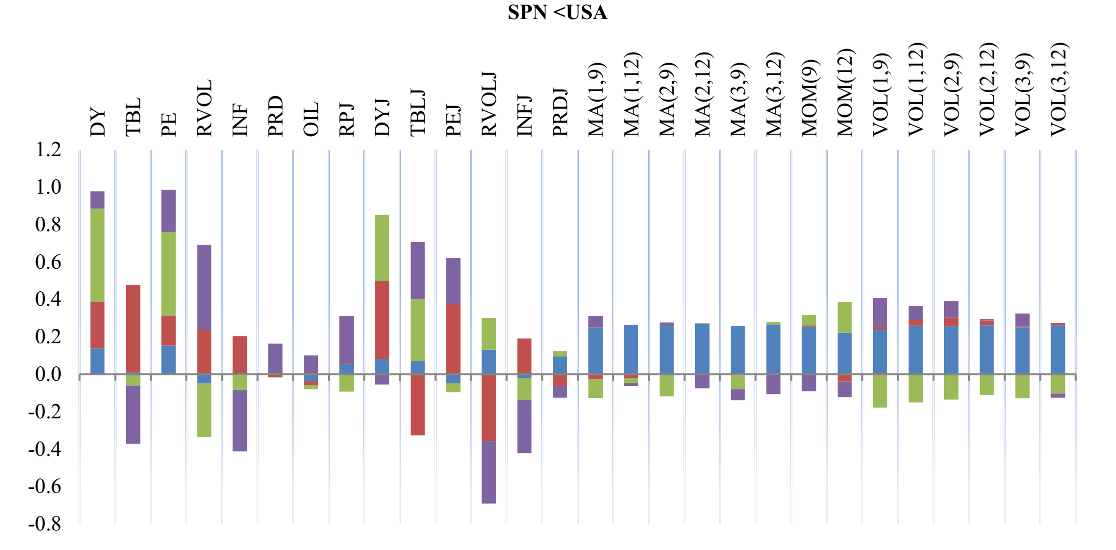
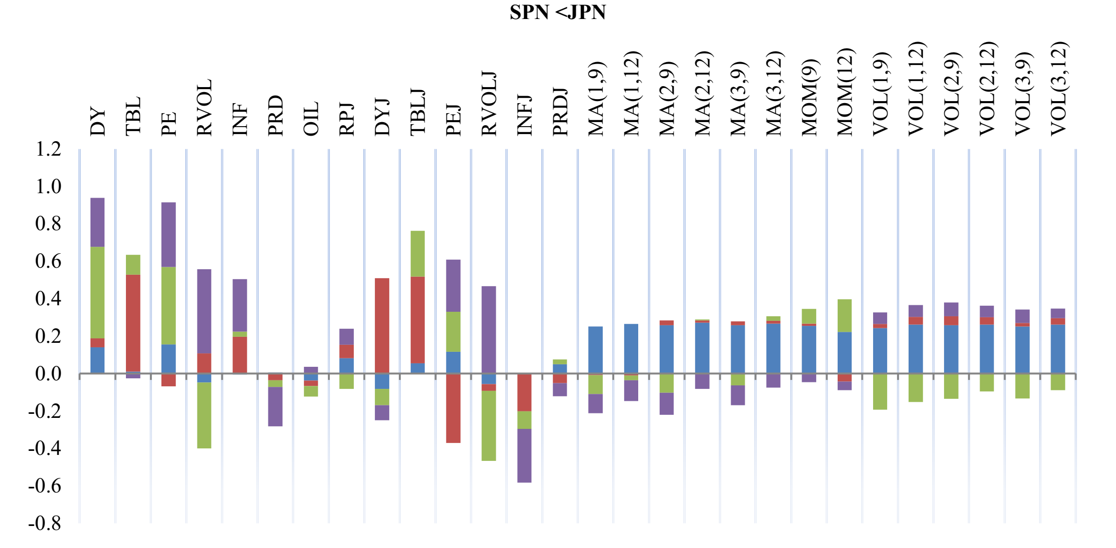
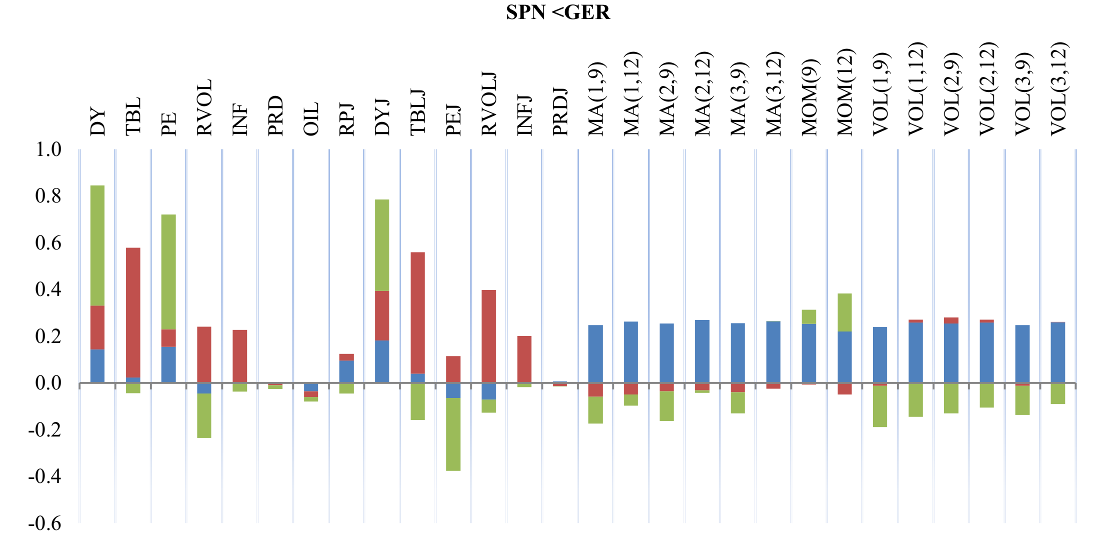


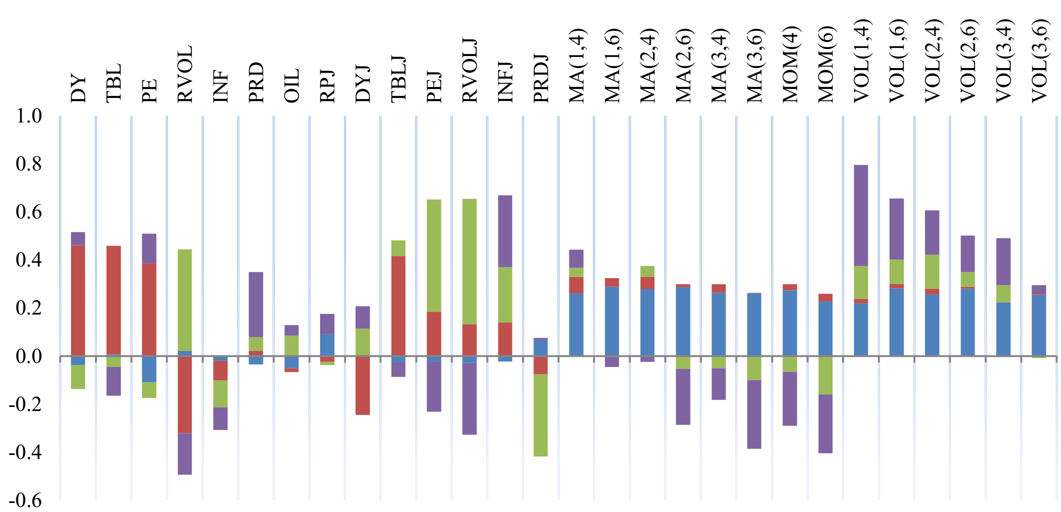
APPENDIX 35: F-ALL Factor Loadings for SPN

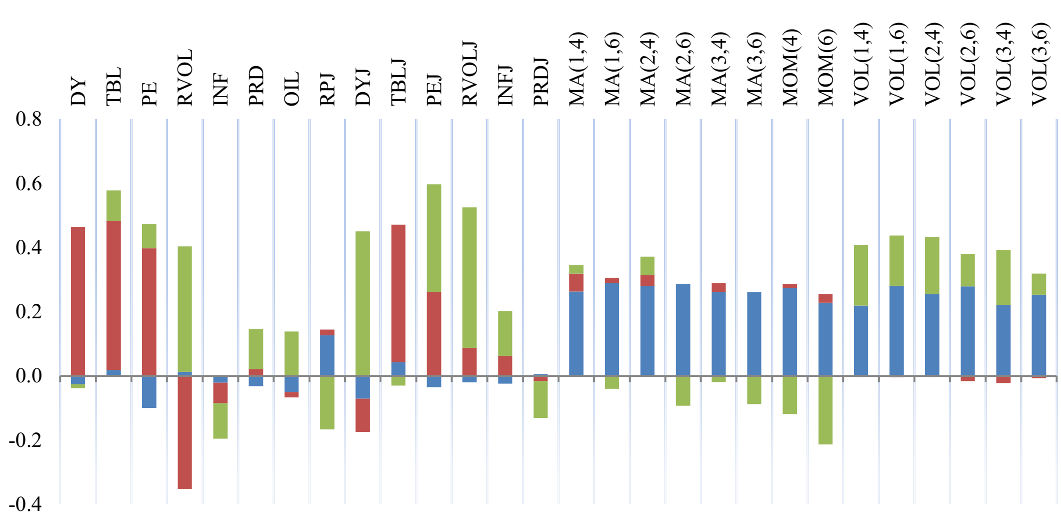






APPENDIX 36: F-ALL Factor Loadings for TWN





APPENDIX 37: F-ALL Factor Loadings for TWN

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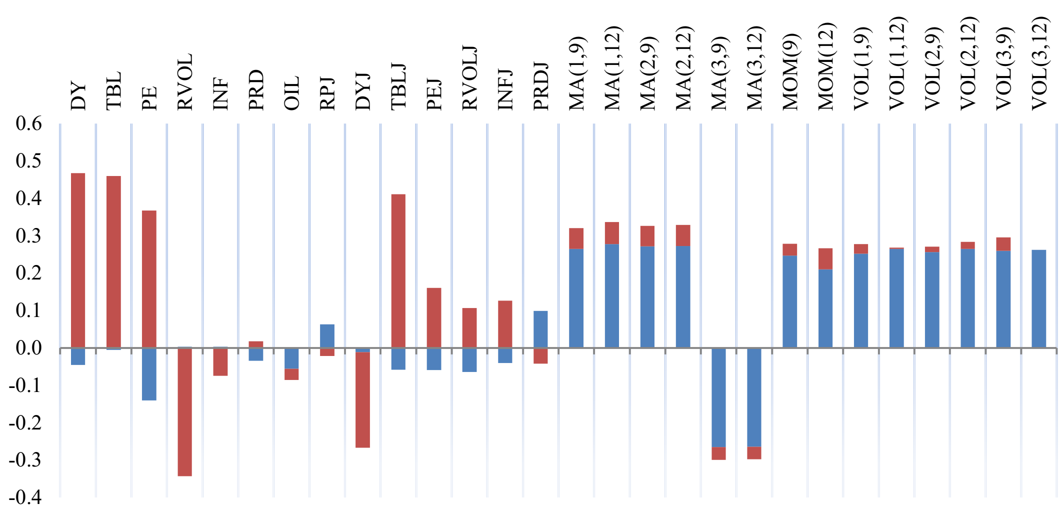

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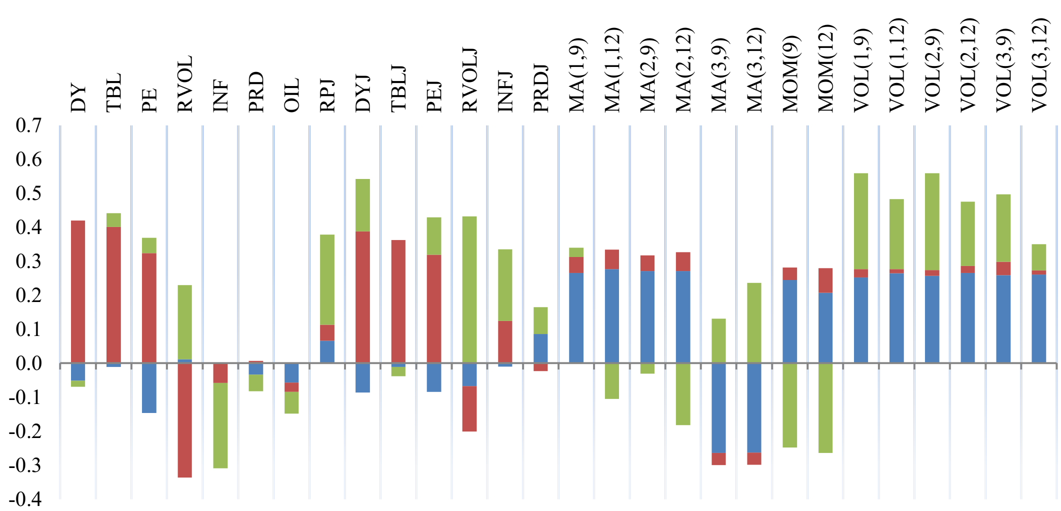

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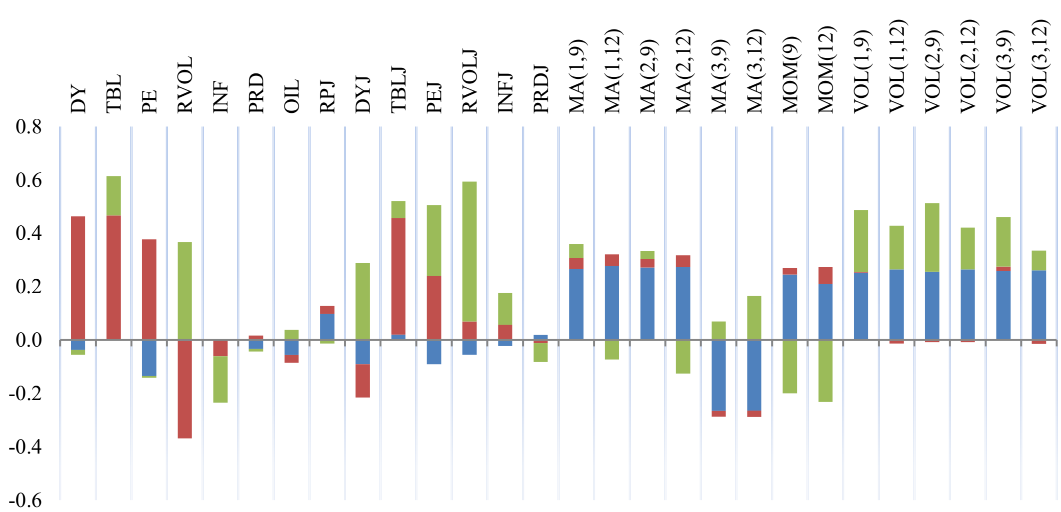
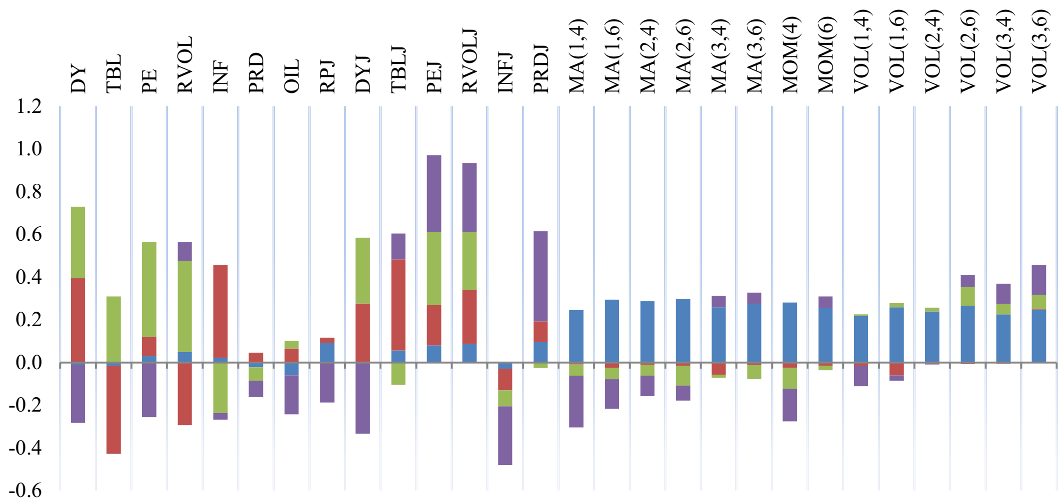


APPENDIX 38: F-ALL Factor Loadings for TUR

TUR<USA

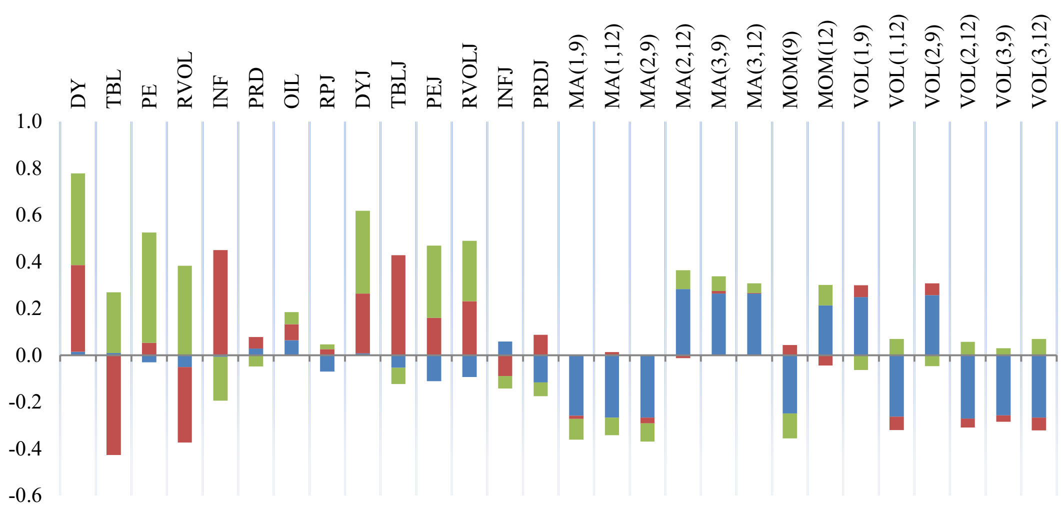


TUR <JPN

TUR <GER

APPENDIX 39: F-ALL Factor Loadings for TUR

TUR<USA



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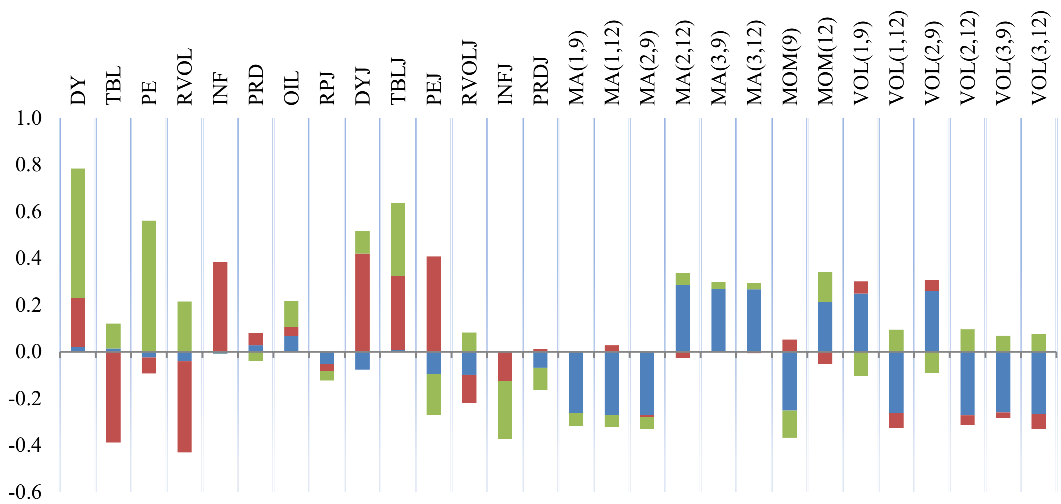

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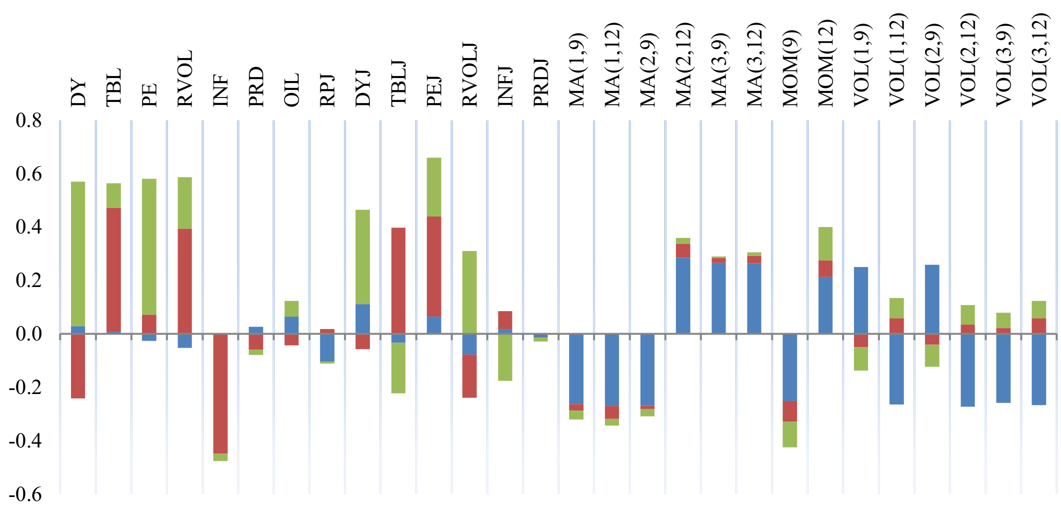
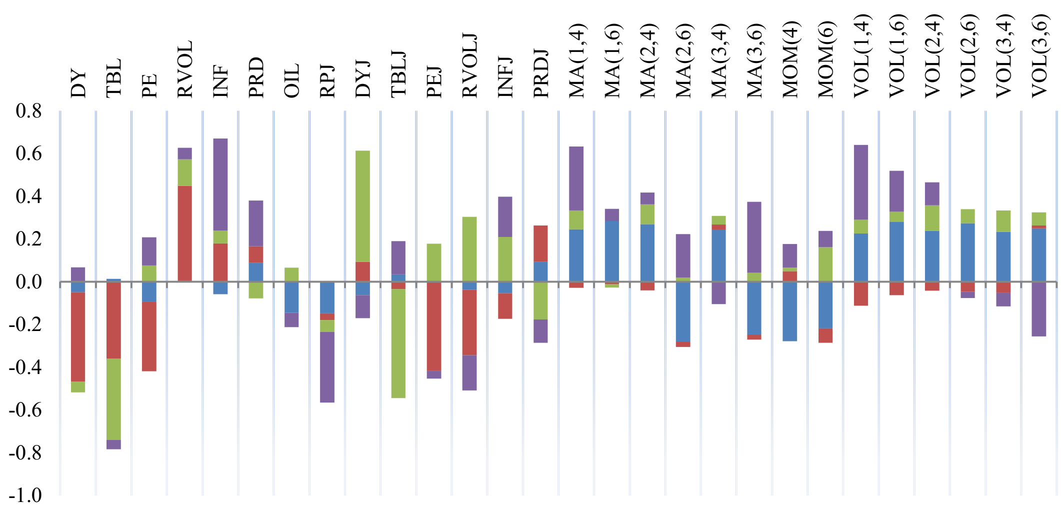


APPENDIX 40: F-ALL Factor Loadings for BRA

BRA<USA



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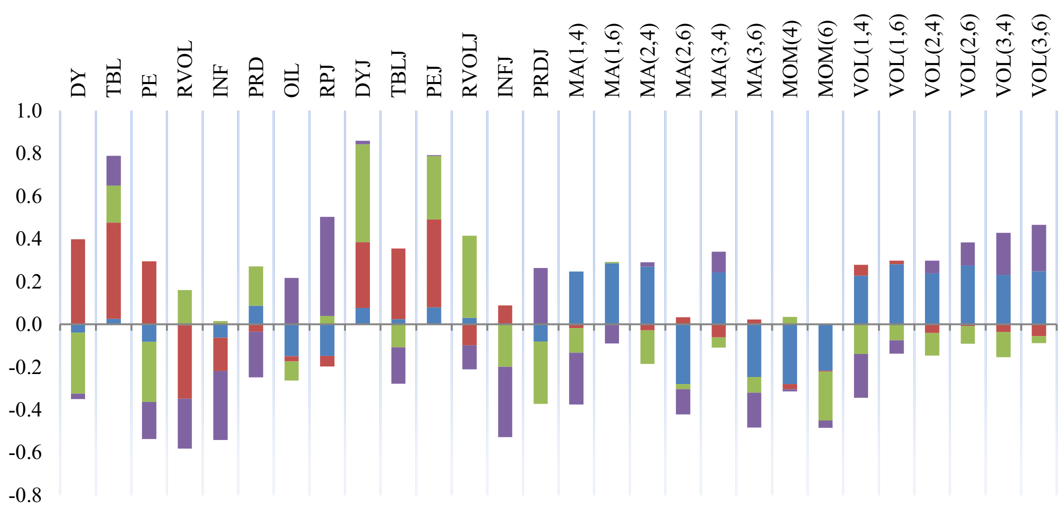

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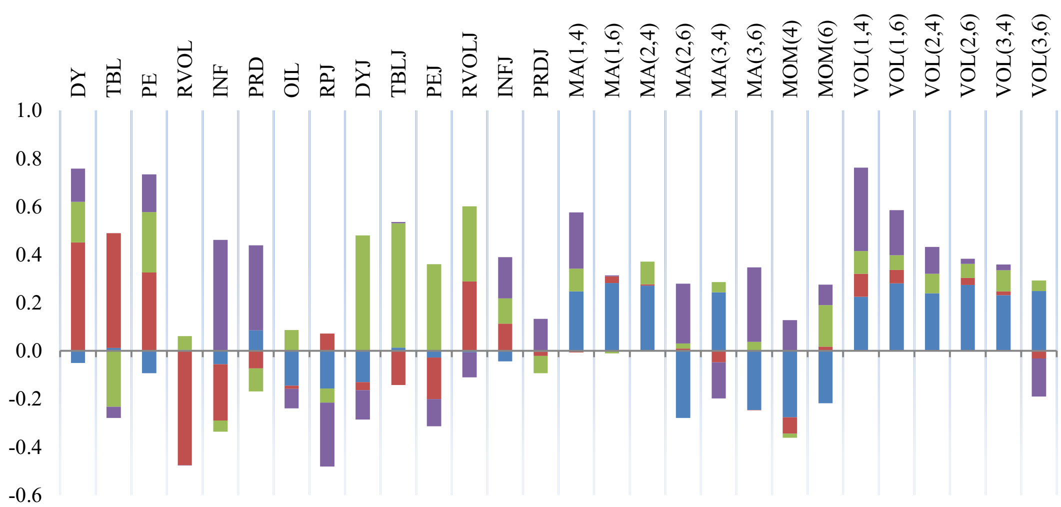
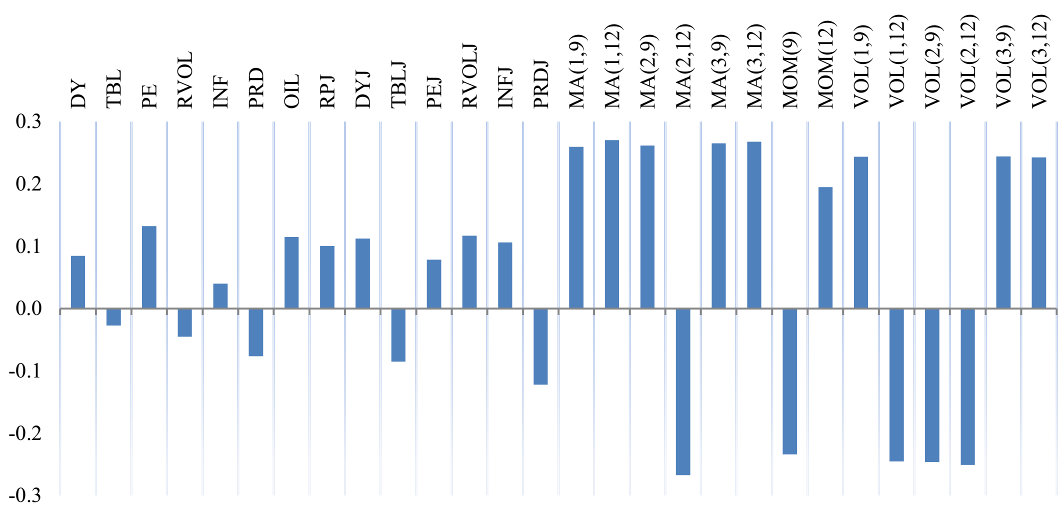


APPENDIX 41: F-ALL Factor Loadings for BRA

BRA<USA



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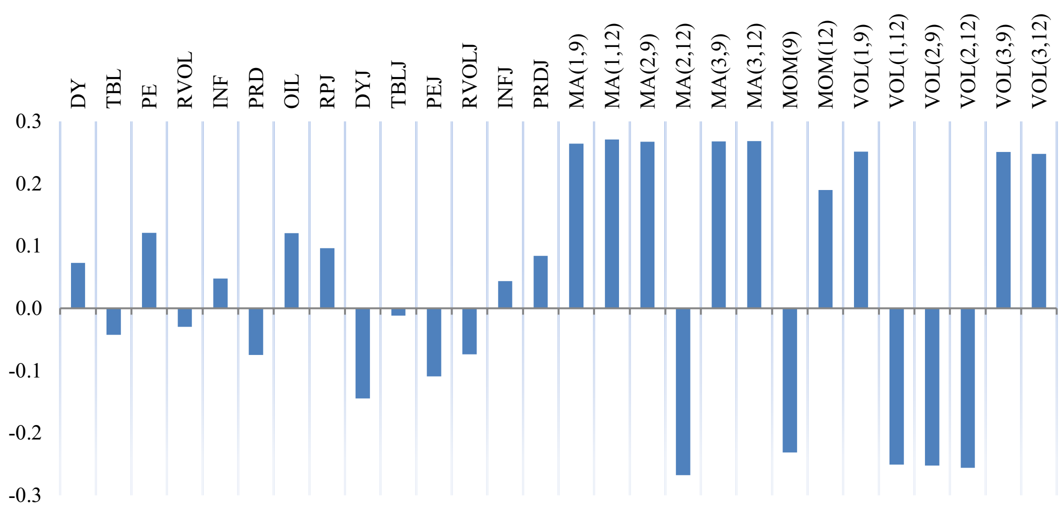

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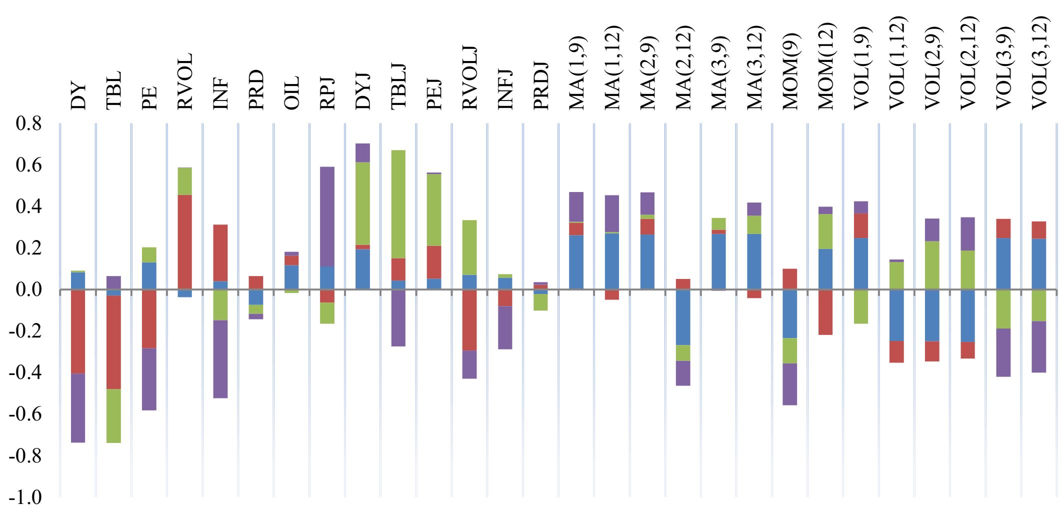
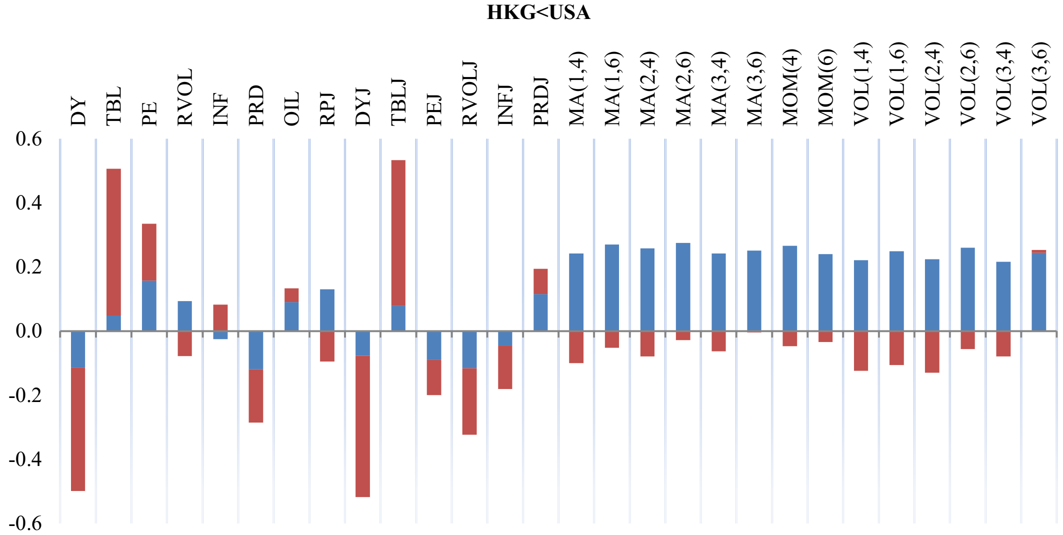
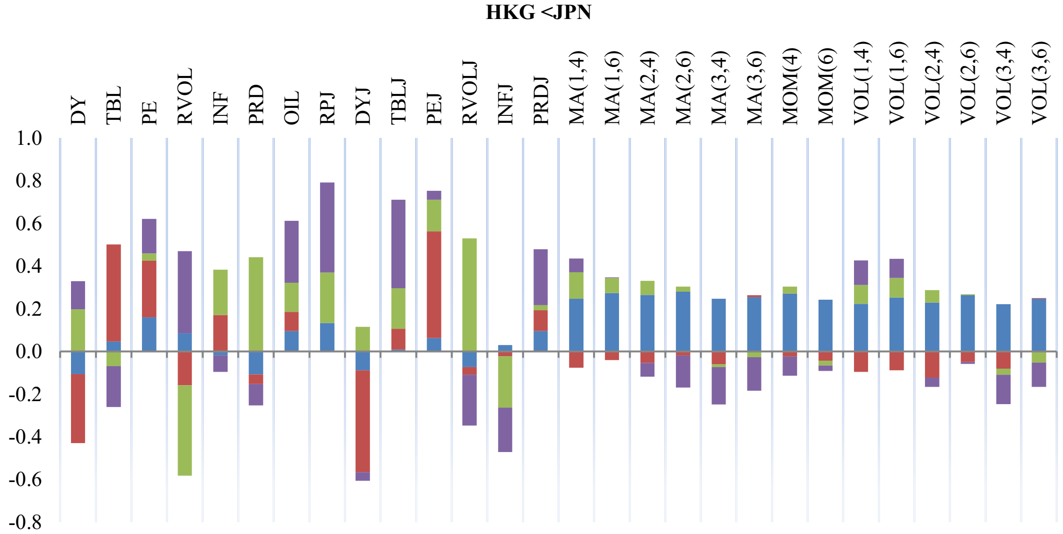
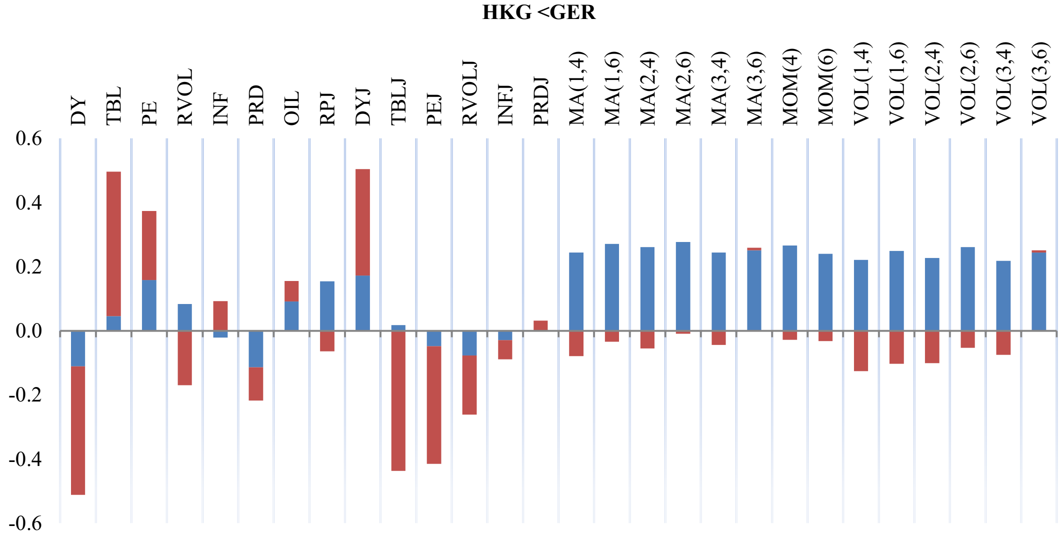


APPENDIX 42: F-ALL Factor Loadings for HKG

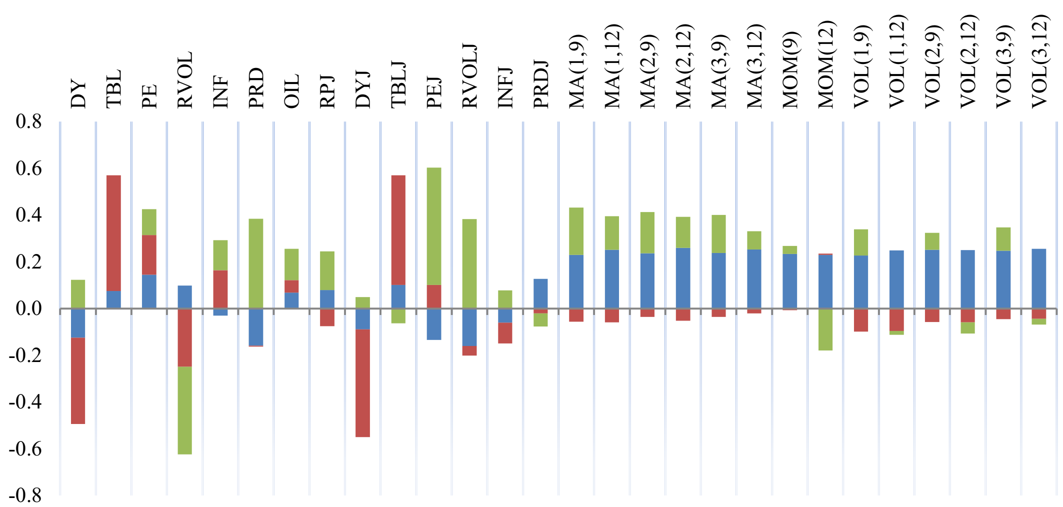






APPENDIX 43: F-ALL Factor Loadings for HKG

HKG<USA



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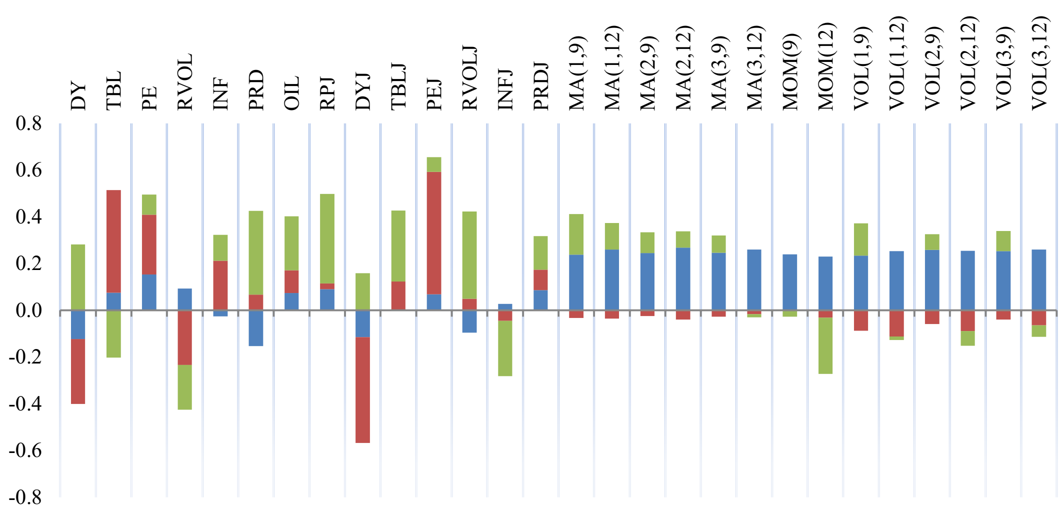

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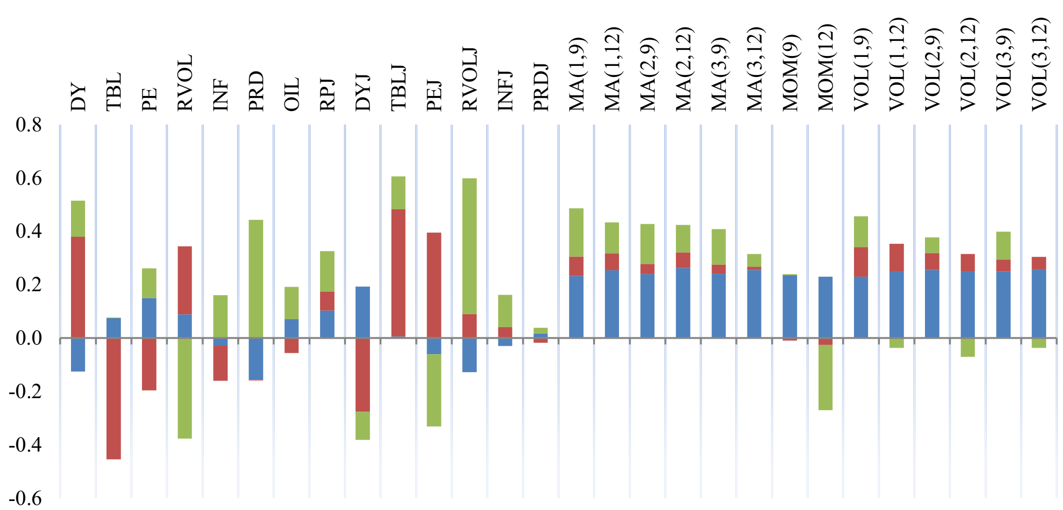
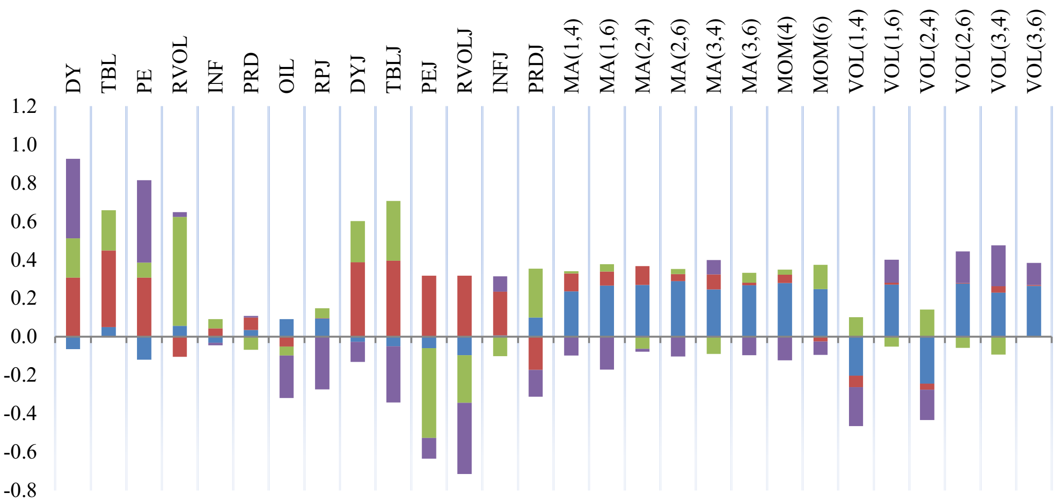


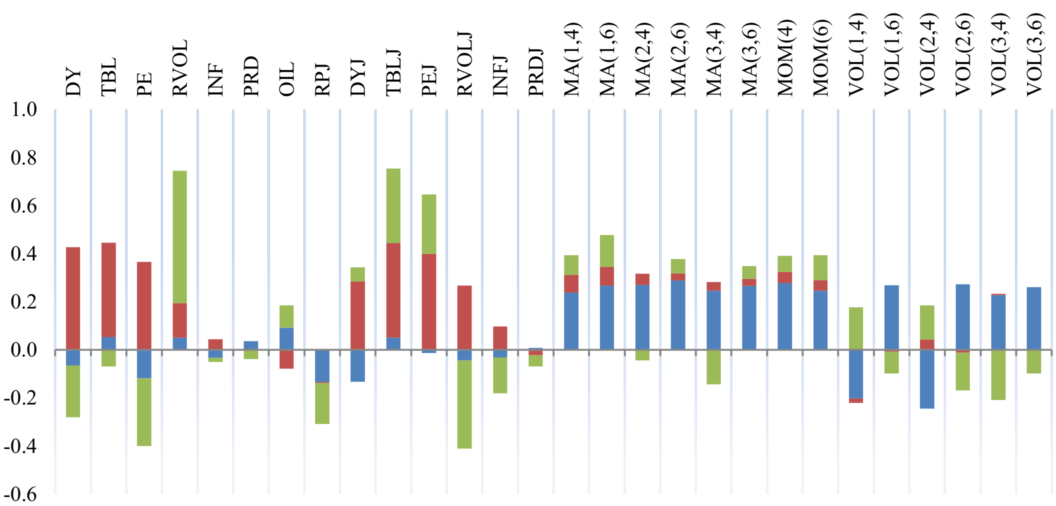
APPENDIX 44: F-ALL Factor Loadings for IND

IND<USA



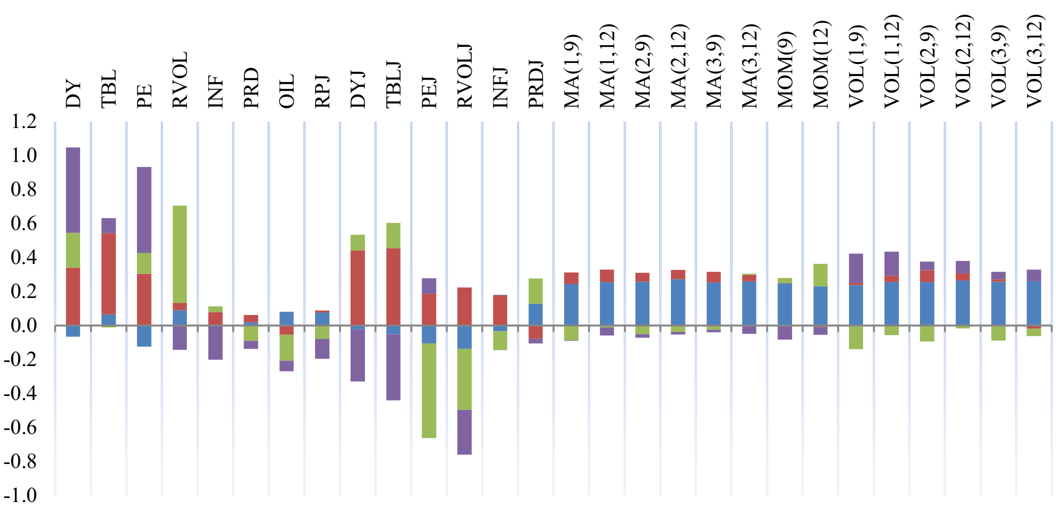
IND <JPN

IND <GER



APPENDIX 45: F-ALL Factor Loadings for IND

IND<USA



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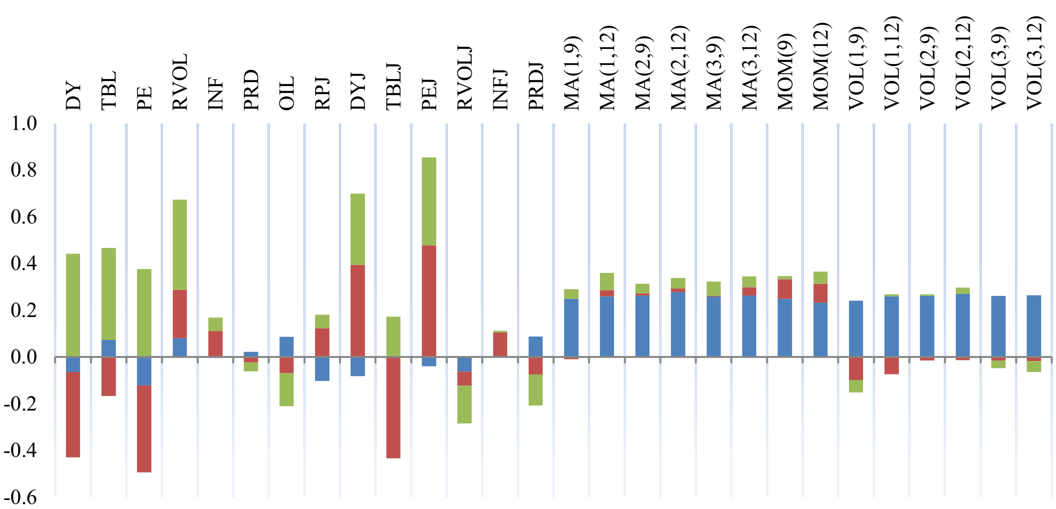

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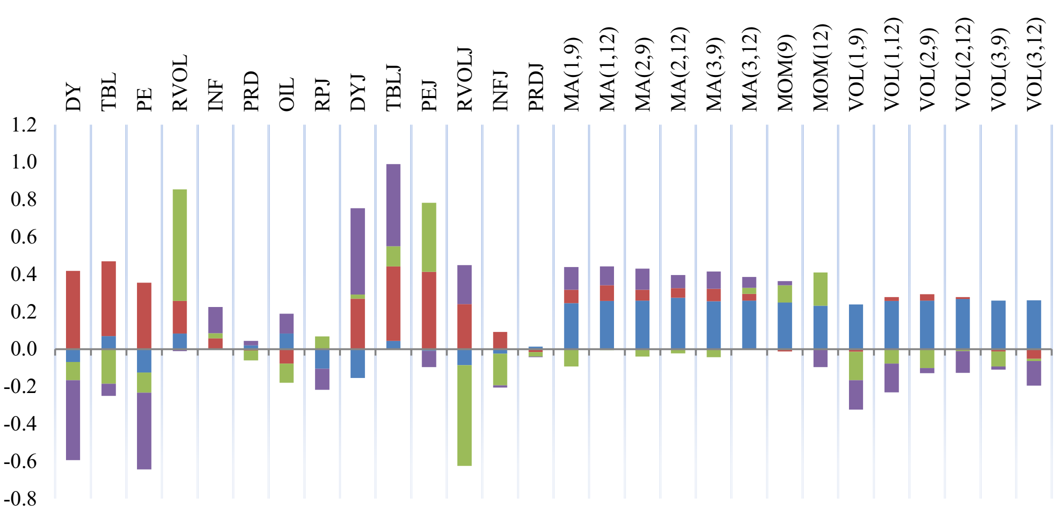
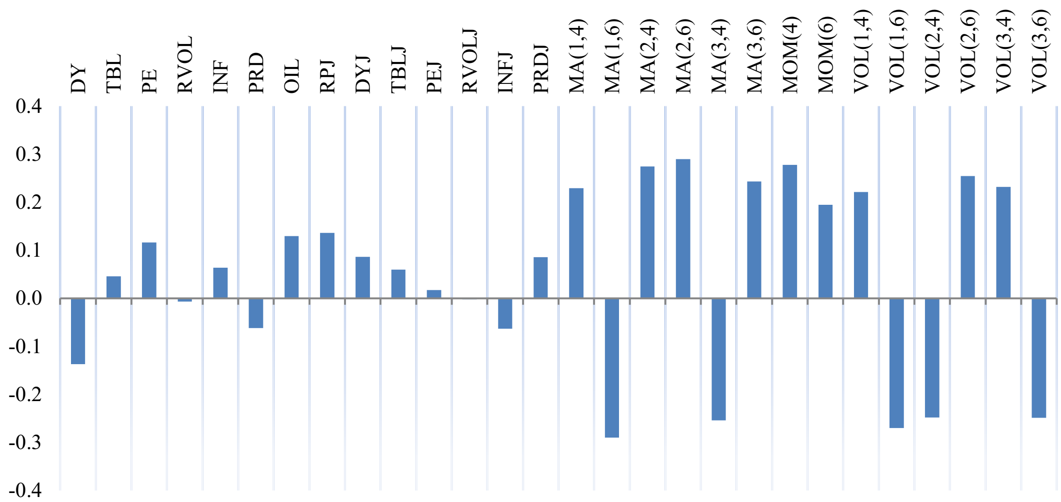


APPENDIX 46: F-ALL Factor Loadings for RUS

RUS<USA



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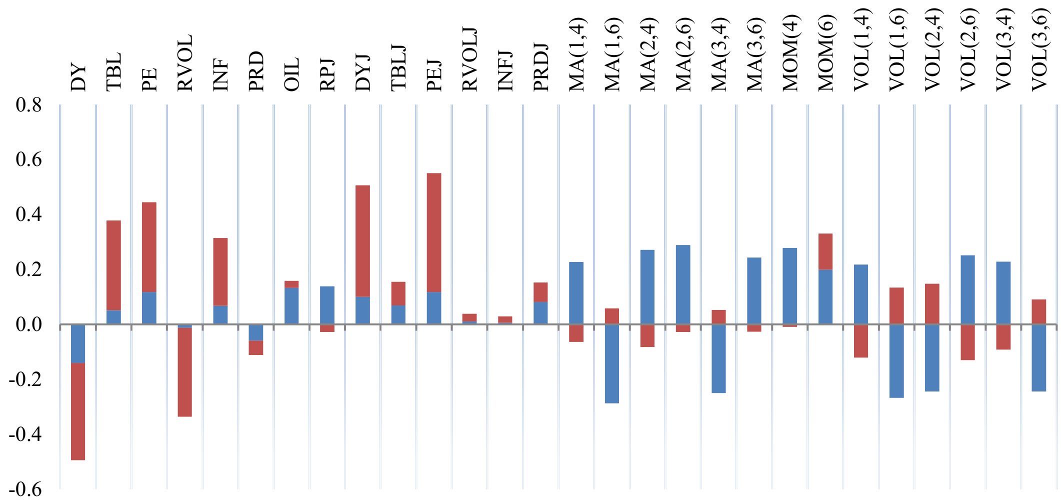

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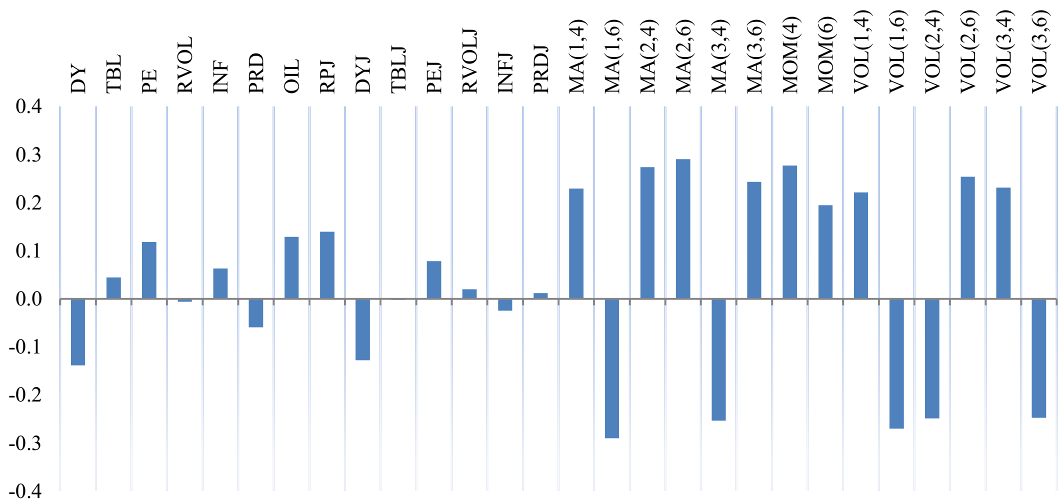
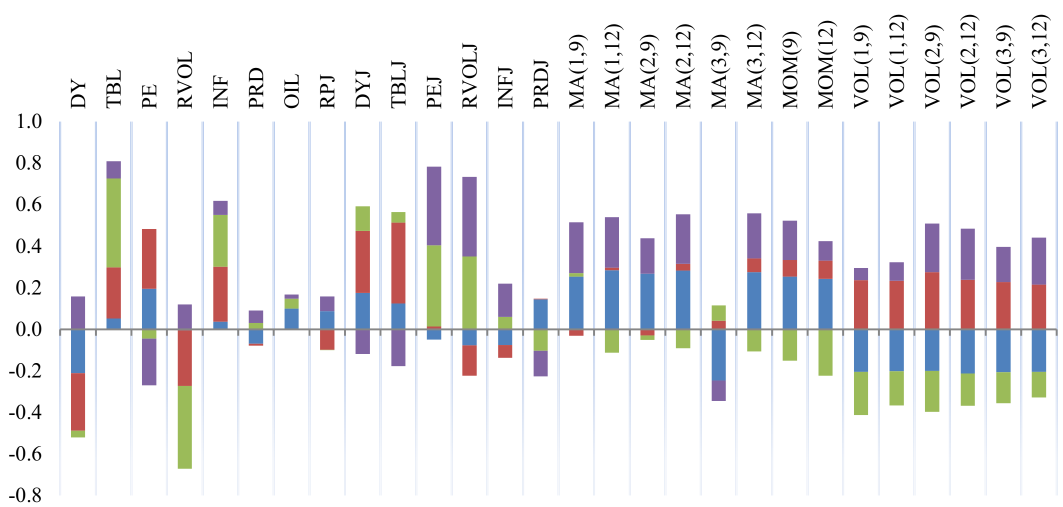
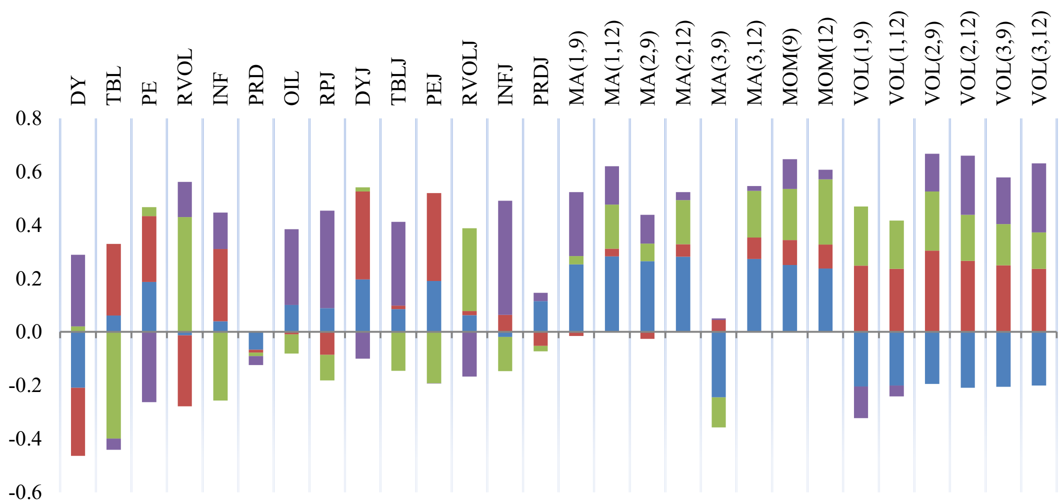


APPENDIX 47: F-ALL Factor Loadings for RUS

RUS<USA



RUS <JPN



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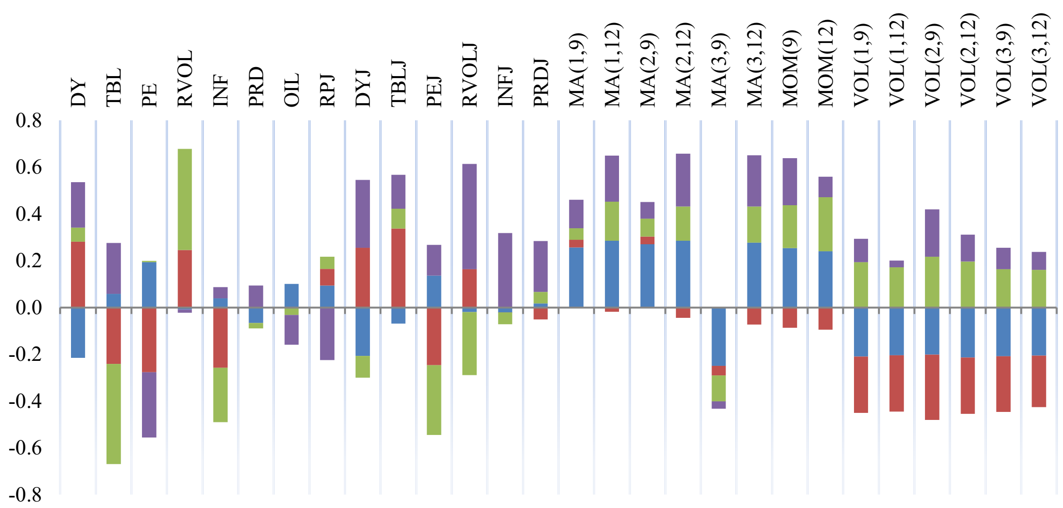
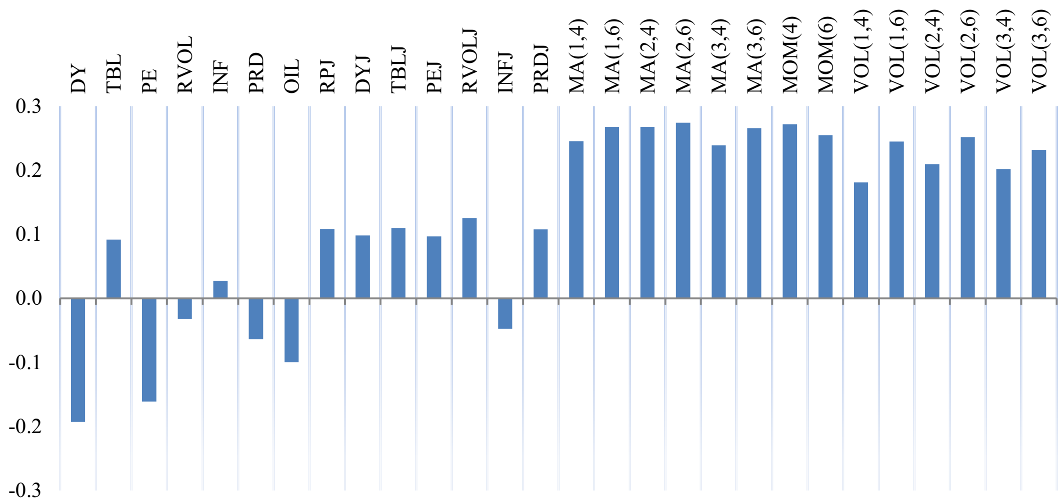


APPENDIX 48: F-ALL Factor Loadings for ZAF

ZAF<USA



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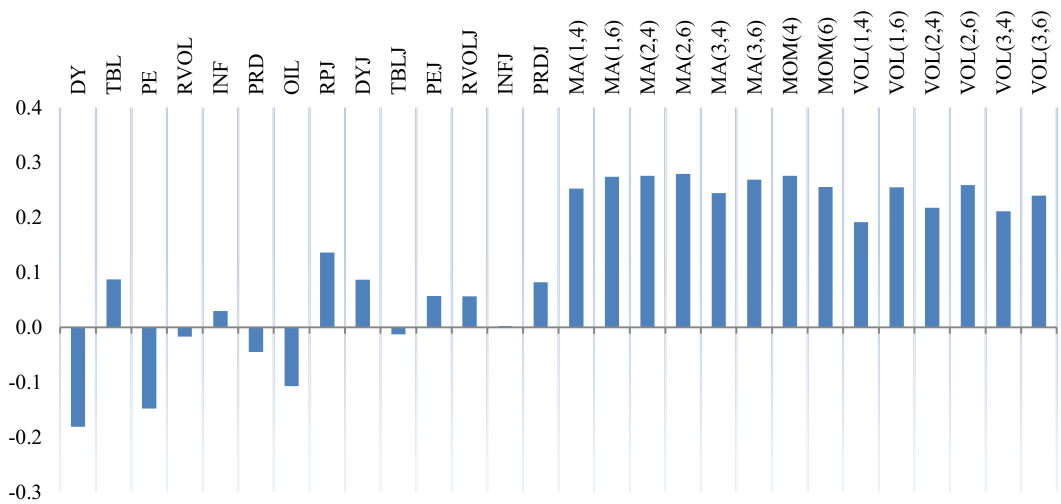

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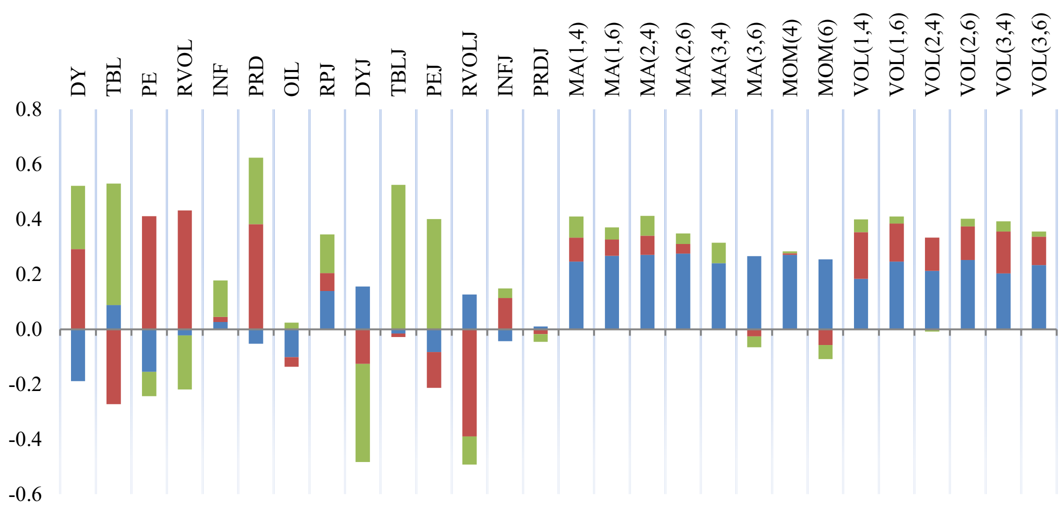
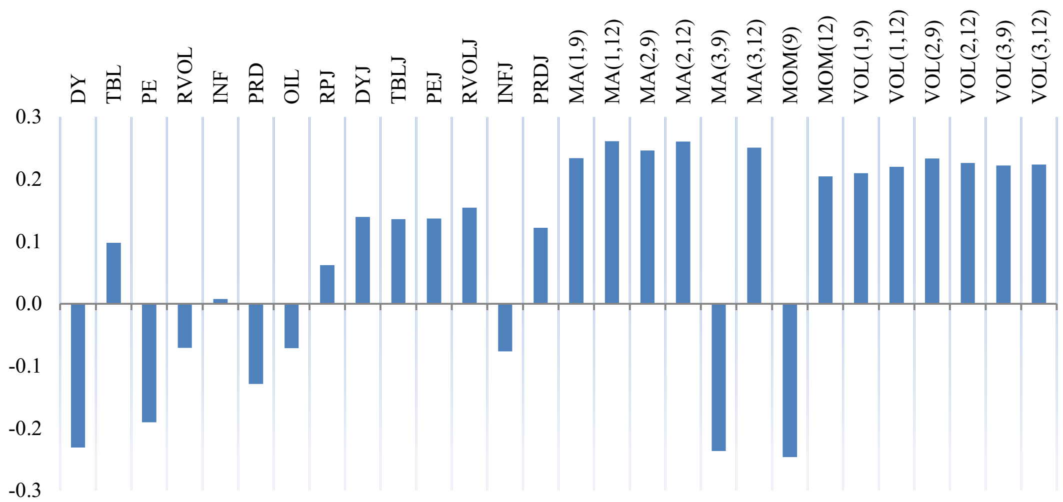


APPENDIX 49: F-ALL Factor Loadings for ZAF

ZAF<USA



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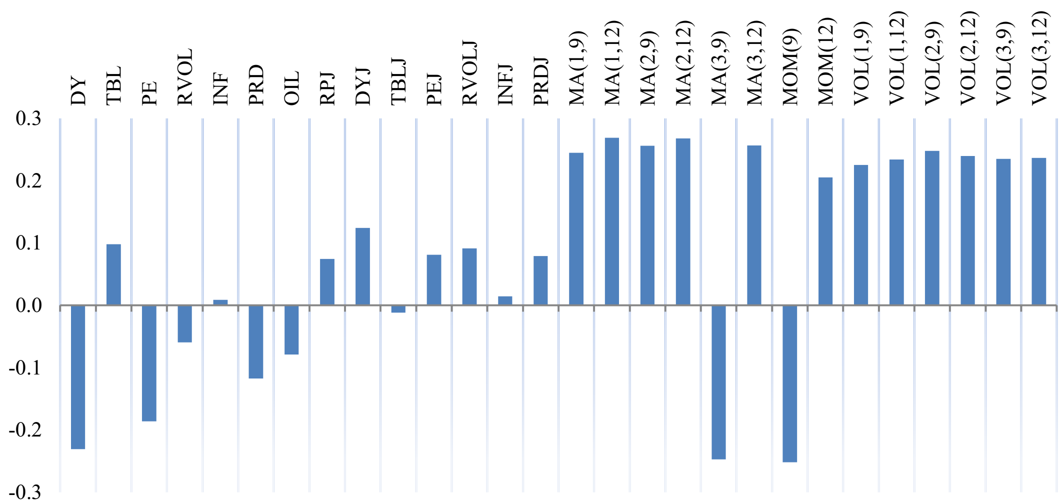

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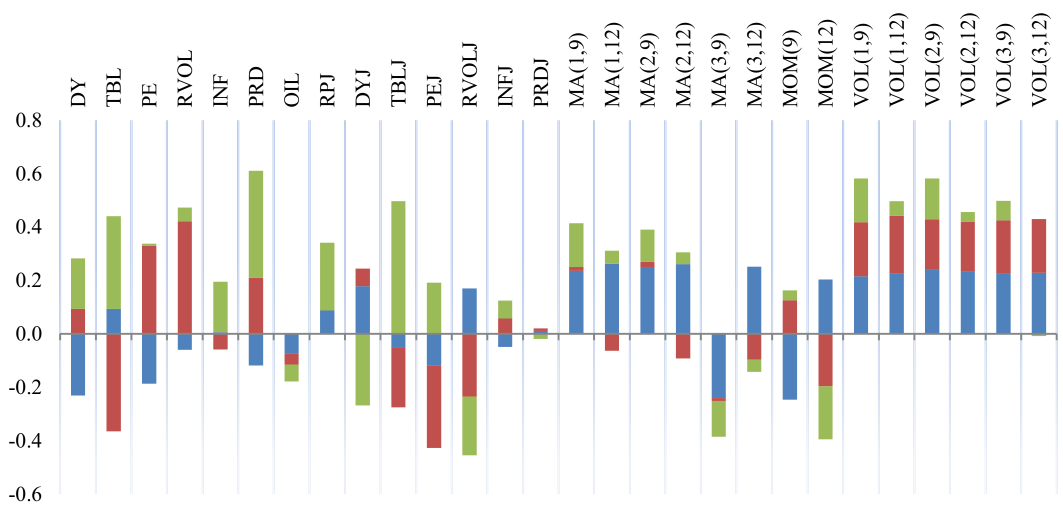

APPENDIX 50: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Domestic Macroeconomic Indicators and Oil

	Overall Period						Expansion Times			Recession Times		
	MSFE	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%) (50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
BEL-HA	24.36			1.58	0.02	1.43						
DY	25.03	-2.75	-0.19	-0.84	***0.05***	-1.03	-6.07	-1.73	-2.92	-1.00	0.35	1.48
TBL	24.16	***0.80***	**1.56**	1.26	***0.12***	1.11	***3.70***	**1.85**	4.47	-0.74	0.37	-2.33
PE	24.01	***1.40***	**1.28**	2.98	***0.13***	2.73	-1.83	0.24	1.22	***3.11***	**1.30**	4.94
RVOL	24.66	-1.27	-1.22	-1.06	-0.01	-1.40	***0.73***	0.93	2.01	-2.32	-1.95	-4.48
INF	24.53	-0.70	-0.09	-0.89	***0.04***	-2.57	***1.64***	**1.73**	2.74	-1.93	-0.74	-4.96
PRD	24.47	-0.49	-1.04	-0.38	0.00	-1.03	-0.83	-1.03	-0.53	-0.31	-0.52	-0.21
OIL	25.01	-2.70	0.85	1.81	***0.12***	-1.41	***0.31***	**1.73**	6.00	-4.30	-0.01	-2.97
GRC-HA	95.23			6.86	-0.01	6.80						
DY	96.05	-0.86	-1.31	-0.56	-0.04	-0.65	-2.07	-1.78	-0.90	***0.17***	0.48	-0.13
TBL	93.39	***1.93***	**1.85**	-2.65	***-0.01***	-2.88	***5.29***	1.06	-0.85	-0.94	**1.52**	-4.93
PE	95.70	-0.49	0.51	-1.49	***0.05***	-1.82	-0.48	0.60	-1.47	-0.51	0.07	-1.50
RVOL	96.10	-0.92	-0.06	-1.18	***0.00***	-1.33	-3.57	-0.90	-3.31	***1.35***	**2.62**	1.50
INF	96.29	-1.12	-1.31	-1.15	-0.07	-1.79	-1.25	-0.92	-2.09	-1.01	-0.93	0.03
PRD	96.74	-1.59	-0.18	-2.98	***-0.01***	-4.51	-3.32	-0.69	-2.56	-0.12	0.35	-3.53
OIL	102.36	-7.49	0.58	-9.93	***0.04***	-12.78	-3.08	**1.70**	0.41	-11.26	-1.06	-22.02
MYS-HA	49.10			2.85	0.00	2.78						
DY	49.45	-0.72	0.09	-0.76	***0.06***	-1.04	-0.25	0.49	1.16	-1.19	-0.65	-5.78
TBL	49.33	-0.45	0.61	0.21	***0.05***	0.06	-0.26	0.76	1.13	-0.65	-0.16	-2.20
PE	50.61	-3.08	-0.55	0.03	-0.01	-0.01	-8.66	-1.74	-0.35	***2.54***	0.78	1.05
RVOL	51.49	-4.86	-0.30	-0.98	-0.04	-1.10	-19.52	-1.92	-0.50	***9.88***	**1.53**	-2.27
INF	48.39	***1.45***	**1.97**	1.64	***0.09***	0.45	***4.03***	**2.22**	2.94	-1.14	-0.41	-1.79
PRD	49.95	-1.72	0.25	-0.91	***0.03***	-3.88	-7.07	-0.82	-0.38	***3.65***	**1.23**	-2.44
OIL	50.56	-2.97	-0.54	-0.51	***0.02***	-2.06	-6.36	-0.71	1.01	***0.44***	0.69	-4.61

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 51: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Domestic Macroeconomic Indicators and Oil

	Overall Period						Expansion Times			Recession Times		
	MSFE	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%) (50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
MEX-HA	53.42			12.57	0.03	12.49						
DY	53.75	-0.61	1.02	-2.06	***0.05***	-2.59	-0.48	1.16	0.56	-0.69	0.30	-6.45
TBL	54.48	-1.99	-0.58	-1.44	-0.02	-1.51	-2.75	-1.27	-2.67	-1.51	-0.06	0.50
PE	53.11	***0.58***	1.11	-1.62	***0.03***	-2.19	***2.11***	**1.37**	1.04	-0.37	0.36	-5.88
RVOL	54.53	-2.08	0.46	0.19	***0.05***	-0.04	-6.85	-0.63	-1.65	***0.88***	1.15	3.10
INF	54.17	-1.40	0.60	-0.06	***0.04***	-0.55	-4.10	-1.19	-3.00	***0.27***	1.02	4.65
PRD	53.65	-0.43	-0.15	0.89	***0.05***	0.34	-0.22	-0.10	0.14	-0.57	-0.13	2.12
OIL	54.56	-2.13	-0.19	-1.25	***0.04***	-3.08	-3.26	-0.43	0.31	-1.44	0.09	-3.84
POR-HA	30.75			2.48	-0.03	2.39						
DY	30.95	-0.65	0.19	-0.38	***0.02***	-0.51	-2.36	-1.24	-2.06	***1.61***	1.18	1.44
TBL	31.49	-2.38	**1.37**	-2.53	***0.10***	-2.77	***2.63***	**1.98**	4.81	-8.97	-2.17	-9.63
PE	31.25	-1.62	-1.52	-1.74	-0.04	-1.87	-2.40	-1.35	-3.10	-0.60	-0.79	-0.26
RVOL	31.12	-1.18	0.78	4.10	***0.17***	3.71	***0.02***	0.91	9.51	-2.75	-0.04	-1.57
INF	30.75	***0.02***	0.75	-1.89	***0.04***	-3.50	***2.44***	**1.62**	2.93	-3.18	-0.76	-6.98
PRD	31.05	-0.97	-0.99	-1.26	-0.05	-1.77	-0.89	-0.60	-1.19	-1.07	-0.90	-1.33
OIL	31.80	-3.40	0.05	-0.84	***0.06***	-3.12	-5.14	-0.37	2.34	-1.12	0.56	-4.28
SPN-HA	36.75			1.94	-0.06	1.85						
DY	37.87	-3.05	-0.71	-2.26	***0.01***	-2.56	-3.67	-0.35	-3.82	-2.30	-1.36	-0.35
TBL	37.17	-1.15	0.51	-3.95	***0.04***	-4.22	***0.74***	1.03	-2.30	-3.40	-1.36	-5.80
PE	37.36	-1.66	-0.63	-1.47	***-0.01***	-1.66	-1.96	-0.55	-3.32	-1.30	-0.32	0.79
RVOL	37.33	-1.59	-1.39	-0.64	***-0.03***	-0.82	-2.42	-1.73	-2.88	-0.60	0.03	2.10
INF	37.05	-0.82	0.61	-2.42	***0.01***	-4.46	***1.78***	**1.72**	4.57	-3.94	-0.35	-10.75
PRD	37.13	-1.05	0.00	-1.57	***-0.02***	-3.21	-2.16	-0.64	0.42	***0.29***	0.56	-4.00
OIL	37.69	-2.56	0.95	2.02	***0.12***	-0.48	-1.66	1.08	6.83	-3.62	0.26	-3.77

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 52: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Domestic Macroeconomic Indicators and Oil

	Overall Period						Expansion Times			Recession Times		
	MSFE	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%) (50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
TWN-HA	57.74			2.11	-0.08	2.07						
DY	58.35	-1.06	1.15	-3.46	***0.01***	-3.69	***0.68***	**1.78**	-1.71	-3.40	-0.27	-8.25
TBL	59.57	-3.17	-0.21	-2.38	***-0.03***	-2.61	-3.94	-0.03	-2.38	-2.14	-0.37	-2.40
PE	58.59	-1.48	1.09	-6.97	***-0.02***	-7.42	***1.02***	**1.97**	-3.05	-4.85	-0.06	-17.73
RVOL	58.28	-0.95	-0.36	0.63	***0.04***	0.64	-2.44	-0.94	0.47	***1.05***	**1.25**	1.06
INF	57.95	-0.37	-0.64	-0.38	-0.10	-0.68	-0.85	-1.26	-0.67	***0.27***	0.61	0.42
PRD	57.97	-0.40	-0.07	0.36	***-0.01***	-0.20	-0.55	-0.01	0.72	-0.19	-0.12	-0.64
OIL	59.02	-2.22	-0.35	-1.87	***-0.05***	-2.70	-4.95	-1.17	-0.40	***1.45***	0.87	-5.91
TUR-HA	178.53			42.33	-0.08	42.31						
DY	179.95	-0.80	1.08	1.75	***0.06***	1.65	-5.81	0.14	2.19	***4.01***	**1.49**	1.13
TBL	182.02	-1.96	-1.13	0.00	-0.12	-0.02	-2.80	-1.03	-0.37	-1.15	-0.52	0.51
PE	183.36	-2.71	**1.60**	-2.21	***0.02***	-2.48	-7.40	**1.24**	4.71	***1.79***	1.02	-12.17
RVOL	180.33	-1.01	0.35	-2.60	***-0.04***	-2.73	-0.56	0.75	-0.05	-1.44	-0.44	-6.25
INF	179.61	-0.60	-0.02	0.68	***-0.01***	0.62	-0.07	0.35	0.00	-1.12	-0.26	1.66
PRD	179.95	-0.79	-0.77	-1.30	-0.09	-1.82	-0.64	-0.24	-0.67	-0.95	-0.90	-2.22
OIL	179.80	-0.71	-0.64	-0.74	***-0.04***	-0.96	-0.64	-0.29	-0.40	-0.79	-0.71	-1.23

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 53: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Domestic Macroeconomic Indicators and Oil

	Overall Period						Expansion Times			Recession Times		
	MSFE	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%) (50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
BRA-HA	45.33			10.77	0.01	10.70						
DY	45.16	***0.38***	0.73	0.82	0.00	0.37	-4.66	-0.78	-3.58	***2.68***	**1.70**	4.32
TBL	45.82	-1.07	-1.04	-1.11	-0.04	-1.31	-2.54	-1.87	-2.42	-0.40	-0.20	-0.07
PE	45.79	-1.00	-0.32	-1.58	-0.01	-1.88	-1.66	-0.16	-2.90	-0.69	-0.35	-0.55
RVOL	45.54	-0.46	-0.25	0.04	-0.02	-0.06	-1.35	-1.57	-0.94	-0.06	0.13	0.83
INF	44.80	***1.17***	**1.49**	1.87	***0.07***	1.21	***2.46***	**1.57**	3.00	***0.58***	0.73	0.99
PRD	45.91	-1.28	0.86	1.59	***0.06***	-0.53	-1.58	0.19	-1.71	-1.15	0.85	4.18
OIL	45.67	-0.75	-0.45	-1.12	-0.04	-1.70	-1.50	-0.49	-1.47	-0.40	-0.19	-0.85
HKG-HA	42.10			0.60	0.07	0.45						
DY	42.66	-1.32	0.44	-4.53	0.07	-5.26	***8.80***	**1.60**	8.65	-10.48	-1.14	-27.51
TBL	42.28	-0.42	0.04	2.22	***0.12***	2.12	-4.52	-1.57	-0.39	***3.29***	**1.43**	6.85
PE	43.07	-2.31	-0.48	-2.62	0.04	-2.93	-6.00	-1.79	-6.06	***1.04***	0.69	3.49
RVOL	41.89	***0.51***	0.62	2.81	***0.14***	2.62	-6.60	-1.19	0.28	***6.95***	**1.58**	7.31
INF	43.19	-2.59	-1.10	-3.02	0.05	-4.51	-3.84	-1.26	-2.29	-1.46	-0.40	-4.35
PRD	42.50	-0.95	-0.59	-1.35	0.04	-1.43	-0.60	0.05	0.37	-1.27	-1.08	-4.42
OIL	42.07	***0.07***	0.45	-0.40	0.07	-1.27	***0.40***	0.64	-0.12	-0.23	0.12	-0.87
IND-HA	57.92			6.70	0.07	6.63						
DY	55.89	***3.50***	**2.05**	6.67	***0.25***	6.29	-6.92	0.30	-0.92	***12.89***	**2.70**	17.87
TBL	54.12	***6.56***	**2.53**	6.90	***0.24***	6.24	***3.25***	**1.33**	2.66	***9.54***	**2.36**	13.23
PE	55.76	***3.72***	**2.24**	5.12	***0.20***	4.53	-5.41	0.74	-2.34	***11.95***	**2.58**	16.07
RVOL	59.77	-3.19	-0.01	-0.02	***0.12***	-0.48	-5.64	-0.10	-0.28	-0.99	0.13	0.67
INF	62.65	-8.17	-1.21	-16.05	-0.04	-17.86	-2.90	0.18	-1.37	-12.91	-1.55	-37.31
PRD	58.55	-1.10	-1.70	-1.22	0.03	-1.74	-2.14	-2.20	-2.11	-0.17	-0.18	0.06
OIL	58.12	-0.36	-0.28	-0.44	0.05	-1.02	-0.63	-0.47	-0.76	-0.10	0.07	0.02

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 54: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Domestic Macroeconomic Indicators and Oil

	Overall Period						**Expansion Times**			**Recession Times**		
	MSFE	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%) (50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
RUS-HA	142.92			-0.39	0.13	-0.50						
DY	143.43	-0.35	-0.27	-1.12	0.12	-1.16	***0.03***	0.13	-0.42	-1.20	-0.70	-2.85
TBL	141.04	***1.32***	1.19	5.62	0.13	5.36	-0.61	0.14	0.05	***5.54***	**1.80**	17.69
PE	143.18	-0.18	-0.39	-0.37	0.12	-0.44	-0.36	-1.46	-1.24	***0.21***	0.33	1.93
RVOL	143.13	-0.14	-0.26	0.98	0.12	0.94	-0.49	-0.82	-0.05	***0.63***	**1.76**	3.00
INF	143.22	-0.21	-0.08	0.48	0.10	0.20	-0.89	-0.90	-1.25	***1.27***	1.21	4.04
PRD	144.10	-0.83	-0.80	-0.58	0.12	-1.34	***0.03***	0.43	1.15	-2.71	-1.64	-4.53
OIL	145.57	-1.85	-0.50	0.35	0.09	-0.81	-3.13	-1.55	-2.75	***0.95***	0.97	6.76
ZAF-HA	23.43			6.66	0.05	6.49						
DY	23.77	-1.45	-1.62	-1.55	0.01	-1.67	-1.35	-1.83	-1.21	-1.56	-0.84	-2.64
TBL	22.45	***4.22***	**2.47**	11.44	***0.31***	11.12	-4.51	0.77	3.06	***14.99***	**4.00**	38.22
PE	23.81	-1.62	-0.99	-1.50	-0.02	-1.61	-2.72	-1.02	-2.11	-0.27	-0.15	0.34
RVOL	24.03	-2.54	-1.68	-2.31	-0.03	-2.48	-3.75	-1.35	-2.08	-1.04	-1.77	-3.11
INF	23.49	-0.25	0.35	2.07	***0.11***	0.07	-0.20	0.42	0.68	-0.31	0.12	6.45
PRD	24.06	-2.66	-0.79	-0.90	0.02	-1.57	-1.76	-0.99	-1.50	-3.78	-0.46	0.93
OIL	23.82	-1.64	-0.04	-1.50	***0.06***	-3.54	***3.27***	**1.52**	3.83	-7.71	-1.12	-17.92

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 55: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Foreign Macroeconomic Indicators

		Overall Period						Expansion Times			Recession Times		
i<j	**Model**	**MSFE**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
	BEL-HA	24.36			1.58	0.02	1.43						
BEL<USA	RPJ	22.67	***6.91***	**2.77**	5.28	***0.19***	1.54	-2.69	1.10	3.13	***11.98***	**2.56**	7.68
	DYJ	24.85	-2.04	0.97	1.04	***0.11***	0.92	-6.48	0.24	-0.64	***0.31***	1.08	2.90
	TBLJ	24.69	-1.38	-1.63	-1.95	-0.01	-2.14	***0.37***	0.83	0.38	-2.31	-2.09	-4.58
	PEJ	24.83	-1.93	0.09	1.86	***0.10***	1.67	-5.48	-1.34	-0.83	-0.06	0.52	4.89
	RVOLJ	24.69	-1.39	-0.32	0.57	***0.05***	0.32	-2.48	-0.64	0.54	-0.81	-0.02	0.62
	INFJ	24.69	-1.37	-1.24	-1.37	0.00	-2.10	-2.90	-2.01	-1.58	-0.56	-0.28	-1.16
	PRDJ	24.01	***1.41***	0.82	0.36	***0.03***	-0.43	-0.01	0.59	0.66	***2.17***	0.73	0.03
BEL<JPN	RPJ	24.15	***0.83***	1.22	0.67	***0.05***	-0.37	-0.47	0.15	0.00	***1.52***	**1.27**	1.42
	DYJ	24.76	-1.65	-0.04	-2.52	***0.04***	-2.74	-1.64	0.00	-0.07	-1.66	-0.05	-5.30
	TBLJ	24.37	-0.05	1.13	-0.66	***0.09***	-0.78	***2.02***	**1.31**	1.97	-1.14	0.35	-3.65
	PEJ	24.67	-1.30	-0.10	-0.05	***0.03***	-0.25	-3.77	-1.19	0.19	***0.01***	0.38	-0.30
	RVOLJ	24.45	-0.38	-0.23	0.05	***0.03***	-0.13	-1.30	-0.59	-0.72	***0.10***	0.24	0.93
	INFJ	24.47	-0.47	0.27	0.98	***0.06***	-0.51	***0.14***	0.55	1.68	-0.79	-0.12	0.21
	PRDJ	24.62	-1.07	0.23	0.21	***0.04***	-1.24	-1.91	0.24	1.19	-0.63	0.11	-0.88
BEL<GER	RPJ	23.70	***2.68***	**2.04**	0.60	***0.07***	-1.50	-1.13	0.40	-1.41	***4.70***	**2.12**	2.86
	DYJ	24.99	-2.61	-0.38	0.22	***0.07***	-0.13	-5.20	-1.26	-2.44	-1.25	0.24	3.21
	TBLJ	24.11	***0.99***	**1.82**	2.31	***0.14***	2.11	***4.22***	**1.99**	5.49	-0.72	0.56	-1.26
	PEJ	24.50	-0.58	-0.35	-2.00	0.01	-2.13	***1.76***	**2.00**	1.38	-1.82	-2.00	-5.77
	RVOLJ	24.69	-1.37	-0.38	0.94	***0.06***	0.71	***1.37***	**1.23**	2.60	-2.81	-0.96	-0.90
	INFJ	24.36	-0.02	0.48	0.29	***0.06***	-1.58	***1.63***	**1.64**	2.55	-0.89	-0.42	-2.27
	PRDJ	24.24	***0.48***	1.03	0.92	***0.06***	-1.25	-1.85	-0.37	0.69	***1.71***	**1.46**	1.15

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 56: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Foreign Macroeconomic Indicators

		Overall Period						Expansion Times			Recession Times		
i<j	**Model**	**MSFE**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**
	GRC-HA	95.23			6.86	-0.01	6.80						
GRC<USA	RPJ	96.18	-1.00	**1.82**	-7.35	***0.07***	-10.41	***1.42***	**2.39**	0.31	-3.07	0.94	-16.55
	DYJ	97.03	-1.89	-0.38	-2.90	***-0.01***	-3.07	-0.13	0.67	-1.22	-3.39	-2.04	-4.96
	TBLJ	93.86	***1.43***	**1.76**	2.40	***0.05***	2.29	-5.18	-0.42	0.69	***7.08***	**2.72**	4.54
	PEJ	97.84	-2.74	-0.46	2.23	***0.04***	2.07	-4.76	-1.40	0.14	-1.02	0.44	4.87
	RVOLJ	96.07	-0.89	-0.80	-0.73	-0.01	-0.87	-0.87	-0.49	0.20	-0.91	-0.64	-1.87
	INFJ	96.96	-1.82	-0.26	-3.90	***0.02***	-5.17	***2.46***	**2.18**	6.59	-5.47	-1.51	-16.67
	PRDJ	95.59	-0.38	0.33	-0.12	-0.02	-0.69	-0.62	-0.33	1.32	-0.18	0.41	-1.88
GRC<JPN	RPJ	94.63	***0.63***	1.16	0.79	***0.02***	-0.10	***0.16***	0.47	0.37	***1.02***	1.07	1.30
	DYJ	94.98	***0.26***	1.03	2.18	***0.01***	2.16	-7.74	-1.05	-0.94	***7.09***	**2.73**	6.12
	TBLJ	95.51	-0.30	-0.37	0.01	-0.05	-0.01	-0.52	-0.31	-1.17	-0.11	-0.22	1.50
	PEJ	93.89	***1.40***	**1.42**	1.54	***0.02***	1.42	-5.70	-0.81	-1.53	***7.47***	**2.75**	5.42
	RVOLJ	98.32	-3.25	-0.82	-0.21	***0.03***	-0.66	-4.37	-0.86	-1.14	-2.29	-0.35	0.98
	INFJ	95.50	-0.29	-0.15	-0.79	***0.00***	-1.30	-0.51	-0.29	-1.35	-0.11	0.10	-0.09
	PRDJ	96.28	-1.11	-1.29	-1.46	-0.05	-1.97	-0.52	-0.46	0.38	-1.61	-1.26	-3.75
GRC<GER	RPJ	94.69	***0.56***	**1.90**	-5.85	***0.06***	-8.57	***1.09***	**2.07**	-3.17	***0.11***	0.99	-8.88
	DYJ	97.18	-2.05	0.69	-6.57	***0.08***	-7.02	-2.46	0.63	-9.19	-1.70	0.32	-3.17
	TBLJ	96.19	-1.01	-0.29	-1.50	***0.00***	-1.61	***1.46***	**1.38**	1.15	-3.12	-2.13	-4.78
	PEJ	95.54	-0.33	-0.32	-1.97	-0.04	-2.07	-0.52	-0.24	-1.88	-0.18	-0.22	-2.10
	RVOLJ	96.21	-1.03	-1.28	-1.14	-0.04	-1.27	-1.80	-1.17	-0.84	-0.37	-0.53	-1.53
	INFJ	95.30	-0.08	0.67	-3.64	***0.01***	-5.27	***2.49***	**2.16**	0.86	-2.28	-0.96	-9.21
	PRDJ	96.12	-0.93	-0.01	-1.45	***0.01***	-2.99	-1.43	-0.25	-2.19	-0.51	0.21	-0.52

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 57: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Foreign Macroeconomic Indicators

		Overall Period						Expansion Times			Recession Times		
i<j	**Model**	**MSFE**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**
	MYS-HA	49.10			2.85	0.00	2.78						
MYS<USA	RPJ	49.36	-0.53	-0.06	1.41	***0.08***	0.14	-0.57	-0.06	2.03	-0.49	-0.03	-0.23
	DYJ	50.68	-3.22	0.16	0.38	***0.02***	0.26	-19.65	-2.06	-0.52	***13.31***	**1.93**	2.76
	TBLJ	49.12	-0.03	0.96	-1.05	***0.00***	-1.21	-0.16	0.80	-0.87	***0.10***	0.53	-1.55
	PEJ	50.11	-2.04	-0.51	0.57	***0.03***	0.43	-8.65	-1.93	0.64	***4.61***	**1.62**	0.40
	RVOLJ	49.71	-1.24	0.58	1.37	***0.08***	1.15	-7.44	-1.53	0.07	***4.99***	**1.71**	4.88
	INFJ	49.27	-0.35	0.46	0.86	***0.07***	-0.24	***1.59***	**2.38**	3.26	-2.29	-1.09	-5.56
	PRDJ	49.71	-1.24	-0.13	2.05	***0.11***	1.08	-3.37	-0.93	1.43	***0.90***	0.64	3.70
MYS<JPN	RPJ	49.60	-1.01	-1.10	0.21	***0.02***	-0.91	-0.06	0.38	0.96	-1.97	-1.61	-1.79
	DYJ	49.85	-1.53	-0.51	0.41	***0.02***	0.33	-6.91	-2.27	-0.73	***3.89***	**1.54**	3.48
	TBLJ	49.72	-1.25	-0.75	-0.27	-0.01	-0.32	-4.74	-2.33	-0.71	***2.25***	**1.42**	0.92
	PEJ	49.53	-0.87	-1.29	-0.81	-0.02	-0.98	-2.36	-2.42	-1.59	***0.62***	1.16	1.29
	RVOLJ	49.33	-0.47	-1.17	-0.45	-0.01	-0.60	-0.77	-1.15	-0.38	-0.16	-0.37	-0.65
	INFJ	49.56	-0.94	-0.87	-0.97	-0.06	-1.84	-1.61	-1.01	-0.93	-0.27	-0.05	-1.08
	PRDJ	49.53	-0.87	-1.35	-0.41	-0.02	-1.08	-0.89	-0.96	-0.33	-0.84	-0.94	-0.64
MYS<GER	RPJ	49.65	-1.11	-0.32	0.94	***0.05***	0.13	-0.62	0.05	1.47	-1.59	-0.78	-0.45
	DYJ	49.69	-1.19	0.89	-1.50	***0.01***	-1.81	-19.60	-1.80	-1.52	***17.34***	**2.17**	-1.53
	TBLJ	49.73	-1.27	-0.44	0.58	***0.04***	0.47	-6.30	-2.14	-0.02	***3.78***	**1.73**	2.16
	PEJ	48.69	***0.84***	**1.83**	-0.69	***0.05***	-0.98	-1.41	0.73	-0.44	***3.10***	**1.98**	-1.42
	RVOLJ	50.03	-1.90	-0.23	0.12	***0.02***	-0.01	-8.62	-2.23	-0.80	***4.86***	**1.42**	2.58
	INFJ	49.28	-0.36	-1.30	-0.69	-0.02	-1.35	-0.62	-1.40	-0.33	-0.10	-0.28	-1.66
	PRDJ	49.61	-1.03	-1.08	-0.60	-0.03	-1.05	-1.96	-1.21	-0.63	-0.11	-0.04	-0.53

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 58: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Foreign Macroeconomic Indicators

		Overall Period						Expansion Times			Recession Times		
i<j	**Model**	**MSFE**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
	MEX-HA	53.42			12.57	0.03	12.49						
MEX<USA	RPJ	53.91	-0.92	-0.29	0.25	***0.05***	-1.02	-3.25	-1.59	-1.62	***0.53***	0.70	3.21
	DYJ	54.53	-2.09	0.57	0.24	***0.04***	0.19	-4.66	0.11	-0.25	-0.49	0.62	0.99
	TBLJ	53.78	-0.67	-1.49	-0.71	0.00	-0.79	***0.01***	0.25	-0.46	-1.09	-1.79	-1.09
	PEJ	54.63	-2.26	-0.27	2.44	***0.10***	2.32	***0.24***	0.55	1.59	-3.80	-0.42	3.84
	RVOLJ	54.41	-1.85	-0.70	-1.86	0.00	-2.10	-2.96	-0.42	-2.12	-1.16	-0.66	-1.42
	INFJ	55.03	-3.02	0.38	-2.21	0.01	-3.81	-12.66	-0.75	-5.96	***2.96***	**1.25**	3.82
	PRDJ	54.16	-1.39	0.14	-0.37	0.03	-1.53	-2.22	0.15	-0.97	-0.87	0.08	0.58
MEX<JPN	RPJ	54.15	-1.36	0.15	-2.35	0.01	-3.93	-2.89	-0.12	-2.10	-0.41	0.33	-2.79
	DYJ	54.69	-2.38	0.44	1.05	0.00	1.00	-4.21	-0.44	-3.41	-1.25	0.69	8.28
	TBLJ	53.89	-0.88	0.64	0.90	0.01	0.92	-4.11	-0.10	-2.41	***1.12***	0.85	6.24
	PEJ	54.07	-1.21	-0.03	-1.20	***0.04***	-1.39	***0.25***	1.03	1.74	-2.12	-1.53	-5.76
	RVOLJ	53.66	-0.44	-0.74	-0.34	0.02	-0.45	-0.54	-0.98	-0.49	-0.38	-0.42	-0.06
	INFJ	53.15	***0.51***	0.96	0.23	***0.05***	-1.34	***4.18***	**1.68**	1.23	-1.77	-0.17	-1.32
	PRDJ	53.82	-0.75	1.03	0.42	***0.08***	-1.80	-2.58	0.52	-1.43	***0.39***	0.89	3.36
MEX<GER	RPJ	54.43	-1.88	-0.29	0.33	***0.05***	-1.23	-6.45	-1.82	-2.34	***0.95***	1.04	4.60
	DYJ	54.29	-1.63	0.72	-3.58	-0.02	-3.95	-6.94	0.00	-2.39	***1.67***	0.95	-5.63
	TBLJ	54.15	-1.37	0.07	0.07	0.00	0.02	-2.08	0.04	-1.48	-0.93	0.05	2.57
	PEJ	52.01	***2.64***	**1.99**	2.42	***0.15***	2.07	***3.70***	**2.76**	5.40	***1.98***	1.04	-2.41
	RVOLJ	54.38	-1.80	-0.17	-1.18	0.02	-1.43	-3.82	-0.19	-1.75	-0.55	-0.05	-0.30
	INFJ	53.97	-1.02	-1.17	-1.32	0.01	-2.37	-0.42	0.03	0.07	-1.40	-1.76	-3.53
	PRDJ	53.51	-0.16	0.56	0.53	***0.05***	-0.91	-4.07	-1.09	-0.80	***2.26***	**1.93**	2.64

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 59: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Foreign Macroeconomic Indicators

		Overall Period						Expansion Times			Recession Times		
i<j	**Model**	**MSFE**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
	POR-HA	30.75			2.48	-0.03	2.39						
POR<USA	RPJ	29.48	***4.12***	**2.06**	4.12	***0.16***	1.83	***4.52***	**1.83**	9.67	***3.60***	**1.23**	-1.71
	DYJ	32.09	-4.34	**1.46**	-0.93	***0.10***	-1.10	-2.44	**1.75**	2.46	-6.83	-1.76	-4.15
	TBLJ	31.28	-1.72	-1.50	-2.42	-0.09	-2.58	***0.63***	1.15	-0.35	-4.81	-2.59	-4.65
	PEJ	31.28	-1.70	-0.12	-0.44	***0.06***	-0.66	-1.02	0.21	-1.12	-2.59	-0.61	0.33
	RVOLJ	31.88	-3.66	-0.59	0.63	***0.06***	0.39	-6.08	-1.35	-0.02	-0.47	0.69	1.34
	INFJ	31.59	-2.73	1.16	-1.97	***0.08***	-4.29	***3.31***	**2.00**	5.29	-10.68	-0.48	-9.49
	PRDJ	30.82	-0.21	0.44	-0.66	***-0.01***	-1.52	-1.94	-0.67	-1.84	***2.07***	0.73	0.62
POR<JPN	RPJ	30.66	***0.32***	0.90	0.59	***0.03***	-0.34	-0.63	-0.33	0.35	***1.56***	**1.40**	0.83
	DYJ	31.31	-1.82	-0.06	-5.06	***0.01***	-5.34	***1.36***	0.96	-3.18	-6.00	-2.96	-6.94
	TBLJ	30.96	-0.66	1.21	-2.08	***0.09***	-2.28	***5.47***	**2.23**	4.72	-8.72	-2.29	-8.74
	PEJ	31.16	-1.31	0.23	1.02	***0.05***	0.88	-2.51	-0.74	0.51	***0.25***	0.85	1.58
	RVOLJ	30.95	-0.63	-0.17	-0.26	***0.03***	-0.53	-0.83	-0.34	-1.44	-0.35	0.20	1.02
	INFJ	31.16	-1.32	-0.67	-0.58	***0.01***	-1.29	-2.57	-0.85	-1.58	***0.32***	0.87	0.51
	PRDJ	31.02	-0.87	-2.24	-0.86	-0.07	-1.22	-1.08	-2.24	-1.23	-0.61	-0.86	-0.46
POR<GER	RPJ	29.62	***3.69***	**2.45**	2.58	***0.13***	0.14	***6.20***	**2.26**	6.90	***0.40***	**1.24**	-1.91
	DYJ	30.80	-0.14	1.18	0.76	***0.13***	0.22	-0.17	1.04	0.88	-0.09	0.59	0.85
	TBLJ	30.88	-0.41	**1.89**	0.40	***0.14***	0.08	***6.46***	**2.67**	8.44	-9.45	-1.05	-7.52
	PEJ	30.96	-0.68	-0.90	-0.98	***-0.02***	-1.10	***0.38***	0.61	-0.69	-2.08	-2.08	-1.29
	RVOLJ	31.49	-2.38	-0.46	1.34	***0.07***	1.16	-3.14	-0.46	2.47	-1.38	-0.11	0.13
	INFJ	30.46	***0.94***	**1.41**	0.22	***0.05***	-1.67	***2.84***	**2.11**	6.01	-1.55	-0.01	-5.95
	PRDJ	31.19	-1.41	-0.37	-1.50	***0.00***	-3.14	-0.59	0.17	-1.85	-2.47	-0.98	-1.11

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 60: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Foreign Macroeconomic Indicators

		Overall Period						Expansion Times			Recession Times		
i<j	**Model**	**MSFE**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**
	SPN - HA	36.75			1.94	-0.06	1.85						
	SPN-HA	36.75			1.94	-0.06	1.85						
SPN<USA	RPJ	37.28	-1.45	1.15	1.78	***0.11***	-0.90	-6.05	-0.14	0.36	***4.04***	**1.65**	3.48
	DYJ	37.46	-1.94	1.10	-0.46	***0.10***	-0.73	-0.26	**1.40**	2.10	-3.93	-1.25	-3.22
	TBLJ	37.26	-1.38	-1.48	-2.41	-0.09	-2.57	-0.36	-0.43	-1.11	-2.60	-1.43	-3.99
	PEJ	37.39	-1.74	-0.42	0.15	***0.02***	-0.06	-0.16	0.21	-0.60	-3.63	-0.59	1.07
	RVOLJ	37.22	-1.29	-1.16	-0.17	***-0.04***	-0.30	-1.25	-1.05	-0.99	-1.34	-0.66	0.82
	INFJ	37.15	-1.09	-0.40	-1.46	***-0.02***	-2.42	***0.73***	1.19	3.32	-3.27	-1.00	-7.22
	PRDJ	36.59	***0.44***	0.68	0.16	***-0.02***	-0.54	-1.27	-0.62	-1.07	***2.48***	0.85	1.65
SPN<JPN	RPJ	36.78	-0.08	0.42	0.56	***0.02***	-0.55	-1.76	-1.17	-1.46	***1.92***	**1.69**	3.03
	DYJ	37.38	-1.73	0.31	-6.55	***0.01***	-6.89	***1.72***	1.22	-1.56	-5.85	-1.46	-12.37
	TBLJ	36.59	***0.42***	**1.26**	-2.15	***0.06***	-2.35	***3.54***	**1.83**	0.83	-3.30	-0.85	-5.54
	PEJ	37.15	-1.09	-0.43	-0.24	***-0.02***	-0.36	-0.52	-0.12	-1.06	-1.77	-0.44	0.75
	RVOLJ	36.92	-0.47	-1.55	-0.27	***-0.05***	-0.36	-0.51	-1.50	-0.79	-0.43	-0.78	0.37
	INFJ	36.96	-0.58	-0.77	-0.18	***-0.05***	-0.84	-0.13	0.06	1.12	-1.12	-1.15	-1.76
	PRDJ	37.09	-0.93	-0.23	-0.42	***-0.03***	-1.02	-3.04	-2.02	-2.67	***1.60***	**1.47**	2.33
SPN<GER	RPJ	37.11	-0.99	0.86	0.87	***0.06***	-1.07	-2.48	-0.17	-0.40	***0.79***	1.20	2.41
	DYJ	37.65	-2.46	-0.18	-1.00	***0.05***	-1.44	-1.90	0.12	-2.28	-3.14	-0.70	0.60
	TBLJ	36.68	***0.18***	**1.65**	-1.70	***0.11***	-2.09	***1.07***	**1.50**	-1.13	-0.88	0.71	-2.31
	PEJ	36.95	-0.55	-0.44	-1.76	***-0.04***	-1.89	***0.08***	0.52	-0.20	-1.30	-1.06	-3.66
	RVOLJ	37.04	-0.81	-1.18	-0.33	***-0.05***	-0.50	-1.29	-1.19	-0.80	-0.24	-0.26	0.23
	INFJ	36.66	***0.23***	0.80	-0.12	***0.02***	-1.63	***1.16***	**1.33**	3.79	-0.89	-0.18	-4.82

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 61: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Foreign Macroeconomic Indicators

		Overall Period						Expansion Times			Recession Times		
i<j	**Model**	**MSFE**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
	TWN-HA	57.74			2.11	-0.08	2.07						
TWN<USA	RPJ	59.22	-2.57	0.03	-0.23	***0.02***	-1.25	-4.03	-0.56	0.72	-0.62	0.42	-2.85
	DYJ	59.42	-2.92	-0.63	-1.20	***-0.05***	-1.34	-0.94	0.02	-0.03	-5.59	-0.72	-4.42
	TBLJ	58.09	-0.62	1.09	-2.19	***-0.01***	-2.32	-1.60	0.87	-1.81	***0.71***	0.65	-3.27
	PEJ	58.73	-1.72	-0.92	0.90	***0.06***	0.85	-1.05	-0.51	0.90	-2.61	-0.77	0.90
	RVOLJ	58.89	-2.01	-0.20	0.47	***0.01***	0.40	-1.95	-0.53	0.27	-2.08	0.05	0.99
	INFJ	58.42	-1.19	-0.27	-1.49	***-0.05***	-1.95	***0.47***	1.02	1.29	-3.43	-1.19	-9.04
	PRDJ	57.48	***0.44***	0.72	0.44	***0.01***	-0.04	-0.01	0.44	0.96	***1.04***	0.60	-0.96
TWN<JPN	RPJ	58.11	-0.65	-1.57	-0.15	-0.11	-0.31	-0.55	-0.91	-0.05	-0.80	-1.39	-0.43
	DYJ	58.46	-1.25	-0.50	-1.21	***-0.07***	-1.31	-0.44	0.27	-1.08	-2.34	-1.16	-1.58
	TBLJ	59.15	-2.45	-0.03	-1.46	***-0.04***	-1.51	-1.38	0.58	-0.18	-3.90	-0.74	-4.94
	PEJ	58.48	-1.29	-1.01	-0.57	***-0.05***	-0.67	-1.75	-1.28	-1.06	-0.67	-0.21	0.74
	RVOLJ	57.85	-0.20	-0.55	0.07	***-0.06***	0.02	-0.22	-0.42	0.11	-0.17	-0.35	-0.02
	INFJ	58.21	-0.82	-1.42	-0.10	-0.10	-0.24	-0.80	-1.64	-0.20	-0.84	-0.70	0.17
	PRDJ	58.59	-1.47	0.54	0.06	***0.05***	-1.12	-0.51	0.60	-0.57	-2.77	0.23	1.75
TWN<GER	RPJ	58.92	-2.06	1.05	0.92	***0.08***	-0.51	-4.62	0.27	0.70	***1.38***	1.16	1.49
	DYJ	60.92	-5.52	-1.29	-0.45	***-0.04***	-0.58	-9.47	-1.41	-0.18	-0.21	0.16	-1.20
	TBLJ	59.26	-2.65	1.16	-0.13	***0.07***	-0.28	-2.02	**1.40**	1.59	-3.49	0.02	-4.83
	PEJ	57.80	-0.11	0.30	-0.61	***-0.02***	-0.71	***0.03***	0.46	-0.51	-0.29	-0.20	-0.92
	RVOLJ	58.36	-1.07	-0.22	0.63	***0.03***	0.58	-0.97	-0.20	0.51	-1.22	-0.12	0.97
	INFJ	57.90	-0.28	-0.17	0.07	***-0.04***	-0.30	***0.21***	0.62	0.61	-0.94	-1.07	-1.40
	PRDJ	58.91	-2.03	-0.44	-1.85	***-0.06***	-2.70	-0.88	0.28	0.42	-3.59	-0.79	-7.99

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 62: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Foreign Macroeconomic Indicators

		Overall Period						Expansion Times			Recession Times		
i<j	**Model**	**MSFE**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
	TUR-HA	178.53			42.33	-0.08	42.31						
TUR<USA	RPJ	180.44	-1.07	1.21	1.20	***0.09***	-0.11	***3.98***	**2.29**	4.82	-5.91	0.09	-3.82
	DYJ	181.97	-1.93	-0.61	0.28	***-0.04***	0.19	-3.32	-1.42	0.62	-0.59	0.19	-0.23
	TBLJ	182.59	-2.27	-0.44	0.05	***-0.06***	0.03	-3.01	-0.81	-0.89	-1.57	0.08	1.40
	PEJ	183.43	-2.75	0.49	0.96	***0.01***	0.88	-6.33	-0.79	0.16	***0.68***	**1.23**	2.11
	RVOLJ	181.78	-1.82	0.30	-0.61	***-0.05***	-0.71	-4.44	-0.58	-0.47	***0.69***	0.90	-0.83
	INFJ	182.16	-2.04	-0.62	-3.04	-0.08	-3.53	-2.31	-0.59	-0.88	-1.78	-0.33	-6.17
	PRDJ	176.55	***1.11***	**1.25**	0.57	***-0.01***	-0.08	-2.43	-0.54	0.67	***4.50***	**1.56**	0.43
TUR<JPN	RPJ	182.02	-1.95	-0.82	-0.51	***-0.02***	-1.27	-3.12	-0.88	0.64	-0.83	-0.17	-2.17
	DYJ	183.48	-2.77	0.57	1.23	-0.11	1.24	-5.83	-0.49	0.49	***0.16***	1.02	2.29
	TBLJ	180.18	-0.92	-0.75	0.56	-0.10	0.55	-2.25	-1.79	-0.58	***0.36***	0.50	2.20
	PEJ	182.63	-2.30	-0.33	-0.14	***-0.01***	-0.15	-5.39	-1.40	-1.45	***0.67***	0.94	1.78
	RVOLJ	183.84	-2.97	**1.43**	-3.58	***0.04***	-4.04	-6.80	0.96	0.98	***0.70***	1.09	-10.05
	INFJ	180.00	-0.82	-1.37	-0.69	***-0.07***	-0.81	-1.02	-0.87	-0.57	-0.63	-1.19	-0.87
	PRDJ	180.04	-0.84	-1.62	-0.38	***-0.06***	-0.65	-0.84	-1.03	-0.15	-0.85	-1.26	-0.71
TUR<GER	RPJ	181.60	-1.72	0.03	-0.41	***0.01***	-1.19	***0.11***	0.78	0.83	-3.47	-0.51	-2.14
	DYJ	182.58	-2.27	-1.19	-0.61	***-0.05***	-0.77	-4.54	-1.88	-1.11	-0.10	0.28	0.10
	TBLJ	181.61	-1.73	-1.31	-0.88	-0.10	-0.92	-3.07	-1.27	-1.91	-0.44	-0.37	0.60
	PEJ	178.26	***0.15***	0.82	-1.06	***-0.06***	-1.17	***1.48***	**1.83**	1.69	-1.12	-0.42	-5.02
	RVOLJ	183.54	-2.81	0.00	-1.31	***-0.05***	-1.44	-3.67	-0.24	-0.85	-1.97	0.23	-1.97
	INFJ	179.66	-0.63	-0.99	-0.48	-0.09	-0.68	-0.19	-0.15	-0.20	-1.05	-1.10	-0.87
	PRDJ	184.91	-3.57	-1.51	-2.12	***-0.06***	-2.62	-3.19	-0.44	-1.63	-3.94	-2.24	-2.77

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 63: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Foreign Macroeconomic Indicators

		Overall Period						Expansion Times			Recession Times		
i<j	**Model**	**MSFE**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
	BRA-HA	45.33			10.77	0.01	10.70						
BRA<USA	RPJ	45.69	-0.79	-0.19	-0.33	-0.02	-1.01	-2.29	-0.55	-1.70	-0.10	0.29	0.74
	DYJ	46.79	-3.22	-0.72	-5.09	***0.01***	-5.46	-0.94	0.21	-3.15	-4.25	-1.23	-6.62
	TBLJ	45.79	-1.00	-0.63	-0.78	-0.06	-0.91	-3.00	-1.70	-2.61	-0.09	0.19	0.66
	PEJ	48.09	-6.08	-0.29	1.60	***0.10***	1.31	***3.51***	**1.52**	4.28	-10.46	-0.75	-0.57
	RVOLJ	45.92	-1.29	-1.21	-0.58	-0.01	-0.76	***0.78***	0.93	0.72	-2.24	-1.68	-1.58
	INFJ	45.38	-0.11	0.51	0.93	***0.02***	0.24	-1.51	-1.15	-1.16	***0.53***	0.83	2.57
	PRDJ	46.24	-2.01	0.92	2.08	***0.08***	0.57	***0.26***	0.45	0.81	-3.05	0.84	3.06
BRA<JPN	RPJ	45.68	-0.76	-0.42	-0.28	-0.04	-0.77	-2.64	-0.99	-1.93	***0.09***	0.39	1.04
	DYJ	46.86	-3.38	-0.10	0.10	0.00	-0.15	-3.85	-1.77	-4.17	-3.16	0.21	3.46
	TBLJ	46.02	-1.52	-0.46	-1.82	-0.03	-2.13	-6.18	-1.27	-5.59	***0.60***	0.56	1.14
	PEJ	46.62	-2.85	-0.90	-2.80	-0.01	-3.15	-3.32	-0.37	-4.79	-2.63	-0.94	-1.25
	RVOLJ	46.58	-2.75	-0.29	1.14	***0.07***	0.76	***0.53***	0.64	1.61	-4.25	-0.65	0.77
	INFJ	44.52	***1.80***	**1.62**	2.07	***0.07***	0.66	-2.75	-0.40	-2.21	***3.88***	**2.08**	5.45
	PRDJ	47.38	-4.52	-0.90	-0.75	-0.04	-1.39	-0.13	0.05	0.38	-6.52	-0.93	-1.62
BRA<GER	RPJ	45.51	-0.39	-0.16	0.18	-0.02	-0.20	-1.47	-0.67	-0.82	***0.09***	0.35	0.97
	DYJ	46.28	-2.10	-0.76	-1.24	-0.03	-1.53	-1.13	-0.44	-1.48	-2.54	-0.64	-1.04
	TBLJ	46.46	-2.49	1.20	0.66	***0.10***	0.31	-24.99	-0.37	-5.63	***7.78***	**1.87**	5.62
	PEJ	46.26	-2.04	-0.66	-2.67	0.00	-3.00	-1.65	-0.18	-1.78	-2.21	-0.67	-3.41
	RVOLJ	45.62	-0.64	0.17	0.66	0.00	0.44	-1.49	-0.50	-1.14	-0.25	0.32	2.09
	INFJ	45.21	***0.27***	1.00	0.56	***0.07***	-2.36	-5.73	-0.07	0.69	***3.00***	1.10	0.40
	PRDJ	45.98	-1.42	0.13	-0.62	-0.01	-2.71	-4.21	-0.31	-2.89	-0.14	0.36	1.15

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 64: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Foreign Macroeconomic Indicators

		Overall Period						Expansion Times			Recession Times		
i<j	**Model**	**MSFE**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**
	HKG-HA	42.10			0.60	0.07	0.45						
HKG<USA	RPJ	42.14	-0.09	0.52	0.20	***0.11***	-1.44	***1.53***	0.80	2.30	-1.55	-0.12	-3.20
	DYJ	43.33	-2.91	-0.69	-5.11	0.07	-5.36	-1.44	0.08	-2.02	-4.24	-1.13	-10.44
	TBLJ	42.70	-1.42	-1.18	-0.49	0.05	-0.60	-3.96	-2.23	-2.41	***0.88***	0.83	2.87
	PEJ	44.03	-4.59	0.05	2.10	***0.15***	1.84	-11.39	-0.55	1.02	***1.58***	1.00	4.20
	RVOLJ	43.20	-2.61	-0.43	-1.95	***0.09***	-2.20	-5.86	-0.74	-3.20	***0.33***	0.51	0.43
	INFJ	42.79	-1.63	0.02	-2.02	***0.08***	-3.24	***1.50***	1.09	2.47	-4.46	-0.27	-10.20
	PRDJ	40.38	***4.09***	1.17	-0.22	***0.08***	-3.09	-14.99	-0.12	0.67	***21.37***	**1.25**	-1.79
HKG<JPN	RPJ	42.59	-1.17	-0.25	-1.94	0.03	-3.62	-2.10	-0.44	-2.04	-0.32	0.12	-1.72
	DYJ	44.06	-4.66	-0.39	-3.82	0.04	-4.14	-13.26	-1.75	-6.68	***3.13***	1.05	1.28
	TBLJ	43.17	-2.55	-0.69	-5.26	0.03	-5.66	-5.46	-0.80	-7.52	***0.09***	0.16	-1.29
	PEJ	43.36	-2.99	-0.66	-4.64	0.04	-4.95	-5.70	-0.79	-6.08	-0.54	0.07	-2.07
	RVOLJ	43.17	-2.53	-0.32	-1.79	***0.09***	-2.12	-7.49	-1.06	-5.13	***1.96***	1.09	4.22
	INFJ	43.84	-4.12	-0.77	-5.03	0.02	-7.20	-2.22	0.08	-1.56	-5.84	-1.20	-11.05
	PRDJ	43.29	-2.83	0.15	-1.45	0.07	-3.24	-5.61	-0.11	-2.85	-0.32	0.36	1.07
HKG<GER	RPJ	41.49	***1.45***	0.94	-0.86	***0.09***	-2.72	***1.08***	0.59	-0.44	***1.79***	0.72	-1.39
	DYJ	43.25	-2.72	-0.21	0.43	***0.08***	0.29	-9.47	-1.68	-1.69	***3.40***	1.13	4.14
	TBLJ	42.57	-1.11	**1.55**	2.85	***0.16***	2.47	-3.22	**1.36**	3.14	***0.80***	0.73	2.34
	PEJ	42.64	-1.28	-0.52	-3.43	0.07	-3.63	***1.83***	**1.34**	-0.16	-4.09	-1.73	-9.00
	RVOLJ	42.26	-0.38	0.27	-0.98	0.05	-1.24	-1.24	-0.20	-2.26	***0.41***	0.66	1.26
	INFJ	42.91	-1.92	-2.65	-2.12	0.02	-2.84	-1.15	-1.63	-0.58	-2.63	-2.16	-4.81
	PRDJ	41.63	***1.12***	0.83	0.58	***0.12***	-2.29	***0.07***	0.54	2.66	***2.07***	0.63	-3.45

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 65: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Foreign Macroeconomic Indicators

		Overall Period						Expansion Times			Recession Times		
i<j	**Model**	**MSFE**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
	IND-HA	57.92			6.70	0.07	6.63						
IND<USA	RPJ	58.54	-1.07	-0.64	-0.83	0.05	-1.59	-0.91	-0.80	-0.73	-1.22	-0.37	-1.04
	DYJ	60.22	-3.97	0.06	-9.27	***0.09***	-9.81	***9.50***	**2.39**	9.88	-16.11	-2.22	-34.90
	TBLJ	60.18	-3.91	-2.15	-4.83	-0.06	-5.00	-4.65	-1.11	-4.17	-3.24	-2.77	-5.89
	PEJ	60.75	-4.89	-0.01	3.56	***0.18***	3.16	-1.24	0.56	4.01	-8.18	-0.58	3.46
	RVOLJ	58.59	-1.16	-0.57	-0.45	***0.08***	-0.67	-0.64	0.01	0.37	-1.64	-0.92	-1.52
	INFJ	58.60	-1.19	-1.11	-0.97	0.03	-1.29	-2.03	-2.70	-1.83	-0.43	-0.04	0.24
	PRDJ	61.40	-6.01	-0.48	-0.35	0.04	-0.80	-12.30	-1.77	-4.09	-0.34	**1.27**	5.09
IND<JPN	RPJ	58.74	-1.43	-2.03	-1.64	0.02	-1.97	-1.79	-2.09	-1.80	-1.10	-0.97	-1.42
	DYJ	62.17	-7.34	-1.43	-5.52	0.01	-6.01	-3.75	-0.62	-1.27	-10.57	-1.30	-11.65
	TBLJ	58.93	-1.74	-0.30	-1.02	0.04	-1.33	-5.58	-1.37	-2.81	***1.71***	0.66	1.53
	PEJ	60.95	-5.24	-0.41	-5.71	***0.07***	-6.09	***4.11***	**1.73**	6.20	-13.66	-2.53	-21.84
	RVOLJ	59.61	-2.93	-0.21	-0.17	***0.12***	-0.62	-3.06	-0.04	-0.90	-2.82	-0.31	1.21
	INFJ	63.82	-10.20	-1.34	-9.79	-0.04	-11.96	-7.88	0.21	0.66	-12.29	-2.34	-24.64
	PRDJ	59.63	-2.97	0.35	1.92	***0.12***	1.16	-0.23	0.14	-0.42	-5.43	0.33	5.34
IND<GER	RPJ	58.30	-0.65	-0.58	-0.08	0.06	-0.48	-1.02	-1.52	-1.00	-0.32	-0.03	1.27
	DYJ	59.61	-2.93	-1.27	-2.67	0.02	-3.13	***0.27***	0.67	1.12	-5.81	-1.87	-8.16
	TBLJ	59.55	-2.81	**1.75**	2.65	***0.20***	2.32	-15.24	0.96	-3.19	***8.37***	**1.65**	11.33
	PEJ	59.11	-2.06	-0.01	-4.24	***0.08***	-4.73	***5.03***	**1.91**	5.61	-8.44	-1.79	-18.05
	RVOLJ	58.86	-1.63	-0.05	0.26	0.06	-0.02	-6.46	-1.05	-3.08	***2.72***	**2.64**	5.09
	INFJ	59.21	-2.23	0.65	4.36	***0.19***	1.39	-17.34	-1.10	-2.08	***11.39***	**1.98**	13.76
	PRDJ	58.28	-0.63	0.69	0.34	***0.11***	-2.40	-1.34	0.51	-1.51	***0.01***	0.47	3.21

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 66: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Foreign Macroeconomic Indicators

		Overall Period						Expansion Times			Recession Times		
i<j	**Model**	**MSFE**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
	RUS-HA	142.92			-0.39	0.13	-0.50						
RUS<USA	RPJ	143.27	-0.24	0.15	0.72	0.13	0.05	***0.07***	0.30	1.81	-0.93	-0.02	-1.75
	DYJ	144.86	-1.35	-0.11	2.39	***0.14***	2.26	-0.46	-0.32	-1.25	-3.32	-0.01	11.11
	TBLJ	143.73	-0.57	-0.81	0.16	0.11	0.08	-0.66	-1.05	-0.44	-0.36	-0.09	1.51
	PEJ	144.16	-0.87	-0.11	-0.64	0.10	-0.86	-1.24	-0.52	-0.73	-0.05	0.35	-1.34
	RVOLJ	142.69	***0.16***	0.70	1.57	***0.13***	1.40	***0.21***	0.73	1.40	***0.05***	0.30	1.44
	INFJ	144.32	-0.98	0.64	4.71	***0.15***	3.34	-3.61	-0.63	-2.59	***4.81***	**1.41**	20.37
	PRDJ	145.41	-1.74	-0.38	-1.96	0.10	-2.49	-0.01	0.24	0.02	-5.54	-0.48	-6.01
RUS<JPN	RPJ	146.39	-2.42	0.56	1.13	***0.15***	-1.49	-3.86	-0.13	-3.75	***0.73***	1.14	11.76
	DYJ	146.62	-2.59	0.25	3.92	0.12	3.70	-2.10	-0.92	-2.66	-3.66	0.59	18.73
	TBLJ	135.81	***4.97***	**2.22**	10.31	***0.22***	10.16	-0.47	1.14	-0.38	***16.92***	**1.95**	34.69
	PEJ	143.89	-0.68	0.49	5.75	***0.13***	5.55	-1.73	-0.48	-2.17	***1.63***	0.81	23.56
	RVOLJ	145.59	-1.87	-0.06	-2.85	***0.15***	-3.09	-1.78	-0.13	-5.99	-2.05	0.07	5.75
	INFJ	142.25	***0.47***	0.76	2.90	***0.14***	1.94	-1.43	-0.46	0.26	***4.64***	**2.65**	8.13
	PRDJ	147.28	-3.05	-1.15	-4.19	0.09	-4.62	-2.32	-1.13	-6.35	-4.65	-0.47	0.94
RUS<GER	RPJ	143.97	-0.74	0.17	0.48	***0.14***	-0.71	-0.18	0.31	1.28	-1.96	-0.04	-0.88
	DYJ	148.66	-4.02	-1.73	-10.62	0.05	-11.13	-0.29	0.18	0.54	-12.20	-2.26	-35.39
	TBLJ	142.78	***0.10***	**1.43**	5.94	***0.25***	5.73	-5.09	0.12	-5.78	***11.48***	**1.86**	32.03
	PEJ	143.55	-0.44	-1.03	-0.51	0.12	-0.57	-0.39	-0.67	-1.00	-0.56	-1.02	0.79
	RVOLJ	143.41	-0.34	-0.25	1.20	0.12	1.06	-0.62	-0.51	0.20	***0.28***	0.40	3.16
	INFJ	140.48	***1.71***	**1.64**	4.91	***0.19***	2.10	***0.54***	**1.34**	2.02	***4.27***	1.08	11.20
	PRDJ	143.50	-0.40	-0.49	0.46	0.12	0.13	-0.32	-0.30	0.05	-0.58	-0.48	1.32

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 67: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Foreign Macroeconomic Indicators

		Overall Period						Expansion Times			Recession Times		
i<j	**Model**	**MSFE**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
	ZAF-HA	23.43			6.66	0.05	6.49						
ZAF<USA	RPJ	24.01	-2.45	0.44	0.01	***0.07***	-3.22	-12.91	-1.66	-3.91	***10.48***	**1.70**	12.09
	DYJ	24.11	-2.88	-0.30	-1.03	0.02	-1.27	-2.41	-1.38	-1.49	-3.46	0.09	0.42
	TBLJ	23.57	-0.57	0.20	1.27	***0.08***	1.14	-0.87	-0.07	-0.23	-0.21	0.27	6.04
	PEJ	24.07	-2.74	0.58	4.19	***0.17***	3.99	***2.37***	**1.61**	3.85	-9.04	0.00	5.53
	RVOLJ	24.00	-2.42	0.35	1.57	***0.11***	1.26	-0.47	1.00	1.82	-4.84	-0.52	1.04
	INFJ	24.07	-2.71	-0.36	1.27	***0.09***	0.33	***1.08***	0.71	2.06	-7.39	-0.70	-1.08
	PRDJ	22.23	***5.14***	**1.43**	2.64	***0.13***	0.52	-6.87	-1.35	-2.40	***19.97***	**1.76**	18.52
ZAF<JPN	RPJ	23.64	-0.90	-0.14	0.29	0.05	-1.06	-3.31	-1.23	-1.86	***2.08***	**1.62**	6.92
	DYJ	24.33	-3.81	0.39	1.55	***0.08***	1.32	-3.50	-0.74	-1.36	-4.18	0.63	10.71
	TBLJ	23.40	***0.15***	0.72	1.96	***0.11***	1.67	-2.71	-0.59	-0.36	***3.67***	**1.56**	9.23
	PEJ	24.05	-2.63	-0.18	-1.43	0.05	-1.74	-2.60	-0.07	0.28	-2.66	-0.18	-6.58
	RVOLJ	23.90	-2.01	-0.16	0.77	***0.08***	0.37	-2.22	-0.32	-0.73	-1.74	0.04	5.57
	INFJ	23.89	-1.96	-0.86	-1.28	0.03	-2.52	-0.76	0.01	0.13	-3.46	-1.10	-5.69
	PRDJ	24.17	-3.13	0.25	-1.19	0.03	-2.39	-7.29	-2.76	-2.95	***2.03***	1.01	4.03
ZAF<GER	RPJ	23.89	-1.93	0.69	2.16	***0.12***	-1.27	-10.90	-0.79	-2.09	***9.16***	**1.83**	15.34
	DYJ	23.68	-1.06	0.88	3.50	***0.16***	3.22	-1.24	0.11	-0.23	-0.84	0.87	15.26
	TBLJ	23.16	***1.19***	**1.45**	5.58	***0.20***	5.23	-5.77	0.04	-0.78	***9.79***	**2.08**	25.66
	PEJ	23.60	-0.72	-0.37	-2.00	0.04	-2.14	***1.59***	**1.29**	1.26	-3.58	-1.98	-12.00
	RVOLJ	23.80	-1.55	0.04	-0.34	***0.08***	-0.70	***0.29***	0.80	1.66	-3.83	-1.53	-6.25
	INFJ	23.71	-1.18	-0.91	-0.69	0.03	-1.62	-1.57	-0.76	-0.41	-0.70	-0.49	-1.56
	PRDJ	23.57	-0.57	-0.08	-1.95	0.03	-3.54	-0.03	0.34	-1.10	-1.23	-0.77	-4.67

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 68: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Technical Indicators

	Overall Period						Expansion Times			Recession Times		
	MSFE	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**
BEL	24.36			1.58	0.02	1.43						
MA(1,4)	23.91	***1.81***	**1.95**	2.70	***0.12***	1.87	***0.70***	0.91	1.31	***2.40***	**1.73**	4.26
MA(1,6)	23.54	***3.34***	**2.52**	5.38	***0.19***	4.52	***2.06***	**1.54**	5.19	***4.01***	**2.01**	5.59
MA(2,4)	24.17	***0.78***	**1.24**	1.00	***0.07***	0.23	***1.59***	**1.49**	1.80	***0.35***	0.53	0.09
MA(2,6)	23.94	***1.72***	**1.79**	3.06	***0.13***	2.44	***2.76***	**1.77**	4.83	***1.18***	1.01	1.07
MA(3,4)	24.19	***0.70***	1.15	1.15	***0.08***	0.31	***1.71***	**1.46**	2.39	***0.16***	0.45	-0.27
MA(3,6)	23.95	***1.67***	**1.72**	4.31	***0.16***	3.82	***1.29***	1.14	4.57	***1.88***	**1.32**	4.01
MOM(4)	23.90	***1.88***	**2.05**	4.25	***0.17***	3.38	***3.09***	**1.82**	6.61	***1.24***	**1.23**	1.60
MOM(6)	23.55	***3.32***	**2.45**	5.16	***0.19***	4.86	***2.99***	**1.84**	5.28	***3.50***	**1.79**	5.03
VOL(1,4)	23.93	***1.76***	**2.01**	2.43	***0.11***	1.65	-1.04	-0.04	0.67	***3.24***	**2.42**	4.40
VOL(1,6)	23.40	***3.92***	**2.79**	5.09	***0.18***	4.27	***2.80***	**1.73**	5.38	***4.51***	**2.22**	4.77
VOL(2,4)	24.49	-0.55	-0.90	-0.58	0.00	-0.97	-1.22	-1.81	-0.99	-0.19	-0.14	-0.12
VOL(2,6)	24.13	***0.92***	1.18	2.45	***0.11***	2.18	***0.29***	0.62	1.53	***1.25***	1.01	3.48
VOL(3,4)	24.45	-0.38	-0.52	-1.10	0.00	-1.63	-1.23	-1.48	-1.34	***0.06***	0.26	-0.84
VOL(3,6)	24.11	***1.00***	**1.32**	2.15	***0.10***	1.76	***0.68***	0.82	1.71	***1.17***	1.05	2.65
MA(1,9)	23.51	***3.47***	**2.40**	6.27	***0.21***	5.80	***1.73***	**1.38**	6.03	***4.39***	**1.97**	6.52
MA(1,12)	23.64	***2.96***	**2.18**	5.07	***0.18***	4.53	***2.93***	**1.77**	5.74	***2.97***	**1.49**	4.33
MA(2,9)	23.34	***4.17***	**2.73**	6.10	***0.21***	5.78	***3.97***	**2.15**	6.52	***4.27***	**1.94**	5.62
MA(2,12)	23.73	***2.56***	**1.94**	4.65	***0.18***	4.40	***0.89***	1.02	4.49	***3.44***	**1.66**	4.82
MA(3,9)	23.70	***2.70***	**2.14**	4.42	***0.17***	4.14	***1.89***	**1.43**	4.31	***3.12***	**1.66**	4.53
MA(3,12)	23.90	***1.87***	**1.65**	4.13	***0.16***	3.87	***0.06***	0.65	3.70	***2.82***	**1.53**	4.60
MOM(9)	23.93	***1.75***	**1.64**	3.45	***0.14***	3.09	-0.90	0.21	1.96	***3.14***	**1.75**	5.12
MOM(12)	23.88	***1.93***	**1.71**	4.45	***0.17***	4.14	***0.70***	1.01	4.26	***2.58***	**1.40**	4.66
VOL(1,9)	23.60	***3.08***	**2.19**	5.51	***0.19***	4.79	***1.57***	**1.35**	5.64	***3.88***	**1.75**	5.36
VOL(1,12)	23.59	***3.16***	**2.15**	5.40	***0.19***	4.89	***2.57***	**1.66**	6.42	***3.47***	**1.54**	4.26
VOL(2,9)	23.83	***2.15***	**1.94**	3.64	***0.15***	3.36	***1.47***	**1.25**	3.24	***2.51***	**1.52**	4.09
VOL(2,12)	23.75	***2.49***	**2.00**	4.23	***0.16***	3.96	***2.06***	**1.50**	4.41	***2.72***	**1.47**	4.01
VOL(3,9)	23.85	***2.09***	**1.92**	3.64	***0.15***	3.38	***2.11***	**1.60**	3.47	***2.07***	**1.33**	3.82
VOL(3,12)	23.78	***2.35***	**1.90**	4.33	***0.16***	4.06	***2.08***	**1.50**	4.64	***2.49***	**1.35**	3.98

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 69: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Technical Indicators

	Overall Period						Expansion Times			Recession Times		
	MSFE	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**
GRC	95.23			6.86	-0.01	6.80						
MA(1,4)	93.59	***1.72***	**1.93**	-0.03	***0.05***	-1.11	-0.03	0.79	-1.85	***3.21***	**1.90**	2.25
MA(1,6)	92.76	***2.59***	**2.32**	2.36	***0.09***	1.64	***0.41***	0.96	1.99	***4.46***	**2.23**	2.83
MA(2,4)	92.48	***2.88***	**2.63**	1.78	***0.06***	1.08	***2.52***	**1.82**	1.53	***3.20***	**1.90**	2.09
MA(2,6)	92.63	***2.73***	**2.55**	2.11	***0.07***	1.68	***0.80***	0.94	0.82	***4.37***	**2.56**	3.73
MA(3,4)	91.76	***3.64***	**3.23**	2.73	***0.09***	1.97	***3.42***	**2.36**	2.10	***3.83***	**2.25**	3.53
MA(3,6)	94.91	***0.34***	0.72	0.82	***0.01***	0.61	-0.59	-0.27	-0.14	***1.13***	1.20	2.03
MOM(4)	94.26	***1.02***	**1.36**	1.82	***0.05***	1.51	-0.15	0.22	1.26	***2.02***	**1.57**	2.52
MOM(6)	92.76	***2.59***	**2.51**	2.26	***0.06***	1.96	***1.33***	1.12	1.30	***3.67***	**2.34**	3.46
VOL(1,4)	89.05	***6.49***	**3.91**	1.71	***0.16***	-0.27	***5.33***	**2.73**	3.04	***7.48***	**2.79**	0.19
VOL(1,6)	91.37	***4.05***	**2.95**	2.97	***0.11***	1.91	***0.03***	1.17	2.78	***7.49***	**2.93**	3.20
VOL(2,4)	89.97	***5.52***	**3.56**	5.39	***0.16***	4.29	***3.25***	**2.19**	8.14	***7.46***	**2.83**	1.97
VOL(2,6)	91.15	***4.28***	**3.07**	3.81	***0.12***	3.36	***0.92***	1.15	1.85	***7.16***	**3.08**	6.27
VOL(3,4)	90.38	***5.09***	**3.85**	3.96	***0.12***	3.26	***3.59***	**2.22**	2.68	***6.37***	**3.17**	5.57
VOL(3,6)	92.05	***3.34***	**2.89**	2.71	***0.08***	2.33	***2.25***	**1.64**	1.56	***4.27***	**2.40**	4.16
MA(1,9)	91.54	***3.88***	**2.97**	3.32	***0.11***	2.86	***1.20***	1.16	1.78	***6.16***	**2.93**	5.25
MA(1,12)	91.61	***3.80***	**2.96**	2.65	***0.09***	2.33	***1.25***	1.18	1.04	***5.98***	**2.87**	4.67
MA(2,9)	93.11	***2.23***	**2.40**	1.88	***0.05***	1.58	***1.00***	1.03	0.59	***3.27***	**2.28**	3.49
MA(2,12)	92.43	***2.94***	**2.62**	2.38	***0.07***	2.09	***1.58***	**1.26**	1.53	***4.10***	**2.36**	3.45
MA(3,9)	93.86	***1.43***	**1.74**	1.72	***0.04***	1.50	***0.79***	0.85	1.46	***1.98***	**1.56**	2.05
MA(3,12)	93.07	***2.26***	**2.14**	1.69	***0.06***	1.31	-0.58	0.41	0.07	***4.69***	**2.50**	3.72
MOM(9)	92.79	***2.56***	**2.37**	2.21	***0.06***	1.98	***1.15***	1.03	1.42	***3.76***	**2.23**	3.20
MOM(12)	91.43	***3.98***	**2.75**	1.80	***0.10***	1.57	***0.77***	1.13	1.30	***6.73***	**2.61**	2.47
VOL(1,9)	93.00	***2.34***	**2.22**	1.55	***0.09***	0.87	-0.55	0.83	1.03	***4.80***	**2.29**	2.22
VOL(1,12)	92.32	***3.05***	**2.37**	2.41	***0.09***	1.90	-0.55	0.49	0.49	***6.13***	**2.81**	4.83
VOL(2,9)	94.15	***1.13***	**1.50**	0.31	***0.01***	0.00	-1.47	-0.18	-2.03	***3.35***	**2.25**	3.25
VOL(2,12)	94.34	***0.93***	**1.30**	0.33	***0.00***	0.07	-1.81	-0.44	-1.96	***3.27***	**2.24**	3.22
VOL(3,9)	93.38	***1.94***	**1.96**	1.40	***0.05***	1.07	-1.37	0.11	-0.93	***4.77***	**2.56**	4.33
VOL(3,12)	93.83	***1.47***	**1.69**	0.97	***0.02***	0.74	-0.55	0.08	-0.79	***3.19***	**2.20**	3.18

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 70: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Technical Indicators

	Overall Period						Expansion Times			Recession Times		
	MSFE	R^2_{OS} (%)	MSFE Adj.	Δ (%)	SR	Δ (%, 50bp)	R^2_{OS} (%)	MSFE Adj.	Δ (%)	R^2_{OS} (%)	MSFE Adj.	Δ (%)
MYS	49.10			2.85	0.00	2.78						
MA(1,4)	47.20	***3.88***	**2.35**	6.21	***0.23***	5.01	-0.25	**1.38**	7.15	***8.03***	**1.93**	3.78
MA(1,6)	49.30	-0.41	0.11	1.59	***0.08***	1.11	-3.23	-1.25	1.52	***2.43***	**1.25**	1.81
MA(2,4)	49.07	***0.06***	0.51	2.10	***0.10***	1.52	-0.46	0.15	1.98	***0.58***	0.56	2.41
MA(2,6)	49.42	-0.65	-0.65	1.02	***0.06***	0.78	-0.59	-0.45	1.25	-0.70	-0.47	0.42
MA(3,4)	50.18	-2.19	-1.68	-3.85	-0.09	-4.46	-2.09	-0.76	-2.60	-2.30	-1.74	-7.21
MA(3,6)	49.82	-1.47	-1.39	-1.29	-0.03	-1.62	-0.66	-0.26	0.16	-2.28	-1.53	-5.14
MOM(4)	49.31	-0.42	0.01	1.13	***0.06***	0.66	-0.55	-0.01	1.76	-0.30	0.02	-0.53
MOM(6)	49.40	-0.62	-0.08	0.48	***0.05***	0.12	-1.62	-0.69	1.61	***0.40***	0.48	-2.54
VOL(1,4)	48.36	***1.51***	**1.41**	4.70	***0.19***	3.45	-1.58	0.48	5.55	***4.61***	**1.49**	2.52
VOL(1,6)	47.88	***2.50***	**2.05**	4.78	***0.18***	4.04	-0.48	1.20	5.37	***5.49***	**1.67**	3.30
VOL(2,4)	49.11	-0.01	0.46	2.53	***0.12***	1.80	-2.03	-0.41	2.25	***2.02***	0.99	3.29
VOL(2,6)	48.89	***0.44***	0.98	3.23	***0.14***	2.78	-2.27	0.06	3.50	***3.17***	1.21	2.54
VOL(3,4)	48.71	***0.81***	1.21	3.26	***0.14***	2.21	***0.23***	0.86	4.19	***1.39***	0.84	0.85
VOL(3,6)	49.43	-0.66	0.02	1.90	***0.10***	1.61	-3.21	-1.14	1.95	***1.89***	0.87	1.77
MA(1,9)	49.35	-0.50	0.13	0.78	***0.06***	0.33	***0.34***	0.86	2.56	-1.33	-0.51	-3.93
MA(1,12)	49.12	-0.03	0.62	1.86	***0.10***	1.55	-4.87	-1.10	1.27	***4.85***	**1.65**	3.46
MA(2,9)	49.63	-1.07	-0.67	0.39	***0.04***	0.10	-1.20	-0.55	1.38	-0.94	-0.40	-2.25
MA(2,12)	49.61	-1.03	-0.21	0.49	***0.04***	0.23	-3.56	-1.37	0.76	***1.50***	0.90	-0.25
MA(3,9)	49.83	-1.48	-0.90	-0.59	***0.01***	-0.94	-1.62	-0.60	0.68	-1.35	-0.67	-3.95
MA(3,12)	50.10	-2.03	-0.80	-1.31	***0.00***	-1.62	-3.15	-0.98	0.59	-0.90	-0.16	-6.37
MOM(9)	49.57	-0.96	-0.15	0.25	***0.04***	-0.13	-2.70	-0.90	0.89	***0.80***	0.62	-1.45
MOM(12)	49.87	-1.56	-0.25	0.49	***0.02***	0.33	-8.44	-2.29	-0.29	***5.36***	**1.63**	2.57
VOL(1,9)	48.97	***0.27***	0.75	2.70	***0.13***	2.30	-3.31	-0.54	3.07	***3.88***	**1.54**	1.73
VOL(1,12)	49.01	***0.18***	0.79	2.89	***0.13***	2.46	-5.32	-0.80	2.90	***5.71***	**1.77**	2.89
VOL(2,9)	49.09	***0.03***	0.64	2.78	***0.13***	2.44	-3.83	-0.69	2.89	***3.93***	**1.44**	2.49
VOL(2,12)	49.35	-0.51	0.65	1.86	***0.10***	1.50	-7.97	-1.10	1.54	***7.00***	**1.81**	2.74
VOL(3,9)	49.58	-0.98	-0.21	1.24	***0.07***	1.00	-3.87	-1.41	1.73	***1.93***	0.90	-0.05
VOL(3,12)	50.51	-2.86	-0.60	-0.70	0.00	-1.04	-9.41	-2.19	-0.55	***3.73***	1.15	-1.10

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 71: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Technical Indicators

	Overall Period						Expansion Times			Recession Times		
	MSFE	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**
MEX	53.42			12.57	0.03	12.49						
MA(1,4)	53.96	-1.02	0.10	1.39	***0.07***	0.54	-4.20	-1.19	-1.07	***0.96***	0.57	5.36
MA(1,6)	53.86	-0.81	0.27	2.21	***0.10***	1.50	-3.18	-0.79	-0.70	***0.65***	0.58	6.91
MA(2,4)	54.17	-1.41	0.02	0.88	***0.06***	0.13	-5.59	-1.62	-1.77	***1.19***	0.63	5.16
MA(2,6)	54.06	-1.19	-0.21	0.93	***0.05***	0.63	-2.82	-1.24	-0.58	-0.18	0.24	3.36
MA(3,4)	53.79	-0.70	0.62	2.17	***0.10***	1.06	-5.49	-0.54	-1.11	***2.27***	0.96	7.46
MA(3,6)	53.74	-0.61	0.46	2.68	***0.11***	2.17	-1.95	-0.12	1.01	***0.22***	0.56	5.38
MOM(4)	54.06	-1.20	-0.44	0.29	***0.03***	-0.14	-1.92	-0.90	-0.40	-0.75	-0.08	1.42
MOM(6)	54.20	-1.47	-1.09	-0.60	0.02	-0.91	***0.95***	**1.55**	0.62	-2.96	-1.55	-2.51
VOL(1,4)	54.26	-1.56	-0.51	-0.13	0.02	-0.45	-3.79	-2.18	-1.38	-0.18	0.13	1.87
VOL(1,6)	54.24	-1.53	-0.79	-3.31	-0.02	-4.00	***0.18***	0.51	-1.06	-2.59	-1.04	-6.96
VOL(2,4)	54.13	-1.33	-0.58	0.15	0.02	-0.14	-2.71	-1.60	-1.02	-0.47	-0.02	2.04
VOL(2,6)	54.24	-1.53	-1.00	-2.75	-0.02	-3.17	-0.83	-0.62	-1.64	-1.97	-0.86	-4.58
VOL(3,4)	53.03	***0.73***	**1.26**	3.55	***0.14***	2.07	-4.67	-0.08	0.24	***4.08***	**1.42**	8.85
VOL(3,6)	54.06	-1.20	-1.52	-1.49	-0.01	-1.77	-0.75	-0.64	-1.07	-1.47	-1.39	-2.15
MA(1,9)	54.84	-2.65	-1.45	-1.86	-0.01	-2.14	-1.11	-1.11	-0.48	-3.61	-1.26	-4.05
MA(1,12)	54.41	-1.85	0.06	2.14	***0.09***	1.81	-1.19	-0.30	0.64	-2.26	0.13	4.58
MA(2,9)	54.66	-2.32	-0.95	-0.53	0.02	-0.80	-0.18	0.14	0.52	-3.65	-1.01	-2.19
MA(2,12)	56.74	-6.21	-1.38	-2.92	-0.02	-3.15	***0.07***	0.33	0.10	-10.10	-1.41	-7.71
MA(3,9)	54.60	-2.20	-1.14	-1.56	0.00	-1.83	***0.39***	0.77	0.19	-3.81	-1.30	-4.34
MA(3,12)	55.87	-4.58	-0.75	-0.97	0.01	-1.19	-0.40	-0.29	-0.22	-7.17	-0.72	-2.17
MOM(9)	54.98	-2.93	-0.67	-0.20	0.03	-0.40	-0.34	-0.03	-0.43	-4.53	-0.67	0.19
MOM(12)	55.24	-3.40	-0.03	2.02	***0.09***	1.82	-1.24	-0.02	0.13	-4.74	-0.02	5.06
VOL(1,9)	54.94	-2.85	-0.98	-4.96	-0.03	-5.47	-0.98	-0.57	-1.90	-4.01	-0.89	-9.97
VOL(1,12)	55.62	-4.12	0.45	-8.05	***0.04***	-8.97	-0.23	0.70	-2.16	-6.53	0.27	-17.95
VOL(2,9)	54.68	-2.36	-0.11	-5.83	-0.02	-6.24	-1.50	-0.34	-2.14	-2.89	-0.04	-11.98
VOL(2,12)	54.86	-2.69	**1.85**	-3.56	***0.09***	-4.25	-5.53	-0.65	-3.45	-0.92	**2.10**	-3.72
VOL(3,9)	54.51	-2.05	0.86	-3.50	0.02	-4.19	-3.02	-0.35	-2.66	-1.44	1.05	-5.05
VOL(3,12)	54.17	-1.40	0.45	-2.29	0.01	-2.66	-2.06	-0.97	-2.14	-0.98	0.77	-2.62

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 72: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Technical Indicators

	Overall Period						Expansion Times			Recession Times		
	MSFE	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**
POR	30.75			2.48	-0.03	2.39						
MA(1,4)	28.91	***6.00***	**3.69**	7.24	***0.23***	5.67	***9.41***	**3.30**	14.87	***1.51***	**1.84**	-0.27
MA(1,6)	29.35	***4.55***	**3.17**	4.06	***0.17***	3.06	***5.16***	**2.54**	6.66	***3.76***	**1.92**	1.42
MA(2,4)	29.52	***4.00***	**2.94**	3.87	***0.17***	2.51	***8.92***	**3.33**	12.34	-2.46	0.63	-4.65
MA(2,6)	29.22	***4.98***	**3.26**	5.29	***0.19***	4.41	***5.91***	**2.60**	9.04	***3.76***	**1.98**	1.48
MA(3,4)	29.92	***2.70***	**2.36**	3.71	***0.16***	2.73	***3.98***	**2.16**	7.07	***1.02***	1.14	0.22
MA(3,6)	30.08	***2.19***	**2.12**	2.03	***0.12***	1.35	***0.94***	1.09	2.34	***3.83***	**1.92**	1.75
MOM(4)	28.85	***6.20***	**3.67**	6.63	***0.22***	5.55	***8.44***	**3.17**	11.93	***3.26***	**1.97**	1.34
MOM(6)	29.31	***4.70***	**3.12**	5.56	***0.20***	4.99	***5.31***	**2.60**	9.85	***3.89***	**1.84**	1.14
VOL(1,4)	28.78	***6.42***	**3.79**	5.30	***0.20***	3.69	***4.48***	**2.30**	8.00	***8.97***	**3.09**	2.64
VOL(1,6)	28.89	***6.05***	**3.72**	4.94	***0.19***	3.98	***3.76***	**2.11**	6.25	***9.06***	**3.16**	3.64
VOL(2,4)	29.71	***3.39***	**2.71**	2.29	***0.13***	1.08	***3.03***	**1.82**	5.40	***3.87***	**2.04**	-0.92
VOL(2,6)	28.65	***6.83***	**3.93**	6.02	***0.21***	5.36	***6.58***	**2.89**	9.18	***7.16***	**2.65**	2.78
VOL(3,4)	29.47	***4.19***	**3.09**	3.41	***0.15***	2.23	***4.81***	**2.58**	6.07	***3.37***	**1.80**	0.63
VOL(3,6)	30.06	***2.27***	**2.48**	1.44	***0.08***	1.09	***0.84***	1.02	1.02	***4.15***	**2.40**	1.90
MA(1,9)	29.76	***3.23***	**2.60**	3.26	***0.16***	2.52	***1.47***	**1.38**	4.08	***5.55***	**2.39**	2.51
MA(1,12)	29.68	***3.49***	**2.74**	4.17	***0.18***	3.40	***1.75***	**1.59**	5.72	***5.78***	**2.46**	2.74
MA(2,9)	30.01	***2.41***	**2.20**	2.17	***0.13***	1.57	***0.20***	0.87	2.02	***5.33***	**2.38**	2.42
MA(2,12)	29.76	***3.23***	**2.54**	2.80	***0.15***	2.35	***1.99***	**1.48**	3.62	***4.85***	**2.16**	2.08
MA(3,9)	29.82	***3.03***	**2.50**	2.56	***0.14***	2.06	***2.10***	**1.51**	3.57	***4.26***	**2.05**	1.60
MA(3,12)	29.72	***3.37***	**2.60**	3.05	***0.16***	2.61	***1.53***	**1.37**	3.84	***5.80***	**2.46**	2.38
MOM(9)	30.03	***2.34***	**2.23**	2.47	***0.14***	1.89	***0.98***	**1.23**	3.32	***4.13***	**1.92**	1.68
MOM(12)	30.24	***1.68***	**1.86**	1.98	***0.13***	1.58	-0.67	0.64	1.99	***4.76***	**2.03**	2.08
VOL(1,9)	29.37	***4.51***	**3.18**	4.38	***0.19***	3.57	***3.40***	**2.03**	7.11	***5.98***	**2.48**	1.81
VOL(1,12)	29.75	***3.25***	**2.82**	3.54	***0.17***	2.69	***2.08***	**1.71**	5.94	***4.78***	**2.30**	1.31
VOL(2,9)	29.94	***2.64***	**2.32**	2.33	***0.14***	1.82	***1.63***	**1.35**	3.51	***3.97***	**1.91**	1.20
VOL(2,12)	30.26	***1.62***	**1.77**	1.16	***0.10***	0.81	***0.40***	0.81	1.32	***3.21***	**1.66**	1.05
VOL(3,9)	30.20	***1.81***	**1.89**	1.17	***0.09***	0.84	***0.57***	0.85	1.07	***3.44***	**1.77**	1.30
VOL(3,12)	30.25	***1.64***	**1.79**	1.01	***0.10***	0.70	***0.09***	0.68	0.72	***3.67***	**1.84**	1.38

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 73: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Technical Indicators

	Overall Period						Expansion Times			Recession Times		
	MSFE	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**
SPN	36.75			1.94	-0.06	1.85						
MA(1,4)	36.79	-0.11	0.71	1.18	***0.06***	0.34	-1.95	-0.30	0.41	***2.08***	**1.51**	2.12
MA(1,6)	36.74	***0.03***	0.90	2.05	***0.09***	1.35	-2.23	-0.16	0.39	***2.73***	**1.66**	4.07
MA(2,4)	36.90	-0.40	0.30	0.01	***0.02***	-0.66	-0.72	0.06	-1.24	-0.03	0.43	1.52
MA(2,6)	36.95	-0.56	0.16	0.37	***0.03***	-0.02	-0.93	-0.01	-1.05	-0.12	0.33	2.09
MA(3,4)	37.06	-0.85	-0.59	-0.25	***-0.02***	-0.65	-0.44	-0.02	-0.11	-1.35	-1.23	-0.42
MA(3,6)	36.74	***0.02***	0.41	0.62	***0.02***	0.32	-0.95	-0.30	-1.19	***1.18***	1.11	2.84
MOM(4)	37.07	-0.88	0.50	-0.01	***0.04***	-0.67	-1.98	-0.02	-1.10	***0.44***	0.85	1.31
MOM(6)	36.37	***1.03***	**1.37**	1.22	***0.07***	0.73	-1.25	0.10	-1.66	***3.75***	**1.90**	4.72
VOL(1,4)	36.53	***0.58***	1.02	1.30	***0.05***	0.57	-1.37	-0.51	-0.34	***2.91***	**2.12**	3.31
VOL(1,6)	36.37	***1.03***	**1.31**	2.19	***0.08***	1.74	-0.72	-0.20	0.36	***3.11***	**1.83**	4.42
VOL(2,4)	37.02	-0.75	-0.71	0.02	***-0.04***	-0.27	-1.56	-1.46	-0.43	***0.22***	0.56	0.58
VOL(2,6)	36.89	-0.38	-0.14	0.78	***0.00***	0.58	-1.51	-1.48	-0.11	***0.97***	1.06	1.87
VOL(3,4)	36.78	-0.09	0.10	0.11	***-0.03***	-0.27	-0.99	-1.28	-1.22	***1.00***	**1.24**	1.73
VOL(3,6)	36.89	-0.40	-0.20	0.02	***-0.01***	-0.22	-0.41	-0.11	-0.53	-0.38	-0.21	0.70
MA(1,9)	36.40	***0.95***	1.20	2.32	***0.09***	2.02	-0.53	0.18	0.85	***2.72***	**1.53**	4.12
MA(1,12)	36.67	***0.21***	0.74	0.82	***0.04***	0.55	-1.22	-0.22	-1.29	***1.91***	1.21	3.38
MA(2,9)	36.70	***0.13***	0.64	0.56	***0.03***	0.27	-1.51	-0.40	-2.06	***2.09***	**1.44**	3.77
MA(2,12)	36.69	***0.16***	0.61	0.71	***0.04***	0.49	-0.52	0.03	-1.01	***0.97***	0.81	2.81
MA(3,9)	36.81	-0.16	0.20	0.49	***0.01***	0.26	-1.35	-0.89	-1.85	***1.25***	1.06	3.35
MA(3,12)	36.55	***0.52***	0.90	0.92	***0.05***	0.70	***0.06***	0.40	-0.72	***1.08***	0.86	2.91
MOM(9)	36.55	***0.54***	0.97	0.88	***0.05***	0.64	***0.61***	0.75	-0.43	***0.46***	0.63	2.48
MOM(12)	36.80	-0.13	0.42	0.44	***0.02***	0.26	-0.63	-0.16	-1.18	***0.46***	0.60	2.42
VOL(1,9)	36.07	***1.83***	**1.85**	3.67	***0.14***	3.17	-0.15	0.63	2.04	***4.20***	**1.93**	5.66
VOL(1,12)	35.49	***3.43***	**2.58**	4.84	***0.17***	4.32	***2.40***	**1.62**	3.82	***4.66***	**2.01**	6.08
VOL(2,9)	35.65	***2.98***	**2.35**	3.89	***0.15***	3.61	***2.30***	**1.56**	3.11	***3.79***	**1.75**	4.85
VOL(2,12)	35.80	***2.59***	**2.21**	4.05	***0.15***	3.82	***0.69***	0.98	2.56	***4.86***	**2.06**	5.86
VOL(3,9)	36.05	***1.90***	**1.88**	3.14	***0.13***	2.97	***1.22***	1.12	2.13	***2.70***	**1.51**	4.36
VOL(3,12)	35.68	***2.91***	**2.33**	4.00	***0.15***	3.82	***1.83***	**1.38**	2.95	***4.21***	**1.87**	5.28

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 74: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Technical Indicators

	Overall Period						Expansion Times			Recession Times		
	MSFE	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
TWN	57.74			2.11	-0.08	2.07						
MA(1,4)	56.16	***2.74***	**2.55**	2.53	***0.13***	1.73	***0.75***	**1.75**	2.34	***5.41***	**1.88**	3.02
MA(1,6)	57.41	***0.57***	**1.51**	0.66	***0.06***	0.08	-0.25	1.19	0.71	***1.66***	0.95	0.51
MA(2,4)	57.07	***1.15***	**1.82**	0.86	***0.07***	0.29	-0.56	1.15	0.61	***3.45***	**1.45**	1.50
MA(2,6)	58.20	-0.81	-0.13	-0.10	***-0.04***	-0.23	***0.18***	0.69	0.30	-2.14	-0.75	-1.18
MA(3,4)	57.71	***0.05***	0.76	0.31	***0.02***	0.04	***0.32***	0.85	0.59	-0.31	0.24	-0.43
MA(3,6)	58.18	-0.77	-0.27	-0.09	***-0.05***	-0.20	***0.05***	0.46	0.27	-1.86	-0.80	-1.06
MOM(4)	57.92	-0.32	0.65	0.44	***0.03***	0.16	***0.18***	0.93	0.97	-0.99	-0.04	-1.01
MOM(6)	58.41	-1.17	-0.94	-0.35	-0.10	-0.43	-0.83	-0.39	-0.18	-1.64	-0.92	-0.83
VOL(1,4)	58.08	-0.59	1.18	0.06	***0.04***	-0.78	-4.32	0.07	-0.39	***4.42***	**1.63**	1.27
VOL(1,6)	57.89	-0.27	**2.09**	0.50	***0.09***	-0.45	-7.09	0.77	-0.87	***8.89***	**2.20**	4.22
VOL(2,4)	56.02	***2.97***	**2.57**	1.30	***0.08***	0.84	-0.67	1.00	0.25	***7.87***	**2.81**	4.17
VOL(2,6)	58.07	-0.58	**1.51**	0.05	***0.05***	-0.45	-4.23	0.60	-0.41	***4.32***	**1.55**	1.26
VOL(3,4)	59.33	-2.77	1.14	-0.29	***0.04***	-1.38	-7.19	0.37	-0.36	***3.17***	**1.33**	-0.15
VOL(3,6)	57.81	-0.13	1.06	0.05	***0.02***	-0.27	-3.34	-0.22	-0.59	***4.19***	**1.69**	1.77
MA(1,9)	57.94	-0.35	0.96	0.65	***0.05***	0.32	***1.29***	**1.55**	1.72	-2.55	-0.15	-2.25
MA(1,12)	58.39	-1.14	-0.13	0.24	***0.00***	0.09	-1.21	-0.04	0.46	-1.04	-0.14	-0.37
MA(2,9)	58.08	-0.59	-0.20	-0.04	***-0.05***	-0.12	-0.32	0.14	0.09	-0.96	-0.40	-0.37
MA(2,12)	58.56	-1.44	-0.25	0.12	***-0.01***	0.02	-1.49	-0.12	0.43	-1.37	-0.23	-0.72
MA(3,9)	58.22	-0.84	-1.47	-0.63	***-0.06***	-0.81	-1.12	-1.32	-0.21	-0.46	-0.65	-1.78
MA(3,12)	58.20	-0.80	-2.07	-0.45	-0.13	-0.51	-0.99	-3.06	-0.45	-0.55	-0.66	-0.43
MOM(9)	58.42	-1.18	-1.44	-0.49	-0.11	-0.58	-1.26	-1.38	-0.41	-1.08	-0.73	-0.71
MOM(12)	58.58	-1.46	-0.84	-0.34	***-0.07***	-0.42	-3.15	-1.86	-0.58	***0.81***	0.65	0.29
VOL(1,9)	58.48	-1.28	**1.30**	-0.26	***0.04***	-0.73	-4.63	0.47	-0.51	***3.22***	**1.34**	0.38
VOL(1,12)	58.24	-0.87	**1.47**	0.04	***0.05***	-0.38	-4.60	0.53	-0.32	***4.13***	**1.47**	1.02
VOL(2,9)	58.00	-0.46	0.48	-0.10	***-0.02***	-0.26	-1.81	-0.27	-0.28	***1.37***	0.81	0.40
VOL(2,12)	57.78	-0.08	0.58	0.03	***-0.03***	-0.07	-0.91	-0.03	0.04	***1.04***	0.76	-0.01
VOL(3,9)	58.08	-0.59	0.30	-0.08	***-0.03***	-0.21	-2.35	-0.79	-0.27	***1.76***	0.95	0.43
VOL(3,12)	58.21	-0.83	-0.96	-0.34	-0.16	-0.39	-1.06	-1.93	-0.17	-0.51	-0.19	-0.81

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 75: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Technical Indicators

	Overall Period						Expansion Times			Recession Times		
	MSFE	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**
TUR	178.53			42.33	-0.08	42.31						
MA(1,4)	182.88	-2.44	-0.67	-0.98	***-0.02***	-1.32	-0.65	0.57	0.59	-4.16	-1.62	-3.19
MA(1,6)	178.35	***0.10***	0.97	0.45	***0.03***	0.20	***1.33***	**1.45**	1.47	-1.08	0.23	-1.00
MA(2,4)	182.32	-2.12	-0.53	-0.23	***-0.01***	-0.51	-2.71	-0.45	-0.13	-1.56	-0.30	-0.35
MA(2,6)	179.69	-0.65	-0.04	0.16	***-0.02***	0.03	-0.15	0.31	0.45	-1.13	-0.21	-0.24
MA(3,4)	180.59	-1.16	0.63	-0.75	***0.01***	-1.16	-3.05	0.02	0.18	***0.66***	0.79	-2.08
MA(3,6)	179.70	-0.65	-0.22	0.41	***-0.02***	0.34	-0.68	-0.35	0.30	-0.63	-0.08	0.57
MOM(4)	178.63	-0.06	0.43	0.86	***0.01***	0.69	***0.79***	**1.29**	1.45	-0.88	-0.14	0.02
MOM(6)	180.27	-0.97	-1.69	-0.52	-0.13	-0.58	-0.90	-1.37	-0.43	-1.04	-1.10	-0.64
VOL(1,4)	181.89	-1.88	-0.60	-1.20	***-0.03***	-1.50	***1.07***	1.13	0.57	-4.71	-2.20	-3.69
VOL(1,6)	180.64	-1.18	-1.54	-0.80	***-0.07***	-0.99	-0.81	-0.45	-0.31	-1.53	-2.05	-1.48
VOL(2,4)	180.39	-1.04	-0.83	-0.19	***-0.05***	-0.41	-0.94	-0.57	0.08	-1.14	-0.61	-0.58
VOL(2,6)	179.96	-0.80	-1.23	-0.18	-0.10	-0.28	-0.39	-0.36	0.04	-1.20	-1.30	-0.50
VOL(3,4)	178.71	-0.10	**1.96**	-2.76	***0.04***	-3.64	***0.38***	**1.68**	1.19	-0.56	1.16	-8.42
VOL(3,6)	180.93	-1.34	-0.58	-0.76	***-0.05***	-0.91	-1.84	-0.73	-0.02	-0.87	-0.15	-1.83
MA(1,9)	180.53	-1.12	-0.17	0.15	***-0.02***	0.05	-1.07	-0.21	0.17	-1.18	-0.08	0.13
MA(1,12)	180.46	-1.08	-1.85	-0.73	-0.14	-0.79	-0.54	-1.22	-0.09	-1.60	-1.52	-1.63
MA(2,9)	179.99	-0.82	-1.15	0.03	-0.09	-0.02	-1.04	-1.75	-0.26	-0.60	-0.43	0.44
MA(2,12)	181.17	-1.48	-0.86	-1.76	-0.12	-1.89	***0.01***	0.28	0.16	-2.91	-1.02	-4.57
MA(3,9)	180.17	-0.92	-1.16	-1.50	-0.13	-1.62	-0.53	-0.46	-0.08	-1.29	-1.10	-3.56
MA(3,12)	180.78	-1.26	-0.52	-2.01	-0.09	-2.14	***1.11***	**1.25**	0.79	-3.54	-1.13	-6.05
MOM(9)	180.44	-1.07	-1.95	-1.25	-0.15	-1.33	-0.19	-0.53	-0.10	-1.92	-1.89	-2.90
MOM(12)	181.30	-1.55	-0.92	-1.50	-0.11	-1.61	-0.39	-0.33	-0.07	-2.67	-0.86	-3.59
VOL(1,9)	180.16	-0.92	-2.31	-0.67	-0.13	-0.74	-0.96	-2.28	-0.50	-0.87	-1.30	-0.92
VOL(1,12)	180.29	-0.99	-0.83	-0.39	***-0.07***	-0.48	-0.99	-0.83	-0.18	-0.99	-0.48	-0.70
VOL(2,9)	180.05	-0.85	-2.29	-0.46	-0.13	-0.51	-0.76	-2.05	-0.33	-0.94	-1.46	-0.63
VOL(2,12)	180.38	-1.04	-1.25	-0.29	-0.12	-0.34	-0.96	-1.08	-0.18	-1.11	-0.79	-0.45
VOL(3,9)	180.15	-0.91	-1.21	-0.29	-0.13	-0.34	-1.03	-1.28	-0.20	-0.79	-0.58	-0.43
VOL(3,12)	180.27	-0.98	-1.22	-0.44	-0.14	-0.48	-1.12	-1.87	-0.28	-0.84	-0.51	-0.67

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 76: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Technical Indicators

	Overall Period						Expansion Times			Recession Times		
	MSFE	R^2_{OS} (%)	MSFE Adj.	Δ (%)	SR	Δ (%, 50bp)	R^2_{OS} (%)	MSFE Adj.	Δ (%)	R^2_{OS} (%)	MSFE Adj.	Δ (%)
BRA	45.33			10.77	0.01	10.70						
MA(1,4)	45.37	-0.07	0.36	0.05	-0.02	-0.42	-1.88	-0.65	-1.34	***0.75***	0.79	1.15
MA(1,6)	46.01	-1.49	-0.77	-1.95	-0.06	-2.36	-2.24	-0.74	-2.11	-1.15	-0.46	-1.83
MA(2,4)	45.78	-0.99	-0.57	-1.12	-0.05	-1.57	-1.78	-0.90	-1.30	-0.64	-0.20	-0.98
MA(2,6)	45.68	-0.76	-0.04	-1.55	-0.01	-2.14	***2.62***	1.15	2.78	-2.30	-0.62	-4.92
MA(3,4)	45.19	***0.31***	0.68	0.64	0.00	0.16	-0.20	0.17	0.11	***0.54***	0.71	1.07
MA(3,6)	45.29	***0.10***	0.48	0.15	***0.04***	-0.59	***1.75***	0.88	2.32	-0.66	0.11	-1.57
MOM(4)	46.15	-1.80	-0.34	-2.74	-0.03	-3.38	-1.59	-0.04	-1.61	-1.90	-0.37	-3.65
MOM(6)	45.82	-1.07	-0.83	-1.10	-0.06	-1.35	-0.35	-0.07	-0.06	-1.39	-0.91	-1.91
VOL(1,4)	45.63	-0.65	0.49	1.15	***0.04***	0.25	-5.93	-0.67	-0.78	***1.77***	1.06	2.67
VOL(1,6)	45.89	-1.22	0.01	0.35	***0.01***	-0.29	-5.09	-0.97	-2.05	***0.55***	0.59	2.23
VOL(2,4)	45.66	-0.71	-0.04	0.03	-0.01	-0.43	-5.02	-1.72	-2.74	***1.25***	0.92	2.22
VOL(2,6)	45.73	-0.86	-0.31	-0.58	-0.03	-0.87	-4.15	-1.57	-3.13	***0.63***	0.79	1.42
VOL(3,4)	45.74	-0.91	-0.04	-0.28	0.00	-0.85	-3.07	-0.52	-1.18	***0.08***	0.45	0.43
VOL(3,6)	46.37	-2.28	-1.03	-1.72	-0.04	-2.07	-3.97	-0.97	-2.92	-1.50	-0.51	-0.78
MA(1,9)	46.12	-1.74	-0.82	-2.33	-0.07	-2.77	***0.34***	0.37	0.56	-2.69	-1.08	-4.59
MA(1,12)	46.57	-2.74	-1.28	-3.67	-0.12	-3.93	-1.80	-0.76	-1.60	-3.16	-1.09	-5.30
MA(2,9)	47.01	-3.71	-0.55	-5.56	-0.05	-6.28	***2.75***	1.12	2.93	-6.65	-1.05	-12.19
MA(2,12)	46.45	-2.46	-1.22	-2.57	-0.11	-2.76	-1.41	-0.70	-1.10	-2.94	-1.04	-3.71
MA(3,9)	45.55	-0.48	0.30	-0.72	***0.02***	-1.42	***0.35***	0.56	1.19	-0.85	0.08	-2.25
MA(3,12)	45.99	-1.46	-0.61	-1.60	-0.06	-1.97	-1.98	-0.87	-1.38	-1.22	-0.34	-1.79
MOM(9)	46.06	-1.60	-0.85	-1.13	-0.07	-1.30	-0.77	-0.44	-0.69	-1.98	-0.75	-1.47
MOM(12)	44.65	***1.52***	**1.46**	2.15	***0.07***	1.78	***0.82***	0.76	0.92	***1.84***	**1.25**	3.11
VOL(1,9)	45.77	-0.96	-0.71	-0.95	-0.04	-1.36	***0.08***	0.20	0.30	-1.43	-0.86	-1.91
VOL(1,12)	45.69	-0.79	-0.43	-0.48	-0.05	-0.80	-0.01	0.13	-0.06	-1.15	-0.51	-0.79
VOL(2,9)	45.84	-1.12	-0.16	-0.08	0.00	-0.36	-1.79	-0.55	-1.38	-0.81	0.03	0.95
VOL(2,12)	46.61	-2.81	-0.61	-1.43	-0.01	-1.69	-3.14	-0.25	-1.13	-2.66	-0.55	-1.68
VOL(3,9)	45.67	-0.73	-1.11	-0.60	-0.03	-0.79	-1.24	-1.14	-1.15	-0.50	-0.57	-0.16
VOL(3,12)	46.07	-1.61	-0.93	-1.10	-0.03	-1.28	-2.24	-0.78	-1.68	-1.33	-0.61	-0.65

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 77: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Technical Indicators

	Overall Period						Expansion Times			Recession Times		
	MSFE	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
HKG	42.10			0.60	0.07	0.45						
MA(1,4)	41.61	***1.17***	1.06	2.81	***0.16***	1.47	***0.82***	0.84	3.49	***1.48***	0.69	1.93
MA(1,6)	42.26	-0.38	0.44	-0.04	***0.11***	-1.01	-3.73	-0.55	-3.06	***2.66***	0.98	5.48
MA(2,4)	43.32	-2.90	-1.63	-5.39	-0.05	-6.17	-3.75	-1.25	-5.21	-2.12	-1.03	-5.88
MA(2,6)	42.86	-1.81	-1.50	-2.67	-0.01	-3.13	-2.62	-1.68	-2.51	-1.08	-0.57	-3.12
MA(3,4)	42.96	-2.04	-1.40	-3.07	-0.01	-3.86	-1.72	-0.77	-1.21	-2.32	-1.17	-6.53
MA(3,6)	42.33	-0.55	-0.02	0.11	0.07	-0.21	-2.07	-0.79	-1.45	***0.83***	0.55	2.82
MOM(4)	42.44	-0.79	-0.56	-1.29	0.04	-1.63	-1.69	-1.10	-1.90	***0.02***	0.16	-0.29
MOM(6)	41.85	***0.60***	0.82	1.21	***0.14***	0.56	-2.08	0.01	-1.63	***3.02***	1.01	6.42
VOL(1,4)	41.02	***2.57***	**1.64**	4.04	***0.17***	3.23	***0.63***	0.77	2.13	***4.33***	**1.46**	7.47
VOL(1,6)	41.43	***1.60***	1.12	4.53	***0.18***	3.78	-0.22	0.53	3.31	***3.24***	0.99	6.84
VOL(2,4)	43.19	-2.59	-2.25	-4.24	-0.04	-4.78	-3.67	-1.78	-4.92	-1.61	-1.36	-3.16
VOL(2,6)	42.15	-0.11	0.23	0.37	***0.08***	0.07	-1.68	-0.85	-0.82	***1.32***	0.77	2.40
VOL(3,4)	42.87	-1.83	-1.10	-2.82	-0.01	-3.85	-2.16	-0.85	-1.55	-1.54	-0.71	-5.28
VOL(3,6)	42.19	-0.21	0.19	0.09	0.07	-0.18	-2.53	-1.20	-1.60	***1.89***	0.99	2.98
MA(1,9)	41.83	***0.65***	0.88	1.98	***0.15***	1.35	-4.74	-0.44	-1.54	***5.54***	**1.36**	8.40
MA(1,12)	42.63	-1.24	0.12	0.14	***0.11***	-0.48	-6.48	-1.16	-2.81	***3.50***	1.03	5.53
MA(2,9)	42.14	-0.09	0.49	1.65	***0.14***	1.24	-5.19	-0.86	-2.23	***4.54***	**1.25**	8.65
MA(2,12)	42.20	-0.24	0.72	1.80	***0.15***	1.45	-9.73	-0.99	-2.57	***8.35***	**1.60**	9.69
MA(3,9)	42.04	***0.14***	0.72	1.96	***0.15***	1.62	-5.74	-0.55	-1.74	***5.48***	**1.31**	8.69
MA(3,12)	42.40	-0.70	0.46	0.77	***0.13***	0.43	-7.98	-1.06	-2.82	***5.89***	**1.36**	7.27
MOM(9)	41.98	***0.30***	0.52	0.93	***0.13***	0.65	-6.42	-1.37	-2.74	***6.39***	**1.76**	7.46
MOM(12)	42.45	-0.82	-0.17	-0.34	***0.09***	-0.50	-5.07	-1.69	-3.10	***3.04***	**1.29**	4.57
VOL(1,9)	41.56	***1.28***	1.09	2.11	***0.16***	1.33	-4.22	-0.09	-0.66	***6.26***	**1.35**	7.25
VOL(1,12)	42.15	-0.10	0.59	0.58	***0.13***	0.21	-5.97	-0.60	-1.43	***5.21***	1.15	4.32
VOL(2,9)	42.39	-0.68	-0.01	1.07	***0.10***	0.88	-5.07	-1.54	-1.84	***3.31***	1.17	6.22
VOL(2,12)	42.33	-0.54	0.12	1.51	***0.11***	1.39	-5.14	-1.28	-1.46	***3.64***	1.13	6.77
VOL(3,9)	42.31	-0.49	0.69	1.70	***0.15***	1.32	-10.04	-0.91	-1.82	***8.17***	**1.43**	8.08
VOL(3,12)	42.44	-0.81	0.11	0.95	***0.12***	0.76	-5.08	-1.03	-1.28	***3.05***	0.91	5.00

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 78: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Technical Indicators

	Overall Period						Expansion Times			Recession Times		
	MSFE	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
IND	57.92			6.70	0.07	6.63						
MA(1,4)	58.50	-1.01	-1.91	-1.07	0.03	-1.30	-1.60	-2.16	-1.52	-0.48	-0.60	-0.42
MA(1,6)	58.63	-1.23	-1.12	-1.31	0.02	-1.67	-1.74	-0.99	-1.63	-0.77	-0.56	-0.86
MA(2,4)	58.09	-0.30	-0.01	0.12	0.06	-0.24	-2.70	-1.44	-2.37	***1.86***	**1.27**	3.73
MA(2,6)	58.50	-1.01	-0.94	-1.20	0.02	-1.45	-2.19	-1.44	-2.17	***0.06***	0.20	0.18
MA(3,4)	58.34	-0.73	-0.49	-0.80	0.03	-1.20	-2.48	-1.22	-2.05	***0.84***	0.96	0.97
MA(3,6)	58.43	-0.88	-0.33	0.33	***0.07***	0.10	-2.70	-1.35	-2.12	***0.76***	0.51	3.91
MOM(4)	58.56	-1.10	-1.05	-0.90	0.03	-1.15	-1.86	-1.45	-1.73	-0.42	-0.18	0.31
MOM(6)	56.97	***1.63***	0.95	4.21	***0.19***	3.96	-2.20	-0.38	0.97	***5.08***	**1.34**	8.97
VOL(1,4)	58.43	-0.89	-1.58	-1.10	0.03	-1.30	-1.89	-2.23	-1.94	***0.01***	0.10	0.08
VOL(1,6)	57.72	***0.34***	0.63	0.73	***0.10***	0.32	***1.45***	1.14	1.45	-0.65	0.13	-0.30
VOL(2,4)	59.32	-2.43	-0.86	-3.09	-0.02	-3.85	-3.37	-0.51	-3.03	-1.59	-0.86	-3.28
VOL(2,6)	58.73	-1.40	-0.05	-0.81	***0.08***	-1.21	-1.26	-0.08	0.82	-1.53	-0.01	-3.14
VOL(3,4)	58.30	-0.66	-0.52	-0.89	0.03	-1.27	-1.86	-1.08	-2.03	***0.43***	0.62	0.72
VOL(3,6)	58.39	-0.82	-0.40	-0.38	0.04	-0.62	-3.29	-1.60	-2.91	***1.40***	0.96	3.29
MA(1,9)	58.51	-1.03	-0.31	0.29	0.06	0.14	-4.13	-1.73	-3.18	***1.76***	0.84	5.35
MA(1,12)	57.82	***0.17***	0.51	1.88	***0.13***	1.48	-2.30	-0.31	0.97	***2.39***	0.84	3.25
MA(2,9)	57.55	***0.63***	0.59	2.79	***0.15***	2.58	-2.96	-0.95	-1.14	***3.85***	**1.27**	8.54
MA(2,12)	56.63	***2.22***	1.17	4.68	***0.19***	4.37	-2.27	-0.05	2.56	***6.27***	**1.43**	7.88
MA(3,9)	57.26	***1.13***	0.77	3.63	***0.17***	3.49	-2.76	-0.67	-0.15	***4.64***	**1.31**	9.17
MA(3,12)	57.04	***1.52***	0.94	3.74	***0.17***	3.45	-1.96	-0.16	1.75	***4.65***	1.22	6.71
MOM(9)	58.30	-0.66	0.48	0.93	***0.13***	0.67	-1.20	0.24	3.20	-0.18	0.42	-2.11
MOM(12)	58.95	-1.78	0.21	0.06	***0.12***	-0.14	-1.98	0.11	2.88	-1.59	0.17	-3.73
VOL(1,9)	58.33	-0.71	-0.05	-0.52	***0.07***	-0.89	-1.02	-0.37	-0.33	-0.43	0.16	-0.79
VOL(1,12)	57.42	***0.86***	0.74	3.07	***0.16***	2.76	-2.22	-0.51	0.09	***3.63***	1.18	7.47
VOL(2,9)	57.78	***0.24***	0.65	2.84	***0.15***	2.47	-2.90	-0.33	0.88	***3.07***	1.00	5.80
VOL(2,12)	57.03	***1.53***	0.98	3.98	***0.18***	3.82	-2.05	-0.29	0.90	***4.76***	**1.35**	8.53
VOL(3,9)	58.09	-0.30	0.16	1.45	***0.11***	1.27	-3.45	-1.32	-1.89	***2.54***	1.03	6.35
VOL(3,12)	57.54	***0.65***	0.65	2.85	***0.15***	2.71	-2.59	-0.71	-0.60	***3.58***	1.19	7.92

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 79: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Technical Indicators

	Overall Period						Expansion Times			Recession Times		
	MSFE	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**	**R^2_{OS} (%)**	**MSFE Adj.**	**Δ (%)**
RUS	142.92			-0.39	0.13	-0.50						
MA(1,4)	144.35	-1.00	-1.54	-1.45	0.10	-1.62	-0.88	-1.34	-0.93	-1.26	-0.83	-2.81
MA(1,6)	146.10	-2.22	-1.31	-7.41	0.08	-7.91	-1.39	-0.67	-4.02	-4.05	-1.23	-15.56
MA(2,4)	146.59	-2.57	-1.26	-6.71	0.07	-7.38	-2.01	-0.87	-3.31	-3.80	-0.90	-15.24
MA(2,6)	146.04	-2.18	-1.64	-5.21	0.07	-5.60	-1.72	-1.17	-2.91	-3.18	-1.14	-10.94
MA(3,4)	148.93	-4.21	-1.26	-10.67	0.06	-11.69	-5.07	-1.38	-12.66	-2.31	-0.26	-7.00
MA(3,6)	147.28	-3.05	-1.67	-4.94	0.06	-5.47	-2.62	-1.59	-2.60	-4.01	-0.88	-11.01
MOM(4)	144.02	-0.77	-0.23	0.81	0.11	0.54	-1.26	-0.71	-0.87	***0.30***	0.38	4.56
MOM(6)	139.78	***2.20***	**1.44**	5.30	***0.18***	4.91	***2.82***	**1.26**	2.00	***0.84***	0.73	13.37
VOL(1,4)	144.53	-1.12	-0.95	-0.71	0.10	-1.15	-2.07	-1.56	-1.73	***0.95***	1.05	0.91
VOL(1,6)	144.61	-1.18	-1.11	-1.35	0.10	-1.77	-1.74	-1.42	-1.77	***0.04***	0.24	-0.96
VOL(2,4)	147.87	-3.46	-0.87	-10.56	0.07	-11.52	-2.53	-0.36	-6.47	-5.51	-0.93	-20.46
VOL(2,6)	149.39	-4.53	-1.48	-7.80	0.03	-8.44	-4.36	-1.26	-3.04	-4.90	-0.80	-20.39
VOL(3,4)	147.23	-3.01	-0.96	-3.43	0.08	-4.53	-3.12	-0.95	-2.13	-2.78	-0.41	-7.06
VOL(3,6)	151.69	-6.13	-0.94	-8.58	0.04	-9.38	-6.60	-0.93	-5.82	-5.11	-0.37	-16.49
MA(1,9)	142.88	***0.03***	0.56	1.02	0.12	0.75	***1.06***	0.93	1.48	-2.24	-0.20	0.33
MA(1,12)	146.43	-2.45	-1.05	-6.74	0.07	-7.15	-0.67	-0.19	0.02	-6.37	-1.07	-22.65
MA(2,9)	147.69	-3.34	-1.42	-8.37	0.04	-8.81	-1.72	-0.65	-1.30	-6.89	-1.27	-25.23
MA(2,12)	146.40	-2.43	-1.11	-6.81	0.07	-7.26	***0.02***	0.35	0.65	-7.80	-1.35	-24.12
MA(3,9)	145.90	-2.08	-0.97	-4.88	0.07	-5.30	-0.06	0.36	2.02	-6.51	-1.37	-21.23
MA(3,12)	147.48	-3.19	-1.15	-6.20	0.07	-6.63	-0.05	0.36	0.16	-10.07	-1.43	-19.87
MOM(9)	144.71	-1.25	-0.17	-0.58	0.11	-0.90	-0.76	-0.72	-1.27	-2.31	0.05	1.34
MOM(12)	146.01	-2.16	-1.28	-4.15	0.08	-4.59	-0.76	-0.70	-0.35	-5.22	-1.09	-12.52
VOL(1,9)	144.77	-1.29	-0.97	-1.92	0.10	-2.36	-0.92	-0.65	0.37	-2.12	-0.72	-7.78
VOL(1,12)	146.73	-2.66	-1.30	-4.83	0.08	-5.56	-2.55	-1.06	-3.93	-2.91	-0.73	-7.55
VOL(2,9)	144.12	-0.84	-0.07	-0.04	0.11	-0.48	-1.29	-0.33	0.71	***0.14***	0.19	-2.98
VOL(2,12)	144.67	-1.22	-0.26	-0.54	0.11	-1.08	-1.00	-0.14	1.53	-1.71	-0.21	-6.35
VOL(3,9)	143.28	-0.25	-0.03	0.59	0.12	0.33	-0.14	0.05	1.66	-0.50	-0.08	-2.41
VOL(3,12)	144.19	-0.89	0.44	0.58	***0.14***	0.03	***0.72***	1.20	7.48	-4.43	-0.23	-17.05

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 80: Out-of-Sample Forecasting Results and Portfolio Performance Measures, Technical Indicators

	Overall Period						Expansion Times			Recession Times		
	MSFE	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	**SR**	**Δ (%, 50bp)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**	R^2_{OS} **(%)**	**MSFE Adj.**	**Δ (%)**
ZAF	23.43			6.66	0.05	6.49						
MA(1,4)	23.68	-1.05	0.58	3.66	***0.16***	2.51	-10.87	-0.94	0.00	***11.07***	**1.86**	14.99
MA(1,6)	23.52	-0.38	0.31	1.26	***0.08***	0.69	-4.53	-1.13	-1.30	***4.74***	**1.64**	9.17
MA(2,4)	22.94	***2.11***	**1.31**	4.35	***0.17***	3.59	-1.09	0.24	1.64	***6.07***	**1.73**	12.72
MA(2,6)	23.11	***1.38***	1.03	3.72	***0.16***	3.13	-3.31	-0.20	0.19	***7.18***	**1.68**	14.74
MA(3,4)	23.39	***0.19***	0.55	1.62	***0.10***	0.80	-0.92	0.07	0.24	***1.55***	0.67	5.92
MA(3,6)	23.56	-0.54	0.08	0.57	***0.07***	0.19	-2.02	-0.67	-0.58	***1.28***	0.67	4.13
MOM(4)	23.74	-1.31	-0.27	0.03	***0.05***	-0.40	-3.62	-1.19	-1.38	***1.55***	0.73	4.38
MOM(6)	23.59	-0.68	-0.05	-0.33	0.05	-0.77	-1.85	-0.69	-0.64	***0.78***	0.51	0.52
VOL(1,4)	23.69	-1.11	0.18	1.83	***0.10***	-0.25	-2.98	-0.19	0.76	***1.19***	0.49	5.06
VOL(1,6)	23.18	***1.08***	0.99	2.56	***0.12***	1.71	-2.67	-0.37	-0.21	***5.70***	**2.44**	11.11
VOL(2,4)	23.37	***0.28***	0.53	1.48	***0.09***	0.44	-0.07	0.27	0.91	***0.72***	0.48	3.24
VOL(2,6)	23.32	***0.48***	0.75	1.05	***0.08***	0.64	-0.44	0.18	0.47	***1.62***	1.22	2.72
VOL(3,4)	23.58	-0.64	0.30	1.63	***0.10***	0.53	-5.50	-1.00	-1.65	***5.36***	**2.10**	11.79
VOL(3,6)	23.30	***0.57***	0.76	0.34	***0.07***	-0.12	-0.54	0.10	0.30	***1.94***	**1.30**	0.21
MA(1,9)	23.70	-1.13	-0.19	0.13	0.05	-0.30	-3.63	-1.45	-1.55	***1.96***	0.83	5.28
MA(1,12)	23.88	-1.92	-1.01	-2.23	0.00	-2.49	-1.89	-2.12	-1.06	-1.96	-0.37	-5.98
MA(2,9)	23.40	***0.15***	0.53	1.74	***0.10***	1.28	-1.42	-0.12	-0.09	***2.08***	0.79	7.43
MA(2,12)	23.80	-1.55	-0.55	-1.25	0.02	-1.52	-1.92	-1.45	-1.11	-1.08	0.00	-1.77
MA(3,9)	24.43	-4.24	-1.39	-5.23	-0.03	-5.64	-2.62	-0.76	-1.82	-6.24	-1.16	-15.93
MA(3,12)	23.98	-2.34	-1.08	-3.24	-0.02	-3.52	-2.47	-2.00	-1.69	-2.18	-0.36	-8.24
MOM(9)	23.88	-1.89	-1.02	-2.43	0.00	-2.68	-1.67	-2.10	-0.81	-2.17	-0.44	-7.59
MOM(12)	24.02	-2.50	-1.11	-3.88	-0.02	-4.15	-1.80	-1.63	-1.34	-3.36	-0.63	-11.99
VOL(1,9)	23.60	-0.73	-0.07	-0.91	0.04	-1.46	-2.24	-0.59	-0.86	***1.14***	0.70	-1.32
VOL(1,12)	23.91	-2.02	-1.12	-2.67	-0.01	-3.23	-2.55	-1.28	-1.67	-1.36	-0.39	-5.97
VOL(2,9)	23.38	***0.25***	0.61	1.18	***0.08***	0.82	-2.74	-0.54	-0.80	***3.94***	**1.84**	7.24
VOL(2,12)	23.74	-1.32	-0.60	-0.93	0.02	-1.16	-2.85	-1.48	-1.70	***0.57***	0.42	1.35
VOL(3,9)	23.39	***0.17***	0.57	2.04	***0.11***	1.75	-2.61	-0.54	-0.72	***3.61***	1.16	10.66
VOL(3,12)	23.53	-0.41	0.32	1.37	***0.09***	1.01	-3.18	-0.86	-0.98	***3.01***	0.98	8.70

Note: Bold values indicate statistical significance at conventional levels. Bold and italic values indicate that forecasting model outperforms the benchmark Historical Average model. 0.00 indicates less than 0.005 in absolute value.

APPENDIX 81: Stock Market Capitalization (Billion, USD)

Date	BEL	GRC	MYS	MEX	PRT	SPN	TWN	TUR	BRA	HKG	IND	RUS	ZAF	USA	JPN	GER
1988	58.90	4.28	23.30	13.80	7.17	91.10	120.02	1.14	32.10	74.40	23.60	N/A	126.00	2790.00	3910.00	252.00
1989	74.60	6.38	39.80	22.60	10.60	123.00	235.93	6.78	44.40	77.50	27.30	N/A	131.00	3510.00	4390.00	365.00
1990	65.40	15.20	48.60	32.70	9.20	111.00	98.93	19.10	16.40	83.40	38.60	N/A	138.00	3060.00	2920.00	355.00
1991	71.30	13.10	58.60	98.20	9.61	148.00	123.46	15.70	42.80	122.00	47.70	0.24	168.00	4090.00	3130.00	393.00
1992	64.20	9.49	94.00	139.00	9.21	99.00	100.16	9.93	45.30	172.00	65.10	0.22	104.00	4490.00	2400.00	348.00
1993	78.07	12.32	220.00	201.00	12.42	119.26	193.19	37.50	99.40	385.25	98.00	0.02	172.00	5136.20	2999.76	463.48
1994	84.10	14.92	199.00	130.00	16.25	154.86	247.18	21.60	189.00	269.51	128.00	0.15	226.00	5067.02	3719.91	470.52
1995	104.96	17.06	222.73	90.69	18.36	197.79	187.21	20.77	147.64	303.71	127.20	15.86	280.53	6857.62	3667.29	577.37
1996	119.83	24.18	307.18	106.54	24.66	242.78	273.61	30.02	216.99	449.38	122.61	37.23	241.57	8484.43	3088.85	671.00
1997	136.97	34.16	93.61	156.60	38.95	290.38	287.81	61.09	255.48	413.32	128.47	128.21	232.07	11308.78	2216.70	825.23
1998	245.66	79.99	98.56	91.75	62.95	402.18	260.02	33.65	160.89	343.39	105.19	20.60	170.25	13451.35	2495.76	1093.96
1999	184.94	204.21	145.44	154.04	66.49	431.67	375.99	112.72	227.96	609.09	184.60	72.21	262.48	16635.11	4546.94	1432.19
2000	182.48	110.84	116.93	125.20	60.68	504.22	247.60	69.66	226.15	623.40	148.06	38.92	204.95	15104.04	3157.22	1270.24
2001	165.84	86.54	120.01	126.26	46.34	468.20	292.62	47.15	186.24	506.07	110.40	76.20	139.75	13854.62	2251.81	1071.75
2002	127.56	68.74	123.87	103.14	42.85	465.00	261.21	33.96	123.81	463.08	131.01	124.20	184.62	11098.10	2126.08	691.12
2003	173.55	106.84	168.38	122.53	58.28	726.24	379.02	68.38	234.56	551.24	279.09	230.79	267.75	14266.27	3040.66	1079.03
2004	273.25	125.24	190.01	171.94	70.24	940.67	441.44	98.30	330.35	665.25	387.85	267.96	455.54	16323.73	3678.26	1194.52
2005	288.52	145.01	181.24	239.13	66.98	960.02	476.02	161.54	474.65	693.49	553.07	548.58	565.41	16970.86	4736.51	1221.25
2006	396.22	208.28	235.36	348.35	104.20	1323.09	594.66	162.40	711.10	895.25	818.88	1057.19	715.03	19425.85	4726.27	1637.83
2007	386.36	264.94	325.66	397.72	132.26	1800.10	663.72	286.57	1370.38	1162.57	1819.10	1503.01	833.55	19947.28	4453.47	2105.51
2008	167.45	90.40	187.07	232.58	68.71	946.11	356.71	117.93	589.38	1328.84	645.48	397.18	491.28	11737.65	3220.49	1107.96
2009	261.43	54.72	255.95	340.56	98.65	1297.23	658.99	225.74	1167.33	915.83	1179.24	861.42	704.82	15077.29	3377.89	1297.57
2010	269.34	72.64	410.53	454.35	82.00	1171.61	818.49	306.66	1545.57	1079.64	1615.86	1004.52	635.35	17138.98	4099.59	1429.71
2011	229.90	33.65	395.08	408.69	61.69	1030.95	635.51	201.82	1228.97	889.60	1015.37	796.38	522.97	15640.71	3540.68	1184.46
2012	300.06	44.58	476.34	525.06	65.53	995.09	735.29	308.77	1229.85	1108.13	1263.34	874.66	612.31	18668.33	3680.98	1486.31

Source: Global Financial Data

Note: N/A stands for Not Available.

APPENDIX 82: Stock Market Capitalization / Nominal Gross Domestic Product (%)

Date	BEL	GRC	MYS	MEX	POR	SPN	TWN	TUR	BRA	HKG	IND	RUS	ZAF	USA	JPN	GER
1988	37.71	5.95	67.06	6.65	13.13	25.05	98.36	0.94	9.82	122.98	7.88	N/A	136.61	53.12	129.67	20.56
1989	47.25	8.56	104.01	8.94	18.00	30.66	155.63	4.71	9.89	111.05	9.09	N/A	136.49	62.04	145.51	30.00
1990	33.08	16.49	112.06	10.96	11.76	21.33	59.97	9.44	3.53	106.86	11.82	N/A	123.22	51.17	94.08	22.95
1991	35.15	13.18	119.27	27.45	10.85	26.41	66.77	7.72	10.50	135.30	17.36	0.03	139.72	66.25	88.50	21.65
1992	28.41	8.66	158.91	33.50	8.65	16.16	45.54	4.64	11.60	162.92	22.20	0.26	79.67	68.66	62.29	16.82
1993	36.13	12.01	328.88	39.88	13.25	23.17	83.43	15.47	22.68	316.37	34.48	0.01	131.85	74.67	67.95	23.08
1994	35.68	13.59	267.18	24.65	16.55	29.99	97.82	12.34	34.58	195.90	38.44	0.05	166.40	69.33	76.69	21.86
1995	36.85	12.94	250.73	26.38	15.77	33.13	68.13	9.12	19.18	207.45	34.70	5.06	185.64	89.48	68.75	22.87
1996	43.43	17.36	304.59	26.82	20.35	39.01	95.03	12.28	25.83	278.49	30.67	9.50	167.95	104.74	65.63	27.52
1997	54.77	25.10	93.45	32.60	33.62	50.67	96.34	23.90	29.31	230.95	30.36	31.66	155.92	131.37	51.26	38.21
1998	95.98	58.48	136.56	18.28	51.16	66.89	94.51	12.48	19.06	202.68	24.53	7.60	126.85	147.99	63.76	50.15
1999	72.57	145.00	183.75	26.59	52.52	69.81	125.74	45.03	38.84	367.49	39.54	36.86	197.20	172.10	102.58	67.12
2000	78.20	86.86	124.67	18.32	51.58	86.63	75.91	26.12	35.08	363.14	31.06	14.99	154.14	146.79	66.73	67.14
2001	71.27	65.99	129.34	17.42	38.48	76.83	99.64	24.05	33.61	298.74	22.35	24.85	117.87	130.39	54.13	56.93
2002	50.28	46.47	122.83	13.91	32.28	67.52	86.75	14.61	24.47	278.38	25.01	35.99	165.79	101.07	53.41	34.32
2003	55.57	54.79	152.79	17.18	35.92	82.01	121.96	22.56	42.46	341.57	45.13	53.64	159.17	123.92	70.66	44.43
2004	75.45	54.37	152.31	22.33	37.84	89.93	129.83	25.06	49.77	393.41	53.75	45.33	207.61	132.96	79.00	43.76
2005	76.33	60.30	126.26	27.62	34.85	84.75	130.47	33.46	53.81	381.94	66.30	71.83	228.96	129.59	103.60	44.07
2006	98.97	79.51	144.62	36.05	51.59	106.92	158.01	30.68	65.28	462.58	86.28	106.79	273.77	140.18	108.48	56.37
2007	83.94	86.62	168.20	38.15	56.99	124.70	168.84	44.33	100.26	549.42	146.88	115.64	291.65	137.75	102.23	63.26
2008	32.85	26.34	80.96	21.13	27.15	59.10	89.13	16.14	35.64	606.00	52.77	23.91	179.66	79.74	66.41	30.43
2009	55.10	17.00	126.53	38.07	42.03	88.97	174.54	36.74	71.95	427.87	86.37	70.46	246.94	104.57	67.09	39.24
2010	57.06	24.64	165.84	43.24	35.75	84.44	191.14	41.92	72.12	472.21	94.58	65.87	173.99	114.58	74.60	43.19
2011	44.75	11.60	136.68	34.95	25.91	70.81	136.61	26.05	49.66	357.97	54.01	42.05	129.34	100.69	59.95	32.62
2012	62.10	17.94	156.32	44.36	30.87	75.20	154.69	39.18	54.71	421.91	67.97	43.64	160.15	114.92	61.99	43.36

Source: Global Financial Data

Note: N/A stands for Not Available.

APPENDIX 83: Total Trade Turnover of Countries with the USA (Billion, United States Dollars)

Date	BEL	GRC	MYS	MEX	POR	SPN	TWN	TUR	BRA	HKG	IND	RUS	ZAF
1988	11.61	1.18	5.83	43.89	1.44	7.42	36.84	2.83	-	-	-	-	-
1989	12.72	1.17	7.61	52.14	1.72	8.11	35.65	3.37	-	-	-	-	-
1990	14.69	1.27	8.70	58.44	1.75	8.52	34.16	3.43	-	-	-	-	-
1991	14.50	1.47	10.00	64.41	1.49	8.32	36.21	3.47	-	-	-	-	-
1992	14.25	1.27	12.66	75.80	1.69	8.54	39.85	3.84	-	-	-	-	-
1993	14.03	1.23	16.63	81.50	1.51	7.16	41.27	4.63	-	-	-	-	-
1994	17.29	1.28	20.95	100.34	1.95	8.18	43.81	4.33	-	-	-	-	-
1995	18.52	1.92	26.27	108.39	1.95	9.41	48.26	4.57	-	-	-	-	-
1996	19.31	1.33	26.38	131.09	1.98	9.78	48.37	4.63	-	-	-	-	-
1997	21.33	1.40	28.81	157.33	2.09	10.14	52.99	5.66	-	-	-	-	-
1998	22.36	1.82	27.96	173.40	2.15	10.23	51.29	6.05	25.24	23.46	11.80	9.30	6.68
1999	21.58	1.56	30.48	196.63	2.45	11.19	54.34	5.85	24.52	23.18	12.76	7.98	5.78
2000	23.86	1.81	36.51	247.28	2.56	12.04	64.91	6.76	29.17	26.03	14.35	9.75	7.30
2001	23.66	1.80	31.70	232.63	2.80	10.95	51.50	6.15	30.35	23.67	13.49	8.98	7.39
2002	23.13	1.70	34.35	232.09	2.53	11.03	50.53	6.63	28.16	21.92	15.92	9.27	6.56
2003	25.38	3.12	36.35	235.47	2.83	12.61	49.05	6.69	29.12	22.37	18.03	11.07	7.44
2004	29.32	2.79	39.03	266.63	3.29	13.89	56.21	8.30	35.05	25.14	21.68	14.85	9.12
2005	31.71	2.08	44.15	290.36	3.46	15.45	56.44	9.42	39.81	25.24	26.72	19.27	9.79
2006	35.75	2.52	48.98	331.97	4.53	17.18	60.92	10.65	45.25	25.69	31.50	24.53	11.96
2007	40.54	3.30	44.31	346.63	5.53	20.26	64.11	11.10	49.82	26.93	39.04	26.60	14.58
2008	46.21	2.93	43.69	367.16	5.10	23.28	61.25	14.60	62.75	27.98	43.39	36.12	16.44
2009	35.43	3.33	33.69	305.55	2.66	16.57	46.85	10.76	46.17	24.62	37.61	23.53	10.33
2010	41.01	1.90	39.98	393.65	3.20	18.91	61.90	14.75	59.38	30.87	48.78	31.68	13.85
2011	47.35	1.99	40.02	460.94	3.90	22.03	67.29	19.88	74.68	40.75	57.66	42.90	16.74
2012	46.81	1.79	38.77	493.50	3.71	21.32	63.21	18.81	75.93	42.92	62.62	40.08	16.22

Source: United States Census Bureau, Foreign Trade Statistics

Note: Total trade Turnover between two counterparties is calculated as the sum of annual exports and imports of goods.

APPENDIX 84: Total Trade Turnover with the USA to Total Trade Turnover of Country *i* (%)

Date	BEL	GRC	MYS	MEX	POR	SPN	TWN	TUR	BRA	HKG	IND	RUS	ZAF
1988	6.30	6.65	15.51	73.04	4.98	7.36	33.41	10.85	-	-	-	-	-
1989	6.38	4.94	16.01	72.85	5.40	7.09	30.03	12.29	-	-	-	-	-
1990	6.14	4.55	14.82	69.36	4.20	5.95	28.02	9.73	-	-	-	-	-
1991	6.06	4.86	14.08	67.80	3.49	5.49	26.01	10.02	-	-	-	-	-
1992	5.75	3.84	15.70	68.14	3.47	5.19	25.95	10.22	-	-	-	-	-
1993	5.84	4.04	17.92	67.73	3.80	5.09	25.52	10.34	-	-	-	-	-
1994	6.31	4.15	17.69	69.70	4.30	4.95	24.56	10.46	-	-	-	-	-
1995	5.52	5.20	17.33	69.75	3.45	4.60	22.42	7.97	-	-	-	-	-
1996	5.28	3.29	16.83	69.11	3.31	4.37	22.29	6.92	-	-	-	-	-
1997	6.48	4.82	18.26	69.84	3.54	4.47	22.55	7.56	-	-	-	-	-
1998	6.21	6.32	21.26	69.80	3.39	4.22	23.80	8.31	22.58	6.54	15.44	6.73	12.01
1999	5.59	4.05	20.32	68.98	3.76	4.40	23.38	8.76	24.57	6.56	15.44	6.70	10.82
2000	6.54	4.61	20.26	70.84	4.17	4.52	22.56	8.22	25.64	6.28	15.28	6.32	12.23
2001	6.41	4.67	19.58	69.50	4.38	4.07	22.41	8.46	26.01	6.05	14.39	5.58	12.85
2002	5.58	4.09	19.84	68.81	3.95	3.84	20.78	7.57	25.56	5.38	14.89	5.32	11.10
2003	5.17	5.41	20.05	68.47	3.95	3.46	18.07	5.74	23.47	4.91	13.71	5.04	9.71
2004	4.94	3.85	16.89	67.38	4.00	3.16	16.44	5.16	21.49	4.74	12.29	5.11	9.13
2005	4.84	2.73	17.29	65.15	4.04	3.23	14.84	4.95	20.29	4.29	11.02	5.05	8.60
2006	4.98	2.86	16.79	64.01	4.18	3.19	14.28	4.73	19.37	3.94	10.49	5.06	8.78
2007	4.80	3.02	13.76	60.96	4.37	3.20	13.76	4.00	17.34	3.78	10.31	4.43	9.20
2008	4.92	2.30	12.28	59.51	3.35	3.35	12.35	4.37	16.50	3.72	8.42	4.56	8.83
2009	4.87	3.42	11.99	64.22	2.29	3.24	12.39	4.43	16.11	3.70	8.91	4.57	7.56
2010	5.13	1.99	11.01	64.04	2.57	3.37	11.76	4.93	15.09	3.75	8.46	4.70	7.87
2011	5.01	1.96	9.63	64.20	2.74	3.33	11.41	5.29	15.15	4.47	7.51	4.95	7.66
2012	5.27	1.81	9.15	64.92	2.84	3.48	11.06	4.84	16.12	4.53	7.96	4.47	7.66

Source: Global Financial Data, United States Census Bureau, Foreign Trade Statistics.
Note: Total trade Turnover between two counterparties is calculated as the sum of annual exports and imports of goods.

APPENDIX 85: Total Trade Turnover of Countries with JPN (Billion, United States Dollars)

Date	BEL	GRC	MYS	MEX	POR	SPN	TWN	TUR	BRA	HKG	IND	RUS	ZAF
1988	4.16	0.79	7.39	2.52	0.71	3.58	-	0.76	-	-	-	-	-
1989	5.26	1.12	9.45	2.21	0.72	3.93	25.10	0.76	-	-	-	-	-
1990	6.34	1.24	11.56	2.91	0.83	4.52	24.34	1.36	-	-	-	-	-
1991	6.61	1.52	15.04	3.20	0.89	4.96	28.05	1.32	-	-	-	-	-
1992	5.89	1.58	15.78	4.14	1.07	5.26	30.66	1.28	-	-	-	-	-
1993	4.91	1.58	18.65	4.41	0.90	3.72	32.16	1.78	-	-	-	-	-
1994	5.43	0.90	22.92	5.18	0.90	4.28	35.01	1.15	-	-	-	-	-
1995	6.66	0.77	30.38	4.90	0.91	5.05	43.42	1.58	-	-	-	-	-
1996	6.49	1.00	29.74	5.65	0.94	4.67	41.15	1.55	-	-	-	-	-
1997	5.87	0.96	27.35	5.92	1.02	4.49	40.71	2.18	-	-	-	-	-
1998	6.42	1.00	19.19	5.86	1.18	4.72	36.32	2.16	5.78	32.37	4.10	2.98	3.54
1999	6.82	1.18	23.47	6.37	1.19	4.82	42.49	1.52	5.03	30.42	4.20	2.56	3.25
2000	7.89	0.95	30.11	8.04	1.09	4.43	55.16	1.77	5.73	36.79	3.78	3.34	3.71
2001	7.04	0.92	25.98	9.51	0.82	4.16	38.96	1.43	5.36	33.95	3.29	3.25	3.15
2002	9.31	1.00	24.70	11.48	0.77	4.14	39.73	1.60	4.68	34.22	3.69	2.76	3.48
2003	11.21	1.99	25.50	9.53	0.86	5.38	45.15	2.08	5.08	39.65	4.21	4.22	5.77
2004	13.18	1.62	29.55	12.83	0.92	7.16	57.52	2.87	5.92	46.77	4.83	7.41	7.65
2005	11.37	1.22	29.82	15.86	0.83	7.33	61.16	3.34	7.22	48.29	6.25	9.61	9.20
2006	13.32	1.68	31.58	18.42	0.83	7.54	62.58	3.48	8.11	50.04	7.23	12.47	11.15
2007	14.78	1.90	35.18	19.89	1.19	8.24	61.87	3.95	9.39	52.24	9.50	20.28	12.80
2008	14.88	1.50	41.06	19.96	1.13	7.90	64.06	4.36	13.62	53.82	10.50	29.15	13.56
2009	13.05	1.01	30.66	14.14	0.51	5.05	50.72	3.01	10.26	44.59	9.57	14.27	7.57
2010	13.39	0.78	41.51	18.44	0.64	5.36	69.92	3.57	14.82	56.19	13.09	22.75	10.83
2011	14.20	0.48	47.97	20.40	0.71	6.02	70.43	4.56	18.13	58.35	16.86	20.97	12.86
2012	14.69	0.22	47.92	22.03	0.60	5.56	66.56	3.93	16.46	58.80	19.10	31.16	10.40

Source: IMF, Global Financial Data, Eurostat, Trade, Bureau of Foreign Trade of Taiwan

Note: Total trade Turnover between two counterparties is calculated as the sum of annual exports and imports of goods.

APPENDIX 86: Total Trade Turnover with JPN to Total Trade Turnover of Country i (%)

Date	BEL	GRC	MYS	MEX	POR	SPN	TWN	TUR	BRA	HKG	IND	RUS	ZAF
1988	2.26	4.47	19.67	4.19	2.47	3.55	-	2.92	-	-	-	-	-
1989	2.64	4.74	19.89	3.09	2.27	3.43	21.14	2.78	-	-	-	-	-
1990	2.65	4.46	19.69	3.46	1.98	3.16	19.96	3.85	-	-	-	-	-
1991	2.76	5.03	21.18	3.37	2.09	3.27	20.14	3.80	-	-	-	-	-
1992	2.38	4.77	19.57	3.72	2.19	3.20	19.96	3.39	-	-	-	-	-
1993	2.04	5.18	20.10	3.66	2.27	2.65	19.89	3.97	-	-	-	-	-
1994	1.98	2.92	19.35	3.60	2.00	2.59	19.62	2.79	-	-	-	-	-
1995	1.99	2.09	20.04	3.15	1.61	2.47	20.17	2.76	-	-	-	-	-
1996	1.78	2.47	18.97	2.98	1.57	2.09	18.96	2.32	-	-	-	-	-
1997	1.78	3.29	17.34	2.63	1.72	1.98	17.32	2.92	-	-	-	-	-
1998	1.78	3.49	14.59	2.36	1.86	1.95	16.86	2.96	5.17	9.03	5.36	2.16	6.36
1999	1.77	3.07	15.65	2.23	1.82	1.90	18.28	2.27	5.04	8.61	5.08	2.15	6.08
2000	2.16	2.41	16.71	2.30	1.77	1.66	19.17	2.15	5.03	8.87	4.03	2.16	6.21
2001	1.91	2.40	16.05	2.84	1.29	1.55	16.95	1.97	4.59	8.68	3.51	2.02	5.47
2002	2.25	2.41	14.27	3.40	1.21	1.44	16.34	1.82	4.25	8.39	3.45	1.58	5.88
2003	2.29	3.45	14.07	2.77	1.21	1.48	16.63	1.79	4.10	8.70	3.20	1.92	7.53
2004	2.22	2.23	12.79	3.24	1.12	1.63	16.82	1.79	3.63	8.82	2.74	2.55	7.65
2005	1.74	1.59	11.68	3.56	0.97	1.53	16.08	1.76	3.68	8.20	2.58	2.52	8.08
2006	1.85	1.91	10.83	3.55	0.76	1.40	14.67	1.55	3.47	7.68	2.41	2.57	8.19
2007	1.75	1.74	10.92	3.50	0.94	1.30	13.28	1.42	3.27	7.33	2.51	3.38	8.08
2008	1.59	1.18	11.54	3.23	0.74	1.14	12.92	1.30	3.58	7.16	2.04	3.68	7.28
2009	1.79	1.04	10.91	2.97	0.44	0.99	13.41	1.24	3.58	6.70	2.27	2.77	5.54
2010	1.68	0.81	11.43	3.00	0.52	0.95	13.29	1.19	3.77	6.83	2.27	3.38	6.15
2011	1.50	0.48	11.54	2.84	0.50	0.91	11.94	1.21	3.68	6.40	2.20	2.42	5.89
2012	1.65	0.22	11.30	2.90	0.46	0.91	11.64	1.01	3.50	6.21	2.43	3.47	4.91

Source: IMF, Global Financial Data, Eurostat, Trade, Bureau of Foreign Trade of Taiwan
Note: Total trade Turnover between two counterparties is calculated as the sum of annual exports and imports of goods.

APPENDIX 87: Total Trade Turnover of Countries with GER (Billion, United States Dollars)

Date	BEL	GRC	MYS	MEX	POR	SPN	TWN	TUR	BRA	HKG	IND	RUS	ZAF
1988	36.57	3.86	1.37	1.78	3.98	14.64	3.784	4.19	-	-	-	-	-
1989	40.98	4.73	1.75	1.37	4.70	16.69	4.51	4.42	-	-	-	-	-
1990	44.77	5.90	2.42	2.18	6.35	22.01	4.713	6.61	-	-	-	-	-
1991	48.63	6.26	2.84	3.09	7.10	24.74	5.842	6.64	-	-	-	-	-
1992	49.07	6.88	3.32	3.22	8.10	26.46	5.898	7.41	-	-	-	-	-
1993	42.16	5.46	3.47	3.54	6.64	22.29	6.573	8.19	-	-	-	-	-
1994	47.14	5.19	4.44	3.79	7.14	23.86	6.936	7.58	-	-	-	-	-
1995	53.52	6.75	5.80	3.47	9.90	31.68	7.543	10.58	-	-	-	-	-
1996	52.95	6.30	5.73	4.13	10.35	32.87	7.17	12.64	-	-	-	-	-
1997	54.85	5.88	5.72	5.01	9.94	32.17	8.142	13.26	-	-	-	-	-
1998	56.08	6.38	4.50	6.17	10.27	34.87	8.612	12.78	8.77	10.93	4.11	11.10	5.56
1999	53.14	5.87	4.05	7.63	10.73	35.50	9.036	11.35	7.73	10.43	3.68	10.37	5.83
2000	59.80	5.19	4.90	7.88	9.35	35.08	11.55	12.38	7.39	11.83	3.65	13.13	5.84
2001	64.83	4.97	4.79	8.19	9.87	35.53	9.987	10.70	7.79	10.90	3.64	13.89	6.08
2002	67.72	4.88	5.03	7.83	10.45	39.03	9.185	12.91	7.37	10.51	4.34	14.54	6.36
2003	73.55	7.42	6.30	8.56	11.60	53.61	8.367	16.94	7.76	12.52	5.23	18.24	8.00
2004	83.70	9.01	7.46	9.55	12.64	64.48	8.977	21.26	9.61	13.23	6.25	23.87	10.61
2005	89.54	10.46	8.06	11.83	14.02	66.04	8.538	23.07	11.78	14.64	8.92	32.97	11.83
2006	99.35	11.36	9.24	13.35	15.97	71.97	9.514	24.43	12.83	15.46	11.05	42.92	13.37
2007	108.50	13.74	11.13	15.86	18.27	89.89	9.727	29.54	16.75	16.57	14.12	52.90	15.34
2008	108.08	14.78	11.36	18.87	19.96	91.73	9.578	31.64	22.08	18.94	17.28	66.44	17.02
2009	89.61	11.49	9.48	13.91	15.19	66.91	7.74	23.88	16.71	16.71	16.17	33.04	12.11
2010	97.54	9.84	12.05	15.76	17.16	68.77	11.24	29.03	21.94	17.82	17.47	42.48	15.43
2011	105.19	9.59	13.23	18.49	18.26	79.92	11.44	36.94	25.76	19.92	23.52	52.27	17.60
2012	100.96	8.18	12.86	19.35	15.46	71.11	10.76	34.52	22.90	17.44	21.91	73.30	16.34

Source: IMF, Global Financial Data, Eurostat

Note: Total trade Turnover between two counterparties is calculated as the sum of annual exports and imports of goods.

APPENDIX 88: Total Trade Turnover with GER to Total Trade Turnover of Country i (%)

Date	BEL	GRC	MYS	MEX	POR	SPN	TWN	TUR	BRA	HKG	IND	RUS	ZAF
1988	19.85	21.74	3.64	2.97	13.76	14.52	3.43	16.08	-	-	-	-	-
1989	20.55	19.95	3.68	1.91	14.75	14.59	3.80	16.13	-	-	-	-	-
1990	18.71	21.16	4.12	2.58	15.24	15.38	3.87	18.75	-	-	-	-	-
1991	20.31	20.69	4.00	3.25	16.61	16.32	4.20	19.18	-	-	-	-	-
1992	19.80	20.81	4.12	2.89	16.63	16.07	3.84	19.73	-	-	-	-	-
1993	17.54	17.94	3.74	2.94	16.72	15.85	4.06	18.28	-	-	-	-	-
1994	17.21	16.84	3.75	2.63	15.76	14.45	3.89	18.32	-	-	-	-	-
1995	15.96	18.28	3.82	2.23	17.52	15.50	3.50	18.47	-	-	-	-	-
1996	14.48	15.57	3.65	2.18	17.31	14.69	3.30	18.90	-	-	-	-	-
1997	16.67	20.27	3.62	2.22	16.84	14.17	3.46	17.73	-	-	-	-	-
1998	15.57	22.15	3.42	2.48	16.22	14.39	4.00	17.55	7.84	3.05	5.38	8.03	10.00
1999	13.78	15.26	2.70	2.68	16.47	13.95	3.89	16.99	7.75	2.95	4.46	8.71	10.92
2000	16.39	13.22	2.72	2.26	15.21	13.18	4.01	15.04	6.49	2.85	3.88	8.50	9.79
2001	17.56	12.90	2.96	2.45	15.46	13.22	4.35	14.71	6.68	2.79	3.89	8.63	10.57
2002	16.34	11.73	2.91	2.32	16.33	13.60	3.78	14.74	6.69	2.58	4.06	8.34	10.76
2003	14.99	12.86	3.47	2.49	16.21	14.71	3.08	14.53	6.26	2.75	3.97	8.31	10.44
2004	14.09	12.42	3.23	2.41	15.36	14.66	2.62	13.23	5.89	2.49	3.54	8.22	10.62
2005	13.67	13.71	3.16	2.65	16.37	13.80	2.24	12.13	6.01	2.49	3.68	8.64	10.39
2006	13.84	12.89	3.17	2.57	14.72	13.34	2.23	10.85	5.49	2.37	3.68	8.85	9.82
2007	12.85	12.58	3.46	2.79	14.43	14.18	2.09	10.65	5.83	2.33	3.73	8.81	9.68
2008	11.51	11.62	3.19	3.06	13.11	13.20	1.93	9.47	5.80	2.52	3.35	8.38	9.14
2009	12.32	11.81	3.37	2.92	13.08	13.08	2.05	9.82	5.83	2.51	3.83	6.42	8.86
2010	12.21	10.32	3.32	2.56	13.80	12.24	2.14	9.69	5.58	2.16	3.03	6.30	8.76
2011	11.13	9.46	3.18	2.58	12.85	12.09	1.94	9.83	5.23	2.18	3.07	6.04	8.06
2012	11.38	8.27	3.03	2.55	11.84	11.62	1.88	8.88	4.86	1.84	2.79	8.17	7.72

Source: IMF, Global Financial Data, Eurostat

Note: Total trade Turnover between two counterparties is calculated as the sum of annual exports and imports of goods.

APPENDIX 89: Stock Market Total Value Traded to GDP (%)

Date	BEL	GRC	MYS	MEX	POR	SPN	TUR	BRA	HKG	IND	RUS	ZAF
1988	-	-	-	-	-	-	-	-	-	-	-	-
1989	4.81	0.53	12.05	2.59	2.45	7.88	0.35	-	-	-	-	-
1990	3.84	2.24	20.03	3.29	2.50	8.27	1.86	-	-	-	-	-
1991	3.02	2.96	21.78	6.65	2.55	7.23	3.87	-	-	-	-	-
1992	3.15	1.79	27.98	10.37	3.09	6.69	4.27	-	-	-	-	-
1993	4.21	1.92	129.16	13.26	4.12	7.77	6.96	-	-	-	-	-
1994	5.06	3.41	186.71	16.65	5.09	10.32	11.40	-	-	-	-	-
1995	5.26	4.37	118.55	15.08	4.36	10.64	17.61	-	-	-	-	-
1996	7.37	5.11	123.54	10.89	4.68	24.77	19.27	-	-	-	-	-
1997	10.50	10.38	153.99	11.77	11.71	58.24	19.04	17.66	183.14	29.11	2.29	23.63
1998	16.58	24.38	99.51	9.64	27.51	95.01	18.83	20.01	209.73	34.09	3.51	35.49
1999	22.06	85.93	49.99	7.24	33.99	114.39	23.90	15.49	137.18	44.84	1.98	47.17
2000	19.27	103.73	56.90	7.04	38.04	140.05	41.60	14.58	181.49	81.55	4.12	53.66
2001	16.88	49.94	42.73	6.93	33.59	148.30	47.25	13.07	170.09	75.52	7.08	56.16
2002	15.31	21.99	24.05	5.15	18.52	138.13	29.27	9.84	122.52	42.52	8.32	61.54
2003	13.42	17.69	35.34	3.45	14.31	121.75	28.53	9.77	140.55	39.95	13.65	63.98
2004	17.61	18.80	44.12	4.26	16.55	106.32	31.86	11.80	154.81	46.62	18.34	64.79
2005	27.42	22.60	39.30	5.69	20.62	121.35	36.79	15.11	158.51	49.07	19.46	74.57
2006	36.64	32.94	36.52	6.92	27.69	141.65	39.25	19.61	179.57	55.69	34.22	95.79
2007	47.29	43.70	56.81	9.39	47.65	174.72	42.51	31.61	306.79	73.39	49.93	126.39
2008	48.62	31.15	53.27	10.10	47.55	177.08	37.79	40.94	580.04	83.21	41.47	142.82
2009	34.64	15.05	38.07	9.44	26.40	133.68	35.82	40.78	726.54	77.00	46.64	131.35
2010	24.98	15.68	34.21	9.18	16.45	103.59	46.20	38.26	667.88	64.33	50.41	101.92
2011	22.07	12.08	38.90	9.55	14.62	96.24	50.93	38.83	633.34	46.88	52.44	88.96
Average	**17.83**	**22.97**	**62.76**	**8.46**	**18.44**	**84.96**	**25.88**	**16.34**	**221.81**	**39.28**	**20.84**	**53.67**

Source: World Bank, Cihak et al. (2012).

Note: The values for TWN are not available.

APPENDIX 90: Stock Market Turnover Ratio (%)

Date	BEL	GRC	MYS	MEX	POR	SPN	TUR	BRA	HKG	IND	RUS	ZAF
1988	-	-	-	-	-	-	-	-	-	-	-	-
1989	11.87	11.12	22.20	35.87	22.37	36.12	24.42	-	-	-	-	-
1990	8.34	37.25	24.71	46.72	15.75	31.94	51.42	-	-	-	-	-
1991	9.15	18.56	20.02	51.07	29.83	31.61	60.17	-	-	-	-	-
1992	11.45	14.51	27.67	38.04	34.82	31.65	78.76	-	-	-	-	-
1993	16.20	27.05	98.88	36.79	48.04	47.49	123.14	-	-	-	-	-
1994	15.51	38.95	60.82	51.97	37.20	45.81	113.35	-	-	-	-	-
1995	15.16	37.44	35.58	41.12	23.16	32.64	288.80	-	-	-	-	-
1996	23.72	40.97	65.64	46.53	33.34	114.37	183.33	-	-	-	-	-
1997	24.62	76.42	82.67	40.39	69.15	181.54	172.82	87.79	113.08	130.01	20.29	19.33
1998	29.06	84.39	35.83	29.32	94.58	203.71	182.16	72.98	53.38	132.98	19.37	31.79
1999	28.06	137.28	39.35	29.81	64.72	182.28	140.78	53.44	51.57	197.44	7.46	35.07
2000	22.13	66.27	44.64	31.97	92.06	224.98	235.73	44.65	61.68	313.48	38.55	35.13
2001	23.80	38.69	17.57	31.59	51.54	174.25	182.47	35.90	34.52	197.05	40.35	45.24
2002	22.27	31.15	22.57	24.52	44.52	211.42	189.63	35.59	43.44	164.25	37.09	52.61
2003	25.99	40.90	34.25	21.96	39.48	146.11	194.54	34.08	48.10	136.72	45.25	38.69
2004	34.36	35.94	33.38	29.77	56.11	137.50	174.70	32.49	46.43	112.23	50.55	42.27
2005	44.38	48.27	26.28	25.42	60.76	163.93	153.09	35.34	43.30	91.92	38.66	38.80
2006	48.23	60.88	31.58	27.49	82.09	168.56	144.48	40.95	51.04	94.42	62.85	50.10
2007	62.54	61.94	52.24	31.10	117.23	183.54	131.30	54.27	90.23	81.41	57.56	56.01
2008	71.44	25.47	31.78	34.65	77.73	168.74	114.74	69.91	130.23	91.02	54.78	64.73
2009	60.96	73.98	33.70	29.04	56.05	146.76	152.94	76.35	132.71	123.28	115.89	57.41
2010	42.90	69.84	26.32	26.62	35.51	114.10	155.08	62.67	161.90	74.63	82.62	46.58
2011	41.32	44.92	31.07	25.82	48.30	125.64	172.27	66.54	157.19	57.56	122.78	63.78
Average	**30.15**	**48.79**	**39.08**	**34.24**	**53.67**	**126.29**	**148.70**	**71.84**	**68.28**	**103.94**	**75.12**	**32.06**

Source: World Bank, Cihak et al. (2012).
Note: The values for TWN are not available.

APPENDIX 91: Number of Listed Companies per 10k Population

Date	BEL	GRC	MYS	MEX	POR	SPN	TUR	BRA	HKG	IND	RUS	ZAF
1988	1878.47	1185.62	1383.56	245.66	1706.65	950.52	95.92	-	-	-	-	-
1989	1851.54	1179.44	1417.51	240.73	1819.09	1090.45	94.22	-	-	-	-	-
1990	1825.96	1427.60	1548.51	231.19	1813.04	1099.09	203.72	-	-	-	-	-
1991	1829.18	1228.51	1715.66	237.80	1805.80	1111.99	244.03	-	-	-	-	-
1992	1702.31	1243.99	1921.36	217.25	1915.76	1021.30	259.79	-	-	-	-	-
1993	1636.18	1366.39	2081.07	207.30	1833.19	959.44	268.02	-	-	-	-	-
1994	1532.29	2046.81	2365.57	220.22	1949.20	964.50	305.48	-	-	-	-	-
1995	1410.70	1993.53	2552.43	193.94	1684.88	919.08	350.29	-	-	-	-	-
1996	1368.56	2091.67	2921.00	198.56	1570.91	904.30	383.56	-	-	-	-	-
1997	1384.90	2134.27	3246.84	200.06	1466.64	970.13	427.35	321.10	10340.10	589.93	141.20	1568.68
1998	1656.37	2251.99	3292.32	192.69	1332.77	1218.50	451.82	310.97	10590.34	581.50	161.34	1594.28
1999	1681.92	2582.11	3306.25	183.74	1228.87	1798.32	457.88	277.90	10852.95	571.99	141.48	1556.26
2000	1697.35	3013.52	3394.43	172.32	1065.93	2530.85	498.62	263.03	11687.92	569.63	170.19	1400.00
2001	1516.54	3086.77	3381.30	159.48	942.39	3580.51	483.62	241.85	12763.80	546.96	161.70	1206.87
2002	1383.94	3103.52	3543.08	155.54	607.62	7227.58	442.93	222.42	14353.29	524.75	134.89	988.29
2003	2409.38	3075.25	3603.76	147.15	526.77	7672.98	430.71	201.92	14441.08	516.01	148.00	923.75
2004	2255.03	3073.67	3792.61	138.96	495.15	7664.26	442.81	194.01	14948.04	425.89	149.46	863.61
2005	2118.60	2764.78	3946.84	136.37	455.00	7604.01	445.80	204.68	14970.94	422.57	206.78	822.06
2006	1450.52	2852.41	3900.92	116.84	444.05	7568.61	457.55	208.36	14889.68	419.49	216.84	840.13
2007	1534.02	2608.83	3863.68	110.10	443.05	7794.30	459.02	232.64	14877.90	421.62	230.82	874.48
2008	1559.29	2669.73	3578.45	108.73	461.29	7761.92	450.52	225.28	17979.82	418.93	221.20	776.75
2009	1537.54	2623.47	3454.44	107.37	451.45	7482.26	442.16	194.84	18758.60	416.34	196.60	736.01
2010	1477.66	2538.14	3384.52	110.28	441.84	7184.57	467.16	191.08	19874.15	413.64	242.29	720.13
2011	1430.16	2433.63	3272.02	107.24	435.73	7019.01	495.49	185.85	20815.66	418.62	228.74	701.76
Average	**1672.02**	**2273.98**	**2952.84**	**172.48**	**1120.71**	**3920.77**	**377.44**	**282.36**	**11795.61**	**463.46**	**144.04**	**1351.34**

Source: World Bank, Cihak et al. (2012).
Note: The values for TWN are not available.