

Price and Earnings Momentum in Emerging Markets

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Abstract

This thesis aims to evaluate the price and earnings momentum trading strategies in Emerging Markets. Profitability of relative strength portfolios as well as hedge portfolios for both price and earnings momentum will be evaluated in 19 Emerging Markets between 1991 and 2007. The study checks the persistency of price and earnings momentum profits based on different evaluation periods of past performance as well as different length of holding periods. The thesis also tries to find whether price momentum returns can be explained by the loadings on Fama-French risk factors or earnings momentum, and further investigates whether illiquidity and information uncertainty can explain the abnormal price momentum returns. We find that both price and earnings momentum returns are significant in some Emerging Markets and that the Fama-French model fails to explain the momentum returns in those markets. The relationship between price and earnings momentum is positive but we cannot conclude that price momentum is subsumed by earnings momentum in Emerging Markets as in the U.S market. Finally, market frictions such as illiquidity and information asymmetry suggest a limited explanatory power to the price momentum profits in Emerging Markets.

Keywords

Post-earnings announcement drift; Price momentum; Earnings momentum; Market efficiency; Emerging Markets

Tutor: Assistant Professor Francesco Sangiorgi

Presentation: 15:15, June 14th, 2011

Venue: Stockholm School of Economics, Room 538

Discussants: Malin Petersson and Jenny Radziwolek

Acknowledgements:

We particularly appreciate our tutor, Assistant Professor Francesco Sangiorgi for his inspiration and guidance throughout the work with this thesis. We would also like to thank Assistant Professor Roméo Tédongap for his valuable suggestions on empirical methodology.

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Dictionary

Earnings momentum	Primarily refers to the abnormal returns of hedge portfolios based on revisions of earnings forecast. Common synonym: post earnings announcement drift (PEAD)
Price momentum	Primarily refers to the abnormal returns of hedge portfolios based on past returns. Common synonym: (medium term) return continuation,
Relative strength portfolio	Quantile portfolios sorted after level of past returns or past revisions of earnings forecasts. Common synonym: winner and loser portfolio, decile portfolios.
Winner portfolio	The portfolio containing stocks with the highest past returns or earnings revisions. Common synonym: winner stocks, past strong performers, P_{10}
Loser portfolio	The portfolio containing stocks with lowest past returns or earnings revisions. Common synonym: loser stocks, past poor performers, P_1
Hedge portfolio	Long-short trading strategy. Common synonym: zero cost portfolio, arbitrage, $P_{10}-P_1$, WML (price momentum hedge portfolio), PMN (earnings momentum hedge portfolio)
Efficient market hypothesis (EMH)	The theory that all value related information, public and private, has been incorporated into the asset price.
Random walk hypothesis	The theory that asset prices follows a drift and any deviation from the drift is independent and random

1. Introduction

“Seek for science. Even to China.”

- Muhammad Ibn Abdullah Ibn Adh al-Muttalib, 7th century.

China together with several other prominent economies forms what today is known as Emerging Markets. The definition of which countries should be included in this classification is varying and under debate, but regardless of composition the Emerging Markets have shown tremendous growth since the late 1980's. Previous state-controlled sectors have gone through extensive but varying liberalization measures. This has allowed the firms in some Emerging Markets to better take advantage of local resources and thereby develop into global powerhouses. The liberalization of national stock exchanges and relaxation of foreign ownership restrictions have also attracted international capital. Emerging Markets' superior rate of stock returns and low correlation with global economies have become desirable characteristics for foreign investors seeking to enhance their portfolios.

The phenomenon that the past winning companies continue to post superior performance and losing companies keep running poorly is known as *momentum*, which has been heavily researched primarily in the developed economies. The feature of momentum is highly interesting from an investor perspective. By investing in past winning stocks, alternatively selling past losers short, an investor could generate positive returns in excess of market beliefs, a clear cut way of making money on the stock market.

However, such a trading strategy implies that the capital markets are inefficient since efficient markets' participants should be fully informed and consequently all public data will have already been incorporated into the asset prices. Therefore, any trading strategy based on the past or present information should not generate “abnormal” returns. Still, momentum is one of few trading strategies that cannot be fully explained by the Fama-French three factor model (Chordia and Shivakumar 2006).

Since momentum cannot be captured by any existing risk factors such as market risk premium and size premium, there has been extensive research on alternative explanations for the persistency of momentum returns in developed economies. Many of these studies have focused on the relationship between momentum and factors implying that the markets are not frictionless in reality. Issues with liquidity and information asymmetries are examples of such

frictions in stock exchanges and these variables are especially profound in economies where the market is not separated from the government's interests. To date, despite several steps towards security market liberalization, most Emerging Markets have governments which have great influence in the economy. Here, political announcements are likely to have the same effect as "private" sector related news. Since the market participants have limited ability to incorporate information, it is very likely that the assets are not adequately priced.

Purpose & Contribution

This thesis aimed to research the momentum anomaly, including both return continuation (price momentum) and post earnings announcement drift (PEAD for short, also called: earnings momentum) in the markets that are defined as emerging. The study evaluated several different forms of portfolios for both *relative strength* (long only) portfolios as well as *hedge* (zero cost) portfolios in accordance with Jegadeesh and Titman (1993).

More precisely, within each Emerging Market we:

- i) Examined whether the past winner portfolios outperform the past loser portfolios varying the lengths of past performance and holding periods and thereby evaluated if there are significant momentum profits.
- ii) Tested if the momentum returns can be explained by Fama-French risk factors through time series regressions.
- iii) Evaluated the relationship between price and earnings momentum.
- iv) Assessed if momentum could express the fallacies of frictionless capital markets.

The main contribution of this thesis is the geographical focus since previous research has mostly been made on developed markets but only a few have conducted research on Emerging Markets such as Rouwenhorst (1999). The thesis also emphasized the local investor's perspective when implementing the momentum trading strategy, which involves limited restrictions on included stocks. Finally, this thesis tested the explanatory power of asset pricing models and market friction factors on momentum returns in each Emerging Market.

By sorting stocks based on their past stock performance and earnings revisions and holding these portfolios for different periods of time, we find that both price and earnings momentum are present in the Emerging Markets but not everywhere. Generally, 1/3 of 19 studied Emerging Markets show the price momentum and 1/2 of 19 studied Emerging Markets demonstrate earnings momentum. Through evaluating the exposures of both price and earnings

momentum profits against Fama-French three factors we find significant alphas for almost all markets demonstrating momentum which means Fama-French risk factors could not fully explain the anomaly. In addition, we examine the relationship between price and earnings momentum and test whether price momentum is subsumed by earnings momentum and not vice versa. However, we haven't found conclusive evidence that price momentum is a noisy proxy of earnings momentum in the Emerging Markets as that found in the U.S. (Chordia and Shivakumar, 2006). Since Fama-French factors cannot fully explain momentum, we wonder whether momentum is driven by some market friction factors such as illiquidity and information uncertainty. We sort price momentum hedge portfolios by market friction proxies such as bid-ask spread, turnover by share and total volatility and find that there is a linkage between price momentum and market friction proxies in some markets, however, none of the proxies has a united explanatory power on price momentum across markets.

The outline of this paper is as follows. Section 2 contains a theoretical framework about momentum and efficient market hypothesis. Section 3 reviews the previous research in price and earnings momentum. In Section 4 we propose our hypothesis. Section 5 describes the data used in this study. In section 6 we develop our methodology. Section 7 represents the empirical results of the study. Section 8 provides the conclusion and in section 9 we give suggestions on future research.

2. Theoretical Framework

The word momentum (*mōmentum*) originates from the Byzantine philosopher John Philoponus and is in turn a refinement of Aristotle's physical concept of motion (*mōtus*) which describes the power of a moving object¹. This phenomenon has been further researched and refined by great scientists like Galileo, René Descartes and Isaac Newton.

Naturally, momentum has mainly been used in the area of dynamic mechanics. However, the concept has also been noted in modern economic environments where firms with past successful operations continue to be profitable while companies with poor performance continue to disappoint. The logic behind this might seem obvious. A firm that has come up with a profitable business idea is likely to cash in on the product or service over the coming years, while a company that encounters hardships in operations can sometime expect a long term suffering from the effects. However, such information should reasonably be incorporated into the value of the firm or its stock price since shares represent claims on the firms' profits.

Efficient Market Hypothesis

- "A market in which prices always fully reflect available information is called efficient" (Eugene Fama, 1970).

As previously stated, the theory of efficient capital markets was first introduced as an academic concept by Fama (1970). The study reviews incorporation of information into security prices on three different levels. The first level is known as the weak form where all historic information has been incorporated into the asset price. Going forward, the form states that there can be no serial correlation in returns or, in less formal words, the asset prices should follow a random walk. The semi strong form of the efficient market hypothesis state that affecting information such as earnings announcements is instantly incorporated in the asset price. Thus, no trading strategy that seeks to profit from information advantage can generate excess returns. This also mitigates the possibility of profits from fundamental and technical analysis. Finally, the strong form stipulates that both public (included in weak and semi strong form) and private information are reflected in the prices. The latter statement is based on that the laws against insider trading which make it impossible to profit from trading on private information.

¹ <http://www.tutorvista.com/chemistry/momentum-gravity>

The foundation of the different forms of efficient markets do rely on a number of conditions. First, there can be no transaction costs related to trading stocks. Second, all information is homogenous i.e. available to all investors at the same time. Third, all investors agree on the impact of the new information and adjust the price accordingly. The implication of this is that investors do not over- or under-react on the information when pricing the asset. The last condition largely relies on the assumption of rationality of the investors. To summarize these three conditions, the market is frictionless.

As mentioned earlier, the EMH and the random walk in asset prices are correlated. The random walk assumption implies that the stock prices follow a drift and any deviation from the expected value should be random and unpredictable (Campbell et al, 1997). This drift is a measure of the expected return that an investor demands as a compensation for the risk associated in investing in the security. There have been numerous studies on possible risk factors that can be used to explain the expected return of a stock.

Capital Asset Pricing Model (CAPM)

The foundation of the Capital Asset Pricing Model (CAPM) was set by Markowitz (1959) when addressing the shortcomings of the martingale process for valuation of stocks, namely the risk-return tradeoff. The conclusions about the mean variance optimal portfolios was later refined and further developed by the Nobel Prize laureates Sharpe (1964) and Lintner (1965) into what is now known as the CAPM. The implication of the model is that the investor will only be compensated for the exposure to the market (the systematic risk). Any excess returns for any single or composition of assets should be explained by a higher market exposure according to this asset pricing model:

$$E(R_{i,t}) - R_{f,t} = \beta[E(R_{m,t}) - R_{f,t}] \quad (1)$$

For an asset, the expected return, $E(R_{i,t})$, in excess of the risk free rate, $R_{f,t}$, should be fully explained by the co-movement with the expected market risk premium, $E(R_{m,t}) - R_{f,t}$.

To date, the CAPM is the most widely used economic model for asset pricing (Cochrane 2005).

Fama French Three Factor Model

While CAPM is the most utilized single factor model for asset pricing it omits certain features of stocks. It was noted that portfolios containing small market value firms posted

returns that were in excess of what should be explained by their market exposure. This “size effect” was originated by Rolf Banz (1981) but came to no conclusion about the underlying reason for its existence. Fama and French (1993) tested different economic models with non-diversifiable risk factors that a rational investor might demand compensation for. In addition to the market risk premium, zero cost portfolios based on the market capitalization and the book to market value of equity ratio were added as possible asset pricing factors. By creating 25 portfolios sorted by size and book to market ratio the model successfully explained the average returns of stocks. Here successful means that the regression coefficients are significant and the intercepts (alphas) are close to zero, which implies that most of the variations in returns over time are captured by these factors. Given this, the excess return of any composition of stocks should be explained by the loadings on the included factors expressing different forms of risks.

$$E(R_{i,t}) - R_{f,t} = \beta_1[E(R_{m,t}) - R_{f,t}] + \beta_2E(SMB_t) + \beta_3E(HML_t) \quad (2)$$

The expected return of an asset in excess of the risk free rate, $E(R_{i,t}) - R_{f,t}$ should be fully explained by the expected risk premium, $E(R_{m,t}) - R_{f,t}$, the size factor returns, $E(SMB_t)$ and the value factor returns, $E(HML_t)$.

Some criticism have been raised regarding the size and value factors, since these asset pricing factors are publically available information and thereby a contradiction of the EMH. The founders however define these factors as risk factors where small firms are more exposed to economic developments and value firms (firms with low market price relative to the book value of equity) are so called “fallen angels” that have had poor profitability for some time and thereby are riskier.

Price Momentum

The price or rather the value of an asset is historically anchored in game theory - the future value of an asset in any period was expected to be equal to the present. Equivalently, conditional on any historic price, the expected value change would be equal to zero and the asset value follows a martingale stochastic process. For a long time this was considered the base of efficient asset markets where the information in the past prices is fully incorporated in the current price as well as in the future price (Campbell et al 1997).

The shortcoming of the martingale process is that it does not take risk return trade-off into account. An investor who purchases a security will demand a compensation for the associated

risks in the investment. Therefore, the expected change in value should not be equal to zero but correspondent to the required payoff given the risk exposures of the asset. Despite this, martingale has been the foundation in asset pricing of modern financial instruments such as derivatives and is the cornerstone of the random walk hypothesis.

Given that all the past related information is incorporated into the current price, the progress of the value should follow a random walk over time where any deviation in actual returns from the expected returns, ε_t , is unpredictable and independent (see Appendix II).

$$r_{t+1} = \mu + \varepsilon_{t+1} \quad (3)$$

The hypothesis is however rejected in the empirical research conducted on time series with market indices where one of the fallacies concerns the assumptions of no serial correlation in returns. The definition of serial correlation is that the return today will be related to the actual return outcome tomorrow which is a violation of the EMH in its weak form. There are several ways of examining this in time series such as variance ratio tests and autocorrelation test, which will also tell whether the serial correlation is positive or negative (see Appendix II).

There are two different possible trading strategies concerning serial correlation. As proposed by DeBondt and Thaler (1985), there is a mean reversion in stock prices in the long run due to negative serial correlation. The trading strategy based on the past long-term poor performers is known as a *contrarian* strategy. The opposite trading strategy based on the findings of positive serial correlation in the medium term (up to one year) is price momentum.

Price momentum is based on the continuation of stock returns in any direction where high returns in one period are likely to be followed by high returns in another period. The momentum strategy is to profit from serial correlation in stock markets by forming portfolios with common shares sorted on the past performance and then take positions in the “extreme” portfolios (winner and loser portfolios). The evaluation of the past performance usually includes both the relative change in the market value and the dividend yield to represent the total proceeds that attribute to the investors during the evaluated period.

$$R_{i,t} = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}} + \frac{D_{i,t}}{P_{i,t-1}} \quad (4)$$

The investor can choose two different strategies based on the return continuation: conducting a relative strength strategy by taking a long position in the past winners portfolio or conducting a zero cost strategy by paying for the long position in winner portfolio using the

proceeds from shorting the loser portfolio. If the random walk hypothesis holds, the proceeds of either strategy will be explained by the loadings on asset pricing risk factors in the market.

The source of this phenomenon is debated but research show that the return continuation accrues to the markets inability to incorporate information and will be persistent due to that the associated transaction costs will limit any arbitrage profits.

Earnings Momentum

The EMH in its semi strong form states that all public information attributing to a certain firm should be i) instantaneously incorporated into the value of the firm (the stock price) and ii) to the correct extent (Fama, 1970).

Of all information announcements that contribute to the valuation of a security, earnings is one of the most crucial signals to investors. The reason for it is quite simple since the earnings of a firm are the cash flows that accrue to the investors either directly in the form of dividends or, if reinvested, indirectly through the increase of the share price. Therefore, news about the firm's profitability should be a key driver to the pricing of the asset. Given that the semi-strong form holds, an investor cannot earn excess returns on the investments based on newly issued public information regarding profitability.

However, this has been disputed, most notably in the field of behavioral finance. Research made on this subject show that while the market do react to announcements such as quarterly earnings but not to the "correct" extent. As a consequence, the asset price seems to drift towards the "appropriate" level over time. See Figure 3 in Appendix II for illustrative examples.

This phenomenon has become known as the PEAD or earnings momentum. The under-reaction to the released information makes it possible for an individual investor to generate excess returns by trading in stocks after the announcement is made publicly. The trading strategy fundamentally relies on the belief that:

$$E(r_{t+1}|z_t = G) > E(r_{t+1}|z_t = B) \quad (5)$$

Here Z_t is the recent announcement that is either positive (G) or negative (B). The model is a violation of the EMH in its semi strong form since the expected future return conditional on any public information, good or bad, should be equal after the announcement has been made (Schleifer, 2000).

An investor who expects equation (5) to hold should conduct a trading strategy based on the nature of the news on the associated firms' earnings. Similar to the intuition behind the price momentum strategy, the profitability of earnings momentum is most likely to be notable in the assets with "extreme" announcements. Consequently, the assets should be ranked after magnitude of the revisions of earnings.

There are several ways of measuring earnings announcements. Chan et al (1996) lists some of these. The most basic measure is the standardized unexpected earnings ratio, SUE, which is based on the actual quarterly earnings announcements. However, using such data is problematic due to the low frequency and unsynchronized posting. An alternative metric measures the changes in profit expectations by market analysts. This measure is known as the earnings revisions ratio, REV, a factor that utilizes changes in the estimates of future earnings. By ranking the magnitude of the changes in earnings (either by SUE or REV) stocks can be sorted into different quantile portfolios on which an investor can trade if they expect equation (5) to hold.

An investor can use these portfolios to trade in two manners. One is to go long in the portfolio consisting of the stocks with highest relative positive earnings change (winner portfolio). The other is to conduct a zero cost hedging strategy by shorting the portfolio with the worst earnings revisions (loser portfolio) and using the proceeds to long the portfolios with the best earnings revisions.

3. Previous Research

Momentum Strategies

Most researchers address Jegadeesh and Titman (1993) as the founders of price momentum. While this study is the first to utilize zero cost portfolios, there have been previous studies on the phenomenon where stocks with past strong performance continue to post positive returns. Levy (1967) put forth a relative strength strategy using 200 stocks listed on New York Stock Exchange (NYSE) between 1960 and 1965. This trading strategy took long positions in stocks whose current prices were significantly higher than their past average. Then by rebalancing the long portfolio on a weekly basis for 26 weeks, Levy (1967) noticed superior returns of the past strong performers compared to the poor performers. Despite that these findings were disputed due to model mining and selection bias, similar trading strategies were successfully employed by market participants such as mutual funds (Jegadeesh and Titman, 1993).

Simultaneously with the Levy (1967)'s research on price momentum, Ball and Brown (1968) submitted evidence against the markets ability to incorporate information and thereby challenging the theory of efficient capital markets. The study was based on the difference in expected and announced net income of firms and its relationship with abnormal stock returns using monthly closing prices of NYSE stocks between 1946 and 1966. The research found that there was a stock price drift in the direction of the expected announcement of firms' earnings up to twelve months prior to the release of such information. This tendency later become known as the post earnings announcement drift (PEAD) or, as it is also known, earnings momentum.

Most research conducted on momentum during the late 90's and 2000's are based on the findings by Jegadeesh and Titman (1993). In this paper securities listed on the NYSE and American Stock Exchange (AMEX) between 1965 and 1989 are researched. The study tested different forms of relative strength strategies when dividing stocks into different equally weighted decile portfolios based on the ranking of the stocks' past performance. Going forward, the study registered the returns of the top decile stocks (the winner portfolio) and the returns of the bottom decile stocks (the loser portfolio). As mentioned earlier, the Jegadeesh and Titman (1993) paper was the first constructing zero cost portfolios through taking a short position in the loser portfolio and using the proceeds to long the winner portfolio. The hedge portfolio profit is the return differential in each relative strength strategy. By varying the

checking back periods and holding periods, significant positive returns were found for all zero cost portfolios except one. Jegadeesh and Titman (1993) also found that the trading strategy worked persistently during 12 months after the portfolio formation but in the subsequent two years the returns turned negative, implying a long term mean reversion. The explanation for the return continuation were however inconclusive in the paper. While the momentum strategy suggested by Jegadeesh and Titman (1993) was well received by market participants it also received criticism for data mining due to limited data availability. Jegadeesh and Titman (2001) addressed this issue by testing momentum using NYSE, AMEX and NASDAQ listed stocks between 1990 and 1998. The results showed that momentum portfolios continue to post superior returns in the new sample.

Following the findings in Jegadeesh and Titman (1993) where price momentum is most notable for the past winning stocks around the earnings announcements, Chan et al (1996) evaluate the relationship between return continuation and PEAD using several definitions of changes in earnings measures. The research does find that there is a positive correlation between earnings momentum and price momentum even though the correlation is not perfect. This is in line with the fact that there are several contributing factors that drive stock prices apart from earnings. Another similar study was conducted by Chordia and Shivakumar (2006), examining the relationship between price momentum (as defined by Jegadeesh and Titman, 1993) and earnings momentum (here defined as earnings surprises using the past six months' information and a holding period of six months). The sample was based on NYSE and AMEX listed firms between January 1972 and December 1999. The aim of the study was to evaluate whether the price momentum is subsumed by earnings momentum or is linked to macroeconomic factors such as GDP. The results suggest that price momentum is a noisy proxy for earnings momentum. In addition, Chordia and Shivakumar (2006) find that the zero cost PEAD portfolio (PMN) has predictive power of macroeconomic factors such as GDP growth, inflation and risk free rate. The study also suggests the possibility of earnings momentum as a risk factor for asset pricing but due to the negative relationship to the macroeconomic factors it should logically not be so.

International momentum studies

Rowenhorst (1998) presents a paper on continuation in stock returns outside the U.S. market. The study evaluated price momentum using an aggregate sample of 2190 public firms from twelve (developed) European markets between 1978 and 1995 following similar trading

strategies as in Jegadeesh and Titman (1993). Using top and bottom decile portfolios of past performers, the paper found that there was a significant positive momentum return of approximately 1% per month in the aggregate sample as well as in each individual market. It was also noticed that the abnormal returns were persistent against the market premium, size and book-market value ratio factors. In addition, the momentum returns were more profound in small size stocks and the past winner portfolio generally had larger market capitalization than the past loser portfolio.

Griffin et al (2003) also studied the presence of momentum in several markets. The results support previous findings of the profitability associated with investing in the past winners. The aim of the study was to evaluate the relationship between momentum returns and macroeconomic factors and thereby try to find an explanation for the phenomenon as a risk variable. The paper includes 39 countries spread over all continents between 1926 and 2000 depending on whether the data are available for each market. The study uses a six month evaluation period and six month holding period. While studying the drivers for momentum in all markets, Griffin et al (2003) cannot find a significant relationship between macroeconomic factors and the price momentum and that the profitability is robust across business cycle turns.

Emerging Markets momentum studies

Rouwenhorst (1999) studies the factors that explain the expected return of stocks in 20 Emerging Markets. The study uses 1705 listed firms in these economies between 1982 and 1997. The paper seeks to evaluate different asset pricing factors (and momentum) both on local and aggregate levels. The research aimed to evaluate the isolation of Emerging Markets i.e. to what extent these markets co-move with developed markets due to the restrictions of foreign ownership. In addition, the paper seeks to research the relationship between liquidity and the factors. The study shows that higher returns are correlated with higher market exposure, small size firms outperform large size ones and value stocks outperform growth stocks.

Working papers

There are presently a number of researches ongoing in the field of medium term return continuation. Note that these papers may be reflected upon in the thesis but will not be used to verify any findings.

Asness et al (2008) evaluate the tendency that momentum and the book to market ratio drive in returns and the relationship between the factors both within and across different markets and asset classes. The study include stocks in 18 markets, 10 exchange rate currencies, 10 different nation's government bonds and 27 different commodity types. The study shows that value-growth and momentum strategies are significantly and negatively related across asset classes. In addition, the study suggests a strong correlation between value-growth and momentum strategies and the illiquidity risk. Value stocks load positively on illiquidity risk while momentum returns load negatively on the illiquidity risk.

Leippold and Lohre (2010) are presently working on a paper concerning price and earnings momentum strategies in 17 developed equity markets (the U.S. and 16 European countries) during the period 1988-2009. The study shows results that supports previous findings in the persistency of both return continuation and PEAD and also evaluate the relationship between price and earnings momentum and the CAPM and Fama-French three factors as well as possible behavioral explanations. The paper suggests that illiquidity and information uncertainty are two key drivers for momentum. Therefore, it is implied that the phenomenon of PEAD and return continuation are explained by actual market conditions that are in violation of the EMH assumptions.

Fama and French (2011) have recently posted findings that further imply significant momentum profits in developed economies with Japan being the exception. Also, the results show that momentum tends to vary depending on market cap of firms and that the spreads between the momentum portfolio returns seemingly decrease with size. The other aim of the paper is to evaluate value and momentum as asset pricing factors both globally and locally (on market level). The findings suggest that the momentum strategy is not fully explained by the Fama-French three factor model but varies with the Fama-French factors. Momentum as a fourth factor to the Fama-French three factor does not work as an international asset pricing model but has a large explanatory power on local levels.

Alternative explanations

Sadka (2006) seeks to explain the price and earnings momentum phenomenon by linking the trading strategies to liquidity using the data from public firms listed on NYSE from January 1983 to August 2001. The paper acknowledges the previous research and the momentum return anomaly but states that this investment strategy implies frequent trading and could therefore be limited by associated trading costs. Sadka (2006) focuses on the relationship

between price impacts and momentum and finds a strong correlation. Therefore, the results show that rather than a momentum factor, an asset pricing model should include a market liquidity risk premium.

Arena et al (2008) evaluate another possible explanation for momentum, idiosyncratic volatility. They studied US stocks listed on NYSE, AMEX or NASDAQ between 1965 and 2002 in order to map the possible sources of price momentum. The study shows that the momentum strategy is not explained by factors such as size, market exposure or trading volumes but shows a strong correlation with idiosyncratic volatility. Arena et al (2008) thereby agree with the interpretation of momentum as an expression of under-reaction of announcements.

Efficient Market Hypothesis

Malkiel (2003), by the author of the famous “A random walk down Wall Street”, examines in this paper the criticism of the EMH and the predictability of stock prices. Giving support to the weak form of the hypothesis, namely the random walk of security value, the author expresses skepticism towards the research supporting predictability in returns. Even if there are anomalies in returns an investor cannot hope to generate significant profits on this trading strategy. This is due to that after the discovery of any such phenomenon the aggregate market will try to exploit it, making it hard for any single investor to earn excess returns. Malkiel (2003) takes the price momentum into account and define it as a “bandwagon effect”. When an investor see a stock move he or she will likely trade in the same direction which gives support to behavioral finance. The paper also recognizes the tendency of under-reaction to new information such as earnings momentum.

However, the paper does not support the notion that the momentum strategies will be persistent over any longer time horizons and point out that there is a reversion to the “true value” of the stock. Malkiel (2003) also emphasizes the associated high risks with large negative returns during financial turmoil which the past winners are especially exposed to. This is supported by Söderström (2008) who examines the performance of momentum portfolios which showed large negative returns in the markets that enter financial hardships such as real estate crashes and currency devaluations.

4. Hypothesis

Hypothesis 1:

- a) Given the less efficient nature of the Emerging Markets we expect to see significant momentum profits in a majority of the included economies.
- b) Conducting relative strength strategies on price and earnings momentum, the winner portfolio will generally generate larger returns than the loser portfolio for most lengths of evaluation and holding periods.
- c) The price and earnings momentum portfolios in Emerging Markets will generally generate larger returns than the correspondent momentum returns in developed markets. However, due to the general volatile nature of stock markets in Emerging Markets, the significance will likely be questionable.

Hypothesis 2:

Given previous research findings about the persistency of momentum profits over time, the shorter term momentum trading strategies are expected to generate larger returns and then weaken over time. The relative strength portfolios are in other words expected to converge. This is in line with previous results showing that after a certain amount of time, the continuation in returns will switch into a mean reversion. Equivalently, the zero cost WML and PMN portfolio excess returns are expected to decrease for longer holding horizons.

Hypothesis 3:

In line with previous research we do not expect the returns of the relative strength portfolios to be fully explained by the Fama French three factor model.

- a) There will be a significant and positive alpha for the zero cost portfolios returns.
- b) The winner portfolio will not have a notably larger exposure to the market risk premium than the loser portfolio.
- c) From previous research of momentum to be strongest in small size firms, the momentum profits are expected to be positively related with lower market cap stocks. Both the winner and loser portfolios are therefore expected to load positively however, the winner portfolio will not have a larger coefficient to the SMB factor.
- d) Using the Fama and French definition of book to market ratio, the relationship between value stocks and momentum profits are assumed to be negative. This is based

on that past winners should have higher stock prices and thereby have a low book to market ratio.

Hypothesis 4:

From previous research and the casual relationship between earnings and stock prices, we expect the two different momentum strategies to be related.

- a) Markets that show significant price momentum profits will also contain significant earnings momentum profits.
- b) The price and earnings momentum returns will be positively related and since a share price depends on earnings but not vice versa, earnings momentum will subsume price momentum.

Hypothesis 5:

Since it is implied that momentum is an expression for market inefficiency, the trading strategy is also expected to be correlated with violations of the EMH conditions.

- a) Relative strength portfolios and hedge portfolios with high levels of information uncertainty are expected to contain larger spreads in returns. Therefore, portfolios with higher levels of (total) volatility will entail larger profits. This is based on the notion of higher information uncertainty makes investors less able to price the asset adequately.
- b) Momentum profits will be positively related to illiquidity. Therefore, when sorting relative strength and the hedge portfolios on turnover by share, more liquid portfolios should show lower spreads. This is an expression for the inability of arbitrageurs to profit on the trading strategy (and thereby correct the asset prices).
- c) Momentum is assumed to have a positive relationship to transaction costs which in part is explained by the bid ask spread. The positive relationship is an explanation why the momentum profit is not arbitrated away since taking positions would imply large transaction costs. Therefore, the spread in returns for relative strength and hedge portfolios is assumed to be larger for those with higher levels of bid-ask spreads. In addition, a positive relationship would imply that momentum trading strategies that require more frequent trading will be costly.

5. Data

Definition Emerging Markets

The definition of Emerging Markets varies between different agencies. Market information providers such as FTSE (owned by Financial Times and London Stock Exchange), MSCI (Morgan Stanley Capital International) and The Economist all have different perceptions about which economies that should be included in the terminology. Generally speaking, an Emerging Market is defined as an economy that is in the process of growth and industrialization. There are several subcategories to Emerging Markets, most notably the BRICS - Brazil, Russia, India, China and South Africa.

The classification of markets is a key input in this thesis. Since the aim of this study is to evaluate the momentum strategy in Emerging Markets, it is vital to have clear selection criteria. The definition of Emerging Markets is situated in between frontier and developed economies. Generally speaking, the Emerging Markets should include countries that are not troubled by poor or non-functioning capital markets but at the same time should exclude the “fully efficient” market economies.

Given the definition, the MSCI Market Classification Framework provides adequate classification of an Emerging Market since it imposes criteria on economic development, size-liquidity and market accessibility (See Table 19 in Appendix III for full description).

The issue of reclassifications of economies is also recognized in this study. Due to the development of politics and/or economy, one country might be transferred from one list to another, either be moved in or out the Emerging Markets list. There have been some reclassifications of economies in the past, especially since 2008 (see Table 20 in Appendix III for the list of reclassified markets). However, most of them do not include Emerging Markets. Some people might argue that Israel and Argentina should also be included in the study they were just moved out of the Emerging Markets list in the most recent reclassification, however, we are mainly interested in “pure” Emerging Markets and these two economies are deemed as borderline and less likely to share the characteristics of the others. Among the presently included economies, South Korea and Taiwan are now under review and will possibly be

reclassified to developed markets quite soon². This is in line with our own assessments of these economies and therefore firms listed in these markets will not be included in the study.

In summary, following the MSCI definition and classification framework with the adjustment stated above the following 19 Emerging Markets will be researched in this study: Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Malaysia, Mexico, Morocco, Peru, Philippines, Poland, Russia, South Africa, Thailand, Turkey.

Sample Selection

For each of the included 19 Emerging Markets a sample of monthly data for publicly listed firms will be collected during the period of January 1991 to December 2007. The main data source is DataStream where the earnings forecasts revisions are provided by the I/B/E/S (Institutional Brokers' Estimate System). A common practice in economic research when studying returns and factor loadings is to only include stocks with at least 60 observations. We find this suitable given that Emerging Markets have had a great number of IPOs after 2005 whose short lifespan is ill suited for time series analysis. Therefore, we will only include stocks with price information before December 2002 (i.e. 60 months prior to December 2007).

The data include both “dead” and active companies during the studied period and therefore mitigate any survivorship bias in our findings. Here, the definition of dead companies is the firms that have been delisted due to the activities such as bankruptcy, merger or buyout. This will help reflecting an asset pricing model based on real world circumstances that an investor are exposed to when trading in stocks.

Double counting is a common problem due to that a firm might be cross listed or that a firm might have two or more types of shares representing different forms of ownership rights (e.g. *Swedish A, B & C shares*). Since we are only interested in the original representation for each firm in each market, the study will only include the primary quote and the major security for each firm.

The momentum trading strategy is based on the performance of equity after portfolio formation. For a better comparison across firms, this study will only include “pure” equity and therefore only take the returns of common shares. The means that all non-pure equity instruments (e.g. ADRs and preferred shares) will not be included in the study.

² http://www.msci.com/products/indices/market_classification.html

All stock prices will be nominated in local currency since the study primarily aims to evaluate the momentum strategies in each geographical market respectively and not to find an investment strategy for an international (global) investor or suggest momentum as an international asset pricing factor. By converting the stock prices into a common currency, the performance of stocks might exposure to the changes in exchange rates which might in turn to distort the validity of the findings.

Finally, since we will evaluate the momentum strategy from a domestic investor's perspective, we do not need to consider any political restrictions of foreign ownership in certain companies. Also, no legal restrictions against short selling will be taken into account. This might seem to be naïve assumptions since such legislations are widely practiced in less developed economies where governments represent an interest group with great influence. However, we will consider this implication when evaluating the relative strength portfolio performance and emphasize the long leg of the hedge momentum portfolio i.e. the long positions in the winner portfolio.

Data description

This study will primarily use monthly data to be consistent with previous research. Where monthly metrics are not available, we will calculate from daily data (See Table 21 in Appendix III for a full description).

Primarily, total return data will be utilized to represent all proceeds that accrue to the shareholders. This means that the performance of stocks will be based on both price movements and the dividend payouts during the evaluated time period.

To evaluate the momentum trading strategy returns against the market exposure, we will use a major equity index in each studied economy (Table 22 in Appendix III). The index should include the aggregate price development of public firms from each sector in the country. If there are missing data of market indices for part of the sample period we will not try to create our own equity index, since the construction of a market index is a highly complex issue including more than the sum of value weighted firm prices. There are many issues such as stock splits and that should be taken into account when constructing an index return for a given month. In addition, it is a question about legitimacy in the thesis. A self-made index could be questioned whether it was constructed objectively or was subject to alternations in order to be more in line with any hypothesis, e.g. CAPM.

The risk free rate in Emerging Markets has limited accessibility. In many cases, the data for any short run equivalent of the U.S. Treasury three month interest rate is difficult to obtain before 2000. A common practice in previous research is to use the U.S. Treasury interest rate as a proxy for the risk free rate for all markets when evaluating momentum in developed economies. However, this would not be satisfactory for the Emerging Markets since Emerging Markets do not share the characteristics of the developed economies with high credit worthiness and correlation between government interest rate fixings. Therefore, this thesis will only use either the interest rates for short run (three months) bills issued by the governments or any similar interest rates that can be served as a proxy when available (Table 22 in Appendix III).

The data for the size and value factors for the Fama-French three factor regression would be most preferably collected directly from any databases such as the French Data Library. However, these data are not available for Emerging Markets. Even though the French Data Library provides size and value factor data for Malaysia, it is only available up to 2001³. Therefore, we will construct the size and value factors for each Emerging Market based on the monthly stock return data in the sample. To calculate the size factor, SMB, each firm's average monthly price and the number of shares will be collected. To compute the value factor, HML, in addition to the market value of equity (which is equal to the market capitalization), the provided book value of equity will be collected for each company.

Illiquidity is measured by both turnover by share and the bid ask spread. Information uncertainty will be approximated by total volatility (Leippold and Lohre 2010). Following Lesmond et al. (2004), the monthly bid-ask spread ratio is calculated by the following formula from the daily data for each security's bid and ask prices.

$$SPR_{i,t} = \frac{1}{D} \sum_{n=1}^{n=D} \frac{Ask_{i,t,n} - Bid_{i,t,n}}{(Ask_{i,t,n} + Bid_{i,t,n})/2} \quad (6)$$

Where $Ask_{i,t,n}$ is the ask price for stock i in the n^{th} day of month t , $Bid_{i,t,n}$ is the bid price for stock i on the n^{th} day of month t , D is the number of days in month t .

The time series monthly data of turnover by share for each stock in each market will be collected directly from DataStream. Following Tsay (2005) the monthly (total) volatility for each stock will be calculated from the daily stock price in each month t as shown by the following formulas:

³ http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#HistBenchmarks

$$\hat{\sigma}_{i,t} = \sqrt{\frac{D}{D-1} \sum_{n=1}^D (r_{i,t,n} - \bar{r}_{i,t})^2} \quad (7)$$

Where

$$r_{i,t,n} = \ln \left(\frac{P_{i,t,n}}{P_{i,t,n-1}} \right) \quad (8)$$

is the return for stock i on the n^{th} day of month t . $P_{i,t,n}$ is the price for stock i on the n^{th} day of month t and

$$\bar{r}_{i,t} = \frac{1}{D} \sum_{n=1}^D r_{i,t,n} \quad (9)$$

is the average return for stock i in month t .

Data Biases

There are many issues on searching for patterns and relationships between variables in any form of data sample. Therefore, when evaluating a trading strategy such as momentum it is important to verify that the findings are independent of previous research and not spurious and consequently a number of data issues must be addressed.

Data Mining

When studying a data base it is possible to find a pattern that might be strong in a specific sample but could also be spurious. Economic literature and previous research stress the importance of performing tests based on the existing theory.

This thesis and previous research address this issue by conducting tests on momentum as an expression for the markets inability to incorporate information instantaneously and to the extent demonstrated by the EMH. The Fama-French three factor model which momentum profits will be evaluated against is also well anchored in economic theory. Finally, the EMH breaking variables such as illiquidity have previously been proposed as risk factors that investors will demand compensation for. Finally, to validate the momentum findings, the strategies will be evaluated in a sample covering the most recent recession period from January 2008 to December 2010.

Data Snooping

When evaluating models suggested by previous research, the same data sample should not be used since any biases such as data mining might spillover to this study. There is plenty of research about momentum after Jegadeesh and Titman (1993)'s publication. Most studies

have involved total returns from developed markets data (Chordia and Shivakumar 2006, Rowenhorst 1998). There are few scholars investigated momentum trading strategies in Emerging Markets but they mainly use time series data prior to 2000 (Rowenhorst 1999, Griffin et al 2003). In addition, the included countries and restrictions of included data in other studies differ from the selection used in this thesis.

Model Mining

When searching for patterns in returns a common attempt is to test several different forms of models to find a significant relationship between variables. As stated earlier, the first published study on the relative strength trading strategy, Levy (1967) was criticized for testing 68 different forms of trading rules before proposing the one that was published.

This is not seen as an issue in this thesis since the purpose is to test existing strategies and possible explanatory models but on a different dataset.

Survivorship bias

When choosing a sample of observations, it is common to only include those who are active at the time of the research. This is known as survivorship bias. By excluding firms that have been delisted from stock exchanges for the reasons such as bankruptcy or acquisitions the sample will be based on an environment that is different from the one an investor is exposed to when conducting trading strategies. Therefore, as stated in the Sample Selection part, this thesis will include all securities that are listed on public stock exchanges during the sample time period including dead and de-listed stocks.

Selection bias

A common caveat in economic research is to impose certain criteria on included variables in a data sample. For example Jegadeesh and Titman (2001) excludes stock with a price below \$5 at the beginning of the holding period and all the stocks in the lowest market capitalization decile. The underlying reason for enacting such selection restrictions is to exclude observations (returns) driven by illiquidity.

This thesis will not enforce such criteria on the observations in the data sample for a number of reasons. Most of all, the sampling should be random in order to better represent the population. Previous findings such as Levy (1967) have been disputed due to accusations that the selection of stocks has been conducted for the model to work (Jegadeesh and Titman

1993). Also, the exclusion of stocks with a share price below \$5 is hazardous in Emerging Markets for two additional reasons. First, it would potentially drop firms that have large market values but low price due to the larger numbers of outstanding shares. Second, the Emerging Markets stock exchanges are volatile and consequently the share price of a firm can temporarily be driven down below the \$5 limit. Even though it might be proper to exclude small capitalization firms to isolate the price driving effect of under-reaction to information, it is not appropriate when researching the possible explanatory for the abnormality.

6. Methodology

When conducting the research on momentum, this thesis takes inspiration from previous research but maintains a focus on a realistic investment environment for an individual or institutional investor. However, non-economic circumstances such as legal restrictions will not be dealt with.

A standard methodological problem is the presence of extreme values in a sample which is also a concern in this thesis due to the nature of Emerging Markets data. In such economies, drastic changes in asset value are common and the extreme values are not necessarily the product of data inconsistencies. Therefore, restatements or adjustments of the data will be kept at a minimum level.

The thesis will primarily focus on the price momentum trading strategy. This is due to a number of reasons. First, the data availability is far better for total returns (the evaluated variable for price momentum) compared to earnings forecasts. Second, the focus on price momentum will be better to link to previous research.

Momentum portfolio creation

This study will follow the Jegadeesh and Titman (1993) paper in portfolio formation but differ from previous research in the holding strategy. As shown in Figure 5 and Table 18 in Appendix II, the previous research adopted the strategy that $1/K$ of the portfolio stocks will be exchanged in each $(t + K)$ month, given the length of the holding period (K) (which is equal to the total amount of the momentum portfolios). The returns of all (K) overlapping portfolios are measured in each month (t). However, this thesis will form the relative strength and zero cost portfolios at the start of each holding period and no new portfolios will be formed until the positions are closed out after K months. This “buy and hold” strategy is conducted in order to be more in line with an investor’s perspective. The profitability will be evaluated in each holding month for both the relative strength portfolios and the zero cost portfolio as in previous research.

This thesis will measure the past performance of the relative strength portfolios following Jegadeesh and Titman (1993)’s methodology but limits the number of checking back periods to two – the six and twelve month lengths. The six month period is most commonly used in previous research due to its higher significance level of the results. The twelve month period

has also been used in studies such as Fama and French (1996) and is the implied the total length of medium term positive serial correlation.

When measuring the past performance for price momentum we will not include the most recent month's $(t - 1)$ returns due to the noted tendency of short term negative serial correlation i.e. a contrarian effect in returns as suggested by Asness et al (2008). To include the most recent month would reduce past performance and should therefore not be measured when ranking the securities for momentum trading strategies (Figure 4, Appendix II).

For price momentum strategy, the past performance for each stock in each market is calculated by the cumulative logarithm returns composed of both the price development and the dividend yield during the checking back period.

$$Ret_{i,6} = \sum_{t=-6}^{t=-2} r_{i,t} \quad (10)$$

Where

$$r_{i,t} = \ln(1 + R_{i,t}) \quad (11)$$

$$R_{i,t} = \frac{P_{i,t} + D_{i,t}}{P_{i,t-1}} - 1 \quad (12)$$

$P_{i,t}$ is the price of stock i in month t , $D_{i,t}$ is the dividend yield of stock i in month t .

In the thesis, all the return measures are in natural logarithm format for the purpose of testing assets' linear relationship with factors such as the market risk premium in the later steps.

There are several ways of measuring the announcements of earnings' changes. In this thesis, we utilize the earnings revisions ratio, REV , due to the reason that the low frequency of the actual earnings announcements make factors such as SUE quite stale and not suitable from an empirical point of view as described in the Theoretical Framework section. In addition, since firms do not report quarterly earnings simultaneously, the work with locating the right data for the measure when creating PEAD portfolios would be unrealistically heavy given the relatively large sample of observations. We do however recognize the concerns with using analysts' forecasts on earnings since these might be driven by other incentives rather than to accurately forecast the earnings (Chan et al 1999).

According to Chan et al (1996), REV is calculated as the sum of monthly earnings revisions during the evaluated time period.

$$REV_{i,t} = \sum_{t=-6}^{t=-1} \frac{f_{i,t} - f_{i,t-1}}{p_{i,t-1}} \quad (13)$$

$p_{i,t-1}$ stands for the last trading day's posted price of the security in previous month. $f_{i,t}$ stands for the mean of 12 months earnings forecasts made by analysts covering the security which could be collected from the Thomson Financial I/B/E/S estimates database⁴. The monthly revisions of earnings expectations are divided by the previous month's stock price. The ratio works as a smoothing mechanism to better represent the past performance of one firm relative to others.

In each month when the momentum portfolio is closed and reformed, we rank all firms according to their historical performance in the checking back period and categorized them into decile portfolios where a top decile (winner) portfolio, P_{10} , a bottom decile (loser) portfolio, P_1 and finally a zero cost portfolio, $P_{10}-P_1$ will be formed. All the decile portfolios will be equally weighted since we wish to avoid size biases as has been done in previous research.

We put a constraint on the minimum number of measured stock returns to ten in each month for all evaluated markets. The purpose is to avoid biases when forming portfolios since the momentum strategy is to utilize decile portfolios to capture excess profits.

In order to evaluate the persistency of the momentum phenomenon, we will test the returns of momentum portfolios holding for different investment horizons: one month, six months and twelve months ($K=1,6,12$). For each strategy with different checking back and holding period, the monthly return will be recorded in each month t but the positions will be kept constant until the portfolio is rebalanced after K months. This is thereby a buy and hold strategy that is evaluated in each month (t) and is in line with an investor perspective who might not realistically be able to conduct the same trading strategy every month. In this thesis, we will refer the strategy that selects stocks on the basis of returns or earnings revisions over the past J months and holds them for K months as a J_K strategy.

The average return of the relative strength portfolios will be measured for each Emerging Market and the zero cost portfolios for both price and earnings momentum, $P_{10}-P_1$ (WML and PMN) will be tested whether they are significantly positive.

⁴ <http://www.rimes.com/Default.aspx?xml=mainmenu.xml&node=2.6.3>

Time series regression analysis

If Emerging Markets also present momentum phenomenon as in developed economies, we are interested what will be the drivers for it. Therefore, time series regressions will be conducted on Fama and French (1993) three factor model to test whether the payoffs of momentum portfolios are merely an expression of other factors representing the risks that the investor demands compensation for. Since Chordia and Shivakumar (2006) found that price momentum is subsumed by earnings momentum and price momentum is a noisy proxy of earnings momentum based on the study of U.S. data, we would like to see whether Emerging Markets will show the same story. For the markets where Fama and French factors cannot capture the abnormal return of the momentum, we will run the time series regression of the payoffs to the price momentum portfolios on a four factor model by adding the earnings momentum based factor (PMN) into the Fama-French three factor model. The purpose is to investigate the drivers for price momentum and study the relationship between price and earnings momentum. Research by Amihud (2002) and Arena et al (2008) have also linked momentum profits to illiquidity and information uncertainty. This thesis will also study the explanatory power of those market friction factors on the price momentum returns.

Fama French Three Factor Model

For the markets showing significant momentum profits, we are interested whether the returns are due to the loading on risk factors. We are going to regress the returns of each decile portfolio and the hedge portfolio on the Fama-French three factor model to see whether momentum could be explained by the market risk premium, size and the book to market ratio. The SMB (small minus big) and HML (high minus low) factors for each market are computed following Fama-French's six portfolio formation method. For each market, we sort all stocks into two groups (small and big) according to their market capitalization. Then the stocks in each group are categorized into three different levels (high, medium, low) of the book to market value ratio (B/M). As a result, six portfolios categorized by size and B/M ratio are formed as shown in Figure 1. Then we will compute the SMB and HML factors by formulas (14)-(15), according to Fama and French (1993)'s definitions⁵.

⁵ http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/six_portfolios.html

Figure 1: Detail for 6 Portfolios Formed on Size and Book-to-Market

		33%	34%	33%
	B/M Size	H	M	L
	S	Small Value	Small Neutral	Small Growth
50%	B	Big Value	Big Neutral	Big Growth

$$SMB = \frac{1}{3}[SM + SH + SL] - \frac{1}{3}[BH + BM + BL] \quad (14)$$

$$HML = \frac{1}{2}[SH + BH] - \frac{1}{2}[SL + BL] \quad (15)$$

The returns of the winner, loser and hedging portfolios will be regressed against the market risk premium, SMB and HML factors for the available data in the time period between Jan. 1991 and Dec. 2007 for each market.

$$R_{Win,t} - R_{f,t} = \alpha + \beta_1[R_{m,t} - R_{f,t}] + \beta_2SMB_t + \beta_3HML_t + \varepsilon_t \quad (16)$$

$$R_{Los,t} - R_{f,t} = \alpha + \beta_1[R_{m,t} - R_{f,t}] + \beta_2SMB_t + \beta_3HML_t + \varepsilon_t \quad (17)$$

$$R_{Win,t} - R_{Los,t} = \alpha + \beta_1[R_{m,t} - R_{f,t}] + \beta_2SMB_t + \beta_3HML_t + \varepsilon_t \quad (18)$$

If the momentum strategy holds the winner portfolio should generate a relative bigger alpha than the loser portfolio and the zero cost strategy would consequently generate a significantly positive alpha.

The relationship between WML and PMN

Previous research has investigated the relationship between price and earnings momentum (Chan et al. 1996, Hong et al. 2003, Chordia and Shivakumar 2006). Chan et al. (1996) has tested whether individual stock earnings surprises subsumes the predictability of future returns based on past return in a cross-sectional approach. Chordia and Shivakumar (2006) extended their research and found strong explanatory power of earnings momentum on price momentum. However, the payoffs to the PMN portfolios are not subsumed by the price momentum factor of Carhart (1997). This thesis will follow Chordia and Shivakumar

(2006)'s methodology and extend the study of relationship between price and earnings momentum into Emerging Markets.

To be specific, for each market presenting price momentum, we will run a time series regression of the relative strength decile portfolios and the hedge strategy on the Fama and French (1993) three factors and the PMN. We will check whether PMN could drive out the abnormal returns of the price momentum portfolios by comparing the value and significance level of the alphas between the Fama and French (1993) three factor model and the four factor model with PMN.

$$R_{Win,t} - Rf_t = \alpha + \beta_1[R_{m,t} - Rf_t] + \beta_2SMB_t + \beta_3HML_t + \beta_4PMN_t + \varepsilon_t \quad (19)$$

$$R_{Los,t} - Rf_t = \alpha + \beta_1[R_{m,t} - Rf_t] + \beta_2SMB_t + \beta_3HML_t + \beta_4PMN_t + \varepsilon_t \quad (20)$$

$$R_{WML,t} = \alpha + \beta_1[R_{m,t} - Rf_t] + \beta_2SMB_t + \beta_3HML_t + \beta_4PMN_t + \varepsilon_t \quad (21)$$

In order to verify whether earnings momentum subsumes price momentum in Emerging Markets, we are also going to run the regression of all decile portfolios sorted by past performance on the three Fama-French factors and the earnings-based factor PMN, and check whether the alphas are jointly equal to zero through the GRS test.

In this study, we will also check whether the price momentum effect (as measured by the portfolio WML) would capture the payoffs of the earnings momentum portfolios or not in the Emerging Markets. Earnings momentum relative strength and hedge strategy portfolios are regressed on the Fama-French factors and the price momentum-based factor WML. We will also run the regression of all decile portfolios sorted by past earnings revisions on the Fama-French factors and WML and check whether the alphas are jointly equal to zero through the GRS test. If the value and significance level of alphas of those regressions will not decrease, it suggests that the payoffs to PMN portfolios are not subsumed by Fama-French factors or the momentum factor of Carhart (1997) in the Emerging Market, which is consistent with the findings by Chordia and Shivakumar (2006) in the U.S.

$$R_{Win,t} - Rf_t = \alpha + \beta_1[R_{m,t} - Rf_t] + \beta_2SMB_t + \beta_3HML_t + \beta_4WML_t + \varepsilon_t \quad (22)$$

$$R_{Los,t} - Rf_t = \alpha + \beta_1[R_{m,t} - Rf_t] + \beta_2SMB_t + \beta_3HML_t + \beta_4WML_t + \varepsilon_t \quad (23)$$

$$R_{PMN,t} = \alpha + \beta_1[R_{m,t} - Rf_t] + \beta_2SMB_t + \beta_3HML_t + \beta_4WML_t + \varepsilon_t \quad (24)$$

The relationship between momentum and market friction factors

The momentum phenomenon has proven itself resistant against the Fama-French three factor model in several previous studies, most notably by the originators of the model in Fama and French (1996). In fact, the researchers suggest for further research to evaluate an asset pricing risk factor capturing the continuation of stock returns.

From an investor perspective, however, it is likely that the phenomenon is allowed to exist for the reasons omitted by the existing economic models that describe the risk-return trade off according to the EMH. The conditions are as stated previously, i) no transaction costs ii) homogenous information and iii) agreement of impact on price. The explanation for momentum might therefore be the factors breaking these conditions, namely information uncertainty and illiquidity.

Previous research has found the linkage between momentum and illiquidity and information uncertainty. Leippold and Lohre (2010) tried to establish a behavioral-based explanation of the momentum anomaly by analyzing the interaction of momentum with measures of information uncertainty and illiquidity risks. They found empirical evidence based on the U.S. and European data that momentum profits to be more pronounced for portfolios characterized by higher information uncertainty and illiquidity which are crucial drivers in governing the momentum effects.

However, in the Rouwenhorst (1999) study on the cross-section of returns in twenty Emerging Markets, he found only a weak linkage between turnover variation and the expected returns of momentum portfolios. He also found that the average median turnover of the loser portfolios is lower than the turnover of the stocks in the winner portfolios in 18 out of 20 studied countries and both winners and losers are more volatile than average stocks.

This thesis will investigate the relationship between momentum portfolios returns and bid-ask spread ratio, share turnover and volatility (proxies for illiquidity and information uncertainty) following Leippold and Lohre (2010)'s methodology. For each market demonstrate price momentum profits, we will sort all the stocks according to their past performance, and then sort each decile portfolio into three terciles (High, Medium, Low) based on one of the illiquidity and information uncertainty proxies: Spread ratio or volatility or share turnover (See Figure2). Then we will compare the returns of hedge (WML) portfolios with different

ranking levels of the proxy factors and try to explore any patterns of the relationship between momentum portfolios returns and illiquidity and information uncertainty.

$$WML_{H,\lambda} = P10_{H,\lambda} - P1_{H,\lambda} \quad (25)$$

$$WML_{L,\lambda} = P10_{L,\lambda} - P1_{L,\lambda} \quad (26)$$

Where H is high level, L is low level for each factor λ . Given that there is a relationship between the factor and price momentum, there should be a return differential or a spread between the high spread ratio/share turnover/volatility and low spread ratio/share turnover/volatility hedge portfolios.

Figure 2: Categorization of relative strength price momentum portfolios according to different levels (High, Medium and Low) of Spread Ratio, Volatility and Turnover by Share

Factor \ Relative Strength	P1	P2	...	P10
H	$P1_{H,\lambda}$			$P10_{H,\lambda}$
M				
L	$P1_{L,\lambda}$			$P10_{L,\lambda}$

Robustness check

When testing the explanatory power of asset pricing model on the momentum trading strategy this will be done through time series analysis using ordinary least squares (OLS) linear regressions., a number of conditions must be satisfied: (1) A linear relationship exists between the dependent and independent variables; (2) The independent variable is uncorrelated with the residual term; (3) The expected value of the residual term is zero; (4) There is a constant variance of the residual term (5) The residual terms is independently distributed, which means there is no autocorrelation in the residual terms; (6) The residual term is normally distributed.

To make sure the regression results are unbiased, we are going to check the robustness of the time series regression models.

First, we will test the unit roots of all the dependent and independent variables through Dickey-Fuller approach (Dickey and Fuller 1979) to check whether they are all stationary. In case both dependent and independent variables are mutually non-stationary, we can test whether the dependent variable and independent variables are co-integrated. If it is, we can still run the time series regressions. However, if either the independent or dependent variable is stationary while the other is not, then no time series regression results will be reliable.

Second, the OLS linear regressions need tests on serial correlation of the residuals. There are several ways of evaluating autocorrelation but this thesis utilizes the Breusch-Godfrey test (Breusch 1979) since it has less restrictions and can check higher order serial correlation compared with the Durbin-Watson method. Also, heteroscedasticity of time series models will be checked through the White's general test (White 1980), since the method works better for non-linear forms of heteroscedasticity and under the situations that the errors are not normally distributed. In addition, the normality of the error terms in the models will be tested. Multicollinearity of the independent variables in time series regressions might also cause the unreliability of the regression results. We are going to test multicollinearity of all the time series models in this study through the Variance Inflation Factor (VIF) approach in STATA. However, the concern regarding the linearity of time series variables is not an issue in this study because of the employment of the natural logarithms forms of returns.

The results of the robustness test are shown as follows:

The Dickey-Fuller tests reject the null hypothesis of unit roots for all dependent and independent variables in each Emerging Market at a 5% significance level. We are therefore comfortable running time series regressions on since all the included variables are stationary (Table 13, Appendix I).

However, heteroscedasticity is a common problem for all the time series regression models in this study. The White's general test rejects the null hypothesis of constant variance / homoscedasticity of the time series regressions in many of the researched Emerging markets (Table 14, Appendix I). We will therefore correct the standard errors with the robust standard error option in STATA.

Testing for autocorrelation using the Breusch-Godfrey method, there are a few markets showing serial correlation in the residuals of time series regressions (Table 14, Appendix I).

The Newey-West approach (Newey and West, 1987) will be conducted to correct autocorrelation (this method also corrects for heteroscedasticity).

The Shapiro-Wilk test on normally distributed residuals rejects the null hypothesis in many of Emerging Market time series regressions at the 5% level (Table 14, Appendix I). This is no surprise since most models demonstrate heteroscedasticity which distorts the normal distribution. We will correct the error terms through the robust standard error option in STATA.

Finally, the multicollinearity is not an issue for all the time series models since all VIF statistics shown in Table 15, Appendix I are smaller than the critical value of 5.0.

7. Results

Price and earnings momentum strategies

Figure 6 shows a summary of price and earnings momentum monthly returns. The price momentum strategy generates significantly positive returns in approximately one third of the studied Emerging Markets. Among different portfolio formations, the 6_6 formation shows the strongest hedge portfolio returns, which is consistent with previous research such as Chordia and Shivakumar (2006). For the 6_6 hedge portfolios, seven out of 19 Emerging Markets show significantly positive profits.

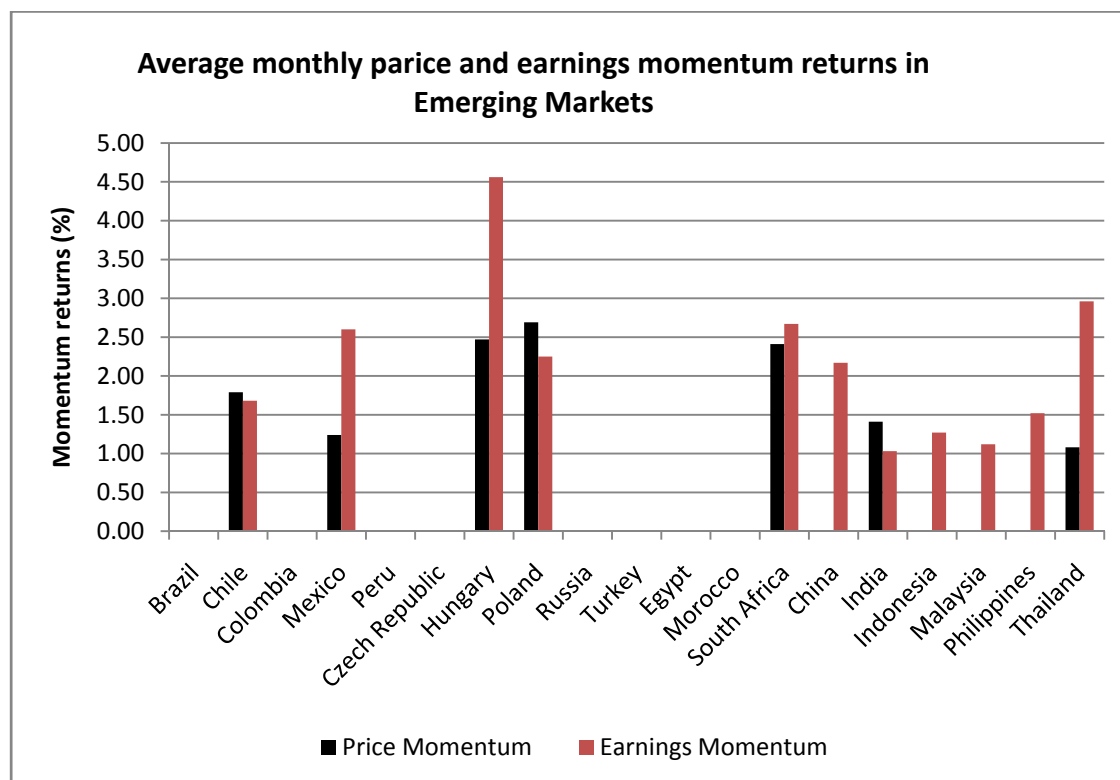
When segmenting the 19 markets into the regions (South America, East Europe, Africa and Asia), there is no notable difference in the percentage of the number of countries that demonstrate significant profits for the 6_6 hedge strategy. This suggests that momentum is not a phenomenon contained to any geographical area as suggested by Söderström (2008).

Moreover, the results in Table1 (Appendix I) demonstrate that an investor conducting a 6_6 formation price momentum trading strategy will in all cases but one not generate returns below zero in Emerging Markets. Studying the outcomes for average WML returns for all formations, there are very few markets that have significant and negative profits. However, only Turkey seems to demonstrate a medium term reversal in most portfolio formations which suggests profitable contrarian strategies in this specific market.

Of the seven economies with significant momentum profits, four markets have a winner portfolio with significant positive returns for the 6_6 formation. This implies that it is the strong performance of the past winners that drive price momentum. From an investor's point of view, this is highly important since the investor can have better performance from only going long in the past winner portfolio if the Emerging Market imposes restrictions or has high transaction costs on short selling. In addition, most of the seven Emerging Markets that show price momentum profits for 6_6 formation also demonstrate momentum profits for the other formations which confirm that the price momentum returns are not coincidental in those markets. What is more, there is a tendency of momentum return convergence over time in the seven markets displaying significant momentum profits. This is notable in almost all markets with significant winner portfolio returns which are smaller for the longer holding periods. Also, the hedge profits approach zero over longer investment horizons (Figure 9).

Figure 6: Average monthly price and earnings momentum returns between Jan. 1991 and Dec. 2007 in Emerging Markets

This figure shows the average monthly price and earnings momentum profits for the hedge portfolios calculated based on the sample period between Jan. 1991 and Dec. 2007 in Emerging Markets. The price momentum portfolios are formed following 6_6 (6 months checking back and holding for 6 months) strategy which shows most frequent momentum profits across different formations. The seven emerging economies demonstrating significant price momentum are Chile, Mexico, Hungary, Poland, South Africa, India and Thailand. The average monthly price momentum returns in those countries are between 1.1% and 2.7%, and all significant at 5% level. The earnings momentum portfolios are formed as 6_1 (6 months checking back and holding for 1 month) strategy which demonstrates most frequent momentum profits across different formations. The 11 emerging economies demonstrating significant earnings momentum are Chile, Mexico, Hungary, Poland, South Africa, China, India, Indonesia, Malaysia, Philippines and Thailand. The average monthly earnings momentum returns in those countries are between 1.0% and 4.6%. The momentum profits in most of the 11 countries are significant at 5% level except for Poland and Philippines which are significant at 10% level. Generally price and earnings momentum co-exist in Emerging Markets.



When studying the earnings momentum results in Table 1, about half of the 19 markets show significant and positive hedge (PMN) returns. To contrast the price momentum, the 6_1 portfolio formation posts the strongest performance across different formations where 11 out

of 19 Emerging Markets demonstrate significantly positive hedge returns for this formation. Regionally, Asia shows earnings momentum in each market for the 6_1 as well as other formations which is in contrast to the low number of markets that exhibit return continuation in this area. Compared to price momentum, earnings momentum showed some similar characteristics in terms of winner portfolio driving the hedge portfolio returns but not as frequent. Also, the earnings momentum seems to diminish over longer horizons and thereby suggest the idea of mean reversion (Figure 10).

To interpret the difference in optimal formations, where both momentum strategies work best with a six month checking back period but have different holding horizons, since the information regarding price on a stock is given continuously, the investors will not react as strongly as to any sudden shock in earnings announcements which are much less frequent. Therefore, the earnings momentum effect will be strongest in the short run but will die out over time.

From the outcome of significant price and earnings momentum returns, the results in Table 1 also suggest a link between the two phenomenon where economies with return continuation generally also demonstrate PEAD. In previous research made by Chan et al (1996), it is noted that price momentum generates higher monthly returns than earning momentum in many of their studied (developed) markets. When comparing Emerging Markets with significant price momentum, the 6_6 formation monthly returns were generally, but not always, larger than the returns for 6_6 formation earnings momentum.

In addition, to verify the persistency of momentum profits under different economic conditions, we have tested both price and earnings momentum in an additional sample during the most recent recession between January 2008 and December 2010. The results show that during this period there were quite few markets that demonstrated any significant and positive momentum returns. Of the studied markets, only South Africa showed proof of continued positive price momentum return but only on a low significance level. Colombia and Morocco also have one formation each with positive WML returns on a 10% significance level which are very likely spurious. The remaining markets show either zero monthly price momentum returns or even reversal. For earnings momentum a similar pattern can be noted (See Table 2 in Appendix I). These findings are not in line with Griffin et al (2003). Momentum strategies are not robust to economic downturn.

Time series regression results on Fama-French model

As Figure 6 shows, there are a number of Emerging Markets demonstrating momentum profits. Then we would like to find out whether this anomaly can be explained by the exposure to known risk factors or if momentum will continue to challenge the notion of EMH.

Table 3 in Appendix I shows the regression results of price momentum relative strength and hedge portfolios on the Fama-French three factors. The significantly positive alphas clearly suggest that the Fama-French three factors cannot fully capture the price momentum returns (Figure 7). The result is consistent in all the seven markets demonstrating price momentum. Also, for the 12 markets that do not show any significant return continuation, the Fama-French model explains most of the variation in returns with intercepts close to zero except for Turkey and Peru. Interestingly, Fama and French three factor model can neither explain medium term momentum nor the contrarian strategy in contrast to the explaining of long term reversal returns in previous research (Fama and French 1996).

The seven Emerging Markets (Chile, Mexico, India, Poland, Hungary, South Africa and Thailand) with significant and positive alphas generated monthly returns of approximately 0.9% to 2.6% after adjusting for the three risk factors- CAPM, SMB and HML. Among those seven Emerging Markets, Poland and South Africa show the highest abnormal returns, 2.6% and 2.1% respectively.

Analyzing the factor loadings of the relative strength portfolios in the seven markets that demonstrate price momentum, we find that the loser portfolios generally have a bigger loading on the market risk premium compared with the winner portfolios, which is in line with our expectations as well as Jegadeesh and Titman (1993). Also, the loser portfolios have stronger linkage and heavier loading on the size factor compared with the winner portfolios in most of the seven markets. This implies that momentum profits are not driven by the size issue, which is consistent with findings in the previous research on market capitalization by Jegadeesh and Titman (1993) as well as the loadings on the SMB returns by Fama and French (1996). The loadings of momentum portfolios on HML factor do not show any clear patterns. However, more than half of the seven markets demonstrate a negative relationship between momentum returns and the HML factor and additionally, the winner portfolios had a higher level of growth stocks, which is in line with Fama and French (1996) statements.

Figure 7: Intercepts (alphas) for the regressions of price momentum returns on Fama-French three factors

This figure shows the alphas for the time series regression of price momentum returns of hedge portfolios (six month checking back and six month holding strategy) on Fama-French three factor model. The bars with colors suggest that alphas are significant at different levels: black for 1% level, dark grey for 5% level and light grey for 10% level. The white bars mean that alphas are not significant. Alphas for the 7 markets (Chile, Mexico, Hungary, Poland, South Africa, India and Thailand) demonstrating price momentum profits are all significantly positive which suggests that Fama-French three factors cannot capture price momentum.

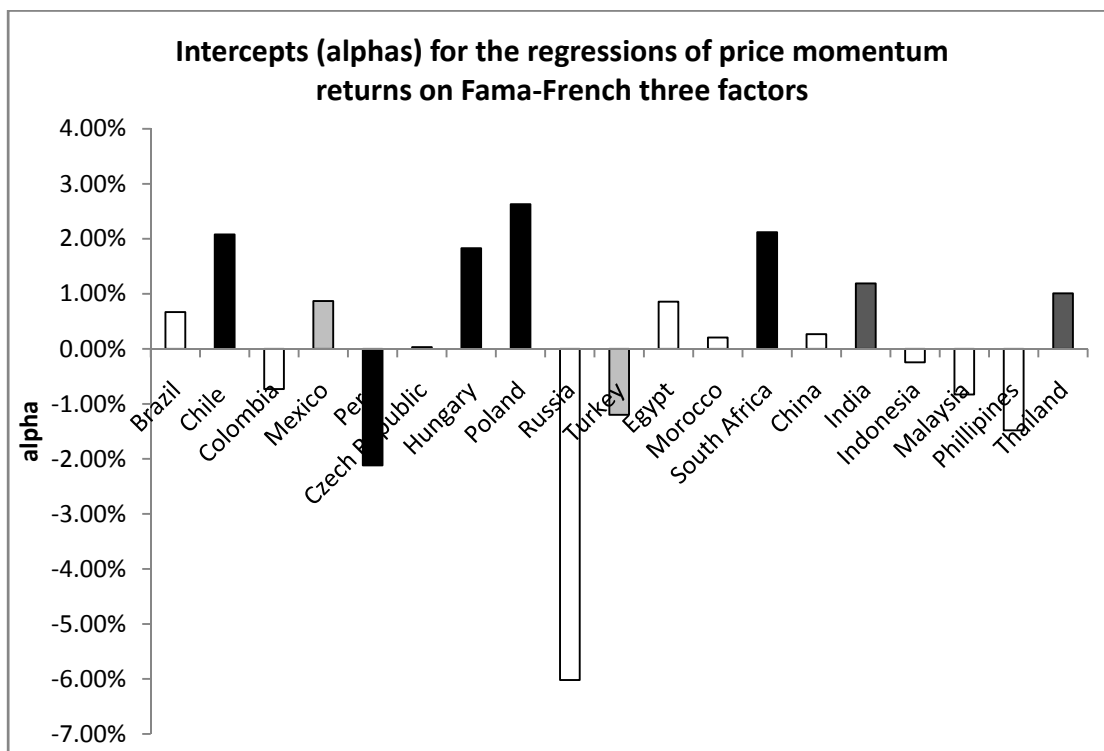
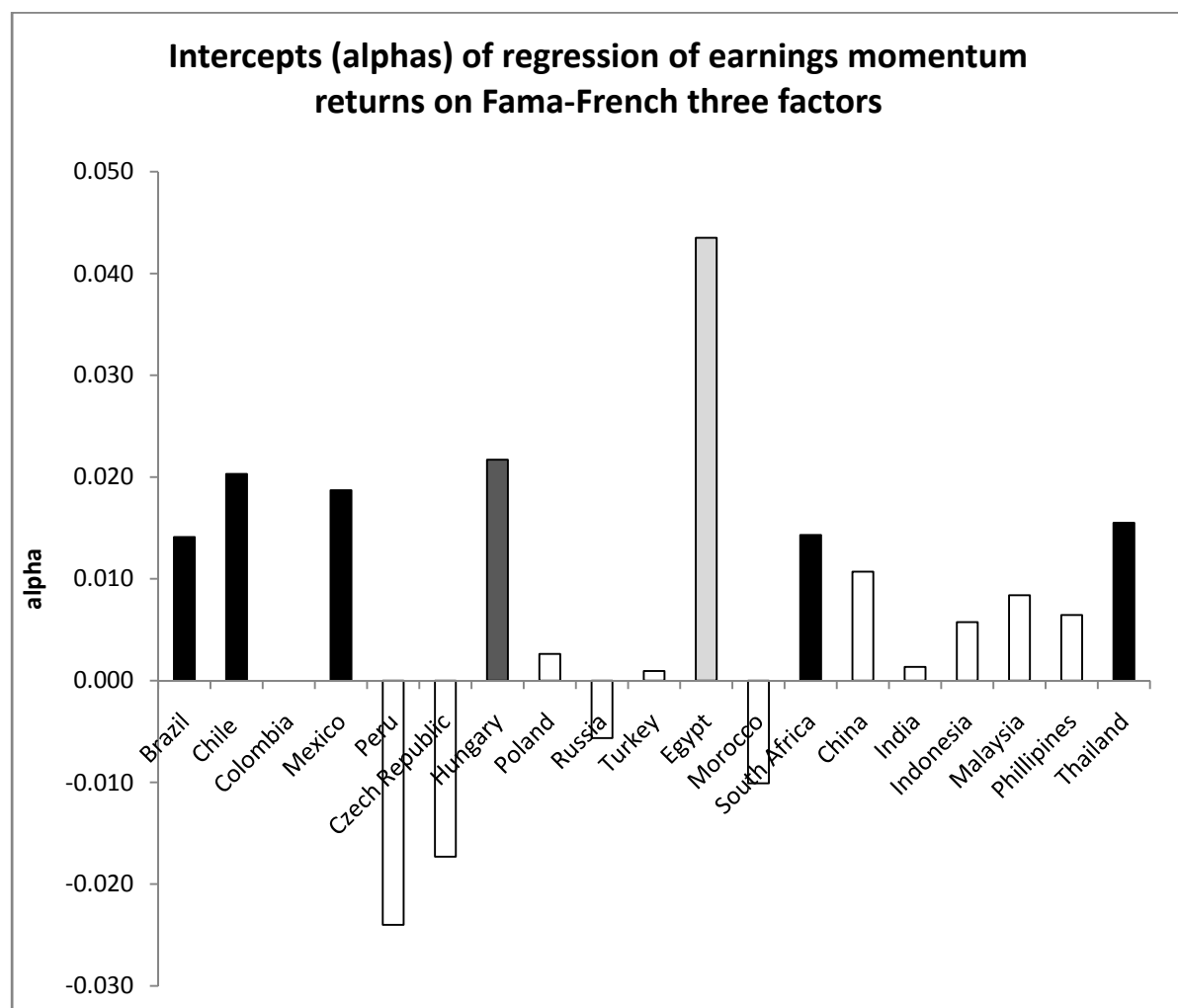


Figure 8: Intercepts (alphas) for the regressions of earnings momentum returns on Fama-French three factors

This figure shows the alphas for the time series regression of earnings momentum returns of hedge portfolios (six month checking back and six month holding strategy) on Fama-French three factor model. The bars with colors suggest that alphas are significant at different levels: black for 1% level, dark grey for 5% level and light grey for 10% level. The white bars mean that alphas are not significant. Among the 7 markets (Chile, Mexico, Hungary, South Africa, China, Indonesia and Thailand) demonstrating earnings momentum for 6_6 formation, 5 markets have significant positive alphas which suggests that Fama-French three factors generally cannot capture earnings momentum.



When investigating earnings momentum (6_6 portfolio formation) exposures on Fama-French factors, we generally find similar results (Figure 8, Table 4 Appendix I). The significant abnormal returns vary from 2.2% in Hungary to 1.4% in South Africa. However, among the seven markets (Chile, China, Hungary, Indonesia, Mexico, South Africa and Thailand) exhibiting PEAD, China and Indonesia have not shown any abnormal returns after adjusted by the Fama-French factors. Moreover, only a part of the markets where earnings momentum is significant, the loser portfolio has a larger loading on the market risk premium and size factor compared with the winner portfolio, which is different from the pattern of price momentum portfolios. Overall, the significant alphas in the regression of hedge portfolios on the Fama-French model suggest that the factors cannot fully explain the earnings momentum. Also, Fama-French model does not fully explain the returns of markets with no earnings momentum i.e. there are several markets with intercepts different from zero. However, the issues with data availability of forecasted earnings do pose problems to state this for certain.

The relationship between price and earnings momentum

Chan et al (1996) finds a positive relationship between compounded past six month returns and the equivalent length of earnings expected revisions, even though the correlation is not perfect positive equal to one. In this study we find the coexistence of the price and earnings momentum strategies, which means that the Emerging Markets exhibiting return continuation (Chile, Hungary, Mexico, Poland, India, South Africa and Thailand) also show PEAD (Figure 6). Moreover, when studying factor loadings of winner and loser portfolios on market risk premium, SMB and HML, both the price and earnings momentum show similar patterns on the factor loadings (see Table 16-17 in Appendix I). For example in India, the winner portfolio has a lower loading on the market risk factor than the loser portfolio for price momentum, the correspondent portfolios for earnings momentum had the same characteristics. The consistency of price and earnings momentum portfolios on factor loadings is an indicator that price and earnings momentum are related.

Figure 9: Price momentum profits for different portfolio formations

This figure shows the average monthly returns of price momentum hedge portfolios varying checking back periods and holding horizons in the Emerging Markets which demonstrate significant momentum profits for most formations. The momentum returns are calculated based on the sample period between Jan. 1991 and Dec. 2007. The bars with colors suggest that momentum profits are significant at least at 10% level. The white bars mean that momentum profits are not significant. Generally this figure indicates that price momentum profits weaken over time.

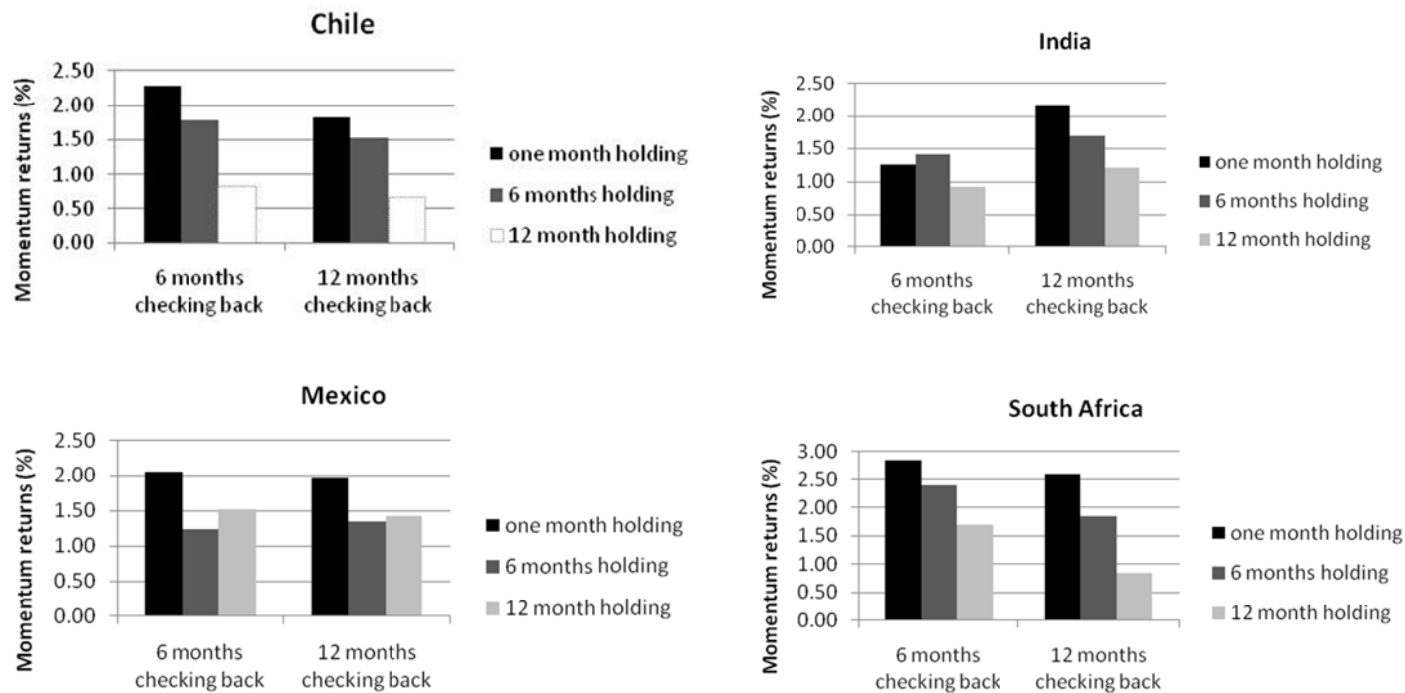


Figure 10: Earnings momentum profits for different portfolios formations

This figure shows the average monthly returns of earnings momentum hedge portfolios varying checking back periods and holding horizons in the Emerging Markets which demonstrate significant momentum profits for most formations. The momentum returns are calculated based on the sample period between Jan. 1991 and Dec. 2007. The bars with colors suggest that momentum profits are significant at least at 10% level. The white bars mean that momentum profits are not significant. Generally price momentum profits weaken over time.

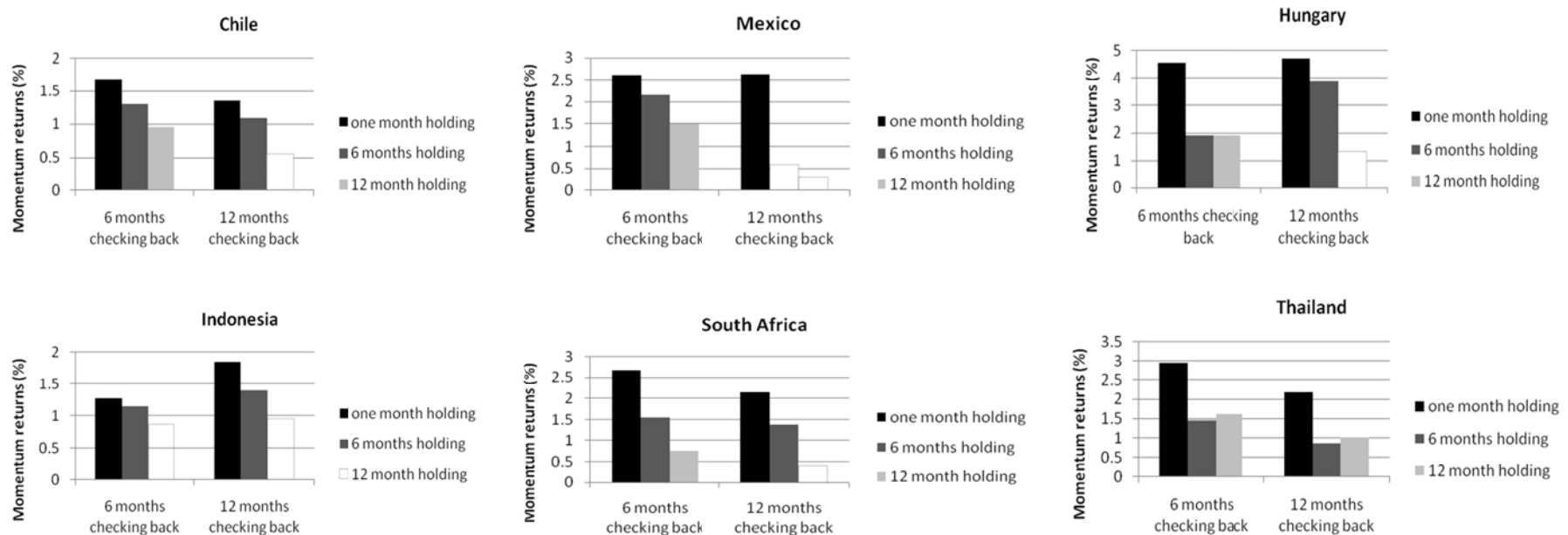


Table 5: Results for time-series regression of price momentum portfolios on Fama-French three factors and earnings momentum-based factor PMN

This table reports the time series regression estimates from time-series regressions of monthly excess returns of the winner decile portfolio (P_{10}), loser decile portfolio (P_1) and the hedge portfolio ($P_{10}-P_1$) on the extended Fama-French model by including PMN as a factor for the emerging markets demonstrating significant price momentum profits. The portfolios are sorted into deciles based on past six-month returns and invested for a six-month horizon. All figures refer to the period from January 1991 to December 2007.

		α		Market		SMB		HML		PMN	
		Cons.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Chile	P10	0.010	2.39	0.852	4.83	0.438	0.79	-0.882	-2.62	0.084	1.86
	P1	-0.008	-2.35	1.090	7.30	1.172	3.66	-0.179	-0.62	-0.064	-1.36
	P10-P1	0.018	3.36	-0.238	-0.95	-0.734	-1.15	-0.703	-1.59	0.147	2.04
Hungary	P10	0.000	-0.06	0.608	8.21	1.053	3.80	0.41	2.99	0.034	0.51
	P1	-0.021	-2.86	1.18	5.58	1.22	4.32	0.933	2.10	0.003	0.03
	P10-P1	0.021	2.00	-0.572	-2.29	-0.167	-0.33	-0.523	-1.09	0.032	0.28
India	P10	0.012	2.96	1.036	13.86	2.001	6.68	-0.276	-0.96	0.124	1.28
	P1	0.001	0.11	1.029	15.33	2.723	12.16	0.524	2.02	-0.054	-0.51
	P10-P1	0.012	1.94	0.007	0.06	-0.722	-2.78	-0.8	-2.81	0.178	1.63
Mexico	P10	0.007	2.28	0.673	9.95	0.260	1.32	0.705	4.70	0.013	0.25
	P1	0.001	0.25	0.821	9.57	0.795	2.82	0.456	1.86	-0.119	-2.10
	P10-P1	0.006	1.22	-0.147	-1.63	-0.535	-1.81	0.249	0.91	0.132	2.20
Poland	P10	0.006	1.48	0.885	15.24	1.184	10.54	-0.161	-1.54	0.052	2.03
	P1	-0.018	-2.85	1.037	9.52	1.301	6.12	-0.0601	-0.27	0.028	0.37
	P10-P1	0.024	3.34	-0.152	-1.25	-0.116	-0.47	-0.101	-0.42	0.024	0.29
South Africa	P10	0.003	0.81	0.690	6.68	0.357	1.77	-0.413	-2.08	0.142	1.99
	P1	-0.014	-3.00	0.781	8.46	0.984	4.06	-0.175	-0.75	-0.177	-2.27
	P10-P1	0.017	2.96	-0.092	-0.70	-0.628	-2.25	-0.238	-0.80	0.318	3.16
Thailand	P10	0.003	0.48	0.777	7.54	1.382	2.42	-0.422	-0.93	-0.013	-0.13
	P1	-0.006	-1.70	0.926	8.06	1.347	2.49	-0.739	-2.79	-0.057	-0.73
	P10-P1	0.009	1.67	-0.149	-1.68	0.035	0.10	0.317	1.33	0.045	0.45

Table 6: Results for time-series regression of earnings momentum portfolios on Fama-French three factors and price momentum-based factor WML

This table reports the time series regression estimates from time-series regressions of monthly excess returns of the winner decile portfolio (P_{10}), loser decile portfolio (P_1) and the hedge portfolio ($P_{10}-P_1$) on the extended Fama-French model by including WML as a factor for the emerging markets demonstrating significant price momentum profits. The portfolios are sorted into deciles based on past six-month earnings forecast revisions and invested for a six-month horizon. All figures refer to the period from January 1991 to December 2007.

		α		Market		SMB		HML		WML	
		Cons	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat
Chile	P10	0,007	1,21	0,991	6,04	-0,138	-0,43	-0,663	-1,51	0,085	0,74
	P1	-0,007	-1,32	1,115	7,06	-0,73	-2,09	-0,207	-0,58	-0,221	-2,47
	P10-P1	0,014	1,74	-0,123	-0,50	0,592	1,10	-0,456	-0,69	0,305	1,94
Hungary	P10	-0,004	-0,7	0,83	9,28	0,395	2,41	0,091	0,73	0,009	0,28
	P1	-0,025	-2,09	1,006	5,72	0,390	1,2	0,284	1,09	-0,015	-0,23
	P10-P1	0,021	1,86	-0,177	-1,14	0,005	0,02	-0,193	-0,83	0,024	0,30
India	P10	0,008	1,55	1,082	16,59	0,981	4,19	1,180	4,51	-0,100	-1,09
	P1	0,008	1,53	1,056	17,18	1,289	5,58	1,245	5,16	-0,230	-2,65
	P10-P1	0,000	-0,04	0,026	0,43	-0,308	-1,57	-0,065	-0,25	0,130	1,41
Mexico	P10	0,003	0,52	0,892	7,79	0,906	3,22	0,617	2,27	0,182	2,05
	P1	-0,014	-2,59	0,714	9,13	0,898	3,45	0,743	3,00	-0,039	-0,49
	P10-P1	0,017	2,38	0,178	1,70	0,009	0,03	-0,126	-0,37	0,221	1,99
Poland	P10	0,005	0,47	0,634	2,14	-0,336	-0,41	-1,738	-1,61	-0,255	-1,34
	P1	0,004	0,46	0,898	5,59	0,808	2,97	-0,140	-0,58	-0,319	-2,54
	P10-P1	0,001	0,08	-0,265	-0,78	-1,144	-1,45	-1,598	-1,59	0,064	0,30
South Africa	P10	0,005	1,26	0,872	13,58	0,518	2,94	0,096	0,64	-0,012	-0,21
	P1	-0,004	-1,05	0,817	10,24	0,412	1,80	-0,271	-1,48	-0,261	-4,00
	P10-P1	0,009	2,11	0,055	0,65	0,106	0,37	0,367	1,64	0,249	3,47
Thailand	P10	0,008	1,50	0,959	9,90	1,271	4,98	-0,815	-2,34	-0,013	-0,09
	P1	-0,007	-1,63	1,031	9,27	0,991	1,93	-0,364	-1,18	-0,073	-0,70
	P10-P1	0,015	2,64	-0,072	-0,62	0,281	0,56	-0,451	-1,23	0,060	0,44

When amending the Fama and French three factor model with momentum as a fourth factor, the results in Table 5 state that the WML has a strong correlation with PMN in Chile, Mexico and South Africa. This due to the significant coefficients on the PMN factor and decrease in both value and significance level of the alphas compared with the intercepts in the Fama-French three factor regression. This provides some evidence that price momentum is subsumed by earnings momentum in those markets, which is in line with the Chordia and Shivakumar (2006) findings. However, in India, Hungary, Poland and Thailand there is no strong co-movement between WML and PMN suggested by the insignificant coefficients of WML loading on PMN. Price momentum has been considered to be a noisy proxy for earnings momentum which is economically intuitive since earnings information affects price movements. However, the inconclusive correlation between the two suggests that other information might aggregately have greater explanatory power in Emerging Markets.

In order to evaluate the explanatory power of PMN on WML, a GRS test has been performed on all the decile portfolios for the markets demonstrating price momentum. The *p*-value of the GRS test (Table 9 in Appendix I) for the regression of decile portfolios on the Fama-French three factor model shows that the alphas were jointly different from zero for decile portfolios in five of the seven markets with price momentum except Thailand and Hungary. When performing the GRS tests on regression of the decile portfolios on the Fama-French three factors and PMN, the results (Table 10 in Appendix I) show a decreasing significance level for all the seven markets. This confirms that PMN has some explanatory power on WML, which is consistent with the findings in U.S. by Chordia and Shivakumar (2006).

In order to verify the hypothesis that price momentum is subsumed by earnings momentum and not vice versa, time series regressions of PMN on the Fama-French three factors and WML and a GRS test for the earnings momentum decile portfolios on the model are conducted. However, the results (Table 6 and Table 11-12 in Appendix I) demonstrate an even stronger explanatory power of WML on PMN for all the seven markets showing price momentum returns. This is not in line with either previous research (Chordia and Shivakumar, 2006) or economic intuition. Earnings momentum should subsume price momentum since the market value of a firm is dependent on the firm's profitability but not the other way around. Therefore, this study hasn't provided any firm evidence for the hypothesis that price momentum is subsumed by the earnings momentum and not vice versa in Emerging Markets.

The linkage between momentum and market friction proxies

We have identified momentum profits in seven of the studied Emerging Markets which generally were bigger than those of developed economies in previous research. One explanation for this is that we chose not to include size constraints on stocks which might lead to larger returns. The other possible explanation is the less developed nature of capital markets in Emerging Markets and therefore, since Fama-French three factor model (and PMN) cannot fully capture the abnormal returns of price momentum, we would like to test whether the price momentum returns are driven by market friction factors.

To evaluate this, the price momentum decile portfolios (ranked by the past six-month performance) are categorized into three terciles based on the illiquidity and information asymmetry proxies: bid-ask spread ratio, share turnover and total stock volatility. Then the return difference between winner and loser portfolios for each level of the three proxies are calculated. If momentum is due to trading costs, the hedge portfolio returns with high bid ask spread ratio should demonstrate higher momentum returns compared with those with low spread ratio as suggested in Chan et al, 1996 where momentum profits will be notably reduced. Figure 11 visually suggests that there is a positive relationship between bid-ask spreads and price momentum monthly returns. However, when testing the significance of the bid-ask spread ratio sorted portfolio returns, only Mexico and Poland support this hypothesis. In India and Hungary, the data for bid ask prices was not sufficient to generate any results (Table 7 Appendix I). If momentum is caused by the risk of illiquidity, we expect that the low share turnover hedge portfolios should outperform the high share turnover hedge portfolios, where share turnover stands for the proxy of liquidity in this study. However, as Figure 12 and Table 7 represent, there is no clear pattern of this notion, and only Mexico suggests supportive results but not the remaining six countries. This is somewhat in line with Rowenhorst (1999) which disputes the momentum profits as a result of illiquidity in Emerging Markets. If the price momentum is driven by information asymmetry, then the hedge portfolios with high information asymmetry level should demonstrate larger price momentum returns. Due to the difficulty of measuring the information asymmetry, this study has employed the total volatility as a proxy for it, inspired by Leippold and Lohre (2010). Hence we expect larger profits for the momentum hedge portfolios with higher volatility than those with a lower volatility level. However, Table 7 and Figure 13 only provides supportive results in Chile and Poland i.e. barely half of the Emerging Markets that exhibit price momentum returns.

To summarize, even though there is some supportive evidence in some Emerging Markets that the price momentum returns have linkage to the market friction, none of the three proxies has an explanatory power across all the seven Emerging Markets that demonstrates price momentum profits. As a result, we cannot conclude that price momentum returns are driven by market frictions which would have been in line with several previous researches and thereby rule out momentum as an illusion in terms of profitable investment strategy. However, we cannot exclude the possibility that the inconclusive results are caused by the limited data accessibility or the poor proxies for the information uncertainty and illiquidity which are difficult to measure.

Figure 11: Average monthly price momentum returns categorized by bid-ask spread ratio

This figure shows the average monthly price momentum returns categorized by different bid-ask spread ratio level for the Emerging Markets demonstrating price momentum. We first sort stocks into 10 deciles based on their past 6-month performance. For each decile the stocks are further sorted into three terciles based on bid-ask spread ratio. Then we calculate the momentum returns of WML portfolios for each spread ratio level. In Chile, Mexico and Poland, higher spread ratio momentum portfolios generate larger momentum returns.

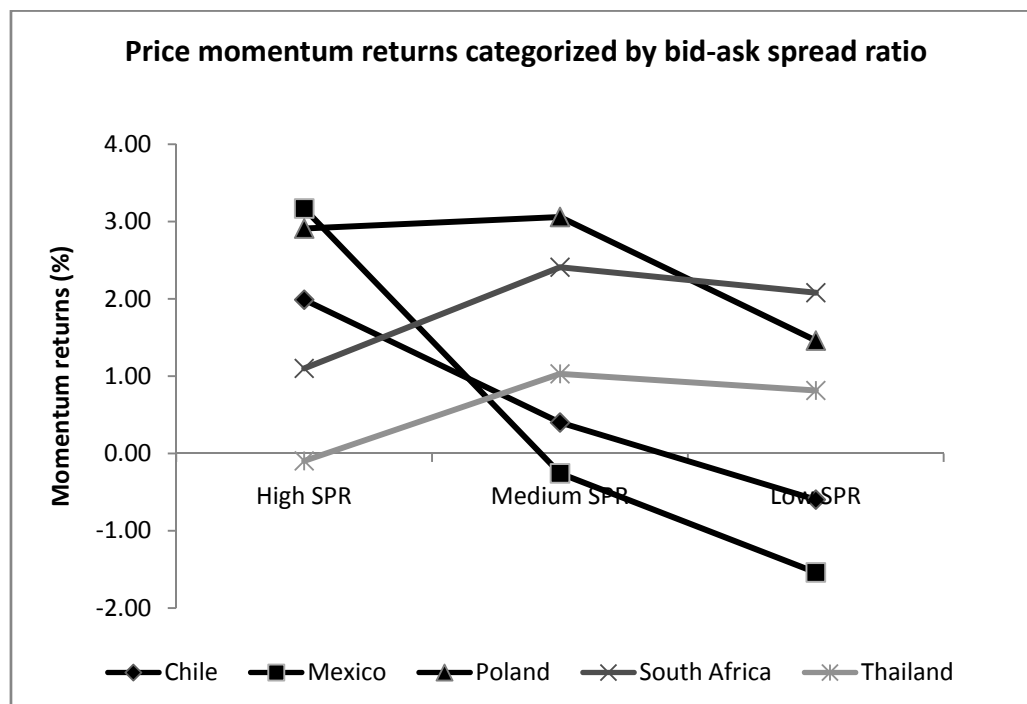


Figure 12: Average monthly price momentum returns categorized by Share Turnover

This figure shows the average monthly price momentum returns categorized by different share turnover level for the Emerging Markets demonstrating price momentum. We first sort stocks into 10 deciles based on their past 6-month performance. For each decile the stocks are further sorted into three terciles based on share turnover. Then we calculate the momentum returns of WML portfolios for each share turnover level. Only Mexico shows that lower share turnover (higher illiquidity) momentum portfolios generate larger momentum returns.

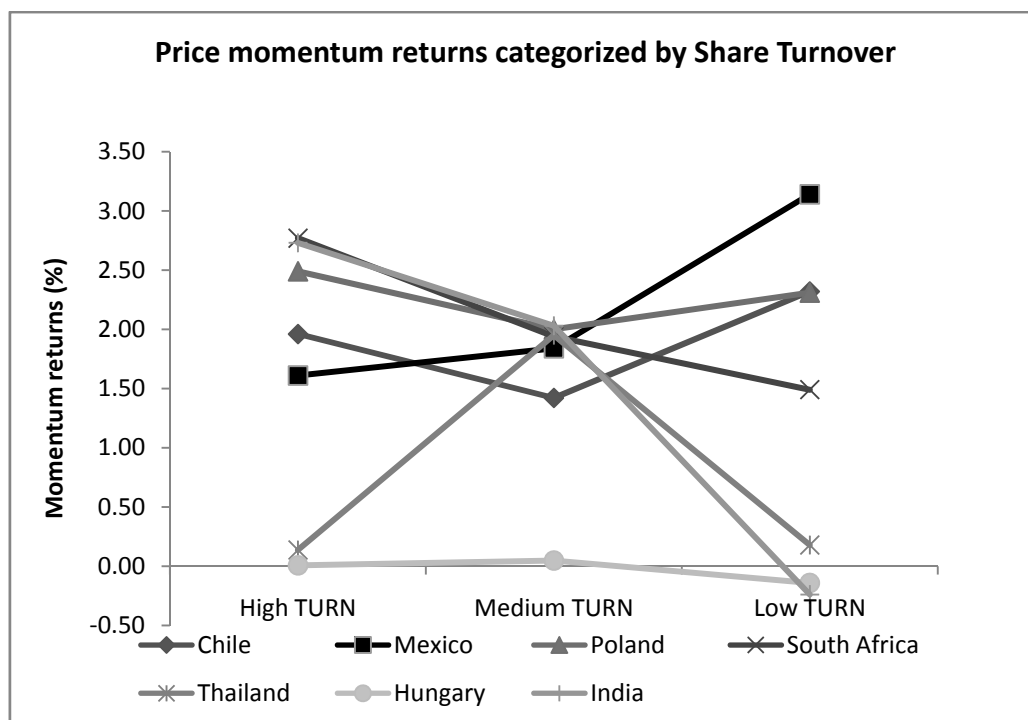
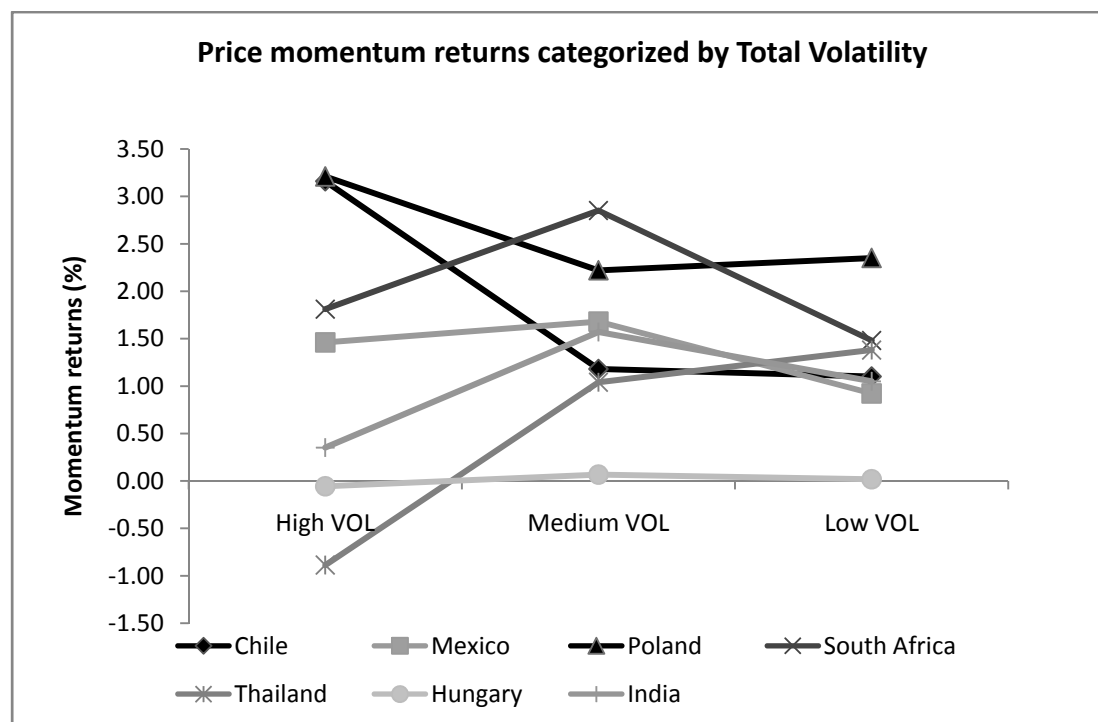


Figure 13: Average monthly price momentum returns categorized by Total Volatility

This figure shows the average monthly price momentum returns categorized by different volatility level for the Emerging Markets demonstrating price momentum. We first sort stocks into 10 deciles based on their past 6-month performance. For each decile the stocks are further sorted into three terciles based on total volatility. Then we calculate the momentum returns of WML portfolios for each share turnover level. Only Chile and Poland show that higher total volatility (higher information uncertainty) momentum portfolios generate larger momentum returns.



We do recognize that there are some limitations in this study. First and foremost, the data availability posed a major constraint when computing the momentum portfolios and explanation factors. For example the data availability for the earnings forecast variable varies between 9% and 39% across markets (see Table 23 in Appendix III). This issue might cause biases on evaluating earnings momentum profits and limited explanatory power of the time series regressions involving the PMN variable. Similarly, the bid ask prices (components of spread ratio) and book values (components of HML) were scarce in supply for Emerging Markets which could also serve as an explanation for the inconclusive results regarding the explanatory power of these factors.

8. Conclusion

The concept of momentum has been a hot topic in both economic research and the financial industry as a whole. As Emerging Markets attract more and more attention due to favorable investment opportunities, this thesis has intended to contribute by shedding some light on the research field of momentum in these specific areas.

From an investor's perspective, this thesis assessed the returns of price and earnings momentum hedging strategies. In addition, it specifically evaluated the performance of relative strength strategies (winner and loser portfolios) due to legislations against short selling of stocks in some Emerging Markets as well as considerations on associated transaction costs. The momentum portfolios have been formed based on different lengths of checking period on past stock performances and earnings revisions as well as different investment horizon in order to evaluate the persistency of momentum. The relative strength portfolio returns and the hedge portfolio returns have been evaluated against the Fama-French three factor model and sorted by different market friction proxies. Finally, the relationship between price and earnings momentum has been tested.

Figure 6 demonstrates a summary of momentum presence. For price momentum, the 6_6 portfolio formation strategy provided the strongest hedging profits among the different formations of price momentum which is in line with Jegadeesh and Titman (1993). For the 6_6 formation, seven out of 19 studied Emerging Markets showed significant price momentum profits. Earnings momentum was more frequently notable in the 19 economies where the 6_1 zero cost portfolios generated significant and positive returns in 11 markets. We stated in Hypothesis 1 that there is momentum in a majority of the emerging economies and a general superior performance of winner portfolios compared with loser portfolios as well as generally larger momentum returns in Emerging Markets compared with those in developed economies. The findings confirms Hypothesis 1.b and 1.c but not Hypothesis 1.a since while earnings momentum was present in more than half of the Emerging Markets, there was only price momentum in a minority of the studied markets. Regarding the winner portfolio superiority our hypothesis is sustained in the sense that by going long in past winner stocks and short selling the losers an investor will generate at least zero percent return in most cases. Comparing the momentum in Emerging Markets with those in developed economies from previous research, the average monthly returns are generally larger but less frequent.

Moreover, we have also found convergence tendencies of both price and earnings momentum over time in Emerging Markets which supports Hypothesis 2 as well as previous research.

However, when examining momentum in the sample of most recent recession period, only a few markets exhibited return continuation and PEAD. Even though Griffin et al (2003) points out that momentum should hold in all parts of a business cycle, our recession sample results do not support this statement.

When regressing the momentum returns on the Fama and French factors, the results suggests that those risk factors cannot fully capture the price and most earnings momentum returns in emerging economies, which is in line with Fama and French (1996) and Hypothesis 3 a. The loadings were not in line with the efficient market theory on the risk-return tradeoff since the loser portfolio generally loaded heavier on market risk premium and SMB in most Emerging Markets with momentum. However, the relationship between momentum and HML was inconclusive. These findings are mainly in line with our expectations in Hypothesis 3 b-d since the winner portfolios were generally not riskier, at least not in a systematic risk sense.

Generally, Emerging Markets that exhibit price momentum also contain earnings momentum and thereby supports Hypothesis 4.a. PMN as a fourth amendment to the Fama-French three factor model has shown some explanatory power on WML in accordance with Chordia and Shivakumar (2006). However, since WML had an even greater explanatory power on PMN, we cannot conclude that price momentum is subsumed by earnings momentum in Emerging Markets which is against Hypothesis 4.b.

When evaluating the possible explanatory power of market frictions, the price momentum returns sorted by spread ratios, turnover by share and total volatility gave some supportive but varying results. Consequently, we cannot with certainty conclude that momentum returns are merely an expression for the fallacies of the conditions behind the EMH as stated in Hypothesis 5. However, only a few of the seven markets, the hedge portfolio returns categorized by level of bid ask spread (Hypothesis 5.a), turnover by share (Hypothesis 5.b) and total volatility (Hypothesis 5.c) gave support.

We admit that that data availability is the main limitation in this study, which could also explain the low number of previous studies in momentum for Emerging Markets but we believe that this study could make some contributions to the international momentum research outside the safe haven of developed economies.

To summarize this study, there is return continuation and PEAD in some Emerging Markets that generate returns which could not be captured by Fama-French three factors. However, the market friction proxies failed to explain the phenomenon as an illusion and therefore momentum continues to challenge the efficient market hypothesis also in Emerging Markets unless momentum can be considered a risk factor that investors should demand compensation for.

9. Future research suggestions

At the moment, there is ongoing research by Fama and French (2011) that evaluates size, value and momentum through a global asset view. However, the outlook from the draft does not seem to support the idea of global economic models and momentum only seems to be persistent on a regional level in some areas.

We advocate for further research to continue to explore possible explanations for the momentum phenomenon that holds across all or most markets. Whether there is another explanation for the returns or if momentum indeed is persistent, it should be considered as an asset pricing factor. However, in order for that to be valid, the factor must be economically intuitive as a risk compensation to investors and hold on all local levels and for all types of assets and preferably work on an international level.

In addition, this thesis evaluated momentum from an investment theory perspective. We would therefore suggest to expand the scope to include variables that are important from an investment management perspective such as mean variance analysis, portfolio management and investment constraints in Emerging Markets.

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Appendix I Results

Table 1: Statistics of momentum portfolio returns

The table represents the average monthly buy-and-hold returns of the winner decile portfolio (P_{10}), loser decile portfolio (P_1) and the hedge portfolio ($P_{10}-P_1$) for both price and earnings momentum dependent on different checking back period and holding horizon in each emerging market. Horizontally, the length of the evaluated past performance is stated first ($X_{_}$) and the holding period is stated second ($_Y$). E.g. 6_6 presents the strategy of evaluating the past six month performance/earnings forecast revision and holding for six month. All figures refer to the period from January 1991 to December 2007. All numbers are in percentages, %. Each portfolio return also contain the level of significance i.e. statistically different from zero. * = $p < 10\%$, ** = $p < 5\%$, *** = $p < 1\%$.

		Price Momentum						Earnings momentum					
		6_1	6_6	6_12	12_1	12_6	12_12	6_1	6_6	6_12	12_1	12_6	12_12
Brazil	P10	1,62*	1,11	1,74**	2,03***	1,65***	0,97	2,34***	1,79**	2,17***	2,32***	1,86**	2,24***
	P1	1,48**	1,40**	0,17	1,34	1,13	0,81	1,46**	1,09*	1,41**	1,31*	1,14	1,54**
	P10-P1	0,15	-0,29	1,57**	0,69	0,51	0,16	0,88	0,71	0,76	1,02	0,71	0,70
Chile	P10	2,20***	1,71***	1,35***	1,79***	1,72***	1,01**	1,87***	1,53***	1,53***	1,61***	1,04**	0,94*
	P1	-0,08	-0,07	0,53	-0,04	0,18	0,35	0,19	0,23	0,59	0,26	-0,05	0,38
	P10-P1	2,28***	1,79***	0,82	1,83***	1,53***	0,67	1,68***	1,30**	0,95*	1,36**	1,09**	0,56
Colombia	P10	0,73	1,33**	1,15*	1,34**	0,93*	1,64***	-0,91	-1,99	-1,58	-0,07	-1,50	-1,11
	P1	0,70	0,70	1,74	0,34	0,46	1,14	0,43	0,49	2,09	3,83	3,15	4,18
	P10-P1	0,03	0,64	-0,59	1,00	0,47	0,50	-1,34	-2,48	-3,67**	-3,90	-4,65	-5,28
Mexico	P10	2,43***	1,94***	1,83***	2,38***	1,88***	1,88***	2,03***	1,31**	1,29**	2,12***	1,24**	0,75
	P1	0,39	0,70	0,31	0,40	0,54	0,47	-0,58	-0,84	-0,22	-0,50	0,65	0,44
	P10-P1	2,05***	1,24**	1,52***	1,97***	1,34**	1,42**	2,60***	2,15***	1,50**	2,62***	0,59	0,31
Peru	P10	1,54*	1,28	1,48*	1,64*	1,87**	0,93	-0,69	-0,98	0,25	-0,14	-0,36	-0,65
	P1	3,15***	3,01***	2,14**	2,20**	0,58	-0,50	-0,22	1,20	-0,59	0,86	1,66	0,75
	P10-P1	-1,61	-1,73*	-0,66	-0,56	1,29	1,42	-0,47	-2,18	0,84	-1,00	-2,01	-1,40
Czech Republic	P10	0,48	0,18	0,20	0,33	0,14	0,07	-0,96	-1,47	-2,10*	-1,59	-1,57	-2,81**
	P1	-1,50**	-0,58	-0,56	-1,12	-0,39	0,16	-3,35*	-2,53	-1,16	-1,78	-1,71	-0,35
	P10-P1	1,99***	0,76	0,76	1,45**	0,53	-0,09	2,39	1,06	-0,95	0,19	0,14	-2,46
Hungary	P10	1,39	1,16	0,06	0,98	1,05	0,51	2,12***	0,80	1,56*	2,06***	1,82**	1,19
	P1	-0,56	-1,31	-0,20	-1,32	-1,02	-1,22	-2,45**	-1,13	-0,36	-2,65**	-2,04	-0,15
	P10-P1	1,95	2,47**	0,26	2,30*	2,07*	1,73	4,56***	1,93*	1,92*	4,71***	3,86***	1,34

Poland	P10	0,99	1,06	0,24	0,90	0,14	-0,49	2,01	1,10	1,08	1,26	0,81	1,11
	P1	-2,21**	-1,64*	-1,52*	-1,75	-1,41	0,04	-0,24	0,37	-0,25	0,22	0,33	0,74
	P10-P1	3,20***	2,69***	1,76**	2,65*	1,54*	-0,52	2,25*	0,73	1,33	1,04	0,48	0,37
Russia	P10	3,46***	3,20***	3,74***	3,30***	4,08***	5,22***	3,43**	3,66***	3,04**	3,72**	3,84***	4,62***
	P1	12,30	12,30	12,10	12,10	11,70	10,80	7,50***	4,44***	5,32***	3,35*	4,27**	2,72
	P10-P1	-8,81	-9,11	-8,40	-8,76	-7,58	-5,62	-4,07**	-0,78	-2,28	0,38	-0,44	1,91
Turkey	P10	1,34	2,37**	2,89***	1,85*	2,42**	2,70**	3,51***	3,40***	2,76**	2,97***	3,73***	3,35***
	P1	3,41***	3,22***	3,36***	3,13***	3,85***	3,76***	3,93***	2,74**	3,91***	3,58***	4,12***	3,98***
	P10-P1	-2,08***	-0,85	-0,48	-1,28*	-1,43**	-1,06*	-0,42	0,66	-1,16**	-0,61	-0,39	-0,63
Egypt	P10	1,19	0,92	1,56*	1,52*	0,86	0,51	1,27	2,41	3,44*	0,93	1,59	1,54
	P1	1,03	0,12	1,27	-0,05	-0,17	0,30	1,11	0,35	-0,26	-0,21	2,39	1,04
	P10-P1	0,17	0,80	0,29	1,57*	1,03	0,21	0,16	2,06	3,69**	1,14	-0,79	0,49
Morocco	P10	0,96*	0,89	0,54	1,17**	1,52***	1,64***	2,45*	2,41*	1,40	1,48	1,15	2,19
	P1	0,56	0,73	1,00	1,26**	1,19*	1,35*	4,50	4,92*	5,20*	2,69*	2,15	1,35
	P10-P1	0,37	0,17	-0,46	-0,08	0,34	0,29	-2,05	-2,51	-3,81	-1,21	-1,00	0,84
South Africa	P10	2,06***	1,84***	1,66***	2,26***	1,83***	1,07**	1,78***	1,53***	1,08**	1,90***	1,44***	0,92**
	P1	-0,77	-0,57	-0,05	-0,35	-0,02	0,22	-0,89*	-0,01	0,32	-0,24	0,08	0,51
	P10-P1	2,83***	2,41***	1,70***	2,60***	1,84***	0,85**	2,67***	1,54***	0,76**	2,14***	1,37***	0,41
China	P10	0,53	1,06	0,50	1,16	0,73	0,69	3,89**	4,52***	3,78**	4,09***	3,80**	2,98**
	P1	0,61	0,18	0,26	0,26	0,50	0,69	1,73	2,45	2,44	2,01	2,04	2,41
	P10-P1	-0,08	0,89	0,24	0,91	0,23	0,00	2,17**	2,07**	1,34	2,09*	1,76	0,57
India	P10	1,72**	1,80**	1,62**	2,49***	2,23***	1,72**	1,01	0,42	0,45	0,67	0,32	0,25
	P1	0,45	0,39	0,70	0,34	0,54	0,52	-0,02	0,28	0,21	-0,10	0,37	0,49
	P10-P1	1,26**	1,41***	0,92**	2,16***	1,69***	1,20**	1,03**	0,14	0,24	0,77	0,06	-0,24
Indonesia	P10	0,24	0,56	0,30	0,16	-0,03	0,05	1,19	1,01	0,65	1,36	1,06	0,84
	P1	0,90	0,25	0,24	1,43	0,70	0,49	-0,09	-0,15	-0,22	-0,49	-0,34	-0,11
	P10-P1	-0,66	0,31	0,06	-1,27	-0,74	-0,44	1,27**	1,15*	0,86	1,85***	1,40**	0,95
Malaysia	P10	-0,32	-0,31	-0,45	-0,37	-0,58	-0,45	1,18	0,59	0,51	1,08	0,77	0,62
	P1	-0,60	-0,66	-0,43	-0,63	-0,76	-0,39	0,07	0,02	0,09	-0,13	0,09	0,26
	P10-P1	0,29	0,35	-0,02	0,25	0,19	-0,07	1,12***	0,57	0,42	1,21***	0,68*	0,36
Philippines	P10	-0,30	0,36	-0,01	-0,38	0,11	-0,34	1,25	0,77	0,91	0,62	1,22	0,95
	P1	1,00	0,69	0,95	0,77	0,66	1,19	-0,27	0,05	0,07	-1,14	-0,59	-0,71
	P10-P1	-1,30	-0,33	-0,96	-1,15	-0,77	-1,53**	1,52*	0,72	0,84	1,76**	1,81**	1,67**
Thailand	P10	-0,77	-0,13	-0,32	-0,40	-0,35	-0,40	1,10	0,31	0,30	0,73	-0,08	-0,10
	P1	-0,75	-1,21	-1,10	-0,74	-0,77	-0,88	-1,86**	-1,15	-1,31	-1,46*	-0,95	-1,13
	P10-P1	-0,02	1,08**	0,78*	0,34	0,42	0,48	2,96***	1,46***	1,61***	2,19***	0,87*	1,03**

Table 2: Out of sample statistics of momentum portfolio returns (2008-2010)

The table represents the average monthly buy-and-hold returns of the winner decile portfolio (P₁₀), loser decile portfolio (P₁) and the hedge portfolio (P₁₀-P₁) for both price and earnings momentum dependent on different checking back period and holding horizon in each emerging market. Horizontally, the length of the evaluated past performance is stated first (X_) and the holding period is stated second (_Y). E.g. 6_6 presents the strategy of evaluating the past six month performance/earnings forecast revision and holding for six month. All figures refer to the out of sample period from January 2008 to December 2010. All numbers are in percentages, %. Each portfolio return also contain the level of significance i.e. statistically different from zero. * = p < 10%, ** = p < 5%, *** = p < 1%.

		Price Momentum						Earnings momentum					
		6_1	6_6	6_12	12_1	12_6	12_12	6_1	6_6	6_12	12_1	12_6	12_12
Brazil	P10	1,81*	2,65***	1,72**	1,36	1,47**	1,29**	2,41*	2,61**	1,80*	2,88**	2,97**	2,56**
	P1	3,28**	2,95*	4,72***	4,85***	4,43***	5,85***	2,98*	3,33**	3,20**	2,57	3,64**	3,61**
	P10-P1	-1,47	-0,29	-3,00**	-3,49**	-2,96**	-4,56***	-0,57	-0,72	-1,40	0,32	-0,67	-1,04
Chile	P10	2,71***	2,69***	2,29***	3,26***	3,08***	3,34***	1,57	3,53**	3,63**	2,63	3,61*	4,01**
	P1	2,65**	2,76*	3,81**	2,22	2,58*	2,65*	3,73**	2,31	5,51**	5,77***	2,62	1,12
	P10-P1	0,06	-0,07	-1,52	1,04	0,50	0,69	-2,15	1,23	-1,87	-3,15*	1,00	2,89
Colombia	P10	2,59***	3,05***	1,80*	2,81***	2,98***	2,09**	-	-	-	-	-	-
	P1	2,10	0,78	1,38	0,49	0,99	1,02	-	-	-	-	-	-
	P10-P1	0,50	2,27	0,42	2,32*	1,99	1,07	-	-	-	-	-	-
Mexico	P10	2,11**	2,29**	2,41***	1,75*	2,39**	2,12**	3,14*	2,90*	2,30	2,18	1,98	1,96
	P1	2,30	2,75*	2,84**	2,96*	2,94*	2,99*	5,11*	3,34*	4,39**	5,09*	3,02	1,23
	P10-P1	-0,19	-0,46	-0,43	-1,20	-0,55	-0,88	-1,97	-0,44	-2,09	-2,90	-1,04	0,73
Peru	P10	3,16**	1,71	1,10	1,77	1,88	2,56	-	-	-	-	-	-
	P1	3,44*	4,17**	4,07**	5,13**	4,00*	4,81*	-	-	-	-	-	-
	P10-P1	-0,28	-2,46	-2,97	-3,36	-2,11	-2,25	-	-	-	-	-	-
Czech Republic	P10	0,75	1,09*	1,12	0,93*	0,64	0,35	-	-	-	-	-	-
	P1	1,70	1,20	0,81	0,88	0,66	0,96	-	-	-	-	-	-
	P10-P1	-0,95	-0,11	0,32	0,05	-0,02	-0,62	-	-	-	-	-	-
Hungary	P10	0,78	-0,57	-0,34	-0,14	-0,12	-0,29	-	-	-	-	-	-
	P1	-0,56	-0,22	-1,94	-0,77	-1,12	-1,07	-	-	-	-	-	-
	P10-P1	1,34	-0,36	1,60	0,63	1,01	0,78	-	-	-	-	-	-
Poland	P10	2,24*	1,63	0,55	0,95	-0,09	0,49	3,09*	2,56*	2,76*	2,81**	1,78	1,46
	P1	1,34	0,55	1,76	1,26	0,71	1,62	1,12	1,74	3,44	2,60	2,01	3,48
	P10-P1	0,90	1,08	-1,21	-0,31	-0,80	-1,13	1,97	0,82	-0,68	0,21	-0,23	-2,03

Russia	P10	7,63***	4,40**	3,00*	1,89	2,45	1,94	3,15	5,13	4,65*	1,21	3,16	3,19
	P1	7,94*	4,55	4,43	5,68	5,91	4,43	1,78	2,19	3,46	5,61	6,20	6,20
	P10-P1	-0,30	-0,15	-1,42	-3,79	-3,47	-2,48	1,37	2,93	1,20	-4,40	-3,04	-3,01
Turkey	P10	2,07	1,76	1,55	2,33*	2,28*	1,73	5,02***	4,99**	5,70**	5,51***	4,56**	4,65**
	P1	4,77**	4,23*	6,07***	6,11***	5,50***	6,27***	4,06**	4,02**	4,36**	5,30***	4,49***	4,06**
	P10-P1	-2,70*	-2,47	-4,52***	-3,79**	-3,22**	-4,54***	0,96	0,97	1,34	0,21	0,07	0,60
Egypt	P10	0,27	0,31	0,21	-0,22	1,27	1,57	4,47**	3,04	4,12**	4,02*	4,14**	3,38*
	P1	3,61	1,21	1,23	3,29	0,91	1,18	-0,69	-0,26	1,11	0,07	0,30	0,10
	P10-P1	-3,35	-0,91	-1,03	-3,51	0,36	0,39	5,16***	3,30*	3,01	3,95**	3,84*	3,28
Morocco	P10	0,92	1,03	0,16	2,15***	2,17***	1,54**	3,20**	4,00***	2,95**	2,74**	3,17**	2,49**
	P1	0,49	0,78	1,29	0,06	1,36	0,92	-1,35	1,54	7,61**	7,61**	7,61**	7,61**
	P10-P1	0,43	0,24	-1,13	2,09*	0,82	0,61	4,55*	2,46	-4,66*	-4,87	-4,44	-5,12*
South Africa	P10	1,78**	1,97*	1,93***	1,95**	1,96***	1,60**	2,19	2,22*	1,52	2,17	1,79	2,09
	P1	0,84	0,90	0,85	0,66	0,66	0,84	1,16	2,12	1,74	1,76	1,69	1,70
	P10-P1	0,95	1,07	1,07	1,29*	1,30*	0,77	1,03	0,10	-0,23	0,42	0,09	0,40
China	P10	2,33	1,48	1,82	1,45	1,45	1,52	3,37	3,08	2,59	2,94	2,77	2,75
	P1	3,31*	3,20	2,73	3,58*	3,55*	3,37*	3,01	2,81	2,92	3,05	2,89	3,00
	P10-P1	-0,98	-1,72	-0,91	-2,13	-2,10	-1,86	0,36	0,27	-0,33	-0,10	-0,12	-0,25
India	P10	3,92**	3,28**	2,66**	2,91**	2,52**	2,15*	5,22**	3,58*	3,75*	4,35**	3,57*	4,03*
	P1	3,42	3,71	4,16	3,72	3,47	2,75	3,28	3,78	4,25	3,94	3,79	3,81
	P10-P1	0,50	-0,43	-1,50	-0,81	-0,95	-0,60	1,94	-0,19	-0,50	0,41	-0,22	0,22
Indonesia	P10	2,25	2,65*	2,63**	2,18*	2,84**	2,22*	7,45***	6,92***	6,90***	8,05***	7,08***	6,55***
	P1	4,78**	5,33**	4,06*	4,87**	5,08**	4,74**	2,67	3,56	3,95*	3,20	4,28*	4,32*
	P10-P1	-2,54	-2,68	-1,43	-2,69*	-2,24	-2,51	4,78**	3,36	2,95	4,85*	2,80	2,23
Malaysia	P10	1,72*	1,19	1,04	1,37*	0,73	0,79	3,63***	3,86***	3,51***	4,16***	3,89***	3,97***
	P1	1,19	1,43	1,23	1,12	1,33	1,10	1,70	2,11	2,83	2,43	2,66	2,79
	P10-P1	0,53	-0,24	-0,19	0,25	-0,60	-0,32	1,93	1,75	0,67	1,73	1,23	1,18
Philippines	P10	3,19**	3,21***	2,11**	2,74**	2,08**	2,46**	7,40***	6,32***	6,22***	5,76***	4,60**	4,66***
	P1	5,25**	5,71**	5,01*	6,52**	5,77**	4,32*	4,56**	6,84**	6,81***	5,72**	7,44***	4,48**
	P10-P1	-2,06	-2,50	-2,91	-3,79*	-3,69	-1,85	2,84*	-0,51	-0,58	0,04	-2,84	0,17
Thailand	P10	4,06***	3,29***	2,77***	3,74***	3,21***	2,49***	6,95***	5,55***	5,22***	6,48***	5,56***	5,28***
	P1	2,36	2,41*	2,82*	2,99*	2,94*	2,67	4,52***	5,60***	4,74***	4,35***	4,91**	5,37***
	P10-P1	1,70	0,89	-0,04	0,75	0,27	-0,18	2,43	-0,05	0,48	2,13	0,65	-0,09

Table 3: Results for time-series regression of price momentum portfolios on Fama-French model

This table reports the time series reports the regression estimates from time-series regressions of monthly excess returns of the winner decile portfolio (P_{10}), loser decile portfolio (P_1) and the hedge portfolio ($P_{10}-P_1$) on the Fama-French three-factor model for each emerging market. The portfolios are sorted into deciles based on past six-month returns and invested for a six-month horizon. All figures refer to the period from January 1991 to December 2007.

		α		Market		SMB		HML				α		Market		SMB		HML	
		Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat			Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat
Brazil	P10	0.013	2.69	0.650	8.00	1.257	4.16	-0.042	-0.18	Egypt	P10	-0.005	-0.79	0.744	7.55	0.365	1.96	0.016	0.13
	P1	0.007	1.31	0.750	9.27	1.792	6.86	0.226	0.87		P1	-0.014	-1.88	0.661	5.80	0.178	0.65	-0.292	-1.80
	P10-P1	0.007	1.09	-0.098	-1.11	-0.535	-1.56	-0.267	-0.98		P10-P1	0.009	1.17	0.083	0.64	0.187	0.66	0.308	1.68
Chile	P10	0.011	2.82	0.835	4.75	0.470	0.85	-0.941	-2.77	Morocco	P10	0.001	0.09	0.869	5.57	0.699	1.96	0.458	1.03
	P1	-0.009	-2.91	1.103	7.29	1.147	3.52	-0.135	-0.47		P1	0.002	0.29	0.876	4.30	0.596	1.92	-0.305	-1.15
	P10-P1	0.021	3.97	-0.268	-1.06	-0.677	-1.04	-0.806	-1.79		P10-P1	-0.001	-0.13	-0.007	-0.04	0.103	0.21	0.764	1.65
Colombia	P10	-0.008	-1.20	0.915	9.04	0.460	1.32	-0.041	-0.19	South Africa	P10	0.005	1.42	0.695	6.71	0.349	1.75	-0.366	-1.86
	P1	-0.001	-0.10	0.924	5.30	1.175	2.82	0.244	0.82		P1	-0.016	-3.65	0.775	8.10	0.994	4.03	-0.234	-0.92
	P10-P1	-0.007	-0.47	-0.009	-0.04	-0.715	-1.03	-0.285	-0.70		P10-P1	0.021	3.92	-0.080	-0.59	-0.645	-2.28	-0.132	-0.40
Mexico	P10	0.008	2.30	0.675	9.99	0.258	1.32	0.704	4.73	China	P10	-0.002	-0.54	1.034	16.52	0.471	2.14	0.172	0.70
	P1	-0.001	-0.23	0.803	9.16	0.809	2.83	0.465	1.84		P1	-0.005	-1.18	1.046	14.46	1.173	3.59	0.041	0.11
	P10-P1	0.009	1.65	-0.128	-1.35	-0.550	-1.81	0.239	0.87		P10-P1	0.003	0.74	-0.012	-0.26	-0.702	-3.59	0.131	0.57
Peru	P10	-0.005	-0.77	0.636	7.60	0.288	1.76	0.094	0.36	India	P10	0.012	2.89	1.039	13.90	1.950	7.01	-0.297	-0.94
	P1	0.016	2.17	0.604	5.12	0.415	2.26	0.038	0.20		P1	0.001	0.10	1.028	15.31	2.745	12.11	0.534	2.11
	P10-P1	-0.021	-2.33	0.032	0.24	-0.126	-0.55	0.056	0.36		P10-P1	0.012	1.97	0.011	0.11	-0.795	-3.04	-0.831	-2.89
Czech Republic	P10	0.000	-0.02	0.513	6.60	0.313	2.10	0.300	3.53	Indonesia	P10	0.001	0.18	0.888	11.77	1.253	4.41	-0.214	-0.87
	P1	0.000	-0.08	0.783	6.24	1.193	6.93	0.388	2.51		P1	0.003	0.61	1.019	8.86	1.737	8.32	-0.789	-3.18
	P10-P1	0.000	0.05	-0.271	-1.94	-0.880	-4.69	-0.088	-0.59		P10-P1	-0.002	-0.32	-0.131	-1.18	-0.483	-1.39	0.575	1.90
Hungary	P10	0.000	0.08	0.615	7.51	0.944	4.42	0.460	3.72	Malaysia	P10	0.003	0.690	0.905	10.69	2.523	5.60	-0.028	-0.08
	P1	-0.018	-2.62	1.127	5.22	1.500	5.33	0.617	1.36		P1	0.012	2.09	1.052	13.78	4.183	11.67	-1.073	-3.00
	P10-P1	0.018	2.19	-0.511	-1.92	-0.556	-1.33	-0.157	-0.31		P10-P1	-0.008	-1.37	-0.147	-1.47	-1.660	-3.99	1.046	2.54
Poland	P10	0.006	1.54	0.840	8.24	1.024	8.15	-0.194	-1.77	Philippines	P10	-0.002	-0.22	0.811	9.01	0.447	1.27	-0.568	-1.92
	P1	-0.020	-3.34	0.946	9.74	1.203	4.62	-0.049	-0.17		P1	0.013	2.02	1.141	10.02	1.647	6.41	-0.192	-0.86
	P10-P1	0.026	3.75	-0.106	-0.72	-0.178	-0.64	-0.145	-0.53		P10-P1	-0.015	-1.60	-0.330	-2.59	-1.199	-3.03	-0.376	-1.18
Russia	P10	0.012	1.79	0.548	6.69	0.173	1.07	0.154	1.08	Thailand	P10	0.003	0.52	0.778	7.62	1.379	2.45	-0.416	-0.95
	P1	0.072	1.13	1.258	1.58	-0.977	-0.83	-0.897	-0.84		P1	-0.007	-1.77	0.931	10.27	1.331	3.11	-0.714	-2.48
	P10-P1	-0.060	-0.91	-0.716	-0.87	1.146	0.94	1.047	0.95		P10-P1	0.010	1.98	-0.152	-1.67	0.048	0.15	0.298	1.27
Turkey	P10	-0.008	-1.72	0.904	18.97	0.372	2.06	0.590	4.22										
	P1	0.004	0.76	0.925	23.08	0.816	3.55	0.731	4.13										
	P10-P1	-0.012	-1.85	-0.021	-0.33	-0.443	-1.85	-0.141	-0.83										

Table 4: Results for time-series regression of earnings momentum portfolios on Fama-French model

This table reports the time series reports the regression estimates from time-series regressions of monthly excess returns of the winner decile portfolio (P_{10}), loser decile portfolio (P_1) and the hedge portfolio ($P_{10}-P_1$) on the Fama-French three-factor model for each emerging market. The portfolios are sorted into deciles based on past six-month earnings forecast revisions and invested for a six-month horizon. All figures refer to the period from January 1991 to December 2007.

		α		Market		SMB		HML				α		Market		SMB		HML	
		Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat			Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat
Brazil	P10	0,017	3,61	0,750	10,65	0,517	1,70	-0,206	-0,99	Egypt	P10	0,014	1,08	0,471	1,61	0,167	0,33	-0,686	-1,59
	P1	0,002	0,49	0,705	9,95	0,321	1,19	0,136	0,65		P1	-0,030	-1,63	0,723	1,90	0,577	0,58	0,148	0,21
	P10-P1	0,014	2,29	0,045	0,50	0,196	0,51	-0,342	-1,27		P10-P1	0,044	1,68	-0,252	-0,41	-0,411	-0,30	-0,834	-0,90
Chile	P10	0,009	1,57	0,969	6,30	-0,196	-0,65	-0,731	-1,73	Morocco	P10	0,007	0,79	0,893	3,78	0,402	1,04	1,373	2,66
	P1	-0,012	-2,34	1,174	7,09	-0,581	-1,69	-0,029	-0,08		P1	0,017	0,82	1,897	2,60	1,634	1,74	3,067	2,35
	P10-P1	0,020	2,65	-0,205	-0,87	0,385	0,75	-0,703	-1,10		P10-P1	-0,010	-0,53	-1,004	-1,37	-1,233	-1,15	-1,694	-1,13
Colombia	P10	-	-	-	-	-	-	-	-	South Africa	P10	0,005	1,32	0,873	13,41	0,526	2,98	0,098	0,65
	P1	-	-	-	-	-	-	-	-		P1	-0,010	-2,45	0,838	9,59	0,581	2,42	-0,236	-1,09
	P10-P1	-	-	-	-	-	-	-	-		P10-P1	0,014	3,33	0,035	0,39	-0,055	-0,19	0,334	1,30
Mexico	P10	0,004	0,79	0,869	7,38	0,806	2,89	0,660	2,43	China	P10	0,026	2,79	0,974	9,78	-0,331	-1,08	1,829	2,94
	P1	-0,014	-2,63	0,719	9,10	0,919	3,53	0,734	2,94		P1	0,015	1,31	0,956	6,51	0,848	1,93	1,568	2,19
	P10-P1	0,019	2,63	0,150	1,35	-0,113	-0,32	-0,074	-0,21		P10-P1	0,011	0,96	0,018	0,13	-1,179	-2,50	0,262	0,50
Peru	P10	-0,011	-1,01	0,555	3,16	0,489	1,56	0,059	0,29	India	P10	0,007	1,39	1,080	16,57	1,060	4,97	1,263	4,70
	P1	0,013	0,86	0,800	2,76	0,462	0,98	-0,063	-0,36		P1	0,005	1,04	1,053	17,96	1,471	6,03	1,436	5,66
	P10-P1	-0,024	-1,28	-0,245	-0,78	0,027	0,05	0,122	0,41		P10-P1	0,001	0,27	0,027	0,48	-0,411	-1,78	-0,173	-0,62
Czech Republic	P10	-0,015	-1,07	0,552	3,26	-0,003	-0,01	-0,175	-0,71	Indonesia	P10	0,009	1,20	1,092	8,50	1,138	2,25	-0,468	-1,14
	P1	0,003	0,16	1,090	4,77	1,199	2,73	0,178	0,53		P1	0,003	0,58	1,258	19,58	1,621	4,20	-0,991	-2,26
	P10-P1	-0,017	-0,89	-0,537	-2,00	-1,203	-2,21	-0,353	-0,86		P10-P1	0,006	0,73	-0,166	-1,41	-0,483	-0,75	0,523	1,13
Hungary	P10	-0,004	-0,66	0,824	10,18	0,393	2,4	0,087	0,73	Malaysia	P10	0,016	3,04	1,040	13,57	1,843	4,99	0,229	0,64
	P1	-0,025	-2,09	1,014	5,96	0,394	1,24	0,290	1,14		P1	0,007	1,12	1,268	10,82	1,769	5,31	-0,030	-0,08
	P10-P1	0,022	1,89	-0,190	-1,25	-0,001	0	-0,204	-0,82		P10-P1	0,008	1,44	-0,228	-2,37	0,074	0,21	0,258	0,67
Poland	P10	-0,001	-0,12	0,674	2,43	-0,300	-0,37	-1,702	-1,54	Philippines	P10	0,006	0,98	0,895	10,03	0,698	2,47	-0,095	-0,41
	P1	-0,004	-0,43	0,949	5,34	0,854	2,73	-0,095	-0,32		P1	0,000	-0,04	1,277	9,49	0,767	2,41	-0,325	-1,17
	P10-P1	0,003	0,24	-0,275	-0,85	-1,153	-1,51	-1,607	-1,66		P10-P1	0,006	0,72	-0,381	-3,04	-0,068	-0,18	0,230	0,74
Russia	P10	0,023	2,15	0,484	2,56	-0,785	-2,00	0,271	1,08	Thailand	P10	0,008	1,63	0,961	10,47	1,27	4,97	-0,818	-2,34
	P1	0,029	2,35	0,432	1,56	-0,020	-0,04	0,357	1,03		P1	-0,008	-1,70	1,043	9,83	0,99	1,95	-0,385	-1,29
	P10-P1	-0,006	-0,37	0,052	0,17	-0,765	-1,13	-0,085	-0,22		P10-P1	0,016	2,78	-0,081	-0,73	0,28	0,57	-0,433	-1,2
Turkey	P10	0,001	0,10	0,981	14,47	0,527	1,53	0,513	1,33										
	P1	0,000	-0,05	1,173	17,88	0,978	2,26	0,569	1,43										
	P10-P1	0,001	0,11	-0,192	-2,49	-0,451	-0,87	-0,056	-0,09										

Table 7: Statistics of price momentum portfolio returns categorized by illiquidity and information uncertainty proxies

This table gives the return differentials of the price momentum hedge strategies by terciles of different illiquidity and information uncertainty metrics. We first sort stocks into ten deciles based on their six-month past performance. For each decile the stocks are further sorted into three terciles based on bid-ask spread ratio, share turnover and total stock volatility. Then we calculate the return difference between winner and loser portfolios for each level of the three proxies. Below the return differentials we give t-statistics. The portfolios are formed based on the six-month checking back and six-month holding strategy. All figures refer to the period from January 1991 to December 2007.

		Spread Ratio			Turnover			Volatility		
		HSPR	MSPR	LSPR	HTURN	MTURN	LTURN	HVOL	MVOL	LVOL
Chile	%	1.99	0.40	-0.60	1.96	1.42	2.32	3.16	1.18	1.10
	t-stat	1.23	0.32	-0.29	2.19	2.26	3.02	2.68	2.64	3.11
Hungary	%	-	-	-	0.01	0.05	-0.14	-0.06	0.07	0.02
	t-stat	-	-	-	0.23	0.40	-1.36	-0.92	2.86	1.10
India	%	-	-	-	2.73	2.03	-0.24	0.35	1.57	1.05
	t-stat	-	-	-	3.84	2.86	-0.39	0.53	2.77	2.18
Mexico	%	3.17	-0.26	-1.54	1.61	1.84	3.14	1.46	1.68	0.92
	t-stat	2.20	-0.22	-1.39	1.60	1.64	2.24	1.14	2.32	2.02
Poland	%	2.91	3.06	1.46	2.49	2.00	2.31	3.21	2.22	2.35
	t-stat	2.46	2.76	1.02	2.22	1.74	2.27	2.41	2.46	3.60
South Africa	%	1.10	2.41	2.08	2.77	1.94	1.49	1.81	2.85	1.48
	t-stat	0.81	3.14	2.94	3.74	2.54	1.64	1.73	4.10	4.80
Thailand	%	-0.10	1.03	0.81	0.14	1.95	0.18	-0.89	1.04	1.38
	t-stat	-0.14	1.30	1.07	0.15	2.67	0.30	-0.86	1.54	3.58

Table 9: GRS test results on time-series regression of price momentum portfolios on Fama-French model

This table presents the intercepts from regressions of the excess return of each decile relative strength price momentum portfolio on the Fama-French model for the emerging markets demonstrating significant price momentum profits. The portfolios are sorted into deciles based on past six-month returns and invested for a six-month horizon. All figures refer to the period from January 1991 to December 2007. The table also gives the Gibbons et al. (1989) test statistics and the associated p-values.

	$R_{p,t}-R_{f,t}=\alpha+\beta_1(R_{m,t}-R_{f,t})+\beta_2SMB_t+\beta_3HML_t+\epsilon_t$											
	alpha										GRS	P-value
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10		
Chile	-0.0094	0.0014	0.0019	0.0073	0.0025	0.0040	0.0072	0.0047	0.0055	0.0114	5.31	0.0000
Hungary	-0.0179	-0.0018	-0.0222	-0.0136	-0.0048	-0.0088	0.0053	-0.0003	0.0012	0.0004	1.11	0.3549
India	0.0005	0.0091	0.0091	0.0081	0.0006	0.0071	0.0057	0.0107	0.0125	0.0124	4.58	0.0000
Mexico	-0.0011	-0.0054	-0.0164	-0.0135	-0.0117	0.0015	0.0028	-0.0009	0.0054	0.0076	6.85	0.0000
Poland	-0.0200	-0.0132	-0.0136	-0.0062	-0.0010	-0.0014	-0.0074	0.0008	0.0008	0.0063	2.05	0.0322
South Africa	-0.0160	-0.0113	-0.0111	-0.0047	-0.0097	-0.0060	-0.0014	0.0009	0.0032	0.0052	3.89	0.0001
Thailand	-0.0073	-0.0012	-0.0035	-0.0079	-0.0039	-0.0031	-0.0006	0.0042	0.0032	0.0028	1.34	0.2116

Table 10: GRS test results on time-series regression of price momentum portfolios on Fama-French three factors and earnings momentum-based factor PMN

This table presents the intercepts from regressions of the excess return of each decile relative strength price momentum portfolio on the extended Fama-French model by including PMN as a factor for the emerging markets demonstrating significant price momentum profits. The portfolios are sorted into deciles based on past six-month returns and invested for a six-month horizon. All figures refer to the period from January 1991 to December 2007. The table also gives the Gibbons et al. (1989) test statistics and the associated p-values.

	$R_{p,t}-R_{f,t}=\alpha+\beta_1(R_{m,t}-R_{f,t})+\beta_2SMB_t+\beta_3HML_t+\beta_4PMN_t+\varepsilon_t$											
	alpha										GRS	P-value
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10		
Chile	-0.008	0.002	0.001	0.006	0.003	0.003	0.006	0.004	0.005	0.010	3.70	0.0002
Hungary	-0.020	0.002	-0.022	-0.013	-0.002	-0.009	0.005	-0.002	0.003	-0.001	0.81	0.6198
India	0.001	0.009	0.009	0.008	0.000	0.007	0.006	0.011	0.012	0.012	4.07	0.0001
Mexico	0.001	-0.005	-0.015	-0.014	-0.014	0.004	0.003	-0.001	0.005	0.007	5.54	0.0000
Poland	-0.018	-0.009	-0.011	-0.005	-0.004	-0.001	0.000	0.003	0.005	0.006	1.89	0.0534
South Africa	-0.014	-0.012	-0.011	-0.005	-0.010	-0.006	-0.003	-0.001	0.003	0.003	3.57	0.0002
Thailand	-0.006	0.000	-0.003	-0.008	-0.003	-0.002	0.001	0.003	0.004	0.003	1.33	0.2163

Table 11: GRS test results on time-series regression of earnings momentum portfolios on Fama-French model

This table presents the intercepts from regressions of the excess return of each decile relative strength earnings momentum portfolio on the Fama-French model for the emerging markets demonstrating significant price momentum profits. The portfolios are sorted into deciles based on past six-month earnings forecast revisions and invested for a six-month horizon. All figures refer to the period from January 1991 to December 2007. The table also gives the Gibbons et al. (1989) test statistics and the associated p-values.

	$R_{p,t}-R_{f,t}=\alpha+\beta_1(R_{m,t}-R_{f,t})+\beta_2SMB_t+\beta_3HML_t+\epsilon_t$											
	alpha										GRS	P-value
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10		
Chile	-0.0116	-0.0051	0.0005	-0.0084	-0.0015	0.0057	0.0012	-0.0031	0.0007	0.0087	2.60	0.0060
Hungary	-0.0254	-0.0138	-0.0016	-0.0117	-0.0126	-0.0016	-0.0050	0.0065	-0.0051	-0.0037	1.48	0.1573
India	0.0052	-0.0007	0.0020	0.0000	0.0034	-0.0034	0.0007	0.0027	0.0072	0.0065	1.00	0.4502
Mexico	-0.0143	0.0008	-0.0047	-0.0040	-0.0049	-0.0048	-0.0039	-0.0003	0.0031	0.0045	1.58	0.1175
Poland	-0.0036	-0.0025	-0.0070	0.0065	-0.0213	-0.0042	-0.0014	0.0020	-0.0048	-0.0010	2.47	0.0098
South Africa	-0.0097	-0.0018	-0.0046	-0.0042	-0.0023	-0.0029	-0.0007	0.0013	0.0009	0.0046	1.77	0.0694
Thailand	-0.0079	-0.0025	-0.0014	-0.0074	-0.0061	-0.0054	-0.0046	0.0007	0.0029	0.0076	2.00	0.0362

Table 12: GRS test results on time-series regression of earnings momentum portfolios on Fama-French three factors and price momentum-based factor WML

This table presents the intercepts from regressions of the excess return of each decile relative strength earnings momentum portfolio on the extended Fama-French model by including WML as a factor for the emerging markets demonstrating significant price momentum profits. The portfolios are sorted into deciles based on past six-month earnings forecast revisions and invested for a six-month horizon. All figures refer to the period from January 1991 to December 2007. The table also gives the Gibbons et al. (1989) test statistics and the associated p-values.

	$R_{p,t}-R_{f,t}=\alpha+\beta_1(R_{m,t}-R_{f,t})+\beta_2SMB_t+\beta_3HML_t+\beta_4WML_t+\varepsilon_t$											
	alpha										GRS	P-value
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10		
Chile	-0.0070	-0.0013	0.0035	-0.0080	-0.0003	0.0099	0.0021	-0.0015	0.0011	0.0069	2.14	0.0247
Hungary	-0.0251	-0.0116	-0.0021	-0.0109	-0.0106	-0.0012	-0.0046	0.0062	-0.0051	-0.0039	1.30	0.2374
India	0.0079	0.0000	0.0030	0.0012	0.0033	-0.0038	0.0013	0.0035	0.0093	0.0077	1.46	0.1576
Mexico	-0.0139	0.0026	-0.0049	-0.0043	-0.0048	-0.0047	-0.0046	0.0001	0.0034	0.0029	1.55	0.1259
Poland	0.0040	-0.0008	-0.0044	0.0087	-0.0207	-0.0032	-0.0012	0.0027	-0.0054	0.0051	2.24	0.0197
South Africa	-0.0042	0.0021	-0.0004	-0.0016	-0.0015	-0.0036	-0.0025	0.0008	-0.0019	0.0048	1.08	0.3828
Thailand	-0.0072	-0.0019	0.0000	-0.0057	-0.0030	-0.0033	-0.0046	0.0007	0.0033	0.0077	1.62	0.1036

Table 13: Z-stats of Dickey_Fuller test on unit roots for all the time series regression variables

This table reports the Z-statistics for the Dickey_Fuller unit roots tests on all the dependent and independent variables in the time series regression models in this study. P10_Rf stands for the excess return of the winner portfolio, P1_Rf stands for the excess return of the loser portfolio. Each Z-stats also contain the level of significance. * = $p < 10\%$, ** = $p < 5\%$, *** = $p < 1\%$.

	Dickey_Fuller test for unit roots (Z-stats)								
	Price momentum			Earnings momentum			Mkt_Rf	SMB	HML
	P10_Rf	P1_Rf	WML	P10_Rf	P1_Rf	PMN			
Brazil	-6.639***	-6.937***	-15.96***	-8.113***	-8.435***	-13.631***	-9.107***	-11.957***	-12.415***
Chile	-6.733***	-8.507***	-16.942***	-8.994***	-9.633***	-13.897***	-8.321***	-12.455***	-11.841***
Colombia	-10.317***	-10.779***	-10.75***	-7.606***	-8.571***	-8.981***	-7.25***	-10.934***	-11.721***
Mexico	-10.498***	-10.309***	-15.29***	-10.574***	-10.479***	-14.281***	-12.5***	-14.41***	-11.163***
Peru	-7.701***	-6.338***	-9***	-7.202***	-6.511***	-8.822***	-8.21***	-7.849***	-9.103***
Czech Republic	-6.406***	-6.336***	-6.466***	-7.349***	-7.45***	-8.335***	-7.885***	-8.623***	-8.021***
Hungary	-11.544***	-11.959***	-15.304***	-9.469***	-9.763***	-12.077***	-9.634***	-14.136***	-12.529***
Poland	-9.011***	-9.964***	-11.055***	-11.823***	-10.123***	-11.731***	-11.701***	-11.66***	-11.281***
Russia	-6.369***	-3.75***	-6.644***	-5.957***	-5.108***	-6.456***	-6.448***	-6.429***	-7.283***
Turkey	-8.382***	-8.847***	-12.416***	-8.954***	-9.737***	-11.834***	-9.882***	-15.69***	-14.51***
Egypt	-5.553***	-4.534***	-10.558***	-3.49**	-5.558***	-7.181***	-3.732**	-4.63***	-5.49***
Morocco	-4.731***	-4.319***	-7.653***	-7.364***	-4.454***	-4.556***	-5.503***	-5.175***	-7.078***
South Africa	-11.422***	-11.3***	-14.789***	-10.368***	-12.487***	-15.814***	-12.142***	-14.314***	-11.186***
China	-5.258***	-5.373***	-6.44***	-5.242***	-4.67***	-6.502***	-5.46***	-6.809***	-7.11***
India	-8.952***	-9.595***	-11.59***	-9.948***	-9.116***	-16.695***	-10.553***	-11.656***	-10.789***
Indonesia	-7.982***	-9.919***	-13.791***	-8.427***	-10.133***	-13.934***	-10.206***	-14.506***	-12.747***
Malaysia	-9.624***	-9.942***	-12.707***	-9.522***	10.009***	-15.191***	-9.599***	-10.673***	-14.098***
Philippines	-11.36***	-11.385***	-13.928***	-11.994***	-11.714***	-14.081***	-12.805***	-12.898***	-13.008***
Thailand	-10.992***	-12.216***	-13.479***	-12.712***	-12.335***	-15.179***	-13.543***	-12.342***	-12.775***

Table 14: Robustness tests on autocorrelation, heteroskedasticity and normality of residuals for time series regression models

This table reports the p -values of Breusch-Godfrey LM test for autocorrelation, White's test for heteroskedasticity and Shapiro-Wilk W test for normality for all the time series regression models in this study. Panel A shows the p -values of the three robustness tests for time series regressions of price momentum on Fama-French three factor model. Panel B shows the p -values of the three robustness tests for time series regressions of earnings momentum on Fama-French three factor model. Panel C shows the p -values of the three robustness tests for time series regressions of price momentum on Fama-French three factors and PMN. Panel D shows the p -values of the three robustness tests for time series regressions of earnings momentum on Fama-French three factors and WML.

Robustness tests on autocorrelation, heteroskedasticity and normality of residuals for time series regressions									
Panel A: Time series regression of Price momentum on Fama-French three factor model									
	$R_{p10,t}-R_{f,t}=\alpha+\beta_1(R_{m,t}-R_{f,t})+\beta_2SMB_t+\beta_3HML_t+\varepsilon_t$			$R_{p1,t}-R_{f,t}=\alpha+\beta_1(R_{m,t}-R_{f,t})+\beta_2SMB_t+\beta_3HML_t+\varepsilon_t$			$R_{p10,t}-R_{p1,t}=\alpha+\beta_1(R_{m,t}-R_{f,t})+\beta_2SMB_t+\beta_3HML_t+\varepsilon_t$		
	Breusch-Godfrey LM test for autocorrelation (Prob>Chi2)	White's test for heteroskedasticity (Prob>Chi2)	Shapiro-Wilk W test for normality (Prob>Z)	Breusch-Godfrey LM test for autocorrelation (Prob>Chi2)	White's test for heteroskedasticity (Prob>Chi2)	Shapiro-Wilk W test for normality (Prob>Z)	Breusch-Godfrey LM test for autocorrelation (Prob>Chi2)	White's test for heteroskedasticity (Prob>Chi2)	Shapiro-Wilk W test for normality (Prob>Z)
Brazil	0.389	0.871	0.316	0.431	0.030	0.452	0.898	0.476	0.208
Chile	0.982	0.000	0.000	0.258	0.111	0.098	0.418	0.000	0.641
Colombia	0.051	0.004	0.010	0.827	0.164	0.000	0.044	0.000	0.000
Mexico	0.898	0.628	0.148	0.669	0.542	0.002	0.601	0.571	0.112
Peru	0.720	0.049	0.000	0.816	0.000	0.001	0.805	0.000	0.002
Czech Republic	0.013	0.276	0.000	0.579	0.021	0.050	0.492	0.012	0.001
Hungary	0.011	0.988	0.002	0.010	0.004	0.002	0.001	0.013	0.041
Poland	0.795	0.000	0.027	0.806	0.002	0.000	0.761	0.000	0.030
Russia	0.691	0.567	0.199	0.817	0.810	0.000	0.896	0.814	0.000
Turkey	0.174	0.844	0.845	0.383	0.000	0.469	0.485	0.001	0.853
Egypt	0.740	0.955	0.272	0.187	0.038	0.361	0.328	0.974	0.721
Morocco	0.028	0.282	0.129	0.276	0.049	0.578	0.984	0.041	0.656
South Africa	0.271	0.000	0.072	0.665	0.043	0.032	0.677	0.002	0.074
China	0.628	0.023	0.000	0.594	0.000	0.000	0.313	0.484	0.204
India	0.000	0.003	0.101	0.185	0.818	0.113	0.144	0.001	0.039
Indonesia	0.053	0.000	0.000	0.192	0.000	0.052	0.543	0.000	0.204
Malaysia	0.405	0.405	0.000	0.542	0.005	0.238	0.210	0.000	0.000
Philippines	0.272	0.550	0.000	0.222	0.007	0.000	0.624	0.008	0.000
Thailand	0.021	0.000	0.000	0.059	0.046	0.000	0.563	0.053	0.000

Panel B: Time series regression of Earnings momentum on Fama-French three factor model									
	$R_{p10,t}-R_{f,t}=\alpha+\beta_1(R_{m,t}-R_{f,t})+\beta_2SMB_t+\beta_3HML_t+\varepsilon_t$			$R_{p1,t}-R_{f,t}=\alpha+\beta_1(R_{m,t}-R_{f,t})+\beta_2SMB_t+\beta_3HML_t+\varepsilon_t$			$R_{p10,t}-R_{p1,t}=\alpha+\beta_1(R_{m,t}-R_{f,t})+\beta_2SMB_t+\beta_3HML_t+\varepsilon_t$		
	Breusch-Godfrey LM test for autocorrelation (Prob>Chi2)	White's test for heteroskedasticity (Prob>Chi2)	Shapiro-Wilk W test for normality (Prob>Z)	Breusch-Godfrey LM test for autocorrelation (Prob>Chi2)	White's test for heteroskedasticity (Prob>Chi2)	Shapiro-Wilk W test for normality (Prob>Z)	Breusch-Godfrey LM test for autocorrelation (Prob>Chi2)	White's test for heteroskedasticity (Prob>Chi2)	Shapiro-Wilk W test for normality (Prob>Z)
Brazil	0.770	0.810	0.412	0.162	0.971	0.977	0.400	0.465	0.693
Chile	0.783	0.727	0.593	0.244	0.898	0.942	0.804	0.316	0.391
Colombia	-	-	-	-	-	-	-	-	-
Mexico	0.783	0.780	0.006	0.346	0.623	0.085	0.515	0.911	0.003
Peru	0.400	0.883	0.002	0.522	0.986	0.020	0.986	0.706	0.505
Czech Republic	0.324	0.185	0.395	0.956	0.751	0.826	0.242	0.166	0.592
Hungary	0.326	0.000	0.037	0.299	0.315	0.000	0.280	0.964	0.064
Poland	0.213	0.000	0.000	0.435	0.011	0.000	0.574	0.000	0.000
Russia	0.835	0.482	0.019	0.618	0.133	0.002	0.971	0.274	0.021
Turkey	0.690	0.957	0.739	0.794	0.255	0.649	0.347	0.156	0.608
Egypt	0.482	0.077	0.390	0.193	0.534	0.005	0.314	0.214	0.011
Morocco	0.991	0.275	0.053	0.155	0.037	0.000	0.381	0.035	0.000
South Africa	0.088	0.969	0.057	0.519	0.000	0.020	0.174	0.000	0.115
China	0.916	0.675	0.853	0.982	0.675	0.796	0.677	0.001	0.837
India	0.837	0.126	0.237	0.537	0.258	0.928	0.013	0.930	0.858
Indonesia	0.607	0.000	0.000	0.010	0.011	0.007	0.890	0.000	0.000
Malaysia	0.876	0.000	0.021	0.073	0.000	0.000	0.539	0.000	0.029
Philippines	0.248	0.003	0.028	0.617	0.007	0.000	0.562	0.003	0.000
Thailand	0.902	0.000	0.000	0.929	0.000	0.000	0.413	0.000	0.000

Panel C: Time series regressions of Price momentum on Fama-French three factors and PMN									
	$R_{p10,t}-R_{f,t}=\alpha+\beta_1(R_{m,t}-R_{f,t})+\beta_2SMB_t+\beta_3HML_t+\beta_4PMN_t+\epsilon_t$			$R_{p1,t}-R_{f,t}=\alpha+\beta_1(R_{m,t}-R_{f,t})+\beta_2SMB_t+\beta_3HML_t+\beta_4PMN_t+\epsilon_t$			$R_{p10,t}-R_{p1,t}=\alpha+\beta_1(R_{m,t}-R_{f,t})+\beta_2SMB_t+\beta_3HML_t+\beta_4PMN_t+\epsilon_t$		
	Breusch-Godfrey LM test for autocorrelation (Prob>Chi2)	White's test for heteroskedasticity (Prob>Chi2)	Shapiro-Wilk W test for normality (Prob>Z)	Breusch-Godfrey LM test for autocorrelation (Prob>Chi2)	White's test for heteroskedasticity (Prob>Chi2)	Shapiro-Wilk W test for normality (Prob>Z)	Breusch-Godfrey LM test for autocorrelation (Prob>Chi2)	White's test for heteroskedasticity (Prob>Chi2)	Shapiro-Wilk W test for normality (Prob>Z)
Chile	0.815	0.000	0.000	0.397	0.276	0.041	0.772	0.000	0.264
Mexico	0.893	0.510	0.155	0.648	0.736	0.001	0.560	0.293	0.031
Hungary	0.014	0.997	0.018	0.003	0.422	0.014	0.000	0.491	0.133
India	0.000	0.006	0.060	0.144	0.355	0.124	0.074	0.006	0.005
Poland	0.302	0.910	0.824	0.668	0.001	0.000	0.827	0.000	0.003
South Africa	0.163	0.000	0.182	0.785	0.564	0.054	0.670	0.016	0.347
Thailand	0.022	0.000	0.000	0.057	0.000	0.000	0.498	0.000	0.000

Panel D: Time series regressions of Earnings momentum on Fama-French three factors and WML									
	$R_{p10,t}-R_{f,t}=\alpha+\beta_1(R_{m,t}-R_{f,t})+\beta_2SMB_t+\beta_3HML_t+\beta_4WML_t+\epsilon_t$			$R_{p1,t}-R_{f,t}=\alpha+\beta_1(R_{m,t}-R_{f,t})+\beta_2SMB_t+\beta_3HML_t+\beta_4WML_t+\epsilon_t$			$R_{p10,t}-R_{p1,t}=\alpha+\beta_1(R_{m,t}-R_{f,t})+\beta_2SMB_t+\beta_3HML_t+\beta_4WML_t+\epsilon_t$		
	Breusch-Godfrey LM test for autocorrelation (Prob>Chi2)	White's test for heteroskedasticity (Prob>Chi2)	Shapiro-Wilk W test for normality (Prob>Z)	Breusch-Godfrey LM test for autocorrelation (Prob>Chi2)	White's test for heteroskedasticity (Prob>Chi2)	Shapiro-Wilk W test for normality (Prob>Z)	Breusch-Godfrey LM test for autocorrelation (Prob>Chi2)	White's test for heteroskedasticity (Prob>Chi2)	Shapiro-Wilk W test for normality (Prob>Z)
Chile	0.631	0.878	0.696	0.344	0.941	0.905	0.778	0.645	0.612
Mexico	0.611	0.970	0.004	0.307	0.576	0.104	0.476	0.886	0.002
Hungary	0.372	0.000	0.176	0.263	0.567	0.000	0.247	0.935	0.172
India	0.935	0.016	0.382	0.271	0.145	0.417	0.032	0.272	0.857
Poland	0.373	0.000	0.000	0.556	0.015	0.000	0.508	0.000	0.000
South Africa	0.092	0.968	0.054	0.589	0.121	0.014	0.168	0.001	0.203
Thailand	0.898	0.000	0.000	0.959	0.000	0.000	0.467	0.000	0.000

Table 15: Variance Inflation Factor (VIF) stats for multicollinearity test on time series regression models

This table reports the Variance Inflation Factor (VIF) statistics for the multicollinearity test on the time series models in this study. Panel A shows the VIF-stats of all independent variables for the regressions of price or earnings momentum on Fama-French three factor model for all Emerging Markets. Panel B shows the VIF-stats of all independent variables for the regression of price momentum on Fama-French three factors and PMN for those Emerging Markets demonstrating significant price momentum profits. Panel C shows the VIF-stats of all independent variables for the regression of earnings momentum on Fama-French three factors and WML for those Emerging Markets demonstrating significant price momentum profits. The critical value for the VIF-stats is 5.0.

[illegible]

Table 16: Illustration of the loadings of the winner and loser momentum portfolios on the Fama-French three factors

This figure illustrates the winner portfolio loadings (the sign on the left hand of < or >) and the loser portfolio loadings (the sign on the right hand of < or >) for price and earnings momentum trading strategy sorted by Fama-French three factors. The symbols +, - and 0 represent the sign of the regression coefficients on Fama-French model. (+ means the coefficients are significantly positive, - means that the coefficients are significantly negative, and 0 means the coefficients are not different from zero). The symbols < and > indicate a comparison of the loadings between winner portfolio and the loser portfolio. For example, the symbols + < + on the left top corner mean that in Chile both winner and loser price momentum portfolios have positive loadings on the market risk factor, and the loser price momentum portfolio has a larger loading on the market risk factor compared with the winner price momentum portfolio.

	Market		SMB		HML	
	Price	Earnings	Price	Earnings	Price	Earnings
Chile	+<+	+<+	0<+	0>-	-<0	-<0
Mexico	+<+	+>+	0<+	+<+	+>+	+<+
Hungary	+<+	+<+	+<+	+>0	+>0	0-0
Poland	+<+	+<+	+<+	0<+	-<0	0-0
South Africa	+<+	+>+	+<+	+<+	-<0	0-0
India	+>+	+>+	+<+	+<+	0<+	+<+
Thailand	+<+	+<+	+>+	+>+	0>-	-<0

Table 17: Summary of the loadings of winner and loser price momentum portfolios on the Fama-French three factors across markets

This figure illustrates a comparison between the price and earnings momentum relative strength portfolios loadings on Fama-French three factors based on the illustration showing in Figure 7. The first row presents the number of markets where the winner (loser) portfolios across markets have the same signs of regression coefficients for both price and earnings momentum on the same factor. The second row demonstrates the number of markets where the winner (loser) portfolios across markets have opposite signs of regression coefficients for both price and earnings momentum on the same factor. The third row is the number of markets where the winner (loser) portfolio has larger loading on a factor than the loser (winner) portfolio for both price and earnings momentum.

	Market		SMB		HML	
	Winner	Loser	Winner	Loser	Winner	Loser
No. Markets with the same signs of loadings for both price and earnings momentum	7	7	4	5	2	2
No. Markets with opposite signs of loadings for both price and earnings momentum	0	0	0	1	0	0
No. Markets with the same loading difference between winner and loser portfolios	5		5		2	

Notes for Table 16-17:

Both the winner and loser portfolios load positively on the market factor for both price and earnings momentum strategies. Also, both the price and earnings momentum returns have similar patterns on market factor loading in a majority of the seven markets exhibiting price momentum. That is to say, in the same market, if the winner portfolio has heavier loading on the market risk premium than the loser portfolio for the price momentum, it will be the same tendency for the earnings momentum relative strength portfolios in the same market.

In most of the seven markets, both the price and earnings momentum returns have similar patterns on the SMB factor loading: the price momentum winner (loser) portfolio has the same sign of loading on SMB with the earnings momentum winner (loser) portfolio; if the winner portfolio has larger loading on SMB than the loser portfolios for price momentum, the same pattern will hold for earnings momentum.

The loadings of both price and earnings momentum portfolios on HML factor haven't shown any clear patterns, and the coefficients are not significantly different from zero in most of the seven markets.

To summarize, in addition to the tendency that the markets exhibiting price momentum also demonstrate earnings momentum, both the price and earnings momentum returns in the same market show similar patterns on the Fama-Frech three factor loadings.

Appendix II

Random walk & serial correlation

The series of stock prices (inclusive of dividends) are in theory expected to follow a random walk if the future changes are not predictable.

$$\log P_{t+1} = \mu + \log P_t + \varepsilon_{t+1}$$

$$\log P_{t+1} - \log P_t = \mu + \varepsilon_{t+1}$$

$$\log\left(\frac{P_{t+1}}{P_t}\right) = \mu + \varepsilon_{t+1}$$

$$\log(1 + R_{t+1}) = \mu + \varepsilon_{t+1}$$

$$r_{t+1} = \mu + \varepsilon_{t+1}$$

If returns follow a random walk, the error term needs to be IID where the expected value of the error term is zero and have a constant variance:

$$\varepsilon_{t+1} \sim IID(0, \sigma^2)$$

Given this holds, the (log) returns will show the following characteristics:

$$E(r_{t+1}) = \mu$$

$$Var(r_{t+1}) = Var(\varepsilon_{t+1}) = \sigma^2$$

Which means the (log) stock returns should follow a stochastic process if the efficient market hypothesis holds:

$$r_{t+1} \sim N(\mu, \sigma^2)$$

There are several empirical findings rejecting the hypothesis that returns are unpredictable and independent over time. The presence of serial correlation in returns is such a violation of the random walk theory.

The serial correlation implies that the error term in one period is dependent on the error term in another period and violating the assumption that the price in one period cannot be used to determine the price in another period.

$$Corr[r_t, r_{t+1}] = Corr[(\mu + \varepsilon_t), (\mu + \varepsilon_{t+1})]$$

Since the drift, μ is deterministic:

$$\rightarrow Corr[\varepsilon_t, \varepsilon_{t+1}]$$

According to the random walk, $Corr[\varepsilon_t, \varepsilon_{t+1}]$ must be equal to zero.

Figure 3 Post Earnings Announcement Drift

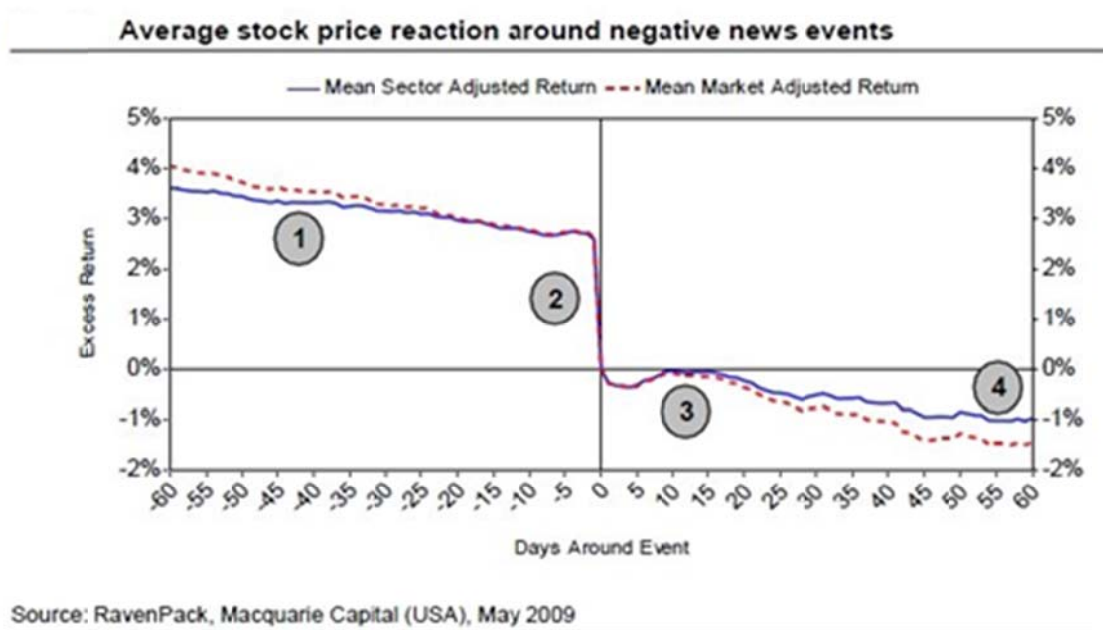


Figure 4: Illustration of past performance checking back (CB) periods for price momentum

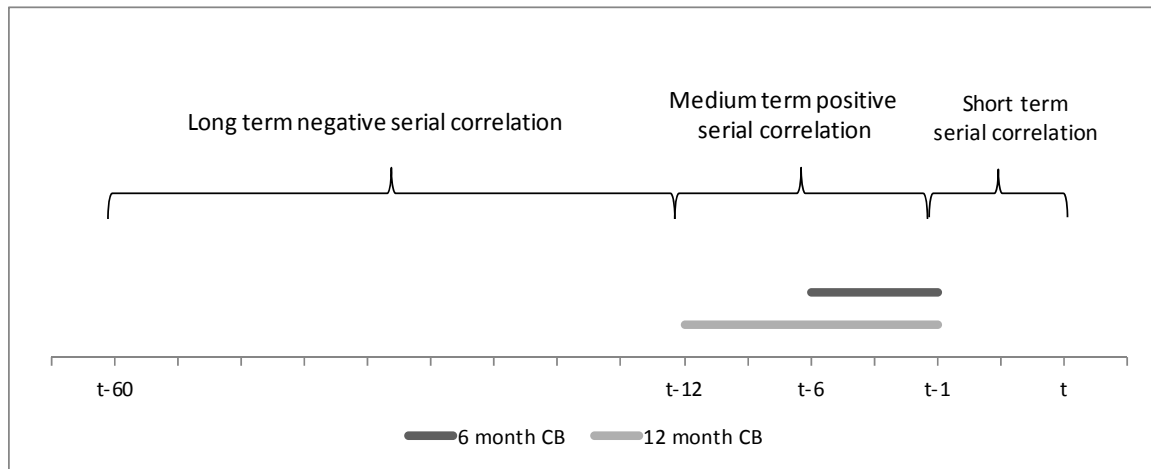


Figure 5: Representation of the six month holding momentum trading strategy

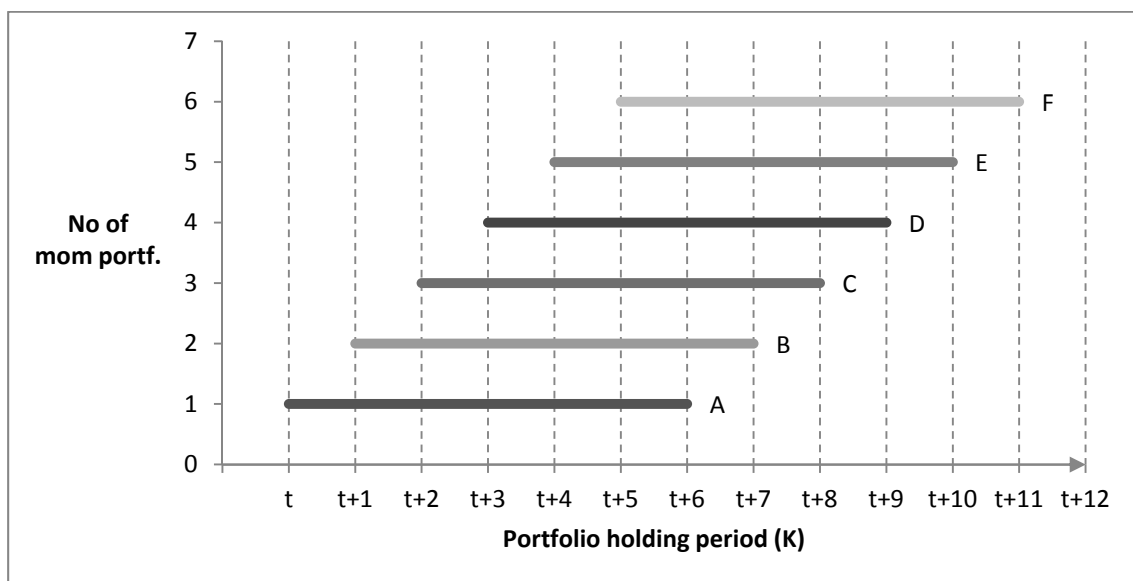


Table 18: Comparison of momentum portfolio formation between previous research and this thesis

Month	Previous Research		Thesis	
	Portfolio Return	Portfolio configuration	Portfolio Return	Portfolio configuration
t	-	Portfolio A formation	-	Portfolio A formation
t+1	A	Portfolio B formation	A	-
t+2	A+B	Portfolio C formation	A	-
t+3	A+B+C	Portfolio D formation	A	-
t+4	A+B+C+D	Portfolio E formation	A	-
t+5	A+B+C+D+E	Portfolio F formation	A	-
t+6	A+B+C+D+E+F	Portfolio A closed out Portfolio G formation	A	Portfolio A closed out Portfolio B formation
t+7	B+C+D+E+F+G	Portfolio B closed out Portfolio H formation	B	-
t+8	C+D+E+F+G+H	Portfolio C closed out Portfolio I formation	B	-

Notes for Figure 4-5 and Table 18:

In previous research the momentum portfolios are created in each month t and the portfolio holding periods are thereby overlapping as shown in Figure 5. This method is widely used to increase the explanatory power of the tests when evaluating the momentum trading strategy.

A common practice in previous research is to form a new portfolio in each month and measure the performance of the momentum portfolio that has been formed as an aggregate composition of K portfolios in each month (Table 18). The total amount of overlapping portfolios in each month t will be equal to the holding period K . As mentioned, the K portfolios are regarded as an aggregate trading strategy. Consequently, in each month t , $1/K$ of the total amount of the stock positions will be rebalanced while the rest is carried on top the next month.

However, this thesis aims to to evaluate the momentum trading strategies from an investor perspective. In reality, the investor will invest in one portfolio at a time and hold it for K months. As a result, this study will not adopt the overlapping portfolios method. Instead, a portfolio will hold for K months and another portfolio will be formed based on its past performance only if the existing portfolio has been closed out. At the same time, we will measure the performance of the relative strength portfolios and the zero cost portfolios in each month t of the holding period (Table 18).

Appendix III Data description

Table 19: Criteria for market indices classification as provided by MSCI Market Classification Framework, June 2010

Criteria	Frontier	Emerging	Developed
A Economic Development			
A.1 Sustainability of economic development	No requirement	No requirement	Country GNI per capita 25% above the World Bank high income threshold* for 3 consecutive years
B Size and Liquidity Requirements			
B.1 Number of companies meeting the following Standard Index criteria Company size (full market cap) ** Security size (float market cap) ** Security liquidity	2 USD 438 mm USD 28 mm 2.5% ATVR	3 USD 876 mm USD 438 mm 15% ATVR	5 USD 1752 mm USD 876 mm 20% ATVR
C Market Accessibility Criteria			
C.1 Openness to foreign ownership	At least some	Significant	Very high
C.2 Ease of capital inflows / outflows	At least partial	Significant	Very high
C.3 Efficiency of the operational framework	Modest	Good and tested	Very high
C.4 Stability of the institutional framework	Modest	Modest	Very high

* High income threshold for 2008: GNI per capita of USD 11,906 (World Bank, Atlas method)

** Minimum in use for the November 2010 Semi-Annual Index Review, updated on a semi-annual basis

Table 20: Previous market reclassifications provided by MSCI

Country Indices	Market Reclassification	Date*
MSCI Israel Index	From Emerging to Developed Markets	May-10
MSCI Bangladesh Index	From Standalone to Frontier Markets	May-10
MSCI Argentina Index	From Emerging to Frontier Markets	May-09
MSCI Pakistan Index**	From Standalone to Frontier Markets	May-09
MSCI Trinidad & Tobago Index	From Standalone to Frontier Markets	May-09
MSCI Jordan Index	From Emerging to Frontier Markets	Nov-08
MSCI Lithuania Index	From Standalone to Frontier Markets	Nov-08
MSCI Serbia Index	From Standalone to Frontier Markets	Nov-08
MSCI Sri Lanka***	From Standalone to Frontier Markets	Nov-07
MSCI Venezuela Index****	From Emerging to Standalone	May-06
MSCI Greece Index	From Emerging to Developed Markets	May-01
MSCI Portugal Index	From Emerging to Developed Markets	Nov-97

**As of the close of the last business day of the month*

***Pakistan was removed from the MSCI Emerging Market Index in December 2008 and maintained as a standalone country index*

****Sri Lanka was removed from the MSCI Emerging Markets Index in June 2001 and maintained as a standalone country index*

*****Index was discontinued on January 2, 2008*

Table 21: Data description

This table represents all data variables that have been included in the thesis as provided by DataStream

Description of datasets			
Company panel data			
Variable	Data type	Data description	Mnemonic in DATASTREAM
ReturnIndex	Monthly	The total return for a security. Includes the increase in market value and the dividend paid to shareholders	RI
Price	Monthly	The closing price for the security. Prices are adjusted for capital actions	P
Earnings	Monthly	12 month forward EPS by analysts as a weighted average of the current fiscal year and the next	F1FD12
NoShares	Monthly	The total number of shares traded for each stock in each day. Taken from primary exchanges for each security	VO
TurnoverByShare	Monthly	The total number of shares that represent the capital of the company	NOSH
BookValue	Monthly	The book value of common equity for each firm	WC05476
Volatility	Computed from daily price	The monthly average volatility for each stock in each month, computed from daily price of the stock	
SpreadRatio	Computed from daily bid and ask price	The monthly average spreadratio for each stock in each month, computed from daily bid and ask price of the stock	
Market macro data			
Market index	Monthly	Major stock index in each market	
Risk free rate	Monthly	3 month T-bill rate or proxy of 3 month T-bill rate in each market	

Notes:

The market indices have been chosen based on the following criteria: i) broadness (aggregate representation of all securities), ii) major benchmark, iii) the length of historic values, iv) currency nomination. For the periods of time where the data has been unavailable, the market index return has been approximated to 10% corresponding the general expected return for a stock market security.

Table 22: Description of Market indices and risk free interest rates

This table presents a description of the market index and interest rate data chosen for each Emerging Market. The choice of interest rate for each emerging market is based on the following criteria: i) frequent restatement, ii) availability of historic data, iii) correspondence to interest rates in other data bases such as those provided by OECD and Trading Economics. Not all of the chosen metrics are in fact an exact definition of risk free rate. However, they serve as proper proxies in terms of the interbank interest rates or benchmark interest rates. Both the market index and interest rate data are nominated in local currency.

Description of Market indices and risk free interest rates data		
Country	Market Index Benchmark	Interest Rate
Brazil	Bovespa	Brazil CDB up to 90 days
Chile	General, IGPA	Chile Discrb promissory notes 90 days
China	Shanghai SE A Share	China Relending Rate 3 months
Colombia	IGBC Index	Intervent rate
Czech Republic	Prague SE PX	Czech Republic Interbank Rate 3 month
Egypt	Hermes Financial	Egypt 91 Day T-bill
Hungary	Budapest BUX	Hungary Central Bank Base Rate
India	BSE 100 National	India T-bill Secondary 91 days
Indonesia	IDX Composite	Indonesian Interbank 3 month
Malaysia	FTSE Bursa KLCI	Malaysia T-Bill Band 4
Mexico	IPC BOLSA	Mexico Cetes 2nd market 90 days
Morocco	MASI	Morocco Time Deposit 3 month
Peru	Lima SE General, IGBL	Peru legal interest rate (Nuevos soles)
Philippines	PSEi	Philippine Treasury Bill 91 days
Poland	Warsaw General Index	Poland Interbank 3 month
Russia	Micex Index	Russia Interbank 31 to 91 days
South Africa	FTSE/JSE All Share	South Africa T-Bill 91 days
Thailand	Bangkok S.E.T	Thailand interbank 3 month
Turkey	ISE National 100	Turkish interbank 3 month

Table 23: Data availability description

This table presents the data availability of all variables in the sample dataset for this thesis. Panel A shows the total number of available companies, total number of observations (No. Observations=No. Companies × No. months between 1991 and 2007) and the percentage of available data by variable calculated based on the total number of observations for all the Emerging Markets. Panel B shows the starting year of the available data by variable for each Emerging Market.

Data availability																				
Panel A: Percentage of available data by variable																				
	Brazil	Chile	China	Colombia	Czechrepublic	Egypt	Hungary	India	Indonesia	Malaysia	Mexico	Morocco	Peru	Poland	Philippines	Russia	SouthAfrica	Thailand	Turkey	AVERAGE
NO. Company	240	165	1115	33	79	107	50	872	286	780	146	55	81	179	179	21	532	491	324	
Total Obs	57840	39765	268715	7953	19039	25787	12050	210152	68926	187980	35186	13255	19521	43139	43139	5061	128212	118331	78084	
ReturnIndex	73%	93%	66%	83%	82%	62%	76%	86%	86%	82%	81%	75%	79%	64%	86%	56%	85%	89%	78%	78%
Price	80%	93%	66%	84%	82%	62%	76%	86%	86%	82%	83%	76%	84%	64%	86%	56%	86%	89%	79%	79%
Earnings	29%	28%	9%	22%	20%	9%	29%	21%	30%	26%	37%	16%	14%	19%	28%	35%	30%	39%	36%	25%
NoShares	57%	74%	64%	60%	33%	56%	55%	63%	69%	75%	53%	63%	43%	53%	70%	48%	55%	68%	71%	59%
TurnoverByShare	84%	93%	66%	84%	82%	64%	78%	87%	86%	82%	82%	76%	85%	64%	86%	56%	85%	89%	81%	79%
BookValue	54%	64%	54%	58%	28%	30%	45%	44%	64%	64%	56%	29%	37%	42%	65%	54%	42%	60%	44%	49%
Volatility	65%	78%	65%	68%	56%	58%	64%	79%	74%	77%	60%	68%	54%	58%	73%	51%	65%	75%	71%	66%
SpreadRatio	48%	14%	62%	0%	0%	52%	29%	3%	53%	58%	37%	32%	3%	35%	58%	37%	41%	32%	34%	33%
Market index	100%	100%	95%	47%	84%	80%	100%	100%	100%	100%	100%	45%	100%	100%	99%	77%	78%	100%	100%	90%
Risk free rate	54%	50%	80%	79%	94%	32%	65%	68%	74%	67%	73%	85%	64%	100%	88%	82%	100%	95%	42%	73%
AVERAGE	61%	67%	57%	57%	48%	49%	56%	59%	68%	68%	61%	54%	50%	50%	69%	49%	61%	68%	62%	59%
Panel B: Starting year of data availability																				
ReturnIndex	1994	1990	1992	1992	1993	1994	1991	1990	1990	1990	1990	1993	1991	1991	1990	1998	1990	1990	1990	
Price	1994	1990	1992	1992	1993	1994	1991	1990	1990	1990	1990	1993	1991	1991	1990	1998	1990	1990	1990	
Earnings	1999	1992	1998	1995	1995	1999	1995	1993	1990	1990	1992	1991	1994	1995	1990	1997	1990	1990	1992	
NoShares	1994	1990	1992	1992	1993	1994	1991	1990	1990	1990	1990	1993	1991	1991	1990	1998	1990	1990	1990	
TurnoverByShare	1994	1990	1992	1992	1993	1994	1991	1995	1990	1990	1990	1993	1991	1991	1990	1998	1990	1990	1990	
BookValue	1996	1990	1992	1990	1995	1997	1992	1990	1990	1990	1990	1997	1991	1992	1990	1996	1990	1990	1990	
Volatility	1994	1991	1992	1992	1993	1994	1991	1991	1991	1991	1991	1993	1991	1991	1991	1998	1990	1991	1991	
SpreadRatio	1996	2006	1994	NA	NA	1996	2001	1996	1997	1997	1996	1993	2009	2002	1996	1998	1996	2001	2002	
Market index	1990	1990	1992	2001	1994	1995	1991	1990	1990	1990	1990	2002	1991	1986	1991	1997	1995	1990	1990	
Risk free rate	2000	2000	1995	1995	1992	2004	1990	1993	1996	1997	1996	1993	1998	1987	1993	1994	1980	1992	2002	